Sustainability of Corporate Finance under ESG Drivers: Moderating investment-financing maturity mismatch

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ABSTRACT

In recent years, corporate ESG performance has received extensive attention from both the academic and business circles and investment-financing maturity mismatch is a core debt issue faced by corporations. To promote the high-quality development of enterprises, this paper examines the impact mechanism of corporate ESG performance on the degree of short-term debt and long-term use based on the data of China's A-share listed companies in the period of 2010-2022. The findings reveal that superior ESG performance significantly reduces the extent of short-term debt overuse by mitigating information asymmetry, fostering increased long-term institutional investor holdings, and curbing corporate over-investment. This negative correlation is particularly pronounced in samples of enterprises characterized by higher risk appetite, non-state ownership, and weaker long-term debt financing capability. This paper not only provides direct empirical evidence for understanding how ESG plays a moderating role in corporate financial decision-making but also provides important insights into how to achieve a balance between long-term growth and risk management while pursuing sustainable operations.

Keywords: ESG, Short-term debt overuse, Financing constraints

1. Introduction

The world is undergoing a significant transformation. The rapid development of a new round of technological revolution and industrial transformation is accompanied by increasingly serious ecological environmental problems, frequent natural disasters, and extreme climate risks. Against this backdrop, enterprises must proactively transform to ensure high-quality sustainable development. The concept of Environmental, Social, and Governance (ESG) has emerged. Incorporating the ESG concept into corporate governance is beneficial for attracting long-term investors, enhancing corporate competitiveness, and realizing long-term value. It aids in the identification and management of potential risks related to the environment, society, and governance, thus reducing financial and reputational risks. Additionally, it promotes enterprises to actively undertake social responsibilities and make positive contributions to employees, communities, and the environment, shaping a favorable corporate image [1]. ESG ratings are widely regarded as important non-financial information in the era increasingly focused on sustainable development, serving as key indicators used by the international community to measure the level of sustainable development of enterprises.

The ESG concept holds significant academic value and practical significance in improving corporate governance and promoting high-quality and sustainable development across various industries and enterprises. Extensive research conducted by the academic circles highlights its multifaceted impact [2]. ESG information disclosure plays a crucial role in improving capital market pricing efficiency by reducing noise trading behaviors among investors and mitigating market information asymmetry [3]. This, in turn, fosters a better relationship between banks and enterprises, incentivizing banks to collect and disclose more enterprise information [4]. Consequently, financing constraints are alleviated, and the proportion of long-term financing increases, signaling a preference for long-term capital in corporate operations and attracting long-term institutional investors. Moreover, companies with strong ESG performance receive more media coverage and face stronger external supervision and constraints, leading to more cautious investment decisions and improved corporate investment efficiency [5]. Overall, integrating ESG into corporate governance helps address the prevalent mismatch between short-term debt and long-term use in corporate financing, thereby reducing potential systemic financial risks.

Since 2015, in order to prevent systemic financial risks, various levels of government in China have vigorously implemented a series of powerful deleveraging policies. However, there is currently insufficient awareness and attention to the phenomenon of short-term debt ratio consistently significantly higher than short-term asset ratio, and long-term debt ratio consistently significantly lower than long-term asset ratio, as well as its potential risks, which is prevalent among Chinese enterprises. The degree of short-term debt usage by listed companies in China has remained above 23% from 2003 to 2022, with a mean value exceeding 27% [6]. Fan et al [7] found that the long-term debt ratio of listed companies in China was the lowest among all 39 sampled countries. Enterprises without long-term loans need to continuously roll over short-term debt to support long-term asset investments, thereby exacerbating operational difficulties and triggering liquidity risks. Once the capital chain of enterprises breaks, various risks caused by default risks will spread to the macroeconomic financial system. The mismatch in maturity has increasingly become the primary trigger for various systemic financial risks in China. And currently, the existing research focuses on the impact and mechanism of bank financing constraints and corporate financial activities on the phenomenon of short-term debt usage for long-term purposes [8]. However, there is a lack of literature studying whether ESG performance can reduce the degree of short-term debt usage by enterprises.

Therefore, this study examines the relationship and impact mechanism between corporate ESG performance and the phenomenon of short-term debt usage for long-term purposes, using data from Chinese A-share listed companies from 2010 to 2022 to empirically test the influence of corporate ESG ratings on the degree of short-term debt usage. The research findings indicate that better ESG performance leads to lower levels of short-term debt usage, and this negative correlation is more significant in samples with either higher risk preferences or weaker long-term debt financing capabilities, particularly evident among non-state-owned enterprises. Corporate ESG performance primarily alleviates the degree of short-term debt usage by enhancing information transparency, promoting long-term institutional investor holdings, improving bank-enterprise relations, mitigating over-investment, reducing financing costs, and loosening financing constraints [9]. Furthermore, by mitigating maturity mismatch issues, improvement of corporate ESG performance enhances capital market investment efficiency, improves corporate performance, and reduces liquidity risks, among other factors [10].

The main contributions of this study are as follows: First, existing literature examines corporate performance mainly based on a variety of financial indicators and lacks the integration of ESG factors and the use of short-term debt within a coherent analytical framework. Previous studies have tended to focus only on financial ratios or ESG performance, failing to capture the interactions between these factors and their combined impact on firm outcomes. This study incorporates ESG and short-term debt usage into a unified analytical framework, and analyzes them from the perspectives of corporate performance and capital market investment efficiency. This study integrates and supplements relevant literature on the analysis of maturity mismatch issues from an ESG perspective, examines the impact mechanism of corporate ESG performance/ratings on the maturity mismatch of investment-financing. This study also enriches the research on factors influencing short-term debt usage by enterprises in the Chinese context both theoretically and empirically.

Second, Previous research on the use of short-term debt by Chinese firms has been limited in both breadth and depth. While some studies have explored the factors that influence firms' debt financing choices, they have not fully explored the unique context and drivers of short-term debt use in the Chinese market. This study aims to enrich the literature by providing theoretical insights and empirical evidence specific to the Chinese context. This study provides new evidence of the positive impact of ESG on mitigating short-term debt usage by companies, from the perspective of reducing corporate and systemic financial risks. Building upon this foundation, it provides governments with innovative pathways and strategies to proactively mitigate financial risks while advancing the objectives of carbon neutrality and peak carbon emissions. By offering concrete solutions and novel approaches, it facilitates the implementation of new policies and initiatives aimed at achieving these ambitious goals.

2. Literature Review

2.1 The Impact of ESG

Currently, research on ESG primarily focuses on the positive impact on corporate performance, such as studying the intrinsic mechanisms by which reshaping the innovation process based on a novel sustainable concept brings competitive value to corporate performance [11]. And also expanding the scale of investment and improving investment efficiency [12]. Moreover, reducing the cost of debt financing and facilitating access to corporate governance information [13]. Claessens S [14] found that ESG ratings can serve as market incentives and external supervision to promote companies to achieve green transformation. Under the pressure of air pollution, corporate ESG performance can alleviate future financing constraints for enterprises and enhance market valuation [15]. ESG impacts debt financing from the perspectives of financial risk, information risk, and agency risk mechanisms. Good ESG performance can exert an "insurance effect," reducing the likelihood of corporate financial distress, fostering a positive brand image, and accumulating significant reputation capital [16], and helping companies better respond to internal and external adverse shocks. Enterprises with good ESG performance have more sound governance mechanisms, weaker motivations for executive involvement in earnings management and concealing negative news, and smaller scope for such activities [17]. High-quality financial information enhances corporate transparency. When external oversight mechanisms are weak, good ESG performance can serve as an alternative mechanism to external oversight, timely constraining managerial behavior and alleviating creditors' concerns about their interests being compromised [18]. Good ESG performance can effectively reduce information asymmetry, lowering the debt financing costs and equity capital

costs for companies [19]. Also, ESG has a differential impact on the financing costs of enterprises. Companies with better environmental and corporate governance performance experience significantly reduced financing costs, with the quality of information disclosure playing a crucial role in this relationship [20]. By reducing financing costs and relaxing financing constraints, on the supply side, it lowers the non-performing loan ratio of banks, controls credit risks, and thereby enhances the long-term financing supply for enterprises. On the demand side, it enhances the credit allocation capability of enterprises, optimizes the term structure of enterprise credit, promotes the transformation of enterprise long-term financing from mortgage loans to credit loans, and alleviates the "financing discrimination" against private enterprises by traditional banks [21]. Enhancing corporate credit allocation capability and alleviating the phenomenon of short-term debt usage, ESG has an optimizing effect on the maturity mismatch of investment-financing.

2.2 Short-term Debt Usage

The long-term debt ratio of Chinese listed companies is relatively low, while maturity mismatch in investment-financing has gradually become the root cause of various systemic financial risks in China [22]. From a macro perspective, the widespread issue of mismatched debt maturity structure in China stems from macro institutional deficiencies such as the unreasonable financial market structure, interest rate term structure, and unstable monetary policy [23]. The moderate elevation of monetary policy can exert direct effects by reducing corporate short-term debt usage and indirect effects by mitigating the negative impact of short-term debt usage on company performance. Short-term debt usage can weaken the positive effect of leverage ratio, intensify the negative impact of leverage ratio, and exacerbate corporate risk financing indicators and bankruptcy risks [24]. The micro perspective primarily focuses on the influence of corporate financial and management characteristics. Leverage ratios of state-owned enterprises and non-state-owned enterprises exhibit divergent trends over time. Financial institutions' tendency to discriminate against non-state-owned enterprises in financing is a significant factor contributing to the short-term debt usage of non-state-owned enterprises. Managerial overconfidence is positively correlated with the phenomenon of corporate short-term debt usage, while internal controls can mitigate the extent of short-term debt usage resulting from managerial overconfidence [25].

In summary, short-term debt usage is a core topic in the study of debt maturity structure and a prominent issue faced by Chinese enterprises. ESG research primarily focuses on corporate performance and financing constraints. There is still a gap in comprehensive quantitative examination of the impact mechanism of short-term debt usage from the ESG perspective. This study investigates the potential influence of corporate ESG performance on short-term debt usage.

2.3 Mechanisms of Effect

ESG ratings serve to convey more internal information about the company to the outside world, enhancing the level of corporate disclosure. They are typically associated with sustainable corporate strategies, signaling long-term business operations, increasing financial institutions' willingness to provide long-term loans, catering to the investment preferences of long-term institutional investors, and reducing the extent of short-term debt usage by companies. And also, they demonstrate a sound risk management level, prompting companies to reduce blind investment behaviors and managerial opportunism, thereby lowering agency costs and enabling more scientifically informed investment decisions. This leads to reduced over-investment and consequently lowers the long-term financing requirements of companies. Moreover, fulfilling social responsibilities enhances corporate reputation

and customer satisfaction, building competitive advantages and improving innovation levels, which positively impacts corporate financial performance. This, in turn, reduces debt financing costs, alleviates financing constraints, and ultimately influences the mismatch of investment-financing, mitigating the extent of short-term debt usage by companies.

Firstly, ESG ratings, as supplementary information disclosure beyond financial performance reports, can convey internal information about the company to external stakeholders. According to signaling theory, companies with good ESG performance transmit their commitment to social responsibility to the public, thereby establishing a responsible image and positive reputation. Companies endeavoring to build a responsible corporate image and reputation through ESG initiatives inevitably enhance the quality of their financial information disclosure. Given the inherent externality and cost of ESG initiatives, disclosing higher-quality financial information while pursuing ESG initiatives sends a positive signal about the company's operational status to external stakeholders. This not only creates a more transparent business environment but also helps establish long-term trust in the market, enhances corporate value alignment, strengthens long-term operational stability, and reduces financial institutions' concerns about default risks. Therefore, financial institutions are more willing to provide long-term loans to support companies with good ESG ratings, sharing in their long-term success and thereby curbing companies' reliance on short-term debt. Additionally, the high cost of long-term financing for companies and bank regulation is a significant factor contributing to the decline in the proportion of long-term financing.

Secondly, good ESG ratings require companies to pay more attention to the social and environmental impacts, avoiding the pursuit of short-term economic benefits only, reducing blind investment behaviors, and mitigating the trend of excessive pursuit of short-term gains. Furthermore, as ESG responsibilities gain attention, corporate governance improves, and managers' power undergoes effective supervision, compelling them to focus more on long-term value creation and reducing managerial shortsightedness caused by lack of funding, technology, management experience, etcetera [26]. Good ESG practices foster more effective corporate governance. By establishing standards for environmental, social, and governance criteria, they enhance the level of trust between management and shareholders, reduce agency costs, improve internal operational efficiency, and alleviate the additional costs arising from the principal-agent problem between shareholders and management. The thought process considered in ESG ratings encourages companies to prioritize social responsibility and sustainability, reducing preferences for projects that may lead to over-investment [27]. Companies tend to select projects that align with CSR standards and have minimal social and environmental impacts, thereby mitigating the financial risks associated with over-investment. Consequently, by reducing blind investments, managerial opportunism, agency costs, and over-investment, companies can better maintain financial health over the long term. This reduction in the urgent need for long-term financing enables companies to respond more flexibly to fluctuations in the financing market.

Thirdly, through the fulfillment of social responsibility, companies demonstrate their concern for society and the environment, thereby establishing competitive advantages. Consumers tend to support companies that have a positive impact on society. Additionally, social responsibility also fosters innovation within companies, driving them to seek more environmentally friendly and sustainable business practices, thereby enhancing their level of innovation [28]. The higher the quality of ESG information disclosure, the more it contributes to the improvement of corporate performance, while the debt financing costs of companies are significantly negatively correlated with performance

[29]. Therefore, strengthening the attractiveness of long-term investments for companies facilitates obtaining long-term investments, mitigates the extent of short-term debt usage, enhances long-term financial stability, and prevents and resolves major risks. On the other hand, there is a negative correlation between corporate social responsibility (CSR) and debt financing costs. Actively undertaking CSR initiatives can promote a reduction in debt financing costs, improve the financing environment, and enhance corporate performance.

Based on this, the hypotheses proposed in this paper are as follows:

H_1: Corporate ESG performance reduces the extent of short-term debt usage.

3. Research Design

The study uses a sample of Shanghai and Shenzhen A-share listed companies from 2010 to 2022. To ensure the accuracy and stability of the data, data cleaning was conducted, excluding samples with missing data for a given year, ST and ST* companies, and financial industry companies. In the end, a total of 29,064 observations were obtained. The ESG ratings in this paper were obtained from the Huazheng Index of the Wind Financial Terminal (WFT) according to their website (https://www.wind.com.cn/), while company-level financial data came from the China Stock Market and Accounting Research (CSMAR) database and annual reports of the companies. To mitigate the impact of outliers on regression results, this paper winsorized all continuous variables at 1% and 99%. When conducting regression analysis, the paper clustered standard errors at the company level.

3.1 Variable Description

3.1.1 Dependent variable

The extent of short-term debt usage (*SDLA*). Following the approach, this study utilizes the difference between the ratio of short-term liabilities to total liabilities and the ratio of short-term assets to total assets to measure the level of short-term debt usage by companies [30]. The larger the value of the indicator, the more severe the mismatch between the investment and financing horizons of the company. Currently, there is no unified standard in academia for measuring the mismatch between investment and financing. For the sake of robustness, this paper also adopts the system constructed by McLean.R and uses the ratio of short-term liabilities to total assets (*SLEV*) to measure the degree of mismatch between investment and financing for companies [31].

3.1.2 Independent variable

The Corporate Environmental, Social, and Governance (*ESG*) Rating. Considering that the process and standards of Huazheng ESG rating are relatively transparent, with high update frequency, sustainability, comprehensive data, and high market recognition, this paper selects the Huazheng ESG index as a proxy variable for corporate ESG performance. Since year-end data reflects the comprehensive performance of the entire year and is more stable compared to rating data at other time points, it is conducive to reducing data volatility. Therefore, this paper selects fourth-quarter rating data to measure the annual ESG performance of companies. To mitigate the influence of dimensions, this indicator is normalized by dividing by 100. A higher score on this indicator implies better ESG performance of the company.

3.1.3 Control variables

Following the approach, this study selects firm size (*SIZE)*, leverage ratio (*LEV*), return on assets (*ROA*), firm growth (*GROWTH*), operating cash flow (*CF*), proportion of fixed assets (*FA*), board

size (*BOARD*), ownership concentration (*TOP1*), property rights nature (*SOE*), and management shareholding ratio (*MH*) as control variables [32]. The measurement methods are presented in Table 1.

Table 1: Variable Names and Definitions

Variable Type	Variable Names	Variable Symbols	Variable Definitions
Dependent Variable	short-term debt overuse.	*SDLA*	The difference between the short-term liability ratio (short-term liabilities/total liabilities) and the short-term asset ratio (short-term assets/total assets).
		SLEV	
Independent Variable	corporate ESG performance	*ESG*	Normalized scores of Huazheng ESG ratings.
Control variables	firm size	*SIZE*	Take the natural logarithm of total assets at the end of the period.
	leverage ratio	*LEV*	End-of-period total liabilities to end-of-period total assets ratio.
	return on assets	*ROA*	Net profit for the period divided by total assets at the end of the period.
	firm growth	*GROWTH*	Revenue growth rate
	operating cash flow	*CF*	Operating cash flow generated in the current period divided by total assets at the end of the period.
	proportion of fixed assets	*FA*	Net fixed assets to total assets ratio.
	board size	*BOARD*	The logarithm of the total number of board members.
	ownership concentration	*TOP1*	The proportion of shares held by the largest shareholder.
	property rights nature	*SOE*	Nature of actual controller of the company, represented as a dummy variable, with state-owned enterprises coded as 1 and non-state-owned enterprises coded as 0.
	management shareholding ratio	*MH*	Management shareholding ratio expressed as the number of shares held by management divided by total shares outstanding.

4. Results and Discussion

4.1 Model Design

To examine the impact of firm ESG performance on its short-term debt long-term use, this study constructs the following model based on existing literature:

$$SDLA_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 ROA_{it} + \beta_5 GROWTH_{it} + \beta_6 CF_{it} + \beta_7 FA_{it} + \beta_8 BOARD_{it} + \beta_9 TOP1_{it} + \beta_{10} SOE_{it} + \beta_{11} MH_{it} + COMPANY_i + YEAR_t + IND_{it} + \varepsilon_{it} \quad (1)$$

Wherein, the subscripts i and t denote the sample individual and year, respectively. *SDLA* represents the degree of short-term debt and long-term asset mismatch, serving as the dependent variable. ESG stands for the comprehensive ESG score from Huazheng ESG rating agency, serving as the primary explanatory variable. Additionally, this study controls for firm-level ($COMPANY_i$), year-level ($YEAR_t$), and industry-level (IND_{it}) fixed effects. ε_{it} represents the stochastic error term. All sample data have been standardized.

4.2 Descriptive Statistics

As shown in Table 2, the mean value of Short-term Debt to Long-term Assets (*SDLA*) is 0.256, with a standard deviation of 0.236, which is consistent with findings from previous literature, indicating the prevalent occurrence of short-term debt usage among listed companies on the Chinese A-share market. The mean value of ESG Performance (*ESG*) is 0.729, with a standard deviation of 0.055, suggesting that the overall level of ESG performance in the sample is slightly above average. Among the control variables, the mean value of companies' Size (*SIZE*) is 22.19, with a standard deviation of 1.284, indicating that the sample encompasses companies of various sizes. The statistical results of the variables are generally similar to those in existing literature and fall within normal ranges, indicating a certain level of reliability in the data used in this study.

Table 2 Descriptive Statistics

VARIABLES	(1) N	(2) mean	(3) SD	(4) min	(5) max
SDLA	29,064	0.256	0.236	-0.452	0.734
ESG	29,064	0.729	0.055	0.560	0.842
SIZE	29,064	22.19	1.284	19.65	26.21
BOARD	29,064	2.021	0.144	2	3
LEV	29,064	0.431	0.208	0.055	0.951
ROA	29,064	0.040	0.065	-0.252	0.226
GROWTH	29,064	0.192	0.459	-0.573	3.099
CF	29,064	0.047	0.069	-0.168	0.248
FA	29,064	0.216	0.161	0.002	0.706
TOP1	29,064	34.38	14.66	8.448	74.30
MH	29,064	12.76	19.16	0	67.39
SOE	29,064	0.376	0.484	0	1
SLEV	29,015	0.093	0.101	0	0.438

4.3 The Regression Estimation Results

Table 3 presents the baseline regression results for the main hypothesis of this study. From columns (1) and (3) of Table 3, it is observed that the coefficient of corporate ESG performance (*ESG*) on the degree of short-term debt long-term use (*SDLA*) (*SLEV*) is -0.212 (-0.145), which is statistically

significant at the 1% level. From columns (2) and (4) of Table 4, the coefficient of corporate ESG performance (*ESG*) on the degree of short-term debt long-term use (*SDLA*) (*SLEV*) is -0.149 (-0.033), significant at least at the 10% level. This implies that corporate ESG performance helps alleviate the mismatch between investment and financing, confirming the hypothesis H_1 of this study.

Table 3 The impact of corporate ESG performance on short-term debt long-term use

	(1)	(2)	(3)	(4)
VARIABLES	*SDLA*	*SDLA*	*SLEV*	*SLEV*
ESG	-0.212***	-0.149***	-0.145***	-0.033*
	(-6.11)	(-4.45)	(-8.49)	(-2.42)
Constant	0.411***	0.577***	0.199***	0.034
	(16.25)	(4.59)	(16.02)	(0.64)
SIZE		-0.012**		-0.003
		(-2.04)		(-1.21)
LEV		-0.081***		0.293***
		(-3.67)		(31.02)
ROA		-0.146***		-0.033**
		(-5.13)		(-2.73)
GROWTH		-0.002		-0.005***
		(-0.75)		(-4.94)
CF		-0.094***		-0.118***
		(-4.36)		(-14.96)
FA		0.445***		0.033**
		(16.92)		(2.95)
BOARD		0.020		0.009
		(1.31)		(1.41)
TOP1		-0.001***		0.000
		(-3.31)		(0.26)
SOE		0.008		-0.002
		(0.64)		(-0.50)
MH		-0.001***		0.000
		(-2.90)		(1.85)
TOP1		-0.001***		0.000
		(-3.31)		(0.26)
Observations	28,671	28,671	28,622	28,622
R-squared	0.633	0.677	0.608	0.654

Notes: Standard deviation is represented by the value in brackets. Besides, *, ** and *** mean $p < 0.1$, 0.05 and 0.01, respectively.

4.4 Moderation Effect Analysis

The higher the company's risk preference, the stricter the bank's credit allocation may be, leading to a widening gap between the demand for long-term investment and the supply of long-term funds. Companies with a preference for risk may mitigate their "short-term debt long-term use" behavior to

a greater extent if they exhibit good ESG performance. As good ESG performance is typically considered to reflect the company's sustainability and management quality, which helps boost investor confidence and thus reduce financing risk. This study draws on existing literature and uses the return on assets (*ROA*) adjusted by annual industry means as a proxy for corporate risk, i.e., the standard deviation of the sample companies' ROA adjusted by industry from year t-2 to t+2 [33]. Assigning a value of 1 to those above the median and 0 otherwise, the sample is divided into high-risk preference (*RISK-H*) and low-risk preference groups (*RISK-L*). The group regression results are presented in Table 5. In the high-risk preference sample (*RISK-H*), the coefficient of ESG performance on short-term debt long-term use is significantly negative at the 1% level. In the low-risk preference sample (*RISK-L*), the coefficient of ESG performance on short-term debt long-term use is significantly negative at the 5% level. This indicates that in companies with high-risk preferences, the mitigating effect of ESG performance on short-term debt long-term use is more pronounced.

Table 4 The Impact of Corporate Risk Preference on the Relationship between ESG Performance and Short-Term Debt Long-Term Use

VARIABLES	(1) *SDLA* *RISK-H*	(2) *SDLA* *RISK-L*
ESG	-0.160***	-0.104**
	(-3.63)	(-2.20)
Constant	0.467**	0.629***
	(2.92)	(3.51)
Controls	YES	YES
Ind & Year & Company	YES	YES
Observations	14,565	13,486
R-squared	0.721	0.777

Notes: Standard deviation is represented by the value in brackets. Besides, *, ** and *** mean $p < 0.1$, 0.05 and 0.01, respectively.

Considering that state-owned enterprises (*SOE*) may benefit from implicit government guarantees and political connections, making it easier for them to raise funds in the capital market, while non-state-owned enterprises (*NON-SOE*) often face greater financial and operational risks. This leads to "financing discrimination" by banks, preferring to provide loans to *SOE*, exacerbating the mismatch in investment- financing for *NON-SOE*. This study divides the sample into *SOE* and *NON-SOE* based on corporate ownership nature. The group regression results are presented in Table 6. In the sample of *SOE*, the estimated coefficient of ESG performance on short-term debt long-term use (*SDLA*) is negative but not significant. In the sample of *NON-SOE*, the estimated coefficient of ESG performance on *SDLA* is significantly negative at the 1% statistical level. This indicates that the mitigating effect of ESG performance on *SDLA* is more pronounced in *NON-SOE*.

Table 5 The Impact of Corporate Ownership Nature on the Relationship between ESG Performance and Short-Term Debt Long-Term Use

	(1)	(2)

VARIABLES	*SDLA* *SOE*	*SDLA* *SOE-NON*
ESG	-0.084	-0.155***
	(-1.46)	(-3.70)
Constant	0.643**	0.716***
	(3.00)	(4.27)
Controls	YES	YES
Ind & Year & Company	YES	YES
R-squared	0.593	0.651

Notes: Standard deviation is represented by the value in brackets. Besides, *, ** and *** mean p < 0.1, 0.05 and 0.01, respectively.

Based on the previous analysis, it is inferred that corporate ESG performance inhibits the mismatch between investment and financing by alleviating financing constraints. The debt financing capacity of a company is often regarded as a crucial indicator of financing constraints, reflecting the flexibility and feasibility of corporate financing. When a company can easily obtain debt financing, it indicates strong debt financing capacity, whereas constraints are implied otherwise. For companies with weak long-term financing capacity, a positive ESG performance is associated with greater access to long-term debt financing, resulting in a more pronounced alleviation of the mismatch between investment and financing. Therefore, this study selects the corporate long-term debt financing capacity (*LF*) as a proxy variable for financing constraints. Following the methodology used in the reference study, this study computes the residual by subtracting the estimated target long-term asset-liability ratio from the actual long-term asset-liability ratio (*LLEV*) [34]. The formula for estimating the target long-term asset-liability ratio is as follows:

$$LLEV_{it}=\beta_0+\sum\beta_j Controls_{i,\ t-1}+COMPANY+YEAR+\varepsilon_{it} \quad (2)$$

Samples with values exceeding the median are assigned a value of 1, while those below the median are assigned 0, resulting in the High Long-term Debt Financing Capacity group (*LF-H*) and the Low Long-term Debt Financing Capacity group (*LF-L*). The results of the grouped regression are presented in Table 7. In the sample with high long-term debt financing capacity (*LF-H*), the estimated coefficient of ESG performance on short-term debt overuse is negative but not significant. In the sample with low long-term debt financing capacity (*LF-L*), the estimated coefficient of ESG performance on short-term debt overuse is significant at the 1% level. This indicates that the reduction effect of ESG performance on short-term debt overuse is more significant in companies with weak long-term debt financing capacity.

Table 6 The Impact of Financing Constraints on the Relationship between ESG Performance and Short-Term Debt Overuse

VARIABLES	(1) *SDLA* *LF-H*	(2) *SDLA* *LF-L*
ESG	-0.041	-0.110***
	(-1.01)	(-2.63)

Constant	0.385*	0.658***
	(2.38)	(4.07)
Controls	YES	YES
Ind & Year & Company	YES	YES
Observations	12,563	12,387
R-squared	0.735	0.793

Notes: Standard deviation is represented by the value in brackets. Besides, *, ** and *** mean p < 0.1, 0.05 and 0.01, respectively.

4.5 Endogeneity Treatment

Given that ESG disclosure is voluntary, some companies engaged in ESG practices may lack ESG rating data, resulting in their exclusion from the sample studied in this paper and potentially leading to sample selection bias and endogeneity issues. To mitigate this potential self-selection bias, this study draws on the approach used by scholars and employs the Heckman two-stage self-selection correction model to address this issue [35]. A dummy variable for ESG performance (*ESGDUM*) is set and estimated as the dependent variable in the first-stage model. The first stage model is constructed as follows:

$$ESGDUM_{it} = \beta_0 + \beta_1 Controls\_l + \varepsilon_{it} \quad (3)$$

Table 7 Endogeneity Treatment

Variables	(1) *SDLA*	(2) *SLEV*	(1) *SDLA*	(2) *SLEV*
ESG	-5.750***	-1.582***	-0.135***	-0.024*
	(1.481)	(0.466)	(0.035)	(0.015)
IMR			0.014*	0.010***
			(0.007)	(0.003)
Controls		YES		YES
Ind & Year & Company	YES	YES	YES	YES
F	10.758	10.571		
Observations	25,996	25,950	24,736	24,233
R-squared			0.642	0.734

Notes: Standard deviation is represented by the value in brackets. Besides, *, ** and *** mean p < 0.1, 0.05, and 0.01, respectively.

4.6 Robustness Test

Due to insufficient motivation and content in the disclosure of ESG-related information by listed companies and the lack of authority in ESG rating data provided by third-party institutions, this study adopts a cautious approach to mitigate the potential impact of ESG disclosure quality on its conclusions. Specifically, the study utilizes *SDLA* and *SLEV* as dependent variables and incorporates data based on the ESG ratings provided by Commercial Green Finance as key explanatory variables. Regression results in Table 8 consistently demonstrate the effectiveness of corporate ESG performance in reducing short-term debt overuse. Furthermore, to eliminate the influence of equity

financing on the study's conclusions, *Z-index* or *SA-index* can be included as control variables in the model.

Table 8 Robustness Test

Variables	(1) *SDLA*	(2) *SLEV*	(3) *SDLA*	(4) *SLEV*
Huazheng ESG rating	-0.007***	-0.002**		
	(0.002)	(0.001)		
Shangdao Ronglv ESG Rating			-0.011**	-0.002*
			(0.005)	(0.001)
Controls		YES		YES
Ind & Year & Company	YES	YES	YES	YES
Observations	29,919	29,867	3,142	3,142
R-squared	0.629	0.724	0.788	0.841

Notes: Standard deviation is represented by the value in brackets. Besides, *, ** and *** mean $p < 0.1$, 0.05, and 0.01, respectively.

5. Conclusions

This study examines the impact mechanism of corporate ESG performance on its short-term debt overuse, based on data from Chinese A-share listed companies from 2010 to 2022. The research findings indicate that corporate ESG performance significantly reduces the extent of short-term debt overuse. The mechanism of influence operates through enhancing corporate transparency, increasing the holdings of long-term institutional investors, and reducing corporate over-investment, thereby alleviating the degree of short-term debt overuse. Further investigation reveals that this conclusion is more pronounced in companies characterized by high-risk preference, weak long-term debt financing capacity, and non-state-owned samples. Based on the research findings, this paper proposes the following policy recommendations.

The guide proposes measures to encourage and support long-term institutional investors to engage in long-term investment through initiatives such as tax incentives, investor education and training, and the establishment of long-term investment funds by the government. Additionally, it advocates for the introduction of a differential credit allocation system based on ESG evaluation to quantify corporate risks and performance. This system scientifically determines credit limits and interest rate levels, guiding enterprises to improve their ESG performance and alleviate the degree of investment and financing mismatch.

Encourage and standardize the ESG information disclosure of listed companies to enhance corporate transparency. Currently, there are numerous rating agencies in China with inconsistent standards, resulting in poor comparability of ESG levels among different enterprises and the risk of subjective adjustments in weighting. Government authorities can establish unified disclosure frameworks and standards, specifying the required disclosure content and frequency. Institutions or committees can be set up to audit the ESG disclosures of listed companies, ensuring the authenticity,

completeness, and accuracy of the information and preventing occurrences of "Greenwashing". Corresponding regulatory measures should be implemented to strengthen enforcement against companies violating ESG disclosure regulations.

The government should strengthen risk assessment and monitoring, regularly publish monitoring results, and guide enterprises in adjusting their financing structures to ensure the stable operation of financial markets. Governments should encourage enterprises to optimize their financing structures by extending financing maturities and reducing the proportion of short-term debt. They should also promote corporate risk management awareness, establish a sound risk management system, and effectively manage market risk, credit risk, liquidity risk, and other types of risk, thereby reducing the risk of maturity mismatch in investment financing.

This paper provides insights into the impact mechanism of corporate ESG performance on the degree of short-term debt and long-term use. However, it has some limitations. The study is confined to Chinese A-share listed companies, limiting the generalizability of the results. There are subjective and operational challenges in measuring ESG performance and collecting financial data. Future research could broaden the sample scope, consider more potential influencing factors, and improve measurement methods to enhance the credibility and applicability of the study.

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