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The Impact of the River Chief System on Corporate ESG Performance: Evidence from China

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Abstract: This paper takes the implementation of the River Chief System (RCS) as a case study representing government-led environmental governance policies. Based on the sample of 11,654 observations of Chinese A-share-listed companies spanning the years 2009 to 2021, it empirically examines the effect of the RCS on corporate Environmental, Social, and Governance (ESG) performance and the macro- and micro-mechanisms utilizing a staggered Difference-in-Differences (DID) model, controlling for companies' financial and organizational structure characteristic variables, cities' economic characteristic variables, and firm-year two-way fixed effects. The results indicate that the implementation of the RCS significantly enhances corporate ESG performance, a conclusion supported by various robustness checks such as the parallel trend test and placebo test. Further investigation reveals that implementing the RCS, at the micro level, boosts corporate green technology innovation, increases environmental protection investment, and, at the macro level, heightens public environmental attention, thus improving corporate ESG performance. Heterogeneity analysis finds that the RCS has a more pronounced impact on enhancing ESG performance for enterprises in central and western regions of China, state-owned enterprises, enterprises with political connections, and enterprises in mature and declining stages. These research findings of this paper provide valuable insights for local governments seeking to enhance the RCS, enrich environmental governance frameworks, and facilitate corporate green transformation.

Keywords: river chief system; corporate ESG performance; green technology innovation; environmental protection investment; public environmental attention

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1. Introduction

Amid ongoing climate change and environmental crises, society's focus on sustainable development has intensified. Over recent decades, China has witnessed substantial industrial expansion and spectacular economic growth. However, this rapid progress has come with significant costs, including ecological degradation and widespread environmental pollution. Consequently, in recent years, the Chinese government has shifted its priorities toward economic sustainability, placing greater emphasis on the quality of economic development over mere scale expansion. This shift reflects an increasing recognition of the need to balance growth with environmental responsibility. As critical actors in socioeconomic activities, corporations are pivotal in advancing green transformation and enhancing sustainable development capabilities. This is key to achieving a dual win in environmental and economic performance, which further aids the high-quality development of industries. Corporate Environmental, Social, and Governance (ESG) performance, as a comprehensive

indicator of an enterprise's sustainable development capability, is receiving increasing attention in economic practice. Corporate ESG performance provides a reference for institutional investors, regulatory authorities, and other economic actors in evaluating corporate behavior and helps companies attract external capital inflows [1]. Therefore, more companies are incorporating ESG concepts into their development strategies [2], guiding their ESG practices to balance financial performance with responsibilities in ecology, human capital, and social issues, which bolsters sustainable growth and enhances resilience in a complex and dynamic economic environment.

What factors influence corporate ESG performance? Existing research suggests that internal factors, such as a high level of digitalization [3], comprehensive supply chain management [4], and heterogeneous shareholder structures [5], can help companies improve ESG performance. In addition, external factors, such as a stable environment [6] and strengthened local government environmental performance evaluations [7], can also significantly enhance corporate ESG performance. Do local government environmental governance behaviors impact corporate ESG performance? The current literature primarily focuses on environmental regulation, noting that the increased intensity of environmental regulation [8] significantly improves corporate ESG performance in the region. Specific environmental regulatory policies can also impose an observable impact on firms' ESG performance. In terms of the domestic situation in China, environmental protection tax reform [9] and government environmental information regulation [10] can have a significant ESG-enhancing effect; however, some scholars have found that environmental regulation does not help firms improve their ESG performance, but rather has a dampening effect, such as with the natural resource accountability audits pilot [11], and that these effects can be markedly heterogeneous given the differentiated characteristics of firms. [12]. Globally, research primarily concentrates on how corporations' ESG performance affects their own operations, with limited focus on the environmental policies that may impact or disrupt them [13]. However, neither environmental regulation measured by pollution reduction rates nor changes in tax regimes can fully represent the ecological and environment-related governing actions of subnational governments. Local governments have long assumed significant responsibilities in environmental governance and are critical in shaping the business environment in China. The implementation of national environmental policies and local environmental management tailored to regional conditions both have a substantial impact on corporate behavior [14,15].

To address the pollution of rivers, a county government in China introduced the RCS as a pioneering policy which designates local government and party leaders as primary officials responsible for river and lake water environment management. The system consolidates administrative resources and clarifies accountability through a responsibility mechanism [16], resulting in notable improvements in river and lake water management. The existing literature affirms the initial success of the RCS in water pollution control [17]. Moreover, the economic effects of the RCS are notable, with studies identifying its positive impact on urban green productivity [18] and the quality of urban economic growth [19]. However, only a few researchers have examined how the RCS affects corporations' micro-decision-making in terms of green technology innovation [20], energy efficiency [21], etc. In the context of high-quality development, exploring the intervention effect of government environmental governance actions on company ESG performance contributes valuable empirical evidence, offering insights into refining China's environmental governance framework.

To assess the effects of the River Chief System (RCS) on corporations' ESG performance, we employed the Difference-in-Differences (DID) model. This model is well-established for analyzing policy effects and effectively addresses the endogeneity issue arising from bidirectional causality. Additionally, the DID model controls for unobserved factors, allowing

for a more precise estimation of the policy's net effect. This paper's possible contributions are threefold: It is the first to connect a local environmental governance action—the RCS, which has been generally rolled out in cities in China—with corporate ESG performance, analyzing the RCS's enhancement effect on corporate ESG performance, thereby enriching the literature on the micro-level effects of the RCS and providing a new perspective on enhancing corporate ESG performance. Additionally, this paper explores the positive mechanisms of the RCS on corporate ESG performance from the angles of public environmental awareness, green technological innovation, and environmental investment, combining both the macro and micro levels, thus supplementing the understanding of how local governments incentivize corporate ESG improvements through environmental governance. Moreover, the paper provides detailed profiling of corporate attributes, exploring the heterogeneous conditionalities for the functioning of the RCS's effects, which offers empirical evidence to guide ESG performance improvements across companies with varying characteristics.

2. Theoretical Analysis and Research Hypothesis

The RCS is a significant institutional innovation in China's surface water governance, reinforcing local government accountability in environmental management. The system emerged to address societal demands for environmental improvement [22], linking environmental governance outcomes with government officials' career progression, thereby addressing the principal-agent incentive problem. Under performance pressure from the RCS, local government officials are driven to prioritize environmental quality in regional development, tightening oversight on corporate pollution emissions, enforcing penalties on environmental violations, etc. Water-polluting enterprises undergo timely restructuring, while enterprises are incentivized to assume social responsibility and establish a green image. Therefore, we hypothesize that the implementation of the RCS can improve corporate ESG performance.

The RCS promotes corporate green technological innovation, which enhances corporate ESG performance. Green technological innovation is the critical driver for corporate and industrial sustainability enhancement, improving ESG performance. The Porter Hypothesis (1995) posits that justified environmental regulations can encourage environment-friendly innovation behaviors in corporations [23]. The RCS, as an administrative environmental regulation policy, can leverage the government's advantage in accessing green innovation technology information, providing relevant guidance to enhance corporate environmental awareness and, in turn, foster green technological innovation. Green technological innovation can help firms reduce the likelihood of administrative penalties, increase productivity, and improve competitiveness, compensating for the increased production and R&D costs associated with the RCS. As firms' green productivity improves alongside green technological advancements, their environmental performance strengthens, accelerating their transformation into environmentally friendly enterprises. This can help companies attract green financing and alleviate financial constraints, motivating them to assume social responsibilities and enhancing corporate ESG performance as a result [24].

The RCS encourages corporate environmental investment, which supports ESG performance. The ecological environment, as a public good, has long posed externality challenges in environmental governance. Given non-zero transaction costs and often ambiguous property rights, resource allocation through mere property rights delineation is insufficient [25]. Government intervention and regulation are thus necessary. The implementation of the RCS imposes stricter standards on resource utilization, pollution control, and emissions throughout the production process. Enterprises are compelled to increase environmental expenditures on energy conservation and emissions reduction to meet heightened environmental requirements. As a typical command-and-control regulation, the RCS enhances

environmental law enforcement mechanisms, intensifies environmental quality assessment pressure, and mobilizes local government officials to strengthen environmental regulation, thereby urging enterprises to upgrade energy-saving and environmental protection equipment, internalize environmental costs, and correct negative externalities in their production processes. Expanding environmental investment contributes to improving energy efficiency, reducing pollutant emissions, and achieving higher levels of eco-friendly production and management, enabling firms to offer environmentally responsible products that gain consumer favor [26]. Compliance with environmental standards also builds brand reputation, consolidating corporate image and market position, achieving a dual win in environmental and economic performance [27]. By stimulating environmental investment, firms are motivated to assume environmental responsibilities, thereby enhancing corporate ESG performance.

The RCS elevates regional public environmental awareness, which helps improve corporate ESG performance. Based on stakeholder theories, the ecological environment, community, and consumers are essential corporate stakeholders [28], whose demands enterprises should address. The RCS reinforces social environmental awareness through water environment advocacy and civilian river chiefs, raising public expectations for environmental quality. Enterprises, in turn, engage in environmental scanning to monitor economic, political, and social changes in their external environment [29]. To meet public environmental expectations, firms undertake green production upgrades and provide eco-friendly products in response to external environmental shifts prompted by the RCS. Corporate adherence to the triple bottom line [30], including environmental responsibility, is crucial for sustainable development. Building public environmental concern by increasing public environmental participation, enterprises are urged to change their short-sighted behavior of focusing only on profits [31], on the one hand, to adopt cleaner technologies, increase environmental protection investment, improve resource use efficiency, reduce environmental compliance costs, improve community environmental quality, and achieve a higher level of green performance, on the other hand. Furthermore, in meeting public expectations for a sustainable environment, firms incorporate energy conservation and green development into their strategies. The RCS could help companies keep actions in alignment with ethical standards, which strengthens corporate reputation and broadens recognition of their social responsibility, thereby enhancing ESG performance.

Hypothesis 1. *The implementation of the RCS contributes to improving corporate ESG performance.*

3. Research Design

3.1. Sample Selection

This paper selects A-share-listed companies in China from 2009 to 2021 as the research sample to empirically test whether RCS improves corporate ESG performance. The initial data processing involved the following steps: first, exclude companies classified as Particular Transfer (PT), Special Treatment (ST), or *Special Treatment (*ST) during the sample period; second, remove samples with severe missing ESG or control variable data; third, exclude financial and insurance companies due to their unique financial structures and regulatory frameworks; last, exclude companies with negative debt-to-asset ratios. After this processing, the study obtained 11,654 firm-year observations. Corporate ESG performance data were sourced from the China Securities Index ESG Rating Database and city-level RCS data were collected from publicly available online information. Enterprises' data were from the China Stock Market & Accounting Research Database (CSMAR).

3.2. Variable Definitions

3.2.1. Dependent Variable

The dependent variable was corporate ESG performance. Our research utilized the ESG ratings from the China Securities Index ESG Rating Database as a proxy for corporate ESG performance, according to Fang and Hu's method [32]. The rating system evaluated the ESG performance of the listed companies across nine tiers: AAA, AA, A, BBB, BB, B, CCC, CC, and C. AAA was the highest grade, which indicated the best ESG performance, while C was the lowest grade, which indicated the worst ESG performance, and so forth. Following Lin et al. [33], the nine ratings were assigned a value of 1–9, where higher values represented better ESG ratings and, consequently, stronger corporate ESG performance.

3.2.2. Key Independent Variable

The key independent variable was the implementation of the RCS in prefecture-level cities. After initial data processing, the sample included companies in 197 prefecture-level cities. This study manually collected data on the implementation date of the RCS in these cities using three channels: official documents and announcements related to the RCS on local government websites, news reports on the RCS obtained through Baidu, and local regulations and policy documents available on the PKU Law website. The information from these sources was cross-verified to obtain the RCS implementation dates for each city in the sample. Given that the RCS requires various supporting mechanisms to be effective [34] and its impact may have a lag, if the RCS in a city was implemented before July, that year was considered the policy implementation year; if it was implemented in July or later, the following year was designated as the implementation year.

3.2.3. Control Variables

This study incorporates various city- and firm-level variables that could influence corporate ESG performance, drawing on the research of Meng and Li [7], He et al. [9], and Yuan and Yang [14]. Firm-level control variables included firm size, financial leverage, return on net assets, Tobin's Q, loss status, ownership concentration, CEO duality, firm growth potential, and independent director ratio. City-level control variables included per-capita GDP and local fiscal budget expenditure. Table 1 provides detailed definitions.

Table 1. Definition of main variables.

Variable Types	Symbols	Definitions
Dependent Variable	ESG	The Sino-Securities ESG rating; ratings from C to AAA are assigned value 1–9.
Independent Variable	RCS	Taking the value of 1 if the city where the enterprise is has implemented RCS, and 0 otherwise.
Control Variable	Size	The total assets of the enterprise at year-end.
	Lev	The total liabilities of the enterprise at year-end/the total assets of the enterprise at year-end.
	ROE	The net profit of the enterprise at year-end/the owners' equity at year-end.
	Tobinq	The year-end market capitalization of the enterprise/the replacement cost of the enterprise's assets.
	Loss	Taking the value of 1 if the enterprise' net profit at year-end is negative, and 0 otherwise.
	Top1	The ratio of shares held by the enterprise's largest shareholder at year-end.
	Duality	If the chairperson and CEO are both appointed, taking the value of 1; otherwise, 0.
	Growth	The growth rate of the main business income of the enterprise.
	Inded	The proportion of independent directors on corporate boards.
	GDP	The GDP per capita in the city (total GDP of the city/total population).
	Expend	The expenditure within the budget of the city.

3.2.4. Model Specification

We approach the RCS' phased implementation across Chinese cities using a staggered DID model while accounting for firm-specific and time fixed effects. The equation is specified as follows:

$$ESG_{it} = \beta_0 + \beta_1 RCS_{ct} + \beta_2 X_{ict} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (1)$$

where i is the firm, c represents the city, and t signifies the year. The dependent variable ESG_{ict} is the ESG rating of the firm i. The key independent variable RCS_{ct} indicates the implementation of the RCS, where $RCS_{ct} = 1$ if city c has implemented the RCS in year t, and $RCS_{ct} = 0$ otherwise. X_{ict} represents the set of control variables, μ_i and λ_t capture firm and year fixed effects, and ε_{ict} is the error term. The coefficient β_1 is the main parameter of interest, measuring the marginal effect of the RCS on corporate ESG performance.

4. Results and Analysis

4.1. Descriptive Statistics

Table 2 provides an overview of the descriptive statistics for the key variables adopted in the study. The mean ESG rating is 4.401, with values ranging from 1 to 8, clarifying a significant discrepancy in corporations' ESG performance in the sample and reflecting the generally unsatisfactory level of ESG performance over the experimental period. The average of the RCS variable is 0.55, illustrating that roughly 55% of corporations in the research sample are subject to the RCS. The descriptive statistics for other control variables are substantially analogous to prior research and fall within reasonable ranges.

Table 2. Descriptive statistics of main variables.

Variables	N	Mean	SD	Min	Median	Max
ESG	11,654	4.401	1.020	1.000	4.500	8.000
RCS	11,654	0.550	0.497	0.000	1.000	1.000
Size	11,654	23.118	1.376	18.266	23.004	28.548
Lev	11,654	0.474	0.201	0.008	0.486	0.995
ROE	11,654	0.063	0.850	−66.535	0.087	4.248
Tobinq	11,654	2.069	1.727	0.641	1.535	29.167
Loss	11,654	0.072	0.259	0.000	0.000	1.000
Top1	11,654	37.830	16.488	3.390	36.400	89.990
Duality	11,654	0.210	0.407	0.000	0.000	1.000
Growth	11,654	1.970	139.460	−0.953	0.122	14,883.059
Inded	11,654	0.379	0.074	0.143	0.364	0.800
GDP	11,654	11.398	0.539	8.704	11.457	13.056
Expend	11,654	16.319	1.229	11.544	16.214	18.250

4.2. Baseline Regression Results

The regression results for the baseline model are presented in Table 3. While column (1) includes only the RCS variable and firm and year fixed effects, without other variables, column (2) incorporates additional control variables. The estimated coefficients of the key variable are both significant at the 1% level, specifically 0.1 and 0.094, with the significance level unaffected by the inclusion of control variables. The results illustrate that the RCS markedly improves corporate ESG performance, supporting the core hypothesis of this study.

Table 3. The average effect of the RCS on corporate ESG performance.

	(1) ESG	(2) ESG
RCS	0.100 ***	0.094 ***
	(0.035)	(0.035)
Size		0.287 ***
		(0.031)
Lev		−0.967 ***
		(0.126)
ROE		−0.023 ***
		(0.006)
Tobinq		0.021 ***
		(0.007)
Loss		−0.063 *
		(0.033)
Top1		0.001
		(0.002)
Duality		−0.041
		(0.040)
Growth		0.000
		(0.000)
Inded		0.436 ***
		(0.129)
GDP		−0.036
		(0.063)
Expend		−0.091 **
		(0.043)
Constant	4.347 ***	−0.141
	(0.019)	(0.937)
Firm-fixed effect	Yes	Yes
Year-fixed effect	Yes	Yes
N	11,654	11,654
adj. R^2	0.561	0.577

Notes: Robust standard errors clustered to the city level are in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, similarly hereinafter.

4.3. Robustness Tests

This finding highlights the effectiveness of the RCS in driving improvements in Environmental, Social, and Governance practices among corporations. However, the results may be biased by potential endogeneity issues, such as omitted variable bias. Therefore, this study conducts parallel trend tests, placebo tests, and incorporates year–industry interaction fixed effects and PSM-DID to further verify the robustness of the outcomes.

4.3.1. Common Trend Testing

The DID approach requires enterprises in both enforcement and non-enforcement cities to exhibit similar variations in ESG performance before RCS intervention. Following the method of Jacobson et al. [35], the following regression model is constructed:

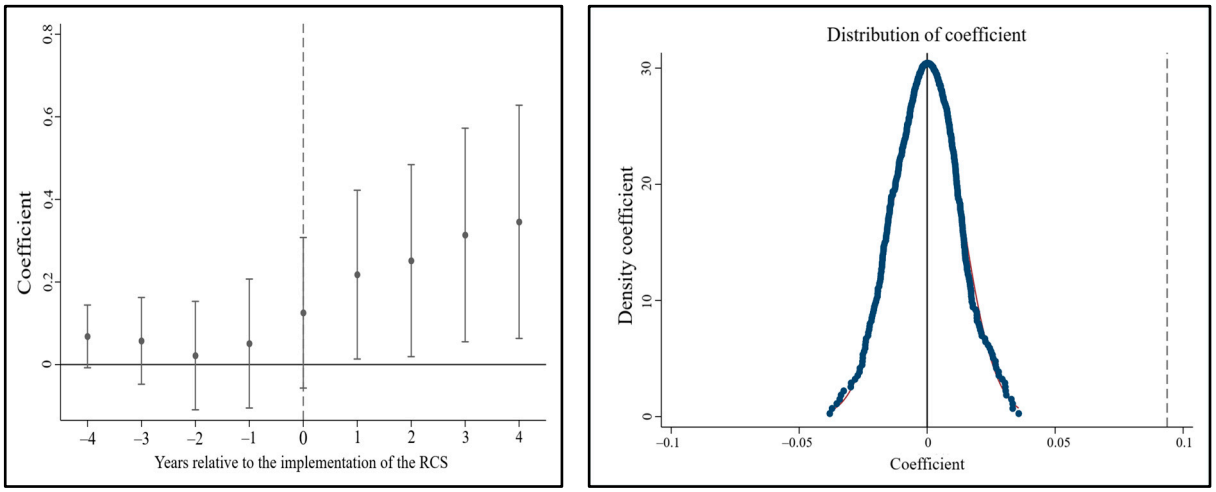
$$ESG_{ict} = \beta_0 + \sum_{i=-4}^{4} \beta_i RCS_{ct}^{i} + \beta X_{ict} + \mu_i + \lambda_t + \varepsilon_{ict} \quad (2)$$

where RCS_{ct}^{i} denotes multiple dummy variables indicating periods before and after the implementation of RCS. If $i < 0$, representing that city c is located before the policy implementation, when the city c is in year $-i$, $RCS_{ct}^{i} = 1$, and $RCS_{ct}^{i} = 0$ otherwise; if $i \geq 0$, it means the periods after the policy implementation, when city c is located in year i, $RCS_{ct}^{i} = 1$, and $RCS_{ct}^{i} = 0$ otherwise. Other variables follow their identical meanings from Model (1). Figure 1a shows the estimates of β_i with corresponding 95% confidence

intervals. The pre-treatment dummy variable coefficients are statistically nonsignificant, indicating that enterprises in both categories exhibit similar trends before the RCS, thus satisfying the common trend assumption.

4.3.2. Placebo Test

To eliminate the potential impact of unobservable factors, this study conducted a version of this test with random assignment of the RCS implementation dates, following Chetty et al. [36]. The random assignment was repeated 500 times, generating 500 estimated coefficients, as shown in Figure 1b. The coefficients from the random assignments are centered around zero, indicating that the estimation outcomes are unlikely to be influenced by unobservable factors.



(**a**) (**b**)

Figure 1. (**a**) Parallel trend test result; (**b**) placebo test result.

4.3.3. Controlling for Time–Industry Interaction Fixed Effects

In addition to firm and time fixed effects, this study controls for time–industry interaction fixed effects to address potential omitted industry-level time-varying factors affecting the regression, as suggested by Ren et al. [37]. The coefficient of the core explanatory variable in Table 4 column (1) remains significant after including time–industry fixed effects, and are similar to our baseline results, suggesting that the ESG performance-enhancing effect of the RCS are not affected by omitted industry-level variables.

Table 4. Robustness checks results.

	Controlling for Time–Industry Interaction Fixed Effects	**PSM-DID**
	(1)	**(2)**
	ESG	**ESG**
RCS	0.090 **	0.093 ***
	(0.035)	(0.035)
Controls	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
N	11,550	11,536
adj. R^2	0.541	0.579

Note: **, *** indicate statistical significance at the 5% and 1% levels, respectively.

4.3.4. PSM-DID

Following the propensity score matching (PSM) method of Heckman et al. [38], firms were matched based on firm size, financial leverage, ROE, Tobin's Q, loss status, ownership concentration, CEO duality, firm growth, independent director ratio, regional GDP per capita, and local fiscal budget expenditure. The RCS and non-RCS firms were matched in a 1:1 ratio utilizing nearest-neighbor matching, and the DID regression was applied to the matched sample. The results in Table 4 column (2) show that the coefficient of the key explanatory variable is significant, with estimates close to the baseline results, illustrating the absence of sample selection bias.

5. Further Analysis

5.1. Mechanism Analysis

Previous empirical outcomes verify that the implementation of the RCS enhances corporate ESG performance and confirms the conclusion's robustness by various tests. This section investigates the mechanisms through which the RCS elevates corporate ESG performance, focusing on green technological innovation, environmental investment, and public environmental awareness at both micro and macro levels.

5.1.1. Testing the Green Technological Innovation Mechanism

This study gathers the annual total of green patent applications from the listed companies through the China Research Data Service Platform (CNRDS) to explore the mechanism of green technological innovation. Following the indicator construction method of Xu and Cui [15] and Wang et al. [20], the total number of green patent applications was logarithmically transformed after adding one to indicate green technological innovation (lnpatent). This is shown in 5. The coefficient for the key explanatory variable shown in Table 5 column (1) is 0.103, which is significant at the 10% level, illustrating that the implementation of the RCS significantly incentivizes enterprises to promote their green technological innovation capacity, improving environmental performance and thus boosting ESG performance.

Table 5. Mechanism analysis results (green technology innovation, environmental invest, and public environmental awareness).

	(1) **lnpatent**	**(2)** **Einvest**	**(3)** **BaiduIndex**
RCS	0.103 * (0.060)	0.006 *** (0.002)	2.200 *** (0.558)
Controls	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
N	6320	11,212	7519
adj. R^2	0.706	0.694	0.935

Note: *, *** indicate statistical significance at the 10% and 1% levels, respectively.

5.1.2. Testing the Environmental Investment Mechanism

To examine the environmental investment mechanism, following the method of Zhang [39] this study aggregates relevant environmental investment expenditures, such as desulfurization and denitrification projects and wastewater treatment projects, reported in the construction work-in-progress section of firms' annual reports. These total environmental investments are standardized by dividing them by annual total assets, resulting in the environmental investment variable (Einvest) for regression analysis, with the results shown in Table 5. The regression results reveal that the key explanatory variable coefficient is

significant at the 1% level in column (2), indicating that the RCS promotes firms to expand their environmental investment, consequently enhancing their ESG performance.

5.1.3. Testing the Public Environmental Awareness Mechanism

To identify the mechanism of public environmental awareness, this study employed the Baidu search index for the keyword "environmental pollution" as a proxy, following the methods of Wang and Zhao [40] and Zheng et al. [41]. As the largest Chinese search engine, Baidu effectively reflects regional environmental concerns, with highly accessible search index data. The total search index from Baidu, combining PC and mobile searches, served as the dependent variable (BaiduIndex). The regression outcomes demonstrate a significant positive effect at the 1% level, suggesting that implementing the RCS notably increases public environmental awareness, compelling enterprises to adopt environmentally responsible practices and build a green corporate image, improving ESG performance.

5.2. Heterogeneity Analysis

While the earlier discussion focused on the effect of the RCS on corporate ESG performance and its mechanisms, this impact may vary across companies with different characteristics. Therefore, this section specifically explores the heterogeneous effects of the RCS on companies with varying attributes.

5.2.1. Heterogeneity by Regional Attributes

Given the significant differences in resource endowments, industrial structures, and marketization levels across the eastern, central, and western regions of China, implementing the RCS may vary accordingly. This study divided the entire sample into firms located in eastern areas and those in central and western regions, performing regression analyses separately. Table 6 reveals that the coefficient for the key explanatory variable is not significant for firms in the eastern region, while the coefficients for firms in the western and central regions are significantly positive at the 5% level. This demonstrates that the RCS exerts more pronounced impacts on ESG performance in central and western region enterprises. This may be because eastern region firms, facing rapid economic growth and higher marketization, already emphasize environmental responsibility and are under intense market competition, compelling them to invest in environment-related projects. Thus, the marginal impact of the RCS on their ESG performance is less noticeable. In contrast, the western and central regions, which are still transitioning industrially and have lower levels of marketization, may benefit more from the RCS in refining their development philosophies and enhancing corporate governance, leading to significant improvements in ESG performance.

Table 6. Heterogeneity by regional attributes.

	(1) **Eastern Areas** **ESG**	**(2)** **Middle and Western Areas** **ESG**
RCS	0.061	0.145 **
	(0.041)	(0.072)
Controls	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
N	8283	3354
adj. R^2	0.586	0.556

Note: ** indicate statistical significance at the 5% levels.

5.2.2. Heterogeneity by Ownership Structure

Differences in ownership structure may influence how the RCS affects firms' ESG performance. Our Table 7 exhibits the outcomes of separate regressions based on differences in ownership structures. The coefficient of the RCS for state-owned enterprise samples is 0.102, which is significant at the 5% level. However, the estimated coefficient for non-state-owned enterprises samples is nonsignificant. This indicates that the RCS enhances ESG performance more significantly in state-owned enterprises (SOEs). SOEs in China are expected not only to lead in optimizing industrial structure and promoting healthy socioeconomic development but also to assume greater social responsibilities. Hence, following the introduction of the RCS, SOEs exhibit more willingness to fulfill policy requirements, actively engage in environmental investment, promote energy conservation and emissions reduction, and enhance corporate governance, thus improving their ESG performance more noticeably compared to non-state-owned enterprises.

Table 7. Heterogeneity by ownership structure.

	(1) **State-Owned Corporations** **ESG**	**(2)** **Private Corporations** **ESG**
RCS	0.102 **	0.053
	(0.046)	(0.053)
Controls	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
N	6222	5318
adj. R^2	0.588	0.579

Note: ** indicate statistical significance at the 5% levels.

5.2.3. Heterogeneity by Political Connections

Political connections can serve as a crucial relational asset for firms, significantly influencing corporate behavior and operational performance [42]. This study examines whether political connections affect the RCS's impact on corporate ESG performance by introducing a political connection variable. Following the method of Jia and Zhang [43], we introduced political correlation variables. If a company's executives (chairperson or general manager) are currently or have previously served as government officials, judicial system members, or legislative representatives, it was coded as 1, and as 0 otherwise. As shown in Table 8, the RCS imposes a more pronounced impact on the ESG performance of politically connected enterprises, with a significant coefficient at the 1% level, whereas the impact on enterprises without political connections is nonsignificant. A potential explanation is that political connections can help firms gain resources. According to resource dependence theory, firms need to maintain these connections to avoid losses. Thus, after the implementation of the RCS, politically connected enterprises tend to actively comply with policy mandates to enhance their image and reinforce government–enterprise relationships. Additionally, the presence of political connections may lead to the stricter governmental enforcement of environmental regulations [44], pushing politically connected firms to adhere closely to the RCS's requirements and actively undertake environmental responsibilities, thus experiencing a more significant enhancement in ESG performance.

Table 8. Heterogeneity by political connections.

	(1) Political Connection ESG	(2) Without Political Connection ESG
RCS	0.158 ***	0.056
	(0.060)	(0.044)
Controls	Yes	Yes
Firm fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
N	3976	7580
adj. R^2	0.587	0.605

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

5.2.4. Heterogeneity by Lifecycle Stage

Enterprises at different lifecycle stages exhibit variations in scale, innovation capabilities, and other characteristics. This section explores whether the impact of the RCS on ESG performance varies by lifecycle stage. Referring to the method of Liu et al. [45], we categorized the research sample into growth, maturity, and decline stages based on cash flow patterns. The results for each stage in Table 9 reveal that the RCS does not significantly affect the ESG performance of firms in the growth stage, while its impact is significant for mature and declining firms, with coefficients at the 10% and 5% levels, respectively. This may be because growth-stage firms typically have limited revenue and funding sources, with investments primarily directed toward physical assets to enhance competitiveness. Their capacity for green technological R&D and social responsibility is often inadequate, leading to a lesser response to the RCS's influence on ESG performance. In contrast, mature firms, with stable profits and reduced financial constraints, are better positioned to optimize production technologies, pursue green development, and enhance their corporate image following the RCS's implementation. Declining firms, although facing decreasing market share and profits, often maintain established structures and financial strength, enabling them to continue green R&D due to the "inertia" of ongoing technological innovation. These firms usually have closer ties with local governments, facilitating access to financial support and incentivizing them to maintain their environmental reputations, thus reflecting a significant positive impact on ESG performance.

Table 9. Heterogeneity by lifecycle stage.

	(1) Growth-Stage ESG	(2) Mature-Stage ESG	(3) Declining-Stage ESG
RCS	0.042	0.091 *	0.191 **
	(0.050)	(0.055)	(0.092)
Controls	Yes	Yes	Yes
Firm fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
N	4964	4501	1471
adj. R^2	0.574	0.607	0.647

Note: *, ** indicate statistical significance at the 10% and 5% levels, respectively.

6. Conclusions and Policy Implications

Understanding whether local environmental governance behaviors can enhance ESG performance is crucial for achieving both economic and environmental benefits. Based on the analysis of A-share-listed companies in China from 2009 to 2021, using a multi-period

DID model, this research empirically verifies the positive effect of the RCS on corporate ESG performance. The findings reveal the following: The RCS significantly enhances corporate ESG performance, strengthening sustainable development capabilities, with results remaining valid after robust checks. Additionally, mechanism analyses indicate that the RCS positively influences corporate ESG performance through green technological innovation, increased environmental investment, and heightened public environmental awareness, operating through multiple channels. Moreover, heterogeneity analyses show that the RCS's effects on ESG performance differ among various firms, with more pronounced improvements for enterprises in the central and western regions, state-owned enterprises, politically connected firms, and those in mature or declining stages.

With its above conclusions, this paper proposes the following coherent policy implications:

Continue to improve the RCS: Establish a long-term mechanism to facilitate corporate green transformation and environmental social responsibility. Enrich the policy toolkit of the RCS and optimize the combination of policy instruments to guide enterprises in energy conservation and emissions reduction. Identify key targets for policy implementation based on differentiated corporate characteristics to avoid a one-size-fits-all approach, promoting ESG performance improvement across industries. Further, clarify responsibility categories to ensure uninterrupted environmental governance and maintain the sustained effectiveness of the RCS.

Actively mobilize social forces: Encourage public participation in the environmental governance process. Societal concern for environmental issues is a crucial factor affecting corporate green transformation. Local governments should emphasize the energy of diverse social stakeholders in environmental governance, enhancing the awareness of green technologies and environmental products to inject stronger momentum into corporate green transformation.

Encourage innovative environmental governance practices: Local governments should analyze local environmental issues in depth, exploring efficient environmental management mechanisms. Through appropriately designed environmental regulations, they should cultivate corporate responsibility awareness without disrupting normal business operations, fostering the growth of the green economy and promoting the continuous enhancement of corporate ESG performance.

The scientific formulation of environmental regulatory policies to guide enterprises to shift their development strategies: The findings of this paper illustrate that there is a significant enhancement effect on corporate ESG performance from environmental governance. Therefore, the environmental policy system should be improved actively, and differentiated policy tools should be adopted in accordance with different corporation attributes to motivate enterprises in the region to improve their governance capacity, actively undertake social responsibility, and promote green transformation. Hence, the sustainable development level of the whole region would be reinforced.

The findings of our study enrich and complement the literature on the connection between environmental regulation and corporate ESG performance, and, based on the conclusions, provide valuable policy recommendations for regional governments to improve corporate sustainability performance through environmental policies. However, this paper still suffers from the following limitations. Firstly, the sample is limited to listed companies in China's A-share market, and it has not explored how more types of companies respond to environmental governance policies. Further research could continue to expand the sample scope and delve into the effect of environment-targeted governance policies on corporate ESG performance more comprehensively by incorporating unlisted companies. Secondly, the channels through which the effects of environmental policies are generated are essential for the more efficient realization of their effects. Therefore, other intermediate

variables of the effects of this policy should be expanded on in future studies to provide more insightful suggestions for improving the policy system.

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