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The Impact of Financial Misallocation on Corporate ESG Performance

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Abstract: Against the strategic backdrop of green finance promoting the achievement of the "dual carbon" goals, enhancing corporate ESG performance has become an important pathway for achieving sustainable development. However, the widespread phenomenon of financial misallocation, particularly the structural imbalance in the allocation of green credit resources, significantly constrains corporate ESG performance. Based on data from China's A-share listed companies from 2009 to 2022, this study examines the impact of financial misallocation on corporate ESG performance. The results indicate that financial misallocation significantly inhibits corporate ESG performance, a conclusion that remains valid after robustness tests. Mechanistically, financial misallocation hinders ESG improvement by exacerbating supply chain concentration, increasing financing costs, and suppressing green innovation. Heterogeneity analysis further reveals that the negative effect of financial misallocation is more pronounced in non-state-owned enterprises with insufficient green finance coverage, high-carbon emission industries, and the western region. This research provides important theoretical support and policy insights for enhancing corporate ESG performance by optimizing the allocation of green financial resources and correcting credit discrimination.

Keywords: Financial Misallocation; Financing Constraints; Green Finance; Supply Chain Concentration; Nature of Ownership

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1.Introduction

Enhancing corporate ESG performance requires substantial resource support, with financial resources being paramount to corporate survival. However, financial misallocation remains pervasive in China, where a significant proportion of financial resources flows not to high-efficiency sectors but concentrates in enterprises with lower returns on capital, thereby deviating from the efficiency principle. Although financial market reforms have deepened in recent years, institutional factors such as excessive regulatory intervention continue to exacerbate resource misallocation[1]. Government intervention, credit discrimination, and an underdeveloped market mechanism collectively intensify financing constraints, increase supply chain concentration, and worsen the information environment[2][3][4]. In particular, financial misallocation significantly inhibits the green innovation capacity of small and medium-sized enterprises (SMEs). Moreover, "ownership discrimination" and "scale discrimination" further distort resource allocation: private enterprises face financing bottlenecks, whereas state-owned and large enterprises gain easier access to funds due to their creditworthiness and scale advantages[5]. Regional disparities in

policies and resources also aggravate financial development imbalances[6].

Based on this analysis, this study uses a sample of A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2009 to 2022 to examine the impact of financial misallocation on corporate ESG performance and to elucidate the underlying mechanisms. We explore the mediating roles of supply chain concentration, debt financing costs, and green innovation in the relationship between financial misallocation and ESG performance. Furthermore, by introducing three moderating variables—operational risk, corporate transparency, and information disclosure quality—we investigate how they moderate the relationship between financial misallocation and corporate green innovation. This approach not only enhances the understanding of the channels and conditional effects through which financial misallocation influences ESG performance but also, through heterogeneity analysis, helps raise corporate awareness of ESG responsibilities and deepens the understanding of the intrinsic logic behind ESG performance. The findings offer practical insights for enterprises, investors, and policymakers.

2.Theoretical Analysis and Research Hypotheses

2.1 Financial Misallocation and Corporate ESG Performance

Financial misallocation refers to the phenomenon where financial resources fail to achieve Pareto-optimal allocation. In China, this is primarily manifested as non-market-based resource allocation caused by government intervention and policy distortions. State-owned enterprises (SOEs), due to their inherent ties with state-owned banks and administrative intervention, have easier access to low-cost capital, leading to low investment efficiency and overcapacity. In contrast, private enterprises face difficulties in obtaining financing and higher financing costs, which suppresses their technological innovation and performance improvement. This structural imbalance in resource allocation reduces overall efficiency and hinders corporate sustainable development.

In summary, the overallocation of financial resources to SOEs and the underallocation to private enterprises reflect a structural imbalance in financial resource distribution, which in turn leads to low utilization efficiency of financial resources and adversely affects the performance of both SOEs and private enterprises. Therefore, this study proposes the following research hypothesis:

H_1：Corporate Financial Misallocation Suppresses ESG Performance

2.2 Mediating Effects Between Financial Misallocation and Corporate ESG Performance

Financial misallocation primarily suppresses corporate ESG performance by intensifying supply chain concentration, increasing debt financing costs, and reducing green innovation.

2.2.1 Mediating Effect of Supply Chain Concentration

Financial misallocation drives resources toward large enterprises, increasing supply chain concentration, weakening bargaining power, and raising operational redundancy. Redundant resources crowd out ESG investments, while exacerbated agency problems reduce motivation for corporate social responsibility, thereby inhibiting ESG performance. Comprehensive understanding and disclosure of ESG information related to the supply chain are challenging for companies. These risks hinder scientific assessment of suppliers' environmental performance, making green innovation more difficult and costly. Thus, supply chain concentration impedes companies' ability to mobilize financial resources for green innovation, thereby lowering ESG performance. Based on this analysis, this study proposes the following research hypothesis:

H_{2a}: Financial misallocation inhibits corporate ESG performance by exacerbating supply chain concentration.

2.2.2 Mediating Effect of Debt Financing Costs

Increased financial misallocation raises financing difficulties and costs for private enterprises and SMEs. To obtain scarce credit resources, companies incur substantial rent-seeking costs or resort to high-interest informal financing, equivalent to reduced financial resource accessibility and heightened financing constraints.

The escalation of financial misallocation exacerbates corporate financing constraints, which in turn diminishes the scale of physical investment and ultimately reduces innovation efficiency. Within China's current financial landscape, numerous enterprises universally face financing constraints—whether moderate or severe—that restrict their ability to secure capital at relatively low costs. Such constraints inhibit firms from expanding production scales and broadening investment scope. In

cases of extreme financing constraints, companies may be forced to forgo financing and fundraising opportunities altogether, likely impairing capital allocation efficiency, depressing performance, and even triggering capital chain ruptures. As one of the four major corporate costs—alongside core business costs, administrative expenses, and sales expenses—debt financing cost is a critical factor influencing corporate performance. Based on the above analysis, this study proposes the following research hypothesis:

H_{2b}: Financial misallocation inhibits corporate ESG performance by increasing debt financing costs.

2.2.3 Mediating Effect of Green Innovation

A theoretical model demonstrates that financial misallocation suppresses green innovation capability, thereby affecting ESG performance. Assuming information asymmetry raises external financing costs above internal financing costs, companies pay a premium C_1 for external funds. With financial misallocation, an additional cost C_2 is incurred, making total cost $C = C_1 + C_2 > 1$. The fixed cost of innovation is F_I. Companies with sufficient internal funds innovate with probability q, while those requiring external funds innovate with probability 1– q. External factors reduce internal liquidity with probability P_L, where $P_L \in \{0, \overline{P_L}\}$. Let π_i denote profits without innovation, where $i = 0$ for internal funds and $i = C$ for external funds, so $\pi_0 > \pi_C$. Similarly, π_i^1 denotes profits with innovation, where $\pi_i{}^1 > \pi_i$.

Innovation profits decrease with financing costs. The expected profit without innovation is:

$$E(\pi) = (\mathrm{q} - P_L)\pi_0 + (1 - q + P_L)\pi_C$$

With innovation, the probability of using internal funds decreases by P_I, so the probability becomes $q- P_I - P_L$ for internal funds and $1 – q + P_I + P_L$ for external funds. The expected profit with innovation is:

$$E(\pi^1) = (q - P_I - P_L)\pi_0{}^1 + (1 - q + P_I + P_L)\pi_C{}^1$$

The incentive to innovate is the difference in expected profits:

$$\Delta_\pi^I \equiv E(\pi^1) - E(\pi)$$

Innovation occurs only if $\Delta_\pi^I > 0$.

The innovation incentive decreases with external financing costs:

$$\frac{\partial \Delta_\pi^I}{\partial P_L} < 0$$

Similarly, higher misallocation cost C_2 reduces the innovation incentive:

$$\frac{\partial \Delta_\pi^I}{\partial C_2} < 0$$

Thus, financial misallocation discourages innovation. Since green innovation directly impacts environmental performance, social responsibility, and governance efficiency, it is a key pathway to improving ESG performance. Based on this analysis, we propose:

H_{2c}: Financial misallocation inhibits corporate ESG performance by suppressing green innovation capability.

2.3 Moderating Effects Between Financial Misallocation and Corporate ESG Performance

2.3.1 Moderating Effect of Operational Risk

Operational risk reflects a company's ability to cope with uncertainties and maintain stability. Financial misallocation exacerbates credit resource imbalances, leading to over-leverage in SOEs and large enterprises (increasing interest burdens and reducing investment efficiency) and credit rationing for private enterprises and SMEs (weakening risk resilience). Both over-leverage and under-leverage elevate operational risk, amplifying default probabilities and volatility under external shocks. According to risk transmission theory, higher operational risk discourages long-term investments like ESG, as management prioritizes short-term actions. Thus, we propose:

H_{3a}: Operational risk negatively moderates the relationship between financial misallocation and corporate ESG performance.

2.3.2 Moderating Effect of Corporate Transparency

Corporate transparency measures the comprehensiveness and accessibility of information disclosure, affecting external investor supervision. High transparency alleviates information asymmetry, reduces market evaluation uncertainty, and enhances the credibility and recognition of ESG practices. Under financial misallocation, companies may reduce disclosure to

conceal financial distress, worsening resource misallocation. Transparent companies can attract long-term green investments by signaling ESG efforts, mitigating financing pressures. Moreover, high transparency improves governance and social responsibility, indirectly enhancing ESG management. Thus, we propose:

H_{3b}: Corporate transparency positively moderates the relationship between financial misallocation and corporate ESG performance.

2.3.3 Moderating Effect of Information Disclosure Quality

Information disclosure quality reflects the level of non-financial information disclosure. High-quality ESG disclosure reduces information barriers, enhances reputation, and builds investor trust. It alleviates agency conflicts, improves green investment matching, and reduces resource waste from misallocation. It also signals compliance and sustainability, helping companies secure favorable terms in green credit and bonds, countering financial misallocation's negative effects. As China's ESG disclosure system improves, high-quality disclosers gain more policy support and market recognition, increasing resilience to resource misallocation. Thus, we propose:

H_{3c}: Information disclosure quality positively moderates the relationship between financial misallocation and corporate ESG performance.

3.Research Design

3.1 Sample Selection and Data Sources

The sample comprises A-share listed companies in Shanghai and Shenzhen from 2009 to 2022, screened as follows: (1) Exclude financial firms due to specialized accounting; (2) Exclude ST and ST* companies with abnormal financial or trading status; (3) Exclude samples with missing key variables; (4) Winsorize continuous variables at 1% and 99%. The final sample includes 29,369 observations. Data on financial misallocation (FM) is from CSMAR and Wind databases; ESG data uses Hua Zheng ESG ratings from Wind; financial expense data (interest, fees) is from Wind; other data from CSMAR. Statistical analysis uses Stata 17.0.

3.2 Regression Model

3.2.1 Baseline Regression Model

To test H1, we estimate:

$$ESG_{tij} = \beta_0 + \beta_1 FM_{tij} + \beta Control_{tij} + \delta_i + \theta_t + \tau_j + \varepsilon_{ijt} \quad (3\text{-}1)$$

Where ESG_{tij} is ESG performance, FM_{tij} is financial misallocation, δ_i is firm fixed effects, θ_t is year fixed effects, τ_j is industry fixed effects, and ε_{ijt} is the error term.

3.2.2 Mediation Effect Model

To test H2a–H2c, we use a three-step approach:

$$M_{tij} = \alpha_0 + \alpha_1 FM_{tij} + \alpha Control_{tij} + \delta_i + \theta_t + \tau_j + \varepsilon_{ijt} \quad (3\text{-}2)$$

$$ESG_{tij} = \gamma_0 + \gamma_1 FM_{tij} + \gamma_2 M_{tij} + \gamma Control_{tij} + \delta_i + \theta_t + \tau_j + \varepsilon_{ijt} \quad (3\text{-}3)$$

Where M_{it} represents mediators: supply chain concentration (SCC), debt financing cost (Dcost), or green innovation (GreenInnovation).

3.2.3 Moderation Effect Model

To test H3a–H3c, we add interaction terms:

$$ESG_{tij} = \omega_0 + \omega_1 FM_{tij} + \omega_2 D_{it} * FM_{tij} + \omega_3 D_{it} + \omega Control_{tij} + \delta_i + \theta_t + \tau_j + \varepsilon_{ijt} \quad (3\text{-}4)$$

where D_{it} represents moderators: operational risk (Z-Score), corporate transparency (Opacity), or information disclosure quality (Tran).

3.3 Variable Definitions

3.3.1 Dependent Variable

The explanatory variable in this study is corporate ESG performance. Currently, China lacks a unified ESG indicator system, and ESG performance data is primarily obtained from third-party research institutions. Domestically recognized ESG rating agencies include the Social Value Investment Alliance, SynTao Green Finance, Wind, and Hua Zheng. As Hua Zheng's ESG rating data is more aligned with the Chinese market, offers broader coverage, and provides higher timeliness, this study

adopts Hua Zheng's ESG ratings and dimensional assessments for constituents of the CSI 300 Index as the standard for measuring corporate ESG performance.

3.3.2 Independent Variable

Financial misallocation (FM), measured as the deviation of a firm's capital cost (interest expense / (liabilities - accounts payable)) from the industry average. Drawing on the methodologies of Ning Xueping & Zhang Qingjun[7], Shao Ting[8], and Zhou Yuhao et al.[9] Higher deviation indicates greater misallocation.

3.3.3 Control Variables

Firm age (ListAge, log of years since IPO), size (Size, log of revenue), profitability (ROA, net income / total assets), cash flow (Cashflow, operating cash flow / total assets), leverage (Lev, total liabilities / total assets), growth (Growth, revenue growth rate), and ownership concentration (Top1, percentage of shares held by largest shareholder).

3.3.4 Mediating Variables

Supply chain concentration (SCC): Average of top 5 suppliers' purchase ratio and top 5 customers' sales ratio.

Debt financing cost (Dcost): Net financial expenses (interest + fees) / total liabilities.

Green innovation (GreenInnovation): Number of green patent applications.

3.3.5 Moderating Variables

Operational risk (Z-Score): Altman Z-Score model[1].

Corporate transparency (Opacity): 1 if audited by Big Four, else 0.

Information disclosure quality (Tran): 1–4 based on Shenzhen Stock Exchange ratings (fail, pass, good, excellent).

Table 3-1 Variable Definitions and Measurement Methods

Category	Variable Meaning	Variable Symbol	Measurement Method
Dependent Variable	Corporate ESG Performance	ESG	Hua Zheng ESG ratings and dimensional assessments for constituents of the CSI 300 Index
Independent Variable	Financial Misallocation	FM	(Firm's capital cost − Industry average capital cost) / Industry average capital cost
Control Variables	Firm Age	ListAge	ln(Current year − Listing year + 1)
	Firm Size	Size	ln(Total Assets)
	Return on Assets	ROA	Net Profit / Average Total Assets
	Cash Flow Ratio	Cashflow	Net Cash Flow from Operating Activities / Total Assets
	Asset-Liability Ratio	Lev	Year-end Total Liabilities / Year-end Total Assets
	Revenue Growth Rate	Growth	(Current Year Operating Revenue / Previous Year Operating Revenue) − 1
	Shareholding Ratio of Largest Shareholder	Top1	Number of Shares Held by the Largest Shareholder / Total Shares
	Supply Chain Concentration	SCC	Average of the sum of the proportions of purchases from the top 5 suppliers and sales to the top 5 customers
Mediating Variables	Debt Financing Cost	Dcost	(Interest Expense + Handling Charges + Other Financial Expenses) / Total Liabilities at Period End
	Green Innovation	GreenInnovation	Number of Green Patent Applications Filed by the Enterprise in the Current Year
	Operational Risk	Z-Score	Calculated with reference to the Z-Score model proposed by Altman[1]
Moderating Variables	Corporate Transparency	Opacity	Equals 1 if the company hired a Big Four accounting firm as its annual report auditor in the current year, otherwise 0
	Information Disclosure Quality	Tran	Assessment results of corporate information disclosure quality from the Shenzhen Stock Exchange regulatory information disclosure system

3.4 Empirical Analysis

3.4.1 Descriptive Statistics

The sample contains 37,098 observations. Descriptive statistics are reported in Table 4-1.

Table 4-1 Descriptive Statistics

Variable	N	Mean	p50	SD	Min	Max
ESG	28992	4.043	4	1.108	1	8
FM	28992	0.0380	-0.0780	1.011	-4.747	17.78
Size	28992	22.11	21.92	1.266	19.41	26.45
Lev	28992	0.405	0.395	0.203	0.0270	0.927
ROA	28992	0.0420	0.0420	0.0690	-0.382	0.255
Cashflow	28992	0.0480	0.0460	0.0690	-0.224	0.283
Growth	28992	0.164	0.109	0.383	-0.653	3.894
Top1	28992	0.333	0.310	0.144	0.0810	0.758
ListAge	28992	2.025	2.079	0.896	0	3.401

3.4.2 Correlation and Multicollinearity Analysis

Correlation coefficients (Table 4-2) show no severe multicollinearity (all VIFs < 2, mean VIF = 1.39).

Table 4-2 Correlation Matrix of Main Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) FM	1.000							
(2) Size	0.041***	1.000						
(3) Lev	0.233***	0.503***	1.000					
(4) ROA	-0.240***	-0.014**	-0.373***	1.000				
(5) Cashflow	-0.093***	0.085***	-0.149***	0.390***	1.000			
(6) Growth	-0.041***	0.042***	0.028***	0.275***	0.033***	1.000		
(7) Top1	-0.123***	0.128***	0.015***	0.150***	0.088***	0.013**	1.000	
(8) ListAge	0.085***	0.477***	0.384***	-0.255***	0.026***	-0.076***	-0.096***	1.000

Note: *、** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Table 4-3 Results of Multicollinearity Test

Variable	VIF	1/VIF
Lev	1.73	0.576559
Size	1.72	0.582584
ROA	1.65	0.604641
ListAge	1.47	0.680241
Cashflow	1.22	0.819869
Growth	1.12	0.894901
FM	1.10	0.906307
Top1	1.08	0.927473
Mean VIF	1.39	

3.4.3 Baseline Regression Results

We examined the direct impact of financial misallocation (FM) on corporate ESG performance. Table 4-4 reports the regression results. Column (1) presents estimates based on a random-effects model without incorporating control variables, showing a coefficient of -0.1615 for FM's effect on ESG, which is significant at the 1% level. Column (2) reports estimates without control variables but with time effects controlled. Column (3) lists estimates without control variables but accounts for industry effects. Column (4) provides estimates without control variables while considering city effects. Building on these findings, we further investigated the correlation between FM and ESG, as shown in Column (5). Finally, all control variables were integrated into the baseline model in Column (6), where the estimated coefficient for FM is -0.1165. The results indicate that the core variable's coefficient is negative and significant, passing the 1% significance test, thereby reinforcing Hypothesis H1. These findings demonstrate that the widespread issue of FM in enterprises significantly suppresses corporate ESG performance.。

Table 4-4 Regression Results of FM on ESG

	(1) ESG	(2) ESG	(3) ESG	(4) ESG	(5) ESG	(6) ESG
FM	-0.1615***	-0.1632***	-0.1629***	-0.1458***	-0.1509***	-0.1165***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)
Size						0.2868***
						(0.007)
Lev						-0.5931***
						(0.043)
ROA						1.5232***
						(0.120)
Cashflow						0.2142**
						(0.100)
Growth						-0.0404**
						(0.017)
Top1						0.3348***
						(0.046)
ListAge						0.0637***
						(0.010)
_cons	4.0489***	4.0490***	4.0489***	4.0484***	4.0486***	-2.3619***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.133)
Year		√			√	√
Industry			√		√	√
province				√	√	√
N	28992.0000	28992.0000	28992.0000	28959.0000	28959.0000	28959.0000
r2	0.0217	0.0408	0.0484	0.0932	0.1375	0.2291

Note: Figures in ( ) are robust standard errors ∗、 ∗∗ and ∗∗∗ denote significance at the 10%, 5%, and 1% levels, respectively. Results in columns (1) – (5) do not include control variables.

3.4.4 Mediation Effect Tests

To examine the mediating role of supply chain concentration (SCC) in the relationship between FM and ESG, this study employs a mediation effect testing approach. The results show that the direct effect of FM on ESG is -0.1165. The coefficient of FM on SCC is 0.8685, indicating that financial misallocation significantly increases supply chain concentration. After including both FM and SCC in the model, SCC exerts a significant negative impact on ESG, and the absolute value of the FM coefficient decreases, suggesting that SCC plays a partial mediating role between FM and ESG. When all mechanism

variables are incorporated into the model simultaneously, the coefficient of FM further declines, again supporting the validity of SCC's mediating effect.

Table 4-5 The Mediating Role of SCC

	(1) ESG	(2) SCC	(3) ESG	(4) ESG
FM	-0.1165***	0.8685***	-0.1113***	-0.0895***
	(0.009)	(0.118)	(0.008)	(0.009)
SCC			-0.0059***	-0.0056***
			(0.000)	(0.000)
Dcost				-2.1324***
				(0.546)
GreenInnovation				0.0966***
				(0.008)
_cons	-2.3619***	109.2184***	-1.7128***	-1.0384***
	(0.133)	(2.136)	(0.139)	(0.149)
Covariates	√	√	√	√
Year	√	√	√	√
province	√	√	√	√
Industry	√	√	√	√
N	28959.0000	28959.0000	28959.0000	28959.0000
r2	0.2291	0.2705	0.2352	0.2406

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Debt Financing Cost (Dcost).Both FM and the mechanism variable (Dcost) exert adverse effects on ESG (as shown in Column (3)). Moreover, the absolute value of the FM coefficient in Column (3) is smaller than that in Column (1), indicating that Dcost plays a mediating role in the FM–ESG relationship. Furthermore, after incorporating all mechanism variables into the equation to observe changes in the FM coefficient, we found a slight decrease in its absolute value. In summary, these results support the mediating effect of Dcost between financial misallocation and corporate ESG performance.

Table 4-6 The Mediating Role of Debt Financing Cost

	(1) ESG	(2) Dcost	(3) ESG	(4) ESG
FM	-0.1165***	0.0093***	-0.0932***	-0.0895***
	(0.009)	(0.001)	(0.010)	(0.009)
Dcost			-2.5127***	-2.1324***
			(0.612)	(0.546)
SCC				-0.0056***
				(0.000)
GreenInnovation				0.0966***
				(0.008)
_cons	-2.3619***	0.0070***	-2.3443***	-1.0384***
	(0.133)	(0.002)	(0.133)	(0.149)
Covariates	√	√	√	√
Year	√	√	√	√
province	√	√	√	√
Industry	√	√	√	√
N	28959.0000	28959.0000	28959.0000	28959.0000
r2	0.2291	0.3734	0.2304	0.2406

Note: Figures in ( ) are robust standard errors *、** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Third, Green Innovation (GreenInnovation). Both FM and the mechanism variable, green innovation, exert adverse effects on ESG (as shown in Column (3)). Furthermore, the coefficient of FM in Column (3) is smaller than that in Column (1), indicating that green innovation plays a mediating role in the FM–ESG relationship. Additionally, when all mechanism variables are incorporated into the equation to examine changes in the FM coefficient, a slight decrease in its absolute value is observed. In summary, these results support the mediating effect of green innovation between financial misallocation and corporate ESG performance.

Table 4-7 The Mediating Role of Green Innovation

	(1)	(2)	(3)	(4)
	ESG	**GreenInnovation**	**ESG**	**ESG**
FM	-0.1165***	-0.0240***	-0.1141***	-0.0895***
	(0.009)	(0.005)	(0.009)	(0.009)
GreenInnovation			0.1022***	0.0966***
			(0.008)	(0.008)
SCC				-0.0056***
				(0.000)
Dcost				-2.1324***
				(0.546)
_cons	-2.3619***	-7.1569***	-1.6303***	-1.0384***
	(0.133)	(0.143)	(0.144)	(0.149)
Covariates	√	√	√	√
Year	√	√	√	√
province	√	√	√	√
Industry	√	√	√	√
N	28959.0000	28959.0000	28959.0000	28959.0000
r2	0.2291	0.3222	0.2339	0.2406

Note: Figures in ( ) are robust standard errors *、** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.5 Moderation Effect Tests

This study introduces three moderating variables—operational risk (Z-Score), corporate transparency (Opacity), and information disclosure quality (Tran)—to examine their influence on the relationship between financial misallocation (FM) and corporate ESG performance. As shown in Table 4-8, the interaction term between operational risk and FM has a coefficient of 0.0011, significant at the 1% level, indicating that lower operational risk amplifies the positive impact of financial misallocation on corporate ESG performance, thus supporting H3a. The interaction term for corporate transparency shows a coefficient of -0.0796, significant at the 5% level, suggesting that higher transparency significantly mitigates the negative effect of financial misallocation, validating H3b. In contrast, the interaction term for information disclosure quality has a coefficient of 0.0309, significant at the 5% level but contrary to expectations, implying that higher disclosure quality strengthens the negative impact of financial misallocation. A possible explanation is that while enhanced disclosure improves information availability, it also intensifies external pressure, prompting firms to adopt short-term strategies or conceal substantive issues to manage stakeholder scrutiny, ultimately adversely affecting ESG performance.

Table 4-8 Regression Results of Moderating Effects

	(1)	(2)	(3)
	ESG	ESG	ESG
FM	-0.1250***	-0.1145***	-0.1884***
	(0.009)	(0.009)	(0.041)
Z-Score	0.0004		
	(0.000)		
Z-Score*FM	0.0011***		
	(0.000)		
Opacity		0.0293	
		(0.030)	
Opacity*FM		-0.0796**	
		(0.037)	
Tran			0.4072***
			(0.011)
Tran*FM			0.0309**
			(0.013)
_cons	-2.3561***	-2.3102***	-2.2629***
	(0.134)	(0.139)	(0.128)
Year	√	√	√
Industry	√	√	√
province	√	√	√
N	28,959	28,959	28,959
r2	0.2294	0.2293	0.2685

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.6 Heterogeneity Analysis

3.4.6.1 Firm Size

Given that enterprises of different sizes vary in financial capacity and development strategies, the constraining effect of FM on ESG may also differ. This study examines the heterogeneous impact of firm size on corporate ESG performance. Based on the annual average size of listed companies, firms with an average size greater than the median value of 22.093 are classified as large-scale enterprises, while those with an average size less than or equal to the median value of 22.109 are classified as small-scale enterprises. A grouped regression of Model (4-1) was conducted, with results presented in Table 4-9. The FM coefficient for large enterprises is -0.132, and for small and medium-sized enterprises it is -0.107, both statistically significant at the 1% level, indicating that FM has a more pronounced negative impact on the ESG performance of large enterprises.

The reasons for this discrepancy may include the following: First, although large enterprises have easier access to financing, financial misallocation may lead to capital surplus, resulting in resource waste or increased non-ESG investments. Second, large enterprises face more severe agency problems, where management may prioritize short-term gains over long-term investments such as ESG initiatives. Third, the complex organizational structures of large enterprises make the implementation and monitoring of ESG measures more challenging. Fourth, large enterprises are often concentrated in traditional high-pollution industries, where transition costs are high, and financial misallocation further undermines their motivation for green transformation. Finally, large enterprises tend to rely more heavily on traditional financing channels, lacking intrinsic incentives to access sustainable financial resources by improving their ESG performance.

Table 4-9 Heterogeneity Analysis: Grouped Regression by Firm Size

	(1)	(2)
VARIABLES	**Large Firms**	**SMEs**
FM	-0.132***	-0.107***
	(-9.20)	(-10.26)
Size	0.336***	0.329***
	(30.17)	(20.16)
Lev	-0.516***	-0.632***
	(-7.48)	(-11.01)
ROA	2.446***	0.982***
	(12.68)	(6.43)
Cashflow	0.066	0.200
	(0.44)	(1.49)
Growth	-0.114***	0.019
	(-4.93)	(0.78)
Top1	0.196***	0.476***
	(3.04)	(7.08)
ListAge	0.029*	0.094***
	(1.65)	(6.96)
Constant	-3.497***	-3.279***
	(-14.75)	(-9.73)
Observations	12,643	16,295
R-squared	0.283	0.190

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.6.2 Ownership Nature

To examine the impact of ownership nature on the relationship between FM and ESG, this study conducts grouped regressions for state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs). The results (Table 4-10) show that the coefficient of financial misallocation is -0.0696 for SOEs and -0.1221 for non-SOEs, both significant at the 1% level, indicating that financial misallocation has a stronger inhibitory effect on the ESG performance of non-SOEs. This finding, to some extent, validates the existence of "ownership discrimination."

The main reasons for this difference may be as follows: SOEs, due to their state-owned attributes, have easier access to formal financing channels and government subsidies, resulting in a higher degree of resource redundancy. Meanwhile, SOEs bear more policy and social responsibilities (e.g., carbon neutrality, employment security), and their ESG behaviors are often incorporated into government assessment systems. Consequently, management tends to prioritize long-term strategies and social objectives, ensuring ESG-related investments even under financial misallocation. Additionally, SOEs are subject to stricter regulatory and policy constraints, which strengthen their motivation for ESG governance. In contrast, non-SOEs are more market-driven and, under financial misallocation, tend to focus on short-term profits, making them more likely to reduce long-term investments such as ESG initiatives.

Table 4-10 Heterogeneity Analysis: Grouped Regression by Ownership Type

	(1)	(2)
VARIABLES	**SOEs**	**Non-SOEs**
FM	-0.0696***	-0.1221***
	(0.014)	(0.010)
Size	0.3291***	0.2563***
	(0.010)	(0.009)
Lev	-0.7554***	-0.5180***
	(0.074)	(0.053)
ROA	1.4956***	1.5153***
	(0.252)	(0.137)
Cashflow	-0.1005	0.2826**
	(0.170)	(0.122)
Growth	-0.0783***	-0.0134
	(0.030)	(0.020)
Top1	0.1775**	0.1857***
	(0.083)	(0.059)
ListAge	0.0716***	0.0546***
	(0.023)	(0.014)
Constant	-3.1823***	-1.6686***
	(0.218)	(0.186)
Observations	8,104	20,849
R-squared	0.3824	0.2052

Note: Figures in ( ) are robust standard errors *、** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.6.3 Region

To examine the impact of regional differences on the relationship between financial misallocation and corporate ESG performance, this study divides the sample into three subsamples based on company location—eastern, central, and western regions—for regression analysis. The results (Table 4-11) are as follows:

Table 4-11 Heterogeneity Analysis: Grouped Regression by Firm Location

	(1)	(2)	(3)
VARIABLES	**Eastern**	**Central**	**Western**
FM	-0.1063***	-0.1578***	-0.1722***
	(0.010)	(0.022)	(0.037)
Size	0.2816***	0.2786***	0.3139***
	(0.008)	(0.017)	(0.020)
Lev	-0.5999***	-0.7669***	-0.4295***
	(0.053)	(0.109)	(0.128)

	(1)	(2)	(3)
VARIABLES	Eastern	Central	Western
ROA	1.6307***	0.7661**	1.4654***
	(0.146)	(0.298)	(0.368)
Cashflow	0.3300***	0.0273	-0.2274
	(0.124)	(0.232)	(0.314)
Growth	-0.0265	-0.0402	-0.0843*
	(0.022)	(0.037)	(0.044)
Top1	0.4046***	0.0463	0.1382
	(0.057)	(0.113)	(0.142)
ListAge	0.0767***	0.0749***	0.0049
	(0.013)	(0.026)	(0.031)
Constant	-2.2631***	-2.1020***	-2.9304***
	(0.164)	(0.350)	(0.409)
Observations	19,203	4,821	3,174
R-squared	0.2157	0.2790	0.3036

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

As shown in Table 4-11, the FM coefficient is -0.1063 in the eastern region, -0.1578 in the central region, and -0.1722 in the western region, all statistically significant at the 1% level. This indicates that the inhibitory effect of financial misallocation on ESG increases progressively from east to west, with the most pronounced impact observed in the western region.

The primary reasons for this regional disparity are as follows: In the western region, the financial system is relatively underdeveloped, capital markets are less mature, and financing channels are limited. Credit allocation tends to favor state-owned enterprises or large-scale projects, exacerbating financing constraints and resource misallocation for small and medium-sized enterprises (SMEs), thereby significantly restricting their ESG investments. Additionally, the western economy relies heavily on resource-intensive industries, which inherently entail higher ESG risks. Financial misallocation further channels funds toward high-pollution and high-energy-consumption sectors, intensifying environmental pressures and suppressing overall ESG. In contrast, the eastern region benefits from a more advanced economy, superior institutional environments, and stronger government support. Enterprises there possess greater motivation and resources for ESG implementation, and their industrial structure is more diversified and environmentally oriented, which helps mitigate the negative impact of financial misallocation to some extent. Consequently, the inhibitory effect of financial misallocation on ESG is more pronounced in the western region.

3.4.7 Endogeneity Tests

3.4.7.1 Interactive Fixed Effects

This study may still suffer from bias due to omitted variables. Additionally, potential reverse causality between FM and ESG cannot be ruled out. To mitigate the impact of endogeneity on the conclusions, beyond the firm and time fixed effects controlled for earlier, we further incorporate industry-year interaction fixed effects to re-estimate the baseline regression, thereby accounting for unobserved heterogeneity. As shown in Column (1) of Table 4-12, the core variable FM remains significantly negative.。

Table 4-12 Regression Results with Interactive Fixed Effects

	(1)	(2)
VARIABLES	**ESG**	**ESG**
FM	-0.1202***	-0.1165***
	(0.009)	(0.009)
Size	0.2837***	0.2868***
	(0.006)	(0.007)
Lev	-0.5919***	-0.5931***
	(0.042)	(0.043)
ROA	1.6054***	1.5232***
	(0.120)	(0.120)
Cashflow	0.3948***	0.2142**
	(0.099)	(0.100)
Growth	-0.0917***	-0.0404**
	(0.017)	(0.017)
Top1	0.2894***	0.3348***
	(0.045)	(0.046)
ListAge	0.0320***	0.0637***
	(0.010)	(0.010)
Year	×	√
Industry	×	√
province	×	√
Year*Industry	√	×
N	28,992	28,959
r2	0.9407	0.2291

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.7.2 Instrumental Variables (IV)

To address potential measurement errors in the FM indicator, this study employs an instrumental variable (IV) approach for re-estimation. A new proxy variable for financial misallocation (FM2) is constructed, defined as the deviation of a firm's capital cost from the industry average, scaled by one minus the industry percentile of the firm's earnings before interest and taxes (EBIT) return rate. After applying two-stage least squares (2SLS) regression, FM2 remains significantly negative at the 1% level, indicating that the inhibitory effect of financial misallocation on corporate ESG performance remains robust after controlling for measurement errors, thereby further supporting the baseline conclusions.

Table 4-13 Instrumental Variable Regression Results

	(1)	(2)
	First Stage	Second Stage
VARIABLES	FM	ESG
FM		-0.201***
		(0.0335)
FM2	0.772***	
	(0.1569)	
Size	0.002	0.292***
	(0.0225)	(0.0219)
Lev	0.768***	-0.918***
	(0.0819)	(0.0829)
ROA	-1.215***	0.0544
	(0.1338)	(0.132)
Cashflow	0.709***	-0.220**
	(0.1264)	(0.103)
Growth	-0.072***	-0.0267*
	(0.0148)	(0.0149)
Top1	-0.595***	1.183***
	(0.1192)	(0.148)
ListAge	-0.049*	0.721***
	(0.0268)	(0.0299)
Year	√	√
Industry	√	√
province	√	√
N	28,579	28,579
r2		0.118
F-value		42.83
Kleibergen-Paap rk LM		118.314
underidentification		[0.000]
Kleibergen-Paap rk Wald F		24.183
weak instrument		{16.38}
Hansen J		0.000

Note: Figures in ( ) are robust standard errors ∗、 ∗∗ and ∗∗∗ denote significance at the 10%, 5%, and 1% levels, respectively. Values in [ ] represent the p-values of each statistic, while values in { } indicate the critical values of the Stock-Yogo test at the 10% significance level.。

To validate the effectiveness of the instrumental variables, this study conducted underidentification, weak instrument, and overidentification tests. The Kleibergen-Paap rk LM test rejected the null hypothesis of "instrumental variable underidentification" (p=0.000). The Kleibergen-Paap rk Wald F statistic was 24.183, exceeding the Stock-Yogo test critical value at the 10% level, thus ruling out weak instrument concerns. The Hansen J test indicated that the instrumental variables are exogenous (p=0.000). In the first stage, FM2 showed a significant correlation with FM. In the second stage, the coefficient of FM was -0.201 and significant at the 1% level, demonstrating that the inhibitory effect of financial misallocation on corporate ESG performance remains robust after controlling for endogeneity.

3.4.7.3 Propensity Score Matching (PSM)

To mitigate the endogeneity arising from firm characteristic differences affecting ESG performance, this study employs the Propensity Score Matching (PSM) method to address sample selection bias. Firms in the top 10% of ESG scores are designated as the treatment group, with the remainder serving as the control group. Covariates including firm size, leverage, profitability, cash flow, growth, ownership concentration, and listing age are used to estimate propensity scores via a logit model. Nearest-neighbor matching is then applied to construct a comparable sample with similar characteristics, enabling a more accurate identification of the net effect of financial misallocation on ESG performance.

Using the above PSM approach, 4,857 matched samples are obtained. As shown in Table 4-14, the balance tests indicate that after matching, the p-values of all characteristic variables are insignificant, demonstrating a successful matching outcome with no significant differences in the covariates between the treatment and control groups.

Table 4-14 PSM Balance Test

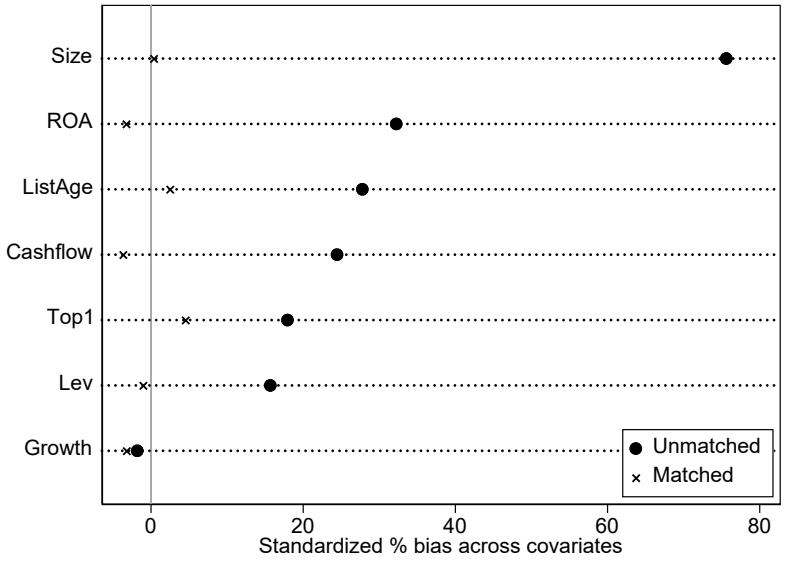
Covariate		Mean			t-test	
	Matching Status	Treatment	Control	%Bias	t-value	p-value
Size	U	23.072	22.012	75.6	42.36	0.000
	M	23.072	23.067	0.3	0.11	0.909
Lev	U	0.43346	0.40234	15.7	7.53	0.000
	M	0.43346	0.43555	-1.1	-0.38	0.707
ROA	U	0.06037	0.03991	32.2	14.58	0.000
	M	0.06037	0.06244	-3.3	-1.25	0.211
Cashflow	U	0.0628	0.04621	24.4	11.91	0.000
	M	0.0628	0.06531	-3.7	-1.32	0.188
Growth	U	0.15875	0.16498	-1.8	-0.80	0.425
	M	0.15875	0.16986	-3.2	-1.29	0.196
Top1	U	0.35754	0.33063	17.9	9.16	0.000
	M	0.35754	0.35076	4.5	1.58	0.113
ListAge	U	2.24	2.0033	27.8	13.00	0.000
	M	2.24	2.2189	2.5	0.91	0.360

Subsequently, this study conducts a regression based on the propensity score-matched sample using Model (4-1), with the results presented in Table 4-15. The coefficient for FM is -0.1052 and remains significant at the 1% level, indicating that even after controlling for differences in the main characteristic variables of enterprises with varying ESG performance, actively mitigating financial misallocation can still enhance ESG performance. This finding confirms that the research conclusions drawn from the full-sample model analysis are robust.

Table 4-15 Propensity Score Matching: Regression Results of Financial Misallocation on Corporate ESG Performance

	(1)	(2)
	Full Sample	**PSM Matched Sample**
VARIABLES	ESG	ESG
FM	-0.1165***	-0.1052***
	(0.009)	(0.026)
Size	0.2868***	0.1358***
	(0.007)	(0.020)
Lev	-0.5931***	-0.3388**
	(0.043)	(0.147)
ROA	1.5232***	0.4718
	(0.120)	(0.439)
Cashflow	0.2142**	0.3388
	(0.100)	(0.335)
Growth	-0.0404**	-0.0666
	(0.017)	(0.064)
Top1	0.3348***	0.2850**
	(0.046)	(0.122)
ListAge	0.0637***	0.1150***
	(0.010)	(0.032)
Constant	-2.3619***	1.5969***
	(0.133)	(0.391)
Year	√	√
Industry	√	√
province	√	√
N	28,959	4,553
r2	0.2291	0.2331
F	474.73	17.55

Note: Figures in ( ) are robust standard errors ∗、∗∗ and ∗∗∗ denote significance at the 10%, 5%, and 1% levels, respectively.



3.4.8 Robustness Checks

3.4.8.1 Alternative ESG Measures

The dependent variable in this study is ESG. To conduct robustness checks, alternative measures of ESG are employed. First, the scoring method for Hua Zheng ESG ratings is modified: whereas the original rating scale (C to AAA) was assigned values from 1 to 9, the revised approach groups CCC, CC, and C as 1; BBB, BB, and B as 2; and AAA, AA, and A as 3, resulting in the variable ESG_2. Second, the one-period lagged Hua Zheng ESG rating is used as an alternative measure, denoted as L.ESG. Table 4-17 reports the regression results using these alternative dependent variables. The coefficients for FM are -0.0271 and -0.0560, respectively, both remaining significantly negative. These results further support Hypothesis 1, indicating that financial misallocation inhibits corporate ESG performance.

Table 4-16 Robustness Test: Replacing the Dependent Variable

	(1)	(2)
VARIABLES	**ESG_2**	**L.ESG**
FM	-0.0271***	-0.0560***
	(0.003)	(0.007)
Size	0.0915***	0.2900***
	(0.003)	(0.008)
Lev	-0.2560***	-0.5323***
	(0.018)	(0.047)
ROA	0.7667***	1.2668***
	(0.051)	(0.128)
Cashflow	-0.0603	0.2328**
	(0.040)	(0.112)
Growth	-0.0426***	-0.0495***
	(0.007)	(0.019)
Top1	0.0722***	0.2676***
	(0.018)	(0.051)
ListAge	-0.0849***	0.0308**
	(0.003)	(0.013)
_cons	-0.0303	-2.3917***
	(0.054)	(0.149)
Year	√	√
Industry	√	√
province	√	√
N	28,959	24,082
r2	0.1713	0.2126

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

3.4.8.2 Lagged FM

The core explanatory variable in this study is FM. Given that many economic and social phenomena exhibit time-lagged effects, the current period's dependent variable may be influenced not only by contemporaneous explanatory variables but also by their past values. To account for this dynamic, the one-period lagged FM (L.FM) is used as an alternative explanatory variable. As reported in Table 4-17, the coefficient of L.FM is -0.0874, which remains significantly negative at the 1% level. This result is consistent with previous findings and provides further support for Hypothesis H1.

Table 4-17 Robustness Test: Replacing the Explanatory Variable

	(1)
VARIABLES	**ESG**
L.FM	-0.0874***
	(0.007)
Size	0.3223***
	(0.007)
Lev	-0.7314***
	(0.044)
ROA	2.1710***
	(0.125)
Cashflow	-0.2349**
	(0.102)
Growth	-0.1097***
	(0.018)
Top1	0.2800***
	(0.046)
ListAge	-0.2296***
	(0.010)
_cons	-2.3672***
	(0.137)
Year	√
Industry	√
province	√
N	24,082
r2	0.2722

Note: Figures in ( ) are robust standard errors *、 ** and *** denote significance at the 10%, 5%, and 1% levels, respectively.

4.Conclusions and Policy Implications

4.1 Conclusions

Based on an empirical analysis of data from China's A-share listed companies spanning 2009 to 2022, this study demonstrates that financial misallocation significantly inhibits corporate ESG performance—a conclusion that remains robust after a series of rigorous tests. Mechanistically, financial misallocation impedes ESG development primarily through three channels: intensifying supply chain concentration, increasing debt financing costs, and suppressing corporate green innovation. Moderating effect analysis reveals that corporate operational risk exacerbates this negative impact, whereas corporate transparency and information disclosure quality effectively mitigate the adverse effects of financial misallocation. Heterogeneity analysis further indicates that the inhibitory effect of financial misallocation is more pronounced in non-state-owned enterprises, large firms, and enterprises located in the western region, reflecting the profound constraints imposed by

"ownership discrimination," "scale discrimination," and regional financial development disparities on ESG practices.

4.2 Policy Recommendations

Based on the research findings, this study proposes the following policy recommendations: Governments should deepen green financial reforms, improve the development of green credit and green bond markets, and guide more capital toward enterprises with leading ESG performance and green innovation sectors, thereby enhancing the efficiency of financial resource allocation at the source. Differentiated support policies should be implemented, such as establishing specialized green credit programs and fiscal incentives for non-state-owned enterprises, small and medium-sized enterprises, and firms in the western region, to alleviate their financing constraints and enhance their ESG implementation capabilities.

Simultaneously, regulatory oversight of corporate ESG information disclosure and transparency should be strengthened, promoting the establishment of a unified and comparable ESG evaluation system to reduce information asymmetry and bolster market confidence. Furthermore, enterprises should be encouraged to optimize their supply chain structures, foster regional collaboration, and advance green industrial transformation. By integrating capacity-building initiatives, performance incentives, and ESG metrics into corporate evaluation systems, a virtuous cycle of "innovation–disclosure–financing" can be established, comprehensively elevating the sustainable development capacity of enterprises.

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No

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

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