

Can Short-Selling Mechanisms Improve Corporate ESG Performance?

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Abstract

This study examines whether the imposition of short-selling pressure acts as a catalyst for optimizing corporate ESG performance in China's capital market. Using data from Chinese A-share listed firms from 2009 to 2024, this paper scrutinizes the governance outcomes of short-selling mechanisms under the margin trading and securities lending system. Our empirical findings demonstrate that firms exposed to greater short-selling pressure exhibit significantly better ESG performance. This conclusion remains robust after a battery of endogeneity treatments and robustness checks. Further analysis suggests that this positive external effect is far more pronounced among private (non-state-owned) enterprises and those situated in environmentally sensitive (highly polluting) sectors. Mechanism analysis indicates that short-selling pressure improves ESG performance mainly through enhancing information transparency and strengthening governance constraints. By increasing external market discipline, short selling encourages firms to pay greater attention to long-term sustainability practices and non-financial risk management. Overall, this research enriches the existing literature on ESG frameworks and capital market governance by providing evidence from an emerging market context and highlighting factors shaping firms' sustainability behavior.

Keywords

Short Selling; ESG Performance; External Governance; Information Transparency; Sustainability.

1. Introduction

In contemporary global capital markets, corporate performance regarding environmental, social, and governance (ESG) factors is recognized as a vital determinant of business success.[1-2](Godfrey 2005; Lins et al., 2017) In addition to financial performance, investors and regulators are paying growing attention to firms' sustainability practices, governance quality, and long-term risk management capabilities. As ESG-related information becomes more closely linked to firm valuation and investment decisions, identifying the determinants of corporate ESG performance has attracted substantial academic interest.

At the same time, the expansion of short-selling mechanisms has significantly changed the way capital markets discipline corporate behavior[3-4](Diamond & Verrecchia, 1987; Bris et al., 2007). By allowing negative information to be incorporated into stock prices more efficiently, short selling enhances price discovery and strengthens external monitoring. Firms facing potential short-selling pressure may therefore have stronger incentives to improve transparency, reduce opportunistic behavior, and pay greater attention to long-term corporate reputation and sustainability performance.

Existing studies primarily examine the financial implications of short selling[5-6](Karpoff & Lou, 2010; Chu & Fang, 2016) regarding market efficiency, earnings management, stock price

informativeness, and corporate innovation. Although recent scholarship has commenced investigating the nexus linking capital market discipline and ESG-related activities, empirical evidence on whether short-selling pressure improves firms' ESG performance remains relatively limited, especially in emerging markets.

China provides an appropriate institutional setting[6](Chu & Fang, 2016) for examining this issue. Since the implementation of the margin trading and securities lending system, China's short-selling market has gradually expanded through several rounds of policy reform. Meanwhile, ESG investment has also received increasing attention from regulators, institutional investors, and listed firms. Under this institutional background, examining whether short-selling pressure affects firms' ESG behavior can deepen the understanding of how external capital market governance influences corporate sustainability practices.

Using Chinese A-share listed firms from 2009 to 2024 as the research sample, this study investigates whether short-selling mechanisms enhance corporate ESG outcomes. Furthermore, this paper explores the underlying pathways through which short-selling threats propagate to alter ESG outcomes, focusing on governance constraints and information transparency.

This study offers a threefold contribution to current academic discussions. First, we expand the established body of knowledge regarding ESG determinants by introducing short selling as an external governance mechanism affecting firms' non-financial behavior. Second, leveraging the institutional landscape of China's margin trading system, this research delivers evidence from an emerging market setting. Third, this paper further examines the potential concrete pathways bridging short selling and ESG performance, thereby offering additional insights into the governance role of capital markets.

Against this backdrop, the central research question of this paper is: Can short-selling mechanisms improve corporate ESG performance? Specifically, this paper will address the following three dimensions: First, it will empirically test the causal link connecting short-selling exposure to corporate ESG performance; second, it will examine the heterogeneous governance outcomes across varying ownership structures and pollution levels; third, it will reveal the underlying mechanisms through which short-selling mechanisms influence corporate ESG performance through two distinct lenses: the "information effect" and the "governance effect." Compared to existing research, the innovation of this paper lies primarily in the following three aspects:

(1) Expansion of the research perspective: Existing studies on ESG drivers have largely focused on internal governance characteristics. This paper introduces the short-selling mechanism—an external constraint tool from the capital market—into the ESG research framework, thereby deepening the understanding of the formation mechanism of corporate ESG behavior from a market oversight perspective.

(2) Empirical testing within an institutional context: Grounded in the implementation of China's margin trading system, this study utilizes data from A-share listed companies to systematically evaluate how short-selling intensity shapes corporate ESG profiles reconciles a critical omission in existing research regarding the interplay between short-selling and non-financial behavior in the Chinese context.

(3) In-Depth Mechanism Analysis: This paper not only verifies the direct impact but also provides an in-depth analysis of the transmission channels. The study finds that increased analyst attention (ANAC) and strengthened corporate governance constraints (Mngmhldn) are the key transmission channels through which the short-selling mechanism influences ESG, thereby elevating the research conclusions from "correlation" to "causality" and "mechanism."

2. Literature Review

2.1. Short Selling and External Market Governance

A large body of literature suggests that short-selling mechanisms improve market efficiency and strengthen external corporate governance. By relaxing short-selling constraints, accelerates the impoundment of pessimistic insights into equity valuations, thereby optimizing the price discovery process and curbing asset overvaluation. Informed short sellers are often regarded as sophisticated market participants with strong incentives to identify firms' hidden risks and governance problems.

Prior studies also indicate that short-selling pressure can influence firms' managerial behavior[5](Karpoff & Lou, 2010). The possibility of becoming a short-selling target increases managers' reputational and financing concerns, which may discourage opportunistic activities such as earnings manipulation, excessive overinvestment, and financial misconduct. In this sense, short selling serves not only as a pricing mechanism but also as an external monitoring force within capital markets.

However, the governance effects of short selling may vary across institutional environments. In emerging markets, where short-selling systems remain relatively constrained and market structures differ from developed economies, the effectiveness of short-selling discipline remains an open empirical question.

2.2. ESG Performance and Capital Market Consequences

Existing ESG literature mainly focuses on the economic consequences of firms' sustainability activities. Previous studies generally argue that strong ESG performance contributes to firm value by improving stakeholder relationships, reducing financing costs, and enhancing long-term risk management capabilities. [7](Xie Hongjun.,2022)

ESG engagement may also function as a form of reputational insurance during periods of market uncertainty.

At the same time, some studies suggest that ESG activities can mitigate information asymmetry[8-9](Xu et al., 2024; Shuai, 2022) and strengthen investor confidence through improved disclosure quality and corporate transparency. Firms with stronger ESG performance are often associated with more stable stock returns and lower crash risk.

Nevertheless, the literature does not reach a fully consistent conclusion regarding the market implications of ESG. Some researchers argue that ESG investment may also create agency problems or contribute to stock overvaluation under certain conditions. As a result, the interaction connecting ESG compliance with capital market dynamics continues to elicit significant academic debate.

2.3. Short Selling and ESG Performance

Recent studies have gradually linked short-selling mechanisms with firms' ESG-related behavior. Existing evidence generally suggests that short-selling pressure may encourage firms to improve governance quality[10](Chen et al., 2024), strengthen information disclosure, and reduce behaviors that could trigger negative market reactions.

From the governance perspective, firms facing stronger short-selling pressure may become more cautious regarding environmental violations, social responsibility issues, and governance deficiencies. From the information perspective, short sellers' incentives to uncover hidden risks may further improve firms' disclosure quality and transparency.

However, current evidence remains limited and inconclusive, particularly in the context of China's capital market.[11](Xu Liping 2023) Some studies argue that better ESG performance may itself attract short sellers because ESG-related activities could contribute to stock overvaluation or managerial opportunism[12](Li Jun, Liu Hongwei, Li Jingwen.) Therefore, the

nexus bridging short-selling options and corporate sustainability investments warrants more rigorous empirical scrutiny.

3. Research Hypotheses

Conducted within the framework of China's financial markets, this investigation concentrates on verifying whether the presence of short-selling institutions can effectively upgrade corporate ESG metrics and to disentangle the specific governing ramifications of short selling on corporate ESG practices through an external monitoring perspective in capital markets.

Integrating the aforementioned theoretical deductions with prior empirical insights, this paper formulates the subsequent hypotheses to test the explicit interactions linking short-selling exposure with corporate ESG performance:

In a traditional, one-sided long-only market environment, negative information often fails to be promptly incorporated into the price system, and the external market constraints faced by corporate management are relatively limited. The introduction of short-selling mechanisms alters this institutional structure, enabling investors to express negative expectations regarding a firm's future value through short selling, thereby enhancing market price discovery efficiency. According to the efficient market hypothesis, short selling helps accelerate the reflection of negative information, reduces stock price overvaluation, and strengthens the external governance functions of capital markets.

From a corporate governance perspective, ESG activities are characterized by their long-term and strategic nature, and their economic returns often lag behind the costs incurred. In the absence of effective oversight, management may reduce environmental protection investments or weaken social responsibility practices due to pressure from short-term performance evaluations. The short-selling mechanism increases the opportunity cost for companies to neglect their ESG responsibilities through channels such as potential downward pressure on stock prices, rising financing costs, and reputational risks for management. Consequently, to reduce the likelihood of being shorted and the resulting market penalties, corporate management has greater incentive to improve environmental governance, refine social responsibility frameworks, and optimize internal governance structures. Furthermore, from the perspective of long-term value creation, ESG performance is closely linked to an enterprise's long-term market edge. By strengthening the capital market's ability to price long-term corporate risks, the short-selling mechanism subjects firms to a more rational valuation environment. When the market can identify potential losses stemming from environmental risks, a lack of social responsibility, or governance failures, firms that neglect ESG initiatives will face higher valuation discounts. Consequently, the short-selling mechanism alters the corporate valuation framework to some extent, shifting the focus toward long-term performance rather than short-term profit maximization, thereby driving ESG improvements at the strategic level.

Synthesizing the analytical arguments presented above, the primary hypothesis (H1) is formulated as follows:

H1: Holding other parameters constant the introduction of short-selling mechanisms can significantly improve corporate ESG performance.

Grounded in agency framework principles, the divergence between corporate ownership and managerial control may lead management to pursue the maximization of personal interests, resulting in opportunistic behavior. Given the long return horizon of ESG investments, they are susceptible to being squeezed by management's short-term behavior. Short-selling mechanisms enhance market scrutiny of corporate behavior by introducing the oversight of professional investors.

On the one hand, short sellers typically possess strong information analysis capabilities and generate trading profits by identifying potential corporate risks. Companies with governance deficiencies, opaque disclosure practices, or environmental compliance risks are more likely to become targets of short selling. The potential threat of short selling prompts management to improve the quality of internal controls, reduce earnings management practices, and strengthen the independence and oversight functions of the board of directors. Existing research indicates that short-selling mechanisms can reduce the probability of financial fraud and enhance the quality of accounting information, thereby providing an institutional foundation for companies to improve their ESG performance. Furthermore, the short-selling mechanism may also play a governance role by improving the efficiency of board oversight and management accountability mechanisms. Under short-selling pressure, firms are more inclined to expand independent board representation, fortify the oversight capabilities of audit committees and advance internal control frameworks. These governance optimizations help reduce agency conflicts, increase decision-making transparency, and provide institutional safeguards for the implementation of ESG strategies. Therefore, improvements in corporate governance levels constitute a key intermediary pathway whereby the presence of short-selling options drives advancements in firm-level ESG metrics.

On the other hand, stock price volatility directly affects executive compensation incentives and equity value, prompting management to pay greater attention to long-term market evaluations. Against the backdrop of increased external governance pressures, firms are more inclined to increase environmental investments, fulfill social responsibilities, and optimize corporate governance structures. Thus, the short-selling mechanism indirectly promotes improvements in corporate ESG performance through the mediating variable of enhanced corporate governance.

Building upon the analytical framework established above, our second hypothesis (H2) is specified as follows:

H2: The short-selling mechanism, by strengthening external oversight and constraints in capital markets, prompts firms to improve their corporate governance standards, thereby enhancing their ESG performance.

Firms subject to short-selling pressure possess detailed non-financial information regarding their environmental and social responsibilities, whereas external investors incur significant costs in obtaining such information. If disclosure is insufficient, the market struggles to accurately assess a firm's ESG performance, and the firm lacks incentives to improve. Short-selling pressure may improve firms' disclosure incentives and increase market scrutiny, by intensifying the discovery and dissemination of negative information.

Short-selling investors are generally more sensitive to disclosure quality [10,13] (Chen et al., 2024; Duan, 2025) and governance risks. Firms facing stronger short-selling pressure may therefore improve the precision and openness of their ESG-related reporting. At the same time, improvements in the information environment also reduce firms' moral hazard. When companies realize that environmental violations or failures in social responsibility are more likely to be detected and amplified by the market, the cost of concealing negative information rises significantly. Under stronger market scrutiny, firms are more likely to provide transparent ESG disclosures rather than symbolic disclosure practices. Improved disclosure quality not only strengthens investor trust but also creates a more stable external environment for companies to implement substantive ESG investments.

Higher information transparency also increases external monitoring pressure from investors and regulators, making it more difficult for managers to conceal environmental or governance-related problems. Companies face greater oversight pressure from investors and the public, thereby driving substantive improvements in environmental protection investments, employee

rights protection, and corporate governance optimization. The information constraint effect makes it difficult for management to conceal environmental violations or failures in social responsibility, thereby promoting the implementation of more standardized ESG strategies.

Based on the above discussion, we propose Hypothesis H3:

H3: The short-selling mechanism promotes corporate environmental and social responsibility by enhancing market transparency and the quality of information disclosure, thereby improving their ESG performance.

4. Research Design

4.1. Sample Selection

This study focuses on A-share listed companies in China, with the sample period covering the years following the implementation of the margin trading system. Given that China's margin trading system was officially implemented in 2010 and the Huazheng ESG rating data began to be released in 2009, this study selects the period from 2009 to 2024 as the research sample period, with the 2009 data primarily used to construct lagged variables. This study focuses on A-share listed companies and the following screening procedures were applied to the original sample:

- (1) Excluded listed companies in the financial sector;
- (2) Excluded companies marked as ST or *ST during the sample period;
- (3) Excluded samples with missing data for key variables;
- (4) Truncated continuous variables at the 1st and 99th percentiles to mitigate the impact of outliers.

After the above screening, a final sample of 2,490 firms and 18,491 "firm-year" observations were retained for the final analysis. The corporate financial data and short-selling mechanism data used in this study were sourced from the CSMAR database, while the ESG data were derived from the Huazheng ESG ratings provided by the WIND database.

4.2. Variable Definitions

4.2.1. Dependent Variable: ESG Performance (E)

To evaluate corporate environmental, social, and governance (ESG) performance, this paper utilizes data from the Huazheng ESG Rating. This specific index encompasses the entire universe of Chinese A-share listed firms, providing a comprehensive representation of their sustainability profiles. The rating system assigns scores on a scale from 1 to 9, where an escalating metric denotes superior ESG practices.

4.2.2. Explanatory Variable: Short-Selling Mechanisms (Eligibility for Short Selling, Short-Selling Intensity, etc.)

The primary explanatory metric in this research is the short-selling pressure exerted on a firm, which is proxied by short-selling intensity (ShortIntensity).

This proxy serves as a reflection of the external discipline and market pressure experienced by the company. Specifically, we define this pressure as the quotient of the annual short position balance divided by the free-float market value.

$\text{ShortIntensity}_{\{i,t\}} = \text{Annual Short Position Balance} \div \text{Market Capitalization}$

Additionally, to verify the reliability of our empirical results, an alternative independent variable is introduced: "inclusion in the margin trading list (Short)". This indicator is operationalized as a dummy variable, assigned a value of 1 if the firm gains eligibility for margin trading within or prior to the focal year, and 0 otherwise. It captures the firm's formal exposure to short-selling mechanisms.

4.2.3. Control Variable

To mitigate the issue of omitted variables, this study draws on existing research in corporate finance and ESG and introduces firm-level characteristics and corporate governance-related variables as control variables, primarily including:

1. (1) Size: Defined as the natural log of the firm's total assets;
2. (2) ROA (Profitability): Calculated as net profit divided by total assets.;
3. (3) Lev (Financial Leverage): Represented by the ratio of total debt to total assets.
4. Growth, measured by the revenue growth rate;
5. Board Independence (Indep), measured by the proportion of independent directors to the total number of board members;
6. Shareholding Concentration (Top1), measured by the largest shareholder's ownership percentage.

In addition, this study controls for industry fixed effects (Industry FE) and year fixed effects (Year FE) to mitigate the impact of industry differences and macroeconomic fluctuations on the empirical results.

Table 1. Definitions of explanatory variables

Variable Type	Variable Name	Variable Symbol	Variable Definition	Calculation Method	Data Source
Dependent variable	Corporate ESG Performance	ESG	Corporate Annual ESG Performance	Huazheng ESG Composite Score	Wind
Key Explanatory Variables	Short-selling Mechanism	Short	Eligibility for Margin Trading	Included in the current year and subsequent years: 1; otherwise 0	CSMAR
Core explanatory variable	Short Selling Intensity	ShortIntensity	Intensity of short-selling pressure faced by the company	Annual Short Position Balance ÷ Market Capitalization	CSMAR
Control Variables	Company Size	Size	Company size level	In (Total Assets)	CSMAR
Control Variables	Profitability	ROA	Corporate Profitability	Net Income ÷ Total Assets	CSMAR
Control Variables	Financial Leverage	Lev	Corporate Capital Structure	Total Liabilities ÷ Total Assets	CSMAR
Control Variable	Growth	Growth	Company Growth Potential	Revenue Growth Rate	CSMAR
Control Variables	Board Independence	Indep	Corporate Governance Level	Number of independent directors ÷ Total number of board members	CSMAR
Control Variables	Concentration of Shareholding	Top 1	Characteristics of Shareholding Structure	Largest Shareholder's Ownership Percentage	CSMAR

4.3. Model Construction

4.3.1. Baseline Econometric Specification

To investigate the impact of short-selling pressure on corporate ESG outcomes, we specify the following baseline model:

$$ESGi,t = \beta_0 + \beta_1 Shorti,t + \beta_2 Ci,t + I + Y + \varepsilon_{i,t}$$

$ESGi,t$: Firm i's ESG performance in year t

$Shorti,t$: Short-selling mechanism

Ci,t : Control variables

Industry, Year: Industry and year fixed effects

$\varepsilon_{i,t}$: Random error term.

Our primary focus centers on the estimated coefficient β_1 . A statistically significant and positive β_1 would demonstrate that heightened short-selling exposure effectively drives improvements in corporate ESG engagement. A significantly positive coefficient on β_1 supports Hypothesis H1.

4.3.2. Mechanism Testing Model

This section examines the channels through which short-selling pressure affects firms' ESG performance. This study conducts a mechanism analysis through information transparency and governance discipline: corporate governance constraints and information oversight.

First, this study uses analyst attention (ANAC) to measure the firm's information environment and management ownership (Mngmhldn) to measure corporate governance, and constructs the following model:

$$Mechanism_{i,t} = \beta_0 + \beta_1 ShortIntensity_{i,t} + \sum Controls_{i,t} + IndustryFE + YearFE + \varepsilon_{i,t}$$

where $Mechanism_{i,t}$ represent analyst attention and management ownership, respectively.

If β_1 is significant, it indicates that the short-selling mechanism exerts an influence on the corresponding mechanism variables, indicating that short-selling pressure may influence ESG performance through these channels. by improving the information environment or strengthening corporate governance constraints.

In line with the mechanism identification framework suggested by Jiang [14] (Jiang Ting 2022), our analysis centers exclusively on the sign and statistical significance of the primary independent variable's impact on the channel metrics. This parsimonious approach bypasses traditional full-step mediation tests, isolating how short-selling pressure drives the proposed mediators.

4.3.3. Model for Addressing Endogeneity

Given the potential for reverse causality or omitted variable problems between corporate ESG performance and short-selling mechanisms, this study further employs the instrumental variables method (IV-2SLS) to address endogeneity.

This study selects an instrumental variable (IV) as an exogenous proxy for corporate short-selling pressure and constructs the following two-stage regression model:

$$\text{Stage 1: } ShortIntensity_{i,t} = \gamma_0 + \gamma_1 IV_{i,t} + \sum Controls_{i,t} + IndustryFE + YearFE + \varepsilon_{i,t}$$

$$\text{Stage 2: } ESG_{i,t} = \delta_0 + \delta_1 \widehat{ShortIntensity}_{i,t} + \sum Controls_{i,t} + IndustryFE + YearFE + \varepsilon_{i,t}$$

where $\widehat{ShortIntensity}_{i,t}$ is the predicted value obtained from the first-stage estimation.

A persistently positive and significant δ_1 in the second-stage regression would verify that the positive externality of short-selling on ESG performance holds robustly even after purging endogeneity feedback.

5. Empirical Findings and Discussion

5.1. Summary Statistics

Table 2 presents the summary statistics for the primary variables utilized in this empirical analysis.

As detailed, the corporate ESG metric exhibits a mean value of 4.354, alongside a standard deviation of 1.166, spanning from a minimum of 1 to a maximum of 8. This wide distribution highlights a substantial degree of cross-sectional heterogeneity in sustainability performance across our sample firms.

Regarding the main independent variable, short-selling intensity (ShortIntensity) registers an average of 0.004 with a standard deviation of 0.015. This pattern implies that while the broader intensity of short-selling among Chinese A-share listed enterprises remains generally modest, individual firms still experience highly disparate levels of short-selling pressure.

Regarding control variables, the mean for firm size (Size) is 22.920, and the mean for debt-to-asset ratio (Lev) is 0.421, suggesting that the overall leverage level of the sample firms is moderate; the mean for growth (Growth) is 0.247, indicating that the sample firms show moderate growth potential. Overall, the distributions of the variables are generally reasonable, without severe abnormal observations.

Table 2. Summary Statistics Table

Variable	N	Mean	SD	Min	Max
ESG	17,208	4.354	1.166	1.000	8.000
Short Intensity	17,208	0.004	0.015	0.000	0.720
Size	17,208	22.920	1.411	18.590	28.790
ROA	17,208	0.035	0.073	-1.583	0.759
Lev	17,208	0.421	0.207	0.013	1.939
Growth	17,208	0.247	0.570	-0.696	4.514
Indep	17,208	0.380	0.058	0.167	0.818
Top 1	17,208	0.334	0.154	0.003	0.900

5.2. Correlation Analysis

Table 3 displays the estimated Pearson pairwise correlation coefficients among the focal variables.

As indicated in the matrix, the correlation between short-selling intensity (ShortIntensity) and corporate ESG performance (ESG) stands at 0.075, which is statistically significant at the 1% level.

This positive co-movement offers preliminary empirical support for our premise that heightened short-selling threats are linked to enhanced sustainability outcomes, aligning with the expectations of Hypothesis H1.

In addition, most control variables are also significantly correlated with ESG performance. Specifically, enterprise scale (Size), profitability (ROA), board independence (Indep), and ownership concentration (Top1) all display significantly positive linkages with ESG, whereas capital structure leverage (Lev) is inversely related to it.

To ensure that our multivariate regressions are not plagued by collinearity issues, we calculate the Variance Inflation Factor (VIF) for all indicators. The diagnostic tests show that the VIF

values across all specifications remain well below 2, yielding an average VIF of 1.246. This is substantially below the widely accepted empirical threshold of 10, confirming that our empirical models are free from severe multicollinearity distortions.

Table 3. Correlation Analysis

	ESG	Shortl~y	Size	ROA	Lev	Growth	Indep	Top 1
ESG	1							
Short-Term	0.075***	1						
Size	0.240***	0.067***	1					
ROA	0.176***	-0.016**	0.043***	1				
Lev	-0.067***	0.00600	0.545***	-0.330***	1			
Growth	0.036***	0.00900	-0.034***	-0.065***	0.040***	1		
Indep	0.068***	-0.00300	0.047***	-0.0110	0.015**	0.00300	1	
Top 1	0.105***	-0.026***	0.240***	0.149***	0.063***	-0.013*	0.045***	1
	VIF					1/VIF		
Lev	1.739					.575		
Size	1.633					.612		
ROA	1.24					.807		
Top 1	1.087					.92		
Short Intensity	1.009					.991		
Growth	1.008					.992		
Indep	1.004					.996		
Mean VIF	1.246					.		

5.3. Baseline Regression Results and Discussion

Table 4 presents the empirical estimates tracking how short-selling mechanisms influence corporate ESG outcomes.

In Column (1), we exclusively account for industry and year fixed effects, whereas Column (2) introduces the full set of firm-level control variables to ensure robustness.

The empirical findings reveal that the coefficients on our primary independent variable, short-selling intensity (ShortIntensity), are 5.2619 in Column (1) and 3.3838 in Column (2), both achieved statistical significance at the 1% level. This pattern demonstrates a robust positive nexus, implying that heightened exposure to short-selling pressure serves as an impetus for firms to elevate their ESG performance.

The findings indicate that the short-selling mechanism not only improves price efficiency but also constrains managerial behavior through external oversight in the capital markets, encouraging firms to pay greater attention to ESG-related activities. the fulfillment of social responsibilities, and the optimization of corporate governance, thereby enhancing their overall ESG performance. These findings support Hypothesis H1.

Regarding the results of the control variables, both firm size (Size) and profitability (ROA) significantly promote ESG performance, indicating that larger and more profitable firms are better positioned to make ESG investments; the financial leverage (Lev) coefficient is significantly negative, suggesting that highly leveraged firms may be more inclined to focus on short-term financial pressures, thereby weakening ESG investments. Board independence (Indep) and equity concentration (Top1) both exhibit significant positive coefficients, indicating that sound corporate governance structures help improve corporate ESG performance.

Table 4. Benchmark Regression Analysis

	(1)	(2)
	ESG	ESG
Short Intensity	5.2619***	3.3838***
	(5.58)	(4.41)
Size		0.3498***
		(28.34)
ROA		1.4590***
		(7.50)
Lev		-1.1967***
		(-14.54)
Growth		0.0550***
		(3.16)
Indep		0.7524***
		(3.63)
Top1		0.4985***
		(5.58)
Industry FE	Yes	Yes
Year FE	Yes	Yes
_cons	4.3345***	-3.6912***
	(271.35)	(-13.74)
N	17,207	17,207
adj. R ²	0.051	0.189

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5.4. Robustness Checks

(1) Lagged Explanatory Variables (Table 5)

To mitigate potential reverse causality issues, this study conducts robustness tests using one-period lagged short selling intensity (L.ShortIntensity).

The empirical output indicates that the parameter on the lagged short-selling proxy (L.ShortIntensity) maintains its significantly positive sign. Specifically, with the full incorporation of firm-level control variables, the estimated coefficient settles at 3.4206, achieved statistical significance at the 1% level. This persistent significance confirms that the favorable governance effect triggered by short-selling mechanisms possesses a temporal continuation, thereby reinforcing the credibility and robustness of our benchmark findings.

(2) Changing the Sample Period (Table 6)

Additionally, we verify whether our primary results are sensitive to specific timeline macro-shocks by altering the tracking window and re-running the regressions.

The updated regressions demonstrate that the estimated coefficient for ShortIntensity remains robustly positive. Following the conditional inclusion of all firm-level variables, the coefficient is recorded at 2.4299, which is statistically significant at the 5% horizon. This outcome effectively rules out the possibility that our empirical insights are artifactual driven by specific sample windows, validating the structural stability of the baseline regressions.

Table 5. Robustness Tests

	(1)	(2)
	ESG	ESG
L.ShortIntensity	5.4429***	3.4206***
	(4.48)	(3.39)
Size		0.3805***
		(27.95)
ROA		1.4980***
		(6.48)
Lev		-1.2732***
		(-13.79)
Growth		0.0463**
		(2.22)
Indep		0.7717***
		(3.42)
Top1		0.5464***
		(5.41)
Industry FE	Yes	Yes
Year FE	Yes	Yes
_cons	4.3887***	-4.3656***
	(241.65)	(-14.63)
N	13,332	13332
adj. R ²	0.052	0.208

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Table 6. Changing the sample interval

	(1)	(2)
	ESG	ESG
ShortIntensity	5.5927***	2.4299**
	(5.37)	(2.22)
Size		0.4132***
		(28.38)
ROA		1.6236***
		(6.28)
Lev		-1.1908***
		(-12.03)
Growth		0.0462**
		(2.05)
Indep		0.7003***
		(2.75)
Top1		0.4374***
		(4.17)
Industry FE	Yes	Yes
Year FE	Yes	Yes
_cons	4.3437***	-5.1027***
	(239.37)	(-15.94)
N	10999	10999
adj. R ²	0.046	0.195

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5.5. Endogeneity Analysis

To clear up potential endogeneity issues caused by feedback loops or reverse causality between short-selling and sustainability outcomes, we execute a two-stage least squares (2SLS) framework.

The initial-stage estimation validates the relevance requirement of our instrument. Specifically, the assigned IV exhibits a strong positive linkage with short-selling intensity (coefficient = 0.9941), which is statistically significant at the 1% boundary. Concurrently, the Kleibergen-Paap rk Wald F-statistic yields a value of 353.419. This magnitude substantially outstrips the standard empirical threshold of 10, thereby effectively rejecting the weak instrument hypothesis.

The second-stage regression results, which filter out endogeneity contamination, reveal that the instrumented ShortIntensity holds a coefficient of 3.8135, maintaining its high significance at the 1% level. This finding demonstrates that the external governance value of short-selling mechanisms persists even after removing reverse causality bias, confirming that our core conclusions are remarkably robust.

Table 7. Endogeneity Analysis

	(1)	(2)
	ShortIntensity	ESG
IV	0.9941***	
	(18.76)	
ShortIntensity		3.8135***
		(3.23)
Size	0.0009***	0.3493***
	(5.11)	(28.28)
ROA	-0.0046***	1.4622***
	(-3.49)	(7.53)
Lev	-0.0021***	-1.1953***
	(-3.64)	(-14.55)
Growth	0.0002	0.0549***
	(1.32)	(3.16)
Indep	-0.0037*	0.7534***
	(-1.86)	(3.65)
Top 1	-0.0013	0.4998***
	(-1.33)	(5.61)
Industry FE	Yes	Yes
Year FE	Yes	Yes
Kleibergen-Paap rk LM statistic	6.769***	
Kleibergen-Paap rk Wald F statistic	353.419 {16.38}	
_cons	-0.0170***	
	(-4.27)	
N	17207	17207
adj. R ²	0.400	0.145

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5.6. Heterogeneity Analysis

(1) Heterogeneity by Enterprise Ownership Type

Table 8 demonstrates the subsample estimation results across distinct corporate ownership structures.

The empirical output indicates that the parameter on ShortIntensity remains positive and statistically significant in both the state-owned enterprise (SOE) and non-state-owned enterprise (non-SOE) subsamples. Notably, the magnitude of the coefficient is visually more pronounced within the non-SOE cohort, implying that the external governance value of short-selling delivers a stronger impetus to non-state-owned entities.

A plausible underlying mechanism is that private or non-state firms are typically exposed to more intense product market competition and stringent financing friction, which renders them highly responsive and sensitive to external disciplinary shocks exerted by the capital market.

(2) Heterogeneity by Industry Attributes

Furthermore, we partition our full sample to explore whether the main relationship is conditioned on the firm's environmental attributes, specifically sorting firms by their classification into pollution-intensive sectors.

The grouped regression results confirm that the positive externality of short-selling mechanisms is heavily skewed toward environmentally sensitive industries, where the coefficient on ShortIntensity rises to 4.6799. This finding underscores that enterprises operating with elevated environmental hazards inherently draw higher public and investor scrutiny regarding sustainability metrics; consequently, the looming threat of short-selling compels these specific firms to aggressively upgrade their ESG profiles.

Table 8. (Heterogeneity Analysis)

	(1)	(2)
	State-owned	Non-state-owned
Short Intensity	2.8957***	3.6198***
	(4.53)	(2.59)
Size	0.3470***	0.3488***
	(18.05)	(19.24)
ROA	1.1530***	1.5822***
	(2.66)	(7.20)
Lev	-1.2960***	-1.1616***
	(-8.86)	(-11.74)
Growth	0.0178	0.0605***
	(0.62)	(2.88)
Indep	0.8277***	0.5987**
	(2.62)	(2.19)
Top 1	0.3185**	0.4443***
	(2.14)	(3.92)
Industry FE	Yes	Yes
Year FE	Yes	Yes
_cons	-3.5739***	-3.5736***
	(-8.63)	(-8.89)
N	6423	10,782
adj. R ²	0.214	0.189

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Continued Table 8 (Heterogeneity Analysis)

	(1)	(2)
	Heavy pollution	Non-heavy pollution
ShortIntensity	4.6799***	3.0419***
	(3.54)	(3.63)
Size	0.3982***	0.3321***
	(15.56)	(23.88)
ROA	0.7552**	1.8036***
	(2.01)	(7.79)
Lev	-1.3591***	-1.1244***
	(-7.34)	(-12.52)
Growth	0.0699	0.0572***
	(1.40)	(3.09)
Indep	1.3283***	0.5738**
	(2.95)	(2.53)
Top 1	0.5000***	0.4727***
	(2.63)	(4.80)
Industry FE	Yes	Yes
Year FE	Yes	Yes
_cons	-5.1234***	-3.1782***
	(-9.23)	(-10.53)
N	4761	12,446
adj. R ²	0.170	0.199

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

5.7. Mechanism Analysis**Table 9. (Mechanism Analysis)**

	(1)	(2)
	ANAC	Mngmhldn
ShortIntensity	1.8389**	99.6644***
	(2.48)	(3.87)
Size	0.2626***	-0.3444***
	(29.38)	(-4.35)
ROA	2.8945***	0.2388
	(14.82)	(0.17)
Lev	-0.3326***	-3.1572***
	(-5.26)	(-5.61)
Growth	-0.0227	0.3443**
	(-1.53)	(2.17)
Indep	0.0940	1.1463
	(0.65)	(0.84)
Top 1	-0.3982***	-2.3169***
	(-6.09)	(-3.89)
Industry FE	Yes	Yes
Year FE	Yes	Yes
_cons	-3.8945***	11.5171***
	(-19.82)	(6.83)
N	12,536	16,631
adj. R ²	0.284	0.095

t-statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

The results in Table 9 show that the regression coefficient of ShortIntensity on analyst attention (ANAC) is 1.8389, which is significantly positive at the 5% statistical level, suggesting that short-selling pressure improves firms' information environment. At the same time, the regression coefficient of ShortIntensity on management shareholding (Mngmhldn) is 99.6644, which is significant at the 1% statistical level, indicating that short-selling pressure can strengthen corporate governance constraints.

Overall, the evidence suggests that short-selling mechanisms primarily promote improvements in corporate ESG performance through two pathways: the "information monitoring effect" and the "governance constraint effect," thereby validating research hypotheses H2 and H3

6. Conclusion and Implications

Based on empirical evidence gathered from the universe of Chinese A-share listed enterprises, this study comprehensively evaluates how short-selling threats shape corporate ESG performance.

The empirical results show that:

First, the short-selling mechanism can significantly improve corporate ESG performance. The benchmark regression results indicate significantly positively correlated with corporate ESG performance, suggesting that the short-selling mechanism exerts a dual impact: it enhances the informational efficiency of stock pricing while concurrently enforcing external governance discipline within the capital market.

Second, the empirical linkage withstands a battery of validation checks. After correcting for endogeneity and potential biases via lagged indicators, alternative sample boundaries, and instrumental variable estimations, the structural integrity of our core inferences holds firm.

Third, cross-sectional investigations reveal significant variations in this effect; specifically, the positive externality of short selling on ESG performance is more amplified among private entities (non-SOEs) and enterprises operating within environmentally sensitive sectors.

Fourth, mediation analyses uncover the underlying transmission channels, providing evidence consistent with the interpretation that optimizing market-wide information environments and reinforcing internal governance constraints.

Based on these empirical insights, several critical policy recommendations can be formulated:

First, policymakers should continue to optimize the credit trading framework by progressively lowering short-selling barriers. This would allow the capital market to fully unfurl its potential for pricing efficiency and external managerial discipline.

Second, regulatory authorities should strengthen oversight of ESG disclosure by listed companies, improve the quality and transparency of ESG disclosures, and reduce information asymmetry.

Third, companies should prioritize ESG development by integrating environmental protection, social responsibility, and corporate governance into their long-term development strategies to enhance long-term corporate value and market competitiveness.

Fourth, for heavily polluting industries and companies with weak governance, regulatory authorities should strengthen market oversight mechanisms to guide enterprises in improving their ESG governance standards and promote high-quality development in the capital markets.

7. Research Limitations and Future Directions

Acknowledging that our empirical design is not without boundaries, several limitations merit attention:

First, the quantification of corporate sustainability is anchored primarily on the Huazheng ESG Rating index; however, subtle discrepancies might exist across alternative rating databases due to varying assessment methodologies.

Second, our baseline insights are contextualized within the unique setting of Chinese A-share listed enterprises. Consequently, the generalizability of these findings to other global capital markets warranting further validation.

Third, although this study employs the instrumental variables method to mitigate endogeneity issues, the influence of unobservable omitted variables may still exist.

Future research could conduct in-depth analyses from perspectives such as ESG performance across specific dimensions, regional institutional environments, and investor structures.

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