Corporate ESG Performance and Financing Constraints: Empirical Evidence from Chinese Listed Companies

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Abstract

In recent years, corporate ESG performance has received extensive attention from academic and practical circles around the world. This paper examines the impact of corporate ESG performance on financing constraints based on data from 2012-2019 Chinese A-share listed companies. The findings show that corporate ESG performance can mitigate corporate financing constraints. The results remain robust after using the new Environmental Protection Law, a quasi-natural experiment, with the difference-in-difference model to mitigate endogeneity. The mechanism test shows that ESG performance can mitigate corporate financing constraints by attracting more analyst attention to mitigate information asymmetry and obtaining more commercial credit. Heterogeneity analysis shows that corporate ESG performance has a more pronounced effect on alleviating financing constraints for non-state and high-tech firms.

Keywords: ESG, Financing constraints, Analyst attention, Commercial credit.

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1. Introduction

In recent years, black swan events have occurred frequently. In 2020, the coronavirus pandemic swept the world; in 2021, an extraordinarily heavy rainfall disaster happened in Zhengzhou, Henan Province, China and etc. Therefore, environmental (E), social (S), and governance (G) issues have once again become a hot topic of global discussion. The concept of ESG was first proposed by the United Nations Environment Programme in 2004, referring to companies and investors to integrate environmental, social, and governance issues into their decision-making systems, and the principle has been actively practiced within various countries around the world since its introduction. In terms of ESG investment, according to the UN Principles for Responsible Investment (UN-PRI), as of early June 2022, 4,984 organizations from more than 80 countries and regions have signed the PRI. In terms of corporate ESG practices, many countries are actively guiding companies to disclose ESG information. For example, in 2014, the EU issued Directive 2014/95/EU guidelines on non-financial information reporting, which requires all listed companies to publish non-financial reports, and the content of the reports need to include at least environment-related, social and labor-related, and human rights-related issues. China has also introduced relevant policies and regulations to regulate and guide corporate ESG activities. In August 2012, the Stock Exchange of Hong Kong, China, issued the first edition of the Environmental, Social, and Governance Reporting Guidelines, advocating ESG information disclosure by listed companies; in September 2018, the China Securities Regulatory Commission issued the Guidelines on Governance of Listed Companies, establishing the basic framework for comprehensive ESG information disclosure. With the development of the ESG concept, more and more companies have started to pay attention to their ESG performance and disclose their ESG information more actively. As of April 30, 2022, a total of 1,366 listed companies in China (excluding newly listed companies in 2022) disclosed their 2021 social responsibility reports on the info website, accounting for 29.42% of all listed companies, an increase of 2.52% over 2020, and this ratio is on a continuous upward trend.

Financing constraints are a common challenge in business development. Financing constraints refer to companies' difficulties and limitations in obtaining external financing. These difficulties and restrictions may prevent enterprises from obtaining the required financing funds or cause problems such as high financing costs and long lead times, thus hindering the development and expansion of enterprises. There are many reasons for financing constraints, including imperfections in the financial market, information asymmetry, and deficiencies in the legal system (SHI et al., 2023). In addition, the firm's characteristics also affect the degree of financing constraints, such as the quality of information disclosure (Zhang and Lv, 2007), and the shareholding of venture capital institutions (HU and ZHOU,2018). The importance of alleviating financing constraints for firms and the economy cannot be overstated. With the development of the ESG concept, companies with better ESG performance are increasingly favored by investors. Institutional investors

show a preference for corporates with better ESG performance (Zhou et al., 2020), and banks are also more favorable to companies with good ESG performance. In this context, we wonder whether better ESG performance helps alleviate firms' financing constraints.

Theoretically, there are two aspects of the impact of ESG performance on corporate financing constraints. On the one hand, from the perspective of management self-interest, scholars, represented by Friedman (1970), argued that CSR performance is a manifestation of management self-interest and increases agency costs. Quan et al. (2015) also found that CSR is a "self-interest tool" in China. Corporate managers may cover up public misconduct through good social responsibility performance (Gao et al., 2012). From this perspective, investment in ESG increases agency costs and then increases the financing constraints of firms. However, on the other hand, some scholars, based on shareholder valueism, found that better CSR and ESG performance can better meet stakeholders' expectations (Gu et al., 2020), reduce corporate business risks (Li et al., 2023), and help to obtain financial resources from banks, investors, etc., thus alleviating the financing constraints of firms.

Based on the above analysis, we can see that there is no consistent conclusion on the impact of corporate ESG performance on financing constraints. Therefore, we would like to explore whether corporate ESG performance increases or alleviates the financing constraints of firms in China. This paper uses panel data of Chinese A-share listed firms from 2012-2019 to explore the impact of firms' ESG performance on financing constraints and further analyzes the mechanisms behind it. The findings show that: first, the ESG performance of firms has an impact on the financing constraints, and better ESG performance significantly alleviates the financing constraints of firms; second, the mechanism test shows that better ESG performance can reduce the information asymmetry degree of firms by increasing analyst attention and obtain more commercial credit financing.

The marginal contributions of this paper are: first, it enriches the relevant studies on the influencing factors of corporate financing constraints from the perspective of ESG performance. While previous studies mainly examined the influencing factors of corporate financing constraints from the policy level and corporate finance level, this paper incorporates corporate ESG performance into the analytical framework and explains the potential mechanisms of ESG performance to alleviate corporate financing constraints from the perspectives of mitigating information asymmetry and resource access, which complements the related studies on corporate financing constraints. Second, it enriches the relevant studies in the field of ESG. Relatively few studies about ESG performance have been conducted on the impact of corporate finance and no uniform conclusions have been drawn. This paper provides empirical evidence from China to understand the relationship between ESG performance and corporate financing constraints. Third, this paper finds that corporate ESG performance helps to alleviate corporate financing constraints, which complements the understanding of the economic consequences of corporate ESG practices and provides some guidance for corporate governance practices.

The rest of the paper is organized as follows. Section 2 is the literature review;

Section 3 discusses the study design; Section 4 represents the empirical results; Section 5 is the mechanism analysis; Section 6 is the heterogeneity analysis; and Section 7 concludes.

2. Literature review

The research in this paper deals with the impact of corporate ESG performance on financing constraints. The relevant literature is divided into the following two categories for review to sort out the research progress in related aspects.

2.1   Economic Consequences of Corporate ESG Performance

With the development of the ESG concept, a large number of scholars have conducted in-depth studies on the topics related to corporate ESG to help corporate managers understand the economic consequences of improving their ESG performance. Gillan et al. (2010) studied the relationship between corporate ESG ratings and corporate performance and found that higher ESG ratings lead to higher business performance. However, Servaes and Tamayo (2013) found that the interaction between ESG/CSR attributes and firm value depends on the level of advertising, and they found that ESG/CSR investments either hurt firm value or are not related to firm value in companies that do not advertise. In the Chinese market, Quan et al. (2015) found that CSR investments exacerbate firms' risk of stock price collapse, suggesting that firms' pursuit of social responsibility reflects management's self-interest characteristics rather than creating value for shareholders. However, Li et al. (2023) found that firms' ESG performance can significantly reduce firms' debt financing costs. Jiang et al. (2022) conducted a product market perspective analysis and found that active corporate social responsibility can improve product market performance. We can conclude from the above discussion that there is still a debate on whether it is beneficial or detrimental for companies to take ESG responsibility.

2.2   Influencing Factors of corporate financing constraints

The financing constraint is a common problem encountered by enterprises in various countries in the process of operation and development. The root cause of the financing constraint is the information asymmetry between enterprises and external capital holders (Myers and Majluf, 1984). Due to the information asymmetry, external capital holders need to spend a lot of time and effort to investigate the investment target firm, and even then, it is difficult to make an accurate assessment of the firm's value. To offset the possible losses caused by adverse selection and moral hazard, external investors usually adopt a risk compensation approach, i.e., they demand a higher financing premium from the firm, which eventually leads to a higher cost of exogenous financing than the opportunity cost of endogenous financing (HU and ZHOU, 2018). In addition to information asymmetry, the ability to access resources is also an important factor affecting the financing ability of enterprises. China has a highly centralized financial system

dominated by state-owned banks, and there is a sequential order of ownership nature in credit allocation so private firms face serious financing discrimination (Lin and Li, 2001). Yu et al. (2012) conducted a study on the Chinese market and found that politically connected firms are more likely to obtain bank loans, have easier access to the capital market, and face relatively fewer financing constraints. In addition, other scholars have studied the legal environment and found that investor legal protection enhances investors' willingness to provide capital and helps to alleviate corporate financing constraints (La Porta et al., 1997). In general, financing constraints are influenced by many factors, macroscopically by the legal environment, the state of economic development, and the level of capital market development. At the micro level, both the ownership structure and the firm's corporate governance level also have an impact on the firm's financing constraint ability.

Although previous studies have produced fruitful results on the topic of financing constraints and ESG performance, there is no consistent conclusion on the relationship between ESG performance and corporate financing constraints. And relatively little research has been conducted on the ESG performance of Chinese companies. Therefore, this paper explores the relationship between ESG performance and corporate financing constraints based on Chinese A-share companies to see whether corporate ESG performance exacerbates or alleviates corporate financing constraints.

3. Study design

3.1   Model design

To investigate the impact of corporate ESG performance on corporate financing constraints, we design the following model

$$KZ_{i,t} = \alpha + \beta_1\, Esgscore_{i,t} + \beta'_2 X_{i,t-1} + \theta_i + \theta_t + \varepsilon_{i,t} \qquad (1)$$

where $Esgscore_{i,t}$ denotes the ESG score of the firm, i represents the firm, and t represents the year. $KZ_{i,t}$ denotes the firm's financing constraint level, $X_{i,t-1}$ denotes a set of control variables that may affect the financing constraint, θ_i is the firm fixed effect, θ_t is the time fixed effect, and $\varepsilon_{i,t}$ is the unobserved error component. To improve the robustness of the regression results, the following basic treatments are carried out in this paper: first, both firm fixed effects θ_i and time fixed effects θ_t are controlled; second, the standard errors of all OLS regression results in this paper are adjusted by firm-level clustering to eliminate the effects of correlation and heteroskedasticity within the potential residual groups.

3.2   Sample selection and data sources

The initial sample of this study is the annual panel data of A-share listed companies from 2012 to 2019. To ensure the validity of the study, the initial sample is

processed as follows: (i) ST and *ST companies are excluded; (ii) financial listed companies are excluded; (iii) samples with missing indicators such as ESG scores and financial variables are excluded; and (iv) all continuous variables are winsorized by 1% and 99%. The ESG score data are obtained from the Hexun ESG rating database, and the remaining variables are obtained from CSMAR, CNRDS and WIND databases.

3.3   Variable selection and description

The level of financing constraints (*KZ*). Theoretically, the degree of financing constraint of a firm can be indirectly reflected by several key corporate financial indicators. Various measures have been developed in the field of corporate finance, mainly the KZ index (Kaplan and Zingales, 1997), the WW index (Whited and Wu, 2006), and the SA index (Hadlock and Pierce, 2010). In this paper, our baseline regression uses the KZ index, which takes five factors including net cash flow from operations, cash holdings, payout level, degree of debt, and growth as proxy variables to characterize the financing constraints. The KZ index in this paper is obtained from the CSMAR database, and the specific calculation formula is shown in the Appendix.

Corporate ESG performance (*Esgscore*). This paper uses the ESG score from the Hexun website, which is based on the social responsibility reports and financial reports of listed companies in China. It establishes 13 secondary indicators and 37 tertiary indicators in five aspects: shareholders' responsibility, employees' responsibility, suppliers', customers' and consumers' rights and interests' responsibility, environmental responsibility, and public responsibility, to systematically evaluate the social responsibility of enterprises, which can more comprehensively reflect the ESG performance of enterprises in an objective way.

Control variables (*X*). Based on the summary of previous literature, we consider the following factors that may affect the firm's financing constraints: firm size (*Size*), defined as the natural logarithm of total assets; leverage (*Lev*), defined as the ratio of total liabilities to total assets at year-end; return on total assets (*ROA*), defined as net income divided by the average balance of total assets; growth rate of operating income (*Growth*), defined as the annual growth rate of operating income; cashflow ratio(*Cashflow*), defined as net cash flow from operating activities divided by total assets; Tobin Q, defined as Tobin's market value/total assets; concentration of shareholding (*Top1*), defined as the proportion of shares held by the largest shareholder; institutional shareholding (*INST*), defined as the total number of shares held by institutional investors as a percentage of the total shares of a listed company; the percentage of independent directors (*Indep*), defined as the ratio of the number of independent directors to the number of directors; two positions in one (*Dual*), where the chairman and general manager are the same person is 1, otherwise is 0; nature of ownership (*SOE*), state-owned enterprises is 1, non-state-owned enterprises is 0.

3.4 Summary statistics

Table 1 reports the basic statistical characteristics of the main variables. The results show that the mean value of the *KZ* is 1.218, with a standard deviation of 2.071, indicating that there are significant differences in the level of financing constraints faced by different firms. The mean value of *Esgscore* is 23.828, the maximum value is 74.820, and the minimum value is -3.600, which also indicates that there are significant differences in the ESG performance of different enterprises.

Table 1: Summary statistics

Variable	Mean	Min	Max	SD	p25	p50	p75
KZ	1.216	-4.814	6.173	2.071	0.014	1.381	2.580
Esgscore	23.828	-3.600	74.820	15.510	16.200	21.800	27.280
Size	22.103	19.828	26.091	1.290	21.159	21.917	22.842
Lev	0.416	0.049	0.894	0.210	0.244	0.404	0.575
Roa	0.046	-0.177	0.213	0.057	0.016	0.042	0.075
Cashflow	0.043	-0.161	0.231	0.069	0.004	0.042	0.084
Growth	0.184	-0.518	2.602	0.404	-0.006	0.117	0.276
Indep	0.374	0.333	0.571	0.053	0.333	0.333	0.429
Tobinq	2.028	0.893	8.514	1.281	1.247	1.607	2.306
Top1	0.354	0.088	0.750	0.150	0.236	0.336	0.455
INST	0.379	0.000	0.882	0.240	0.169	0.385	0.568
SOE	0.361	0	1	0.480	0	0	1
dual	0.275	0	1	0.446	0	0	1

4. Empirical results

4.1 Baseline regression

To test the effect of corporate ESG performance on the level of financing constraints, this paper runs an OLS regression on the full sample according to equation (1), and the results are shown in Table 2. Column (1) is the result of not including control variables when controlling for firm and year-fixed effects. In this situation, the coefficient of *Esgscore* is -0.018, which is significantly negative at the 1% level. Column (2) further adds control variables, and the coefficient of *Esgscore* is -0.016, again significantly negative at the 1% level. In an economic sense, for every unit increase in a firm's ESG score, the firm's level of financing constraints decreases by 0.016 units. Overall, the results of the baseline regression suggest that the better the firm's ESG performance, the lower the firm's financing constraints.

Table 2: Baseline regressions

VARIABLES	(1) KZ	(2) KZ
Esgscore	-0.018***	-0.016***
	(-15.364)	(-16.786)
Size		0.395***
		(8.929)
Lev		3.171***
		(20.668)
Roa		-3.830***
		(-11.286)
Cashflow		-1.732***
		(-7.064)
Growth		-0.043
		(-1.396)
Indep		0.311
		(0.972)
Tobinq		0.150***
		(7.167)
Top1		-1.163***
		(-4.705)
INST		0.053
		(0.609)
SOE		0.210*
		(1.785)
dual		-0.080**
		(-2.008)
Constant	2.781***	-6.691***
	(58.286)	(-6.963)
Time fixed effect	YES	YES
Firm fixed effect	YES	YES
Observations	19,135	19,135
Adjusted R-squared	0.137	0.251

4.2   Endogenous problems

In model (1), although this paper tries to control for factors that may affect both corporate ESG performance and corporate financing constraints, the empirical results may still be influenced by some unobservable factors, and such omitted variables may lead to biased estimated coefficients. In addition, firms with lower financing constraints may have more funds to improve their corporate ESG performance, and there may be reverse causality between the two. To mitigate the endogeneity problems caused by omitted variables, measurement errors, and

reverse causality, this paper further uses the difference-in-difference method for estimation. On January 1, 2015, the New Environmental Protection Law of the People's Republic of China came into effect, which further emphasizes the responsibilities of different subjects in environmental regulation and pollution prevention, and makes the completion of environmental protection targets an important basis for the assessment and evaluation of government officials. Since heavy-polluting enterprises make the main polluters of the environment and are more likely to attract the attention of governmental supervision, the impact of the new environmental protection law on heavy-polluting enterprises is correspondingly greater. It has been demonstrated in the literature that the implementation of the new environmental protection law promotes green innovation among heavy-polluting enterprises (WANG et al., 2020). Since the environment is an important part of ESG, the ESG performance of heavy-polluting enterprises will correspondingly improve. This provides an opportunity for this paper to construct a difference-in-difference model to identify the causal relationship between firms' ESG performance and financing constraints.

Drawing on CUI et al. (2019), this paper takes A-share heavy-polluting enterprises from 2012-2019 as the experimental group[2] and other listed companies in the same category of heavy-polluting enterprises as the control group[3] to examine the trend of corporate financing constraints before and after the implementation of the new Environmental Protection Law. The specific model is constructed as follows:

$$KZ_{i,t} = \alpha + \beta_1 Treat \times Post + \beta'_2 X_{i,t-1} + \theta_i + \theta_t + \varepsilon_{i,t} \qquad (2)$$

where $Treat$ indicates whether it is an experimental group: if the firm is a heavy-polluting enterprise $Treat$ is 1; otherwise, it is 0. $Post$ is a policy dummy variable. Since the new Environmental Protection Law has been in effect since January 1, 2015, $Post$ is 1 if the sample observations are in 2015 and later; o otherwise it is 0. The coefficient of $Treat \times Post$ captures the impact of the implementation of the environmental law, and if β_1 is negative, it indicates that the mitigation of corporate financing constraints is more pronounced in firms that are hit heavily by the new environmental law, i.e., corporate ESG performance significantly mitigates corporate financing constraints. Table 3 reports the estimation results of DID. The results show that the coefficient of $Treat \times Post$ is significantly negative at least at the 1% level, which is consistent with expectations.

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2 Based on SFC Industry Classification 2001 Edition, experimental group includes B (extractive industries), C0 (food, beverage), C1 (textiles, clothing, fur), C3 (paper, printing), C4 (petroleum, chemical, plastic, plastic), C6 (metal, non-metal), C8 (medicine, biological products), D (electricity, gas and water production and supply industry).

3 Based on SFC Industry Classification 2001 Edition, contral group includes C2 (wood, furniture), C5 (electronics), C7 (machinery, equipment, instruments), C99 (other manufacturing).

Table 3: DID results

	(1)
VARIABLES	***KZ***
Treat×Post	-0.354***
	(-3.927)
Control variables	YES
Time fixed effect	YES
Firm fixed effect	YES
Observations	5,060
Adjusted R-squared	0.274

The parallel trend assumption is a key assumption for unbiased DID estimators. In this paper, referring to BIAN et al. (2021), using 2012 as the base year, we test whether there is a significant difference between the two ex-ante samples in terms of financing constraints by adding the interaction term of *Treat* and year dummy variables in the regression. The results are shown in Figure 1. We can see that the coefficients of *before1*(one year before the policy), and *before2*(two years before the policy) are not significant, which indicates that in years before the policy shock, the experimental group is not significantly different from the control group, It is consistent with the prerequisite of the difference-in-difference model.
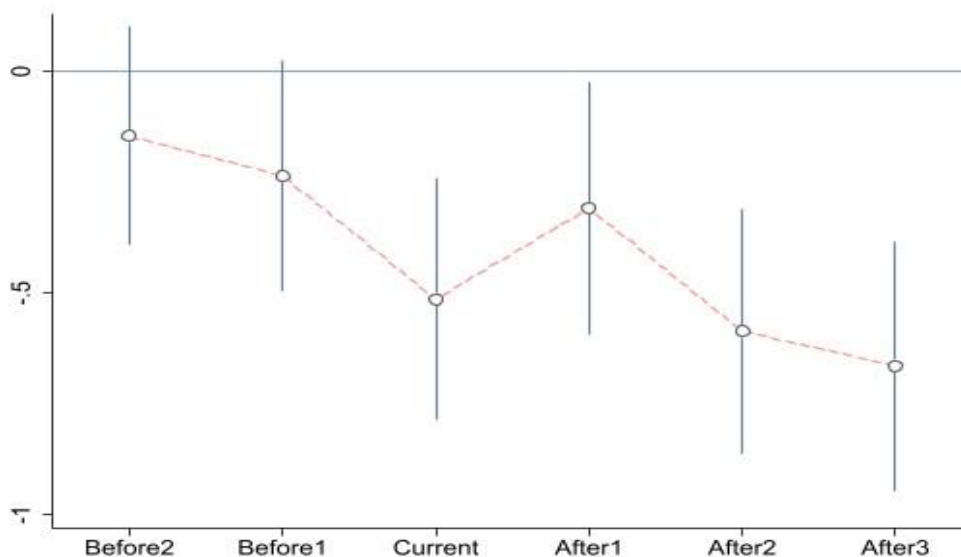

Figure 1:Parallel trend test

To exclude the potential interference of other factors on the regression results, this paper constructs the experimental and control groups by random sampling in the full sample, and the generated results are regressed with the model (2) 500 times. The probability densities of the estimated coefficients and the corresponding p-value distributions of the regressions are shown in Figure 2. The coefficient of baseline, -0.354, lies outside the estimated results of the random grouping. And it can be seen that the p-value of the random grouping is overwhelmingly greater than 0.1, indicating that there is no fake treatment effect and that the regression results of DID are robust.
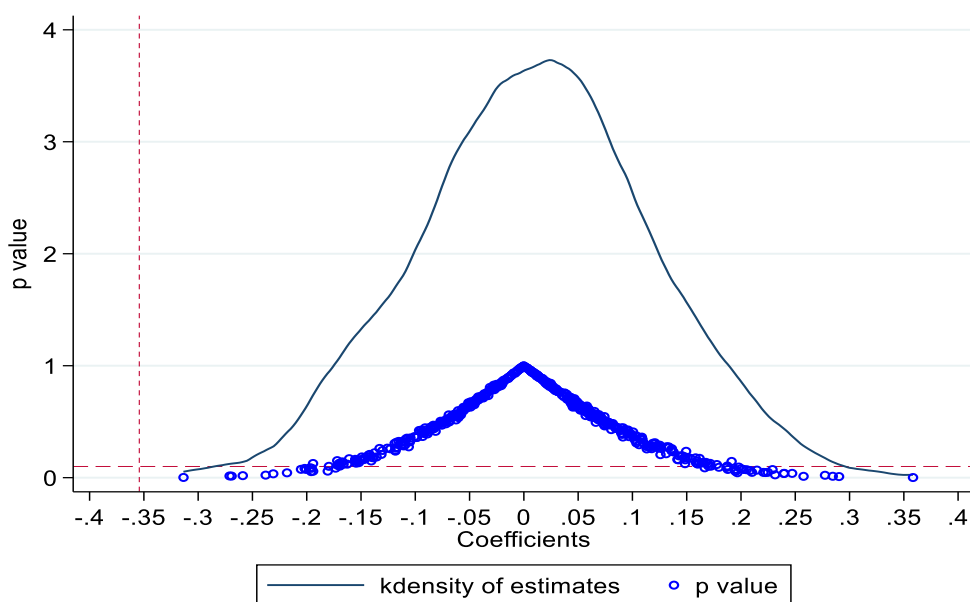
Figure 2: Placebo test

4.3   Robustness test

4.3.1   Replace the measure of financing constraints

As one of the robustness tests, this paper uses different methods to measure the level of financing constraints by referring to the existing literature. Column (1) of Table 4 shows the results of the SA index, where the higher the SA index is, the higher the financing constraint level, and column (2) of Table 4 shows the results of the WW index, where the higher the WW index is, the higher the financing constraint level. We can see that the two coefficients are significantly negative at the 1% level, which is consistent with the baseline regressions, indicating that ESG performance can alleviate the financing constraints of firms.

Table 4: Robustness test. Replace the measure of financing constraints

	(1)	(2)
VARIABLES	*SA*	*WW*
Esgscore	-0.0004***	-0.001***
	(-10.211)	(-21.178)
Control variables	YES	YES
Time fixed effect	YES	YES
Firm fixed effect	YES	YES
Observations	19,135	16,321
Adjusted R-squared	0.809	0.186

4.3.2   Replace ESG rating metrics

To avoid possible bias from the accuracy of the Hexun ESG score data, we re-estimate the model (1) using the Huazheng ESG ratings, and the results are displayed in Table 5, where the coefficient of Esgscore is significantly negative at the 5% level, consistent with the baseline regression. It indicates that better ESG performance of firms can alleviate the financing constraints and the results of the baseline regression are relatively robust.

Table 5: Robustness test. Replace ESG rating metrics

	(1)
VARIABLES	**KZ**
Esgscore	-0.039**
	(-2.178)
Control variables	YES
Time fixed effect	YES
Firm fixed effect	YES
Observations	19,135
Number of stock	3,289
Adjusted R-squared	0.233

5. Mechanism Analysis

Based on the above analysis, we can find that better ESG performance of firms can alleviate the financing constraints of firms, and the next key question is, what are the potential mechanisms by which the ESG performance of firms affects the financing constraints? We give possible mechanisms for the impact of corporate ESG performance on financing constraints from two perspectives: information asymmetry mitigation and resource effects.

5.1   Alleviate information asymmetry

Information asymmetry is the root cause of financing constraints, and external financing will be hindered when external fund holders cannot truly grasp the operating and financial status of the enterprise. It has been found that the intervention of financial intermediaries can tap the private information within the enterprise and act as an intermediary for information dissemination between investors and companies, which can effectively reduce the information asymmetry level of enterprises and thus alleviate the financing constraints of enterprises. In recent years, the ESG investment concept has received widespread attention from investors, and for marketing purposes of securities companies, companies with good ESG performance may be followed by more analysts. The more analysts pay attention to companies, the more conducive to the mining of private information and the dissemination of public information, which will further reduce the information asymmetry between companies and the market, thus alleviating the financing constraints of companies (Zhang and Lv et al., 2007).

To test the above mechanism, this paper uses analyst attention as the dependent variable for regression. Analyst attention is measured by the number of analysts followed (*Analyst*) and the number of research reports (*Report*), and both variables are logarithmically treated. The estimated results are presented in Table 6, columns (1) and (2), respectively. It can be seen that the regression coefficients of *Esgscore* are 0.008 and 0.007, respectively, which are significantly positive at the 1% level, indicating that better ESG performance of firms does increase analyst attention, which in turn can alleviate the financing constraints of firms.

5.2   Resource effect

From the perspective of shareholder valueism, companies with good ESG performance pay more attention to the relationship with various stakeholders, such as shareholders, employees, suppliers, customers, consumers, communities, government, and society, and can better meet stakeholders' expectations and facilitate access to strategic resources in the hands of stakeholders, one important aspect of which is business credit. Wang et al. (2013) found that whether suppliers are willing to provide commercial credit to customer companies depends mainly on mutual trust and reputation. ESG encompasses various aspects of a company's climate change, employee diversity, and corporate corruption governance, thus is an important criterion for upstream and downstream companies to judge the company. Good ESG performance helps to improve their trust in the company and thus makes it easier to obtain commercial credit support(Li and Feng,2022). Commercial credit allows the buyer to defer payment without having to pay immediately after obtaining the goods. From a financial point of view, commercial credit is short-term financing from the seller to the buyer. Several scholars have confirmed that commercial credit has a significant mitigating effect on corporate financing constraints (Biais and Gollier, 1997; Shi and Zhang, 2010). Based on the above analysis, firms with good corporate ESG performance are more likely to

receive commercial credit support and thus face a lower level of financing constraints.

To test the above mechanism, this paper applies commercial credit of enterprises as the dependent variable for regression. Referring to ZHONG et al. (2022), in this paper, we calculate the business credit (*TC*) of the firm based on the operating cost, which is calculated as (accounts receivable + notes receivable + prepaid accounts) / operating cost, and we logarithmically treat this variable. The estimated results are displayed in column (3) of Table 6. It can be seen that the regression coefficient of *Esgscore* is 0.001, which is significantly positive at the 10% level, indicating that firms with good ESG performance are more likely to obtain commercial credit, thus alleviating their financing constraints.

Table 6: Mechanism Analysis

	(1)	**(2)**	**(3)**
VARIABLES	*Analyst*	*Report*	*TC*
Esgscore	0.008***	0.007***	0.001*
	(11.953)	(8.935)	(1.743)
Control variables	YES	YES	YES
Time fixed effect	YES	YES	YES
Firm fixed effect	YES	YES	YES
Observations	13,902	13,929	19,089
Adjusted R-squared	0.040	0.136	0.035

The two mechanisms analyzed in this section suggest that corporate ESG performance can affect firms' financing constraints through two channels: mitigating information asymmetry and resource effects. Firms with better corporate ESG performance tend to have more analysts' attention, which reduces the information asymmetry between firms and capital holders. Apart from that, these companies tend to gain the trust of suppliers more easily, which makes it easier to obtain commercial credit support. Both two ways alleviate firms' financing constraints to some extent.

6. Heterogeneity analysis

6.1   Nature of enterprise property rights

In China's special institutional context, large SOEs enjoy a unique advantage in the credit market, while non-SOEs are at a disadvantage in accessing government resources compared to SOEs. As a result, information asymmetry tends to have a greater impact on the financing constraints of non-SOEs, which tend to have a greater need to gain public recognition and achieve resource exchange by assuming responsibility for environmental protection, social responsibility, and governance (Yu and Pan,2010). Therefore, the impact of corporate ESG performance on the financing constraints of firms with different ownership may differ. To explore this

issue in depth, this paper adds the interaction term of corporate ESG performance and the nature of corporate ownership (SOE) to model (1). The regression results in column (1) of Table 7 show that the coefficient of $Esgscore \times SOE$ is significantly positive at the 1% level, indicating that corporate ESG performance has a more significant effect on alleviating financing constraints for non-SOEs compared to large SOEs.

6.2 Whether it is a high-tech enterprise

High-tech enterprises face serious information asymmetry (Guiso, 1998) due to their high technological barriers. Capital holders often have limited knowledge of their profit prospects and risk levels, resulting in serious financing constraints. Therefore, there is more incentive to convey signals of good business conditions to the market through good ESG performance, which makes it easier to gain the trust of suppliers and attract more analysts' attention. Therefore, the mitigation effect of a firm's ESG performance on the financing constraints of high-tech firms may be greater. To explore this issue, this paper adds the interaction term of corporate ESG performance and dummy variable (HTEC) of high-tech firms in the model (1). The regression results in column (2) of Table 7 show that the coefficient of $Esgscore \times$ HTEC is significantly negative at the 1% level, indicating that high-tech firms have a more significant mitigating effect of ESG performance on their financing constraints relative to other firms.

Table 7: Heterogeneity analysis

VARIABLES	(1) KZ	(2) KZ
Esgscore	-0.027***	-0.014***
	(-16.335)	(-10.381)
SOE	-0.216*	0.213*
	(-1.709)	(1.771)
SOE× Esgscore	0.019***	
	(10.064)	
HTEC× Esgscore		-0.005***
		(-2.686)
HTEC		-0.108
		(-0.786)
Control variables	YES	YES
Time fixed effect	YES	YES
Firm fixed effect	YES	YES
Observations	19,135	19,135
Adjusted R-squared	0.256	0.249

7. Conclusion

The factors influencing corporate financing constraints and financing behavior have always been of great interest to the academic community. This paper selects ESG performance, an important indicator of corporate non-financial performance, to examine its impact on corporate financing constraints. Specifically, this paper empirically examines the relationship between corporate ESG scores and corporate financing constraints using panel data of Chinese A-share non-financial listed companies from 2012 to 2019. The findings show that better corporate ESG performance helps alleviate corporate financing constraints, and the results remain significant after a series of robustness tests. The mechanism test shows that corporates with better ESG performance can attract more investors' attention and gain more business credit, thus alleviating the financing constraints of firms. The heterogeneity analysis shows that better ESG performance has a more significant effect on alleviating the financing constraints of non-state-owned enterprises and high-tech enterprises.

Based on the above findings, the policy recommendations in this paper focus on the corporate governance level. First, companies should actively take ESG responsibilities and continuously improve ESG performance. The findings of this paper show that better ESG performance can effectively reduce the financing constraints of companies. Companies can gain external attention and trust by actively participating in environmental protection, climate governance, charitable donations, etc., to alleviate financing constraints. Second, ESG-related information should be actively disclosed. Analysts can reduce information asymmetry to a certain extent by acting as a transmitter of information about corporate activities, but ESG disclosure is still indispensable for companies to better communicate their sustainable development philosophy to stakeholders and thus gain their trust and support for corporate financing.

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Appendix

KZ index
In CSMAR, the KZ index is calculated as shown below:
1. Sample data processing: select listed companies in Shanghai and Shenzhen, exclude company codes in the financial industry, exclude sample data with missing data; winsorize continuous variables at 1% and 99% quartiles by year.
2. Specific calculation process:
a) For each year of the full sample, we calculate the net cash flow from operations/total assets at the beginning of the year $(\frac{CF_{i,t}}{ASSET_{i,t-1}})$、cash dividends/total assets at the beginning of the year, $(\frac{DIV_{i,t}}{ASSET_{i,t-1}})$、cash holdings/total assets at the beginning of the year $(\frac{CASH_{i,t}}{ASSET_{i,t-1}})$、leverage $(LEV_{i,t})$ and Tobin'sQ$(Q_{i,t})$ for classification. KZ1 takes 1 if $\frac{CF_{i,t}}{ASSET_{i,t-1}}$ is below the median and 0 otherwise; KZ2 takes 1 if $\frac{DIV_{i,t}}{ASSET_{i,t-1}}$ is below the median and 0 otherwise; KZ2 takes 1 if $\frac{CASH_{i,t}}{ASSET_{i,t-1}}$ is below the median then KZ3 takes 1, otherwise it takes 0. If $LEV_{i,t}$ is below the median then KZ4 takes 1, otherwise it takes 0. If $Q_{i,t}$ is below the median then KZ4 takes 1, otherwise it takes 0.
b) Calculate the KZ index：KZ=KZ1+KZ2+KZ3+KZ4+KZ5.
c) Ordered logistic regression was applied to model (1), and the KZ index was used as the dependent variable.The regression coefficients of the variables are estimated:

$$KZ_{i,t} = \beta_1 \frac{CF_{i,t}}{ASSET_{i,t-1}} + \beta_2 LEV_{i,t} + \beta_3 \frac{DIV_{i,t}}{ASSET_{i,t-1}} + \beta_4 \frac{CASH_{i,t}}{ASSET_{i,t-1}} + \beta_5 Q_{i,t} \qquad (1)$$

d) Using the estimated results of the above regression model, the KZ index of the degree of financing constraints is calculated for each listed company for each year.

WW index

In CSMAR, the WW index is calculated as shown below:

1. Sample data processing: excluding sample data with missing data (any indicator involved in the calculation is empty, and the final result is empty);
2. Specific calculation process:

$$WW = -0.091CF - 0.062DivPos + 0.021Lev - 0.044Size + 0.102ISG - 0.035SG \qquad (2)$$

where, CF: Cash flow to total assets ratio = net cash flow from operating activities/total assets

DivPos: Cash dividend payment dummy variable, 1 if cash dividend is paid in the current period, 0 otherwise.

Lev: long-term debt to asset ratio;

Size: the natural logarithm of total assets;

ISG: industry average sales growth rate; according to the 2012 SEC industry classification standard, the manufacturing industry takes two codes while other industries are coded with one digit:

SG: sales revenue growth rate;

SA index

In CSMAR, the SA index is calculated as shown below:

$$SA = -0.737sIZE + 0.043Size^2 - 0.040Age \qquad (3)$$

where Size: the natural logarithm of the size of the enterprise's total assets;

Age: Corporate operation year = observation year (current statistics cut-off date) - corporate establishment time (year)

Any of the indicators is empty, the calculation result is empty.