

Study on the Impact of Short Selling Mechanism on ESG Scores of Listed Companies in China

Yanan Wang

School of Accounting, Tianjin University of Commerce, Tianjin, China

Abstract: Amidst the escalating importance of sustainable development and socially conscious investment strategies, environmental, social, and corporate governance (ESG) scores have emerged as pivotal metrics for evaluating corporate social responsibility and sustainability performance. These indicators carry substantial weight in shaping investment decisions, reflecting a transformative shift towards integrating ethical and environmental considerations into financial decision-making processes. Nevertheless, little research has been done on the impact of short-selling mechanisms, a key aspect of capital markets, on ESG scores of listed companies. In this research endeavor, leveraging empirical data sourced from Chinese A-share listed entities, we meticulously explored the intricate mechanism of short selling's impact on Environmental, Social, and Governance (ESG) scores, employing the sophisticated Heckman two-stage model to account for potential selection biases and uncover nuanced relationships within the financial and sustainability landscape. The results show that the implementation of short-selling mechanism significantly improves the ESG scores of listed companies, especially in the realm of corporate governance. This highlights the positive role of short selling mechanisms in bolstering listed companies to meet their social responsibilities and promote sustainable development. It provides new insights and strategies for investors, regulators and corporate managers to use short-selling mechanisms. In addition, it elucidated how such mechanisms can contribute to enhancing the environmental protection, social accountability, and corporate governance efficacy of listed entities. The robustness of these results is verified by fixed effect model, multivariate logistic regression and instrument variables, which ensures the scientific and accuracy of

empirical analysis.

Keywords: ESG Scores; Short Selling Mechanism Listed Companies; Sustainability

1. Introduction

As one of the important mechanisms of capital market, short selling mechanism has an important influence on the governance and normative development of listed companies. Nowadays, the relationship between short-selling mechanism and ESG rating of listed companies has become the focus of academic and practical circles. Conventional wisdom holds that short selling mechanism can lead to extraordinary volatility in share prices, increase market speculation and negatively impact the performance of publicly traded ESG [1]. However, in recent years, many scholars have argued from an information transparency perspective that short selling can, by its very nature, promote information disclosure and transparency in the operations of companies, thereby having a positive impact on ESG performance [2].

Based on the above background, this paper attempts to explore whether and how the short-selling mechanism affects the ESG scores of listed companies. High-quality ESG performance not only helps the company build a good social image, but also brings economic benefits such as lower financing costs and better investor recognition [3]. Considering that short selling mechanism can force enterprises to improve the quality and transparency of information disclosure, the following research hypothesis is put forward.

H1: Allowing firms to engage in short selling is associated with notably higher ESG scores compared to companies that prohibit this practice.

H2: An elevated volume of short-selling activities is associated with a more pronounced enhancement in a company's ESG score.

In order to test the above hypotheses, this paper

takes the listed companies in China during 2010-2023 as the research sample, and applies econometric methods such as multiple regression to systematically examine the impact of short selling mechanism on ESG scores.

2. Overview of Short Selling Mechanisms

In March 2010, China started to launch the financing and securities financing trading system, fully absorbing the lessons learnt from the "loose and soft" regulation of overseas short-selling before the financial crisis, taking trading security as the value orientation, drawing on the credit trading rules of mature markets, and fostering a wide range of credit trading entities and diversified channels for securities financing. In October 2011, the Securities and Futures Commission (SFC) issued the Measures for Transferring and Financing. In October 2011, the Securities and Futures Commission (SFC) issued the Measures on Transfer and Financing, and in August 2012 and February 2013, the China Securities Finance Corporation (CSFC) launched the Transfer Financing and Transfer and Financing business respectively, which continued to deepen the marketisation of the "dual-financing" business. In November 2018, the Fund Industry Association promulgated the "Green Investment Guidelines (Trial)", aiming to guide investors to make sustainable investments and practice ESG principles. The scale of underlying stocks for financing and bond financing has also been expanding, and the number of stocks under financing and bond financing has increased from 1,000,000 in 2010 to 1,000,000,000 in 2023.

Several studies have revealed that short selling can effectively deter opportunistic behaviors in publicly traded companies and prompt them to enhance their Environmental, Social, and Governance (ESG) disclosures [5]. Upon identifying ESG risks in listed firms, short sellers exert pressure through the short selling mechanism, compelling company management to address these concerns proactively and implement corrective measures with the aim of elevating the firm's ESG rating [8]. Consequently, in well-established capital markets, the short selling mechanism serves as a form of "watchdog," contributing to the improvement of listed companies' ESG performance and ensuring the healthy and orderly progression of the market landscape. In general, short selling is crucial for risk

management and price discovery in capital markets. Its significance in influencing the ESG performance of listed companies has recently garnered academic and regulatory interest. As ESG investing gains momentum, it's anticipated that short selling will evolve into a pivotal external governance tool, compelling listed firms to adhere to their ESG obligations.

3. ESG Scores of Listed Companies

3.1 ESG Scoring Criteria and Significance

ESG scoring criteria assess the level of sustainability of a company through its performance in three areas: environmental, social and governance. These criteria usually include carbon emissions [9], energy efficiency, waste management, employee protection, supply chain management, board independence and transparency of information disclosure [10]. Different ESG rating agencies differ in the specific scoring indicators and weightings, but generally aim to comprehensively assess the non-financial risks and long-term development potential of enterprises.

Currently, representative ESG rating systems in the international arena include the MSCI ESG Index, the Dow Jones Sustainability Index, the FTSE Social Responsibility Index, etc. These indexes provide an important reference for investors by quantitatively assessing and ranking the ESG performance of listed companies. These indices provide an important reference for investors by quantitatively assessing and ranking the ESG performance of listed companies [10]. Some of these indices are also linked to the stock prices of enterprises, forming financial products such as ESG-themed investment funds.

3.2 Role and Impact of ESG Scores on Listed Companies

ESG scores can affect the value and development of listed companies from multiple dimensions, such as financial, operational and reputational.

From a financial perspective, companies exhibiting high ESG scores are disproportionately preferred by the capital market. Institutional investors tend to prioritise companies with high ESG performance and give higher weight to them in their investment decisions [12]. In addition, high ESG scores imply that companies do better in environmental protection, social responsibility, corporate

governance, etc., face lower ESG-related risks, and tend to have more robust financial performance^[2].

From an operational perspective, ESG scores can be an important tool for improving a company's internal management. On the one hand, ESG disclosure requirements prompt companies to establish better information collection, processing and reporting mechanisms, so as to optimise internal management processes and improve operational efficiency^[7]. On the other hand, many ESG indicators, such as energy efficiency, employee satisfaction, supply chain management, etc., are key aspects of value creation. Improving ESG performance can help strengthen the core competitiveness of a company.

From the perspective of reputation, ESG has become an important indicator for measuring the comprehensive strength and development potential of modern enterprises. Companies exhibiting high ESG scores are disproportionately favored in garnering consumer trust, attracting talented people, gaining social respect, and the higher the brand reputation⁻⁽¹²¹⁾. On the contrary, if an ESG scandal breaks out, it will cause great damage to the company's reputation, and it is not uncommon for the market value to evaporate by hundreds of millions of dollars.

In general, ESG rating is both an opportunity and a challenge for listed companies. On the one hand, ESG points out the direction for companies to create long-term value and achieve sustainable development. On the other hand, the assessment system is still immature, the breadth and depth of ESG disclosure still need to be strengthened, and there are significant discrepancies in the ratings given by different rating agencies.

4. Research Methodology and Data Sources

4.1 Description of the Research Methodology

This paper adopts an empirical research method to analyse the correlation between short selling mechanism and ESG scores by constructing a feasible model, combining different ESG scores and short selling data. The data of ESG scores of listed companies in major developed countries in the world from 2010 to 2023 and the short-selling data of the corresponding time period are selected. The ESG data are mainly obtained from CSI ESG ratings data, while the

short-selling data are obtained from major stock exchanges in various countries and financial data service providers such as Bloomberg and Lufthansa, etc.^{-(13)]}.

In terms of research methodology, this paper firstly conducts descriptive statistical analyses of ESG scores and short-selling volume to observe the trends of both in the time series. Secondly, a panel data model is established, with ESG scores of individual stocks as the explanatory variables and short-selling trade share as the explanatory variables, and control variables such as institutional investors' shareholding proportion (Inst) and Independent Director Share (Indep) are added to examine the impact of short-selling on the ESG scores of the companies^[3]. The model is set up as follows.

$$ESG_{i,t} = \beta_0 + \beta_1 MK_{i,t} + \text{controls} + \text{Firm}_i + \text{Year}_t \quad (1)$$

Where the dependent variable $ESG_{i,t}$ is the ESG rating of firm i in year t , and can be categorized into E, S, and G to represent environment, social responsibility, and corporate governance respectively. The independent variable $MK_{i,t}$ is whether or not firm i belongs to the firms in the list of margin trading securities in year t , 1 for yes, 0 for no. Firm_i represents the firm's individual fixed effects, and Year_t represents the time fixed effects.

In conclusion, this paper uses multivariate econometric modelling and event studies to comprehensively examine the relationship between short-selling and ESG performance from different angles, and attempts to draw reliable research conclusions.

4.2 Data Acquisition and Processing

This paper employs panel data of Chinese A-share listed companies from 2010 to 2023 for empirical research. Shorting data is based on basic securities information from the Shanghai Stock Exchange and SSE. ESG rating data is based on CSI's ESG rating database. The company is rated "AAA-C" and is graded quarterly, with four ratings in January, April, July and October, and nine ratings on a scale of 1-9. In this article, we rated each of the nine ratings on a scale of 1-9 and use the average of quarterly ratings to measure an enterprise's annual ESG performance.

Data on company's financial and other control variables come from the CSMAR and RESSET databases.

With regard to data processing, on 31 March 2010, the Shanghai and securities trading system

stock exchanges officially opened the financing and shorting operations, and pilot financing were officially launched. CSX ESG ratings started in 2009, and this paper selected A-share listed companies from 2010 to 2023 as the sample for the preliminary study.

The initial sample screening process is as follows:

- (1)Excluding financial listed companies;
- (2)Excluding ST and *ST listed companies;
- (3)Sample excluded from the list of bids withdrawn from short sale as at 31 December 2023
- (4)Samples with missing data were excluded.

In this paper, the underlying data of financing and bond financing come from RESSET database, the financial data of enterprises come from CSMAR database, and the ESG performance data of enterprises come from CSI ESG rating system.

4.3 Indicator Measurement and Selection

4.3.1 Explained Variables

ESG performance. The CSI ESG ratings are used in the empirical model for measurement. The following is a specific description of the CSI ESG rating system:

The CSI Index is an evaluation methodology developed by combining the mainstream international ESG evaluation system with specific practical experience with Chinese characteristics and fully absorbing the opinions of external market experts, mainly using public market information and official documents provided by issuers to evaluate listed companies. Specifically, the CSI ESG evaluation consists of three aggregated items: environment (E), society (S) and corporate governance (G), each of which is divided into a number of themes, and then the themes are further divided into a number of key indicators to build the evaluation system from the top down, with a total of 16 themes in the three individual items, which are subdivided into 44 key indicators, covering all the listed

companies in the A-share market. In the evaluation process, the indicators are assigned values taking into account the findings of literature, practical experience and national standards, so as to set up benchmarks for each indicator. At the same time, different data types are distinguished, and different assignment methods are used for structured and unstructured data. Finally, the missing values are filled in using statistical methods. In terms of weighting, industry attributes are taken into account, and key indicators are assigned values according to the time and degree of influence of each indicator on the industry, i.e., the higher the degree of influence, the higher the weight, and the longer the time of influence, the higher the weight, and non-industry core issue indicators are directly set to zero, and then finally, the three sub-items and the ESG composite score are weighted from the bottom up.

4.3.2 Explanatory Variables

MK for short selling. That is, the firm becomes a dummy variable for the financing and financing securities underlying. It is defined as a value of 1 assigned to a listed company at the beginning of the year in which it is included in the underlying, and a value of 0 otherwise; if the firm has not been included in the list of financing and financing securities underlying throughout the observation period, the value of 0 is assigned.

4.3.3 Control Variables

The control variables designed in this paper include gearing ratio (Lev), firm growth (Growth), return on equity (ROE), dual (Dual), proportion of independent directors (Indep), proportion of shares held by the first largest shareholder (Top1), proportion of shares held by institutional investors (Inst), and whether there is a Big Four (Big4). In addition, the paper controls for individual and year fixed effects. The variable definitions and descriptions are specified in Table 1.

Table 1. List of Variable Definitions and Descriptions

Variable type	variable name	variable symbol	Variable Definition
explanatory variable	ESG performance	ESG	CSI ESG Rating Index
	sell short	MK	Whether company i is in the list of financing facilities in year t: 1 for yes, 0 for no
control variable	gearing	Lev	Total liabilities/total assets
	Company Growth	Growth	Total assets growth rate = (total assets at the end of the period - total assets at the end of the previous period)/total assets at the end of the

			previous period
	return on net assets	ROE	Net profit/shareholders' equity balance
	two jobs in one	Dual	Whether the chairman of the board and the general manager are the same person: 1 for yes, 0 for no
	Proportion of independent directors	Indep	Number of independent directors/total number of board of directors
	Shareholding ratio of the largest shareholder	Top1	Number of shares held by the largest shareholder/total number of shares
	Structured investor shareholding	Inst	Total number of shares held by institutional investors divided by outstanding share capital
	Are the four major	Big4	Whether the auditor is from an international Big 4: 1 for yes, 0 for no

5. Empirical Analysis

5.1 Descriptive Statistics

Table 2 presents the descriptive statistics of the main variables. It can be seen that the average

ESG score of the sample companies is 47.62, with a large difference in ratings, which reflects the significant differences in the performance of sample companies in the ESG area^[3]

Table 2. Table of Descriptive Statistics

Variable	sample size	average value	(statistics)	standard deviation	minimum value	maximum values
ESG	8148	74.039		5.009	41.19	90.93
MK	8148	0.604		0.489	0	1
ROE	8148	0.07		0.526	-45.737	1.117
Lev	8148	0.473		0.19	0.01	0.979
Inst	8148	50.671		21.483	0.001	98.584
Indep	8148	37.01		5.378	16.67	80
Growth	8148	0.137		0.353	-0.907	15.888
Dual	8148	0.191		0.393	0	1
Big4	8148	0.089		0.285	0	1
Top1	8148	34.609		15.283	3.39	89.99

Next, the paper constructs the following empirical model.

$$ESG_{i,t} = \beta_0 + \beta_1 MK_{i,t} + \text{controls} + \text{Firm}_i + \text{Year}_t$$

Where the dependent variable $ESG_{i,t}$ is the ESG rating of firm i in year t . The independent variable $MK_{i,t}$ is whether or not firm i belongs to the firms in the list of margin trading securities in year t , 1 for yes, 0 for no. Firm_i represents the firm's individual fixed effects, and Year_t represents the time fixed effects.

Controls are a series of control variables, including gearing ratio (Lev), firm growth (Growth), return on equity (ROE), dual position (Dual), proportion of independent directors (Indep), proportion of shareholding of the first largest shareholder (Top1), proportion of shareholding of institutional investors (Inst), and whether it is a big four (Big4), in order to

eliminate the effects of other factors.⁽¹⁾^[2]. The model also controls for firm and year fixed effects.

5.2 Correlation Analysis

Table 3 shows the results of Pearson correlation test between the two variables. The correlation coefficients of each variable is less than 0.5, which indicates that there is no multicollinear problem in this study.

5.3 Analysis of the Impact of Short Selling Mechanism on ESG Scores

In this paper, the impact of short selling mechanism on ESG scores of listed companies is studied by using multivariate linear regression. Take 8148 observations of all A-share listed companies between 2010 and 2023.

Table 3. Table of Correlation Analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) ESG	1.000									
(2) MK	0.200*	1.000								
	(0.000)									

(3) ROE	0.031*	-0.009	1.000							
	(0.005)	(0.425)								
(4) Lev	-0.005	0.060*	-0.064*	1.000						
	(0.663)	(0.000)	(0.000)							
(5) Inst	0.110*	0.084*	0.049*	0.169*	1.000					
	(0.000)	(0.000)	(0.000)	(0.000)						
(6) Indep	0.083*	0.066*	0.003	0.043*	-0.029*	1.000				
	(0.000)	(0.000)	(0.759)	(0.000)	(0.009)					
(7) Growth	0.010	-0.105*	0.053*	-0.005	0.035*	-0.022	1.000			
	(0.386)	(0.000)	(0.000)	(0.656)	(0.002)	(0.051)				
(8) Dual	-0.038*	-0.039*	-0.028*	-0.081*	-0.172*	0.121*	0.039*	1.000		
	(0.001)	(0.000)	(0.013)	(0.000)	(0.000)	(0.000)	(0.000)			
(9) Big4	0.098*	0.093*	0.020	0.071*	0.269*	-0.002	-0.021	-0.045*	1.000	
	(0.000)	(0.000)	(0.067)	(0.000)	(0.000)	(0.889)	(0.060)	(0.000)		
(10) Top1	0.035*	-0.020	0.032*	0.144*	0.610*	0.028*	-0.025*	-0.107*	0.169*	1.000
	(0.001)	(0.077)	(0.004)	(0.000)	(0.000)	(0.011)	(0.023)	(0.000)	(0.000)	

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

The regression results are shown in Table 4. Where (1) shows the regression results of control variables on dependent variables, and (2) shows the regression of key independent variable MK and control variables on dependent variables. The coefficient of MK is significantly positive at 1% level, which indicates that the introduction of short-selling mechanism significantly improves ESG scores of listed companies, and this result supports the research hypothesis of this paper [2].

Among the control variables, both the institutional investors' shareholding proportion (Inst) and Independent Director Share (Indep) coefficients were 1%, indicating that the increase in institutional investors' shareholding proportion and the increase in the proportion of independent directors on the board had a positive impact on ESG performance. Institutional investors, prioritizing long-term value and sustainability, significantly enhance ESG performance by actively engaging in corporate governance and decision processes. Independent directors, leveraging their autonomy, ensure unbiased and equitable oversight of ESG aspects. The Lev and Top1 shareholding ratio, both at 1%, suggest a direct correlation: as debt levels escalate, the concentration of shareholding among the top shareholder increases, which is indicative of deteriorating ESG performance. Excessive debt burdens can undermine environmental, social, and governance (ESG) performance by prioritizing immediate financial targets over sustainable, long-term environmental stewardship and social accountability. Conversely, an overconcentration of equity among large shareholders might exacerbate this issue, as these stakeholders might

disproportionately align their interests with short-term gains, potentially at the expense of broader corporate social responsibility and environmental protection efforts, thereby compromising the comprehensive ESG performance of the enterprise.

In view of the above, combined with the China's unique institutional background, this paper finds that introducing the short-selling mechanism through multiple regression method can significantly improve the ESG score of listed companies, and provide a new perspective for regulators to improve the short-selling rules and guide the sustainable development of capital market. In the future, we can explore the impact of short selling on ESG performance through channels such as enterprise risk taking and management compensation [3].

This exploration could shed light on the dynamic relationship between short selling and ESG performance. For example, it is important to understand how enhanced scrutiny of short sellers leads to stronger governance practices or incentivizes companies to adopt sustainable strategies. In addition, an analysis of management responses from the perspective of taking risks under such pressure may shed further light on the relationship. Ultimately, our findings could contribute to a broader discussion of the role of market mechanisms in promoting responsible corporate behaviour while balancing investor interests and societal impact.

Table 4. Regression Results Table

	(1)	(2)
	ESG	ESG
ROE	-0.076	-0.066
	(-0.931)	(-0.813)
Lev	-1.785***	-1.969***
	(-3.971)	(-4.388)

Inst	0.020*** (4.119)	0.020*** (4.148)
Indep	0.059*** (4.925)	0.054*** (4.465)
Growth	0.150 (1.219)	0.246** (1.990)
Dual	-0.169 (-1.117)	-0.173 (-1.147)
Big4	0.487 (1.282)	0.330 (0.871)
Top1	-0.033*** (-4.714)	-0.022*** (-2.998)
MK		0.754*** (7.196)
cons	72.795*** (125.502)	72.229*** (123.803)
N	8148	8148
R ²	0.010	0.016
F	9.169	13.958

***p<0.01, **p<0.05, *p<0.10

6. Conclusion

Empirical findings demonstrate that short-selling effectively improves the ESG performance of listed companies.

To ensure long-term value creation, listed companies should confront the external pressures exerted by short selling and uphold the principles of ESG values. They must also enhance their information disclosure mechanisms.

This alignment is crucial for sustainable corporate growth [13]. Future research could delve into the nuanced impacts of short selling on the performance of companies across different ESG categories. It would be insightful to ascertain how this practice affects specific areas such as environmental sustainability, social responsibility, and governance effectiveness. Moreover, designing appropriate institutional arrangements could be instrumental in directing short-selling institutions towards a positive role as "external watchdogs" for ESG compliance and enhancement.

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