

ESG 성과가 중오염기업의 채무불이행 위험에 미치는 영향 -용자규제 기반 매개효과에 관한 연구-

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The Impact of ESG Performance on Debt Default Risk of Heavy Polluter Firms

-Study of mediation effects based on financing constraints-

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요약 본 연구는 2012년부터 2022년까지 중국 A주 상장회사 중에서 중오염기업을 표본으로 하여 기업의 ESG 성과가 채무불이행 위험에 미치는 영향을 분석하였다. 연구 결과는 좋은 ESG 성과가 기업의 채무불이행 위험을 효과적으로 감소시키는 것으로 나타났다. 추가 분석에서는 기업의 ESG 성과가 자금조달 제약의 영향을 완화시켜 채무불이행위험을 감소시키는 것을 보여주었다. 본 연구는 ESG 성과의 관점에서 채무불이행 위험의 영향 요인을 탐색하고, 기업의 ESG 성과가 경제적으로 미치는 영향에 대해 연구하여, 기업의 채무불이행 위험 예방에 대한 실증적 자료를 제공하였다.

주제어 ESG 성과, 부도위험, 자금조달 제약, 채무불이행, 중오염기업

Abstract This study examines the impact of corporate ESG performance on debt default risk using a sample of Chinese A-share listed. The Impact of ESG Performance on Debt Default Risk of Heavy Polluter Firms from 2012 to 2022. The findings show that good ESG performance can effectively reduce firms' debt default risk. Further analysis shows that firms' ESG performance reduces debt default risk by mitigating the impact of financing constraints. This study explores the influencing factors of debt default risk from the perspective of ESG performance, and also enriches the research on the economic impact of corporate ESG performance, providing empirical evidence for the prevention of corporate debt default risk.

Key Words ESG Performance, Default Risk, Financing Constraints, Debt Defaults, Heavy Polluter Firms

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1. Introduction

1.1 Background and significance

The concept of ESG was first articulated by the United Nations in 2006, and since then ESG has gained widespread attention around the world. ESG is an acronym for the initial letters of Environment, Social and Corporate Governance, which provides investors with a comprehensive framework for evaluating corporations, and is an extension of the concept of green and sustainable development of corporations, reflecting the contribution of corporations to green investment, responsible investment and ethical investment. Reflecting the contribution of enterprises in green, responsible and ethical investment, its concepts are highly compatible with China's goal of high-quality sustainable development, and provide viable elements of thought for sustainable economic and social development.

Debt default risk refers to the risk that a debtor is not capable of repaying the debt when it is due or is unable to repay the principal and interest on time, thereby causing the creditor to suffer losses. As of the beginning of 2023, 1,052 bonds in China's bond market had defaulted, totaling 852,795 billion yuan, and a large number of bank loan rollovers have defaulted in recent years, which has severely impacted the stability of the capital market. Many defaulted companies have poor financial disclosure quality and serious non-financial issues. ESG information covers non-financial information on corporate governance, environment and social responsibility, which improves the transparency of the company and reduces the information asymmetry among stakeholders, and it can complement the financial performance to help external investors to identify repayment risks, make scientific decisions, and reduce investment losses. The heavy pollution industry, as the industry with the largest energy consumption and the highest environmental pollution emissions among industrial indus-

tries, is subject to stricter environmental regulation and has a higher probability of debt default risk compared to other industries, so it is necessary to explore the relationship between ESG performance and default risk of heavy pollution enterprises, in order to provide the listed companies, various stakeholders and governmental departments with a better way to scrutinize the value of corporate ESG and to prevent the Financial Risks.

1.2 Research Purpose

In this paper, we study the relationship between ESG performance and default risk of heavy polluters listed on China's A-share market, and further explore its mechanism to provide scientific basis for creditors' decision-making and companies' choice of ESG transformation.

1.3 Innovative Points

Unlike previous studies that focused on the impact of ESG performance on firm value, firm performance and investment and financing activities, this paper explores the impact of ESG on debt default risk from the perspective of ESG as a whole and further analyzes the mechanism of action, enriching the study of the economic consequences of ESG performance.

2. Theoretical Foundations and Prior Research

2.1 Theoretical Foundations

2.1.1 Information Asymmetry Theory

The theory of information asymmetry was first proposed by the American economist George Akerlof, and information asymmetry refers to the inequality of information held by stakeholders. Firms have more comprehensive information about the firm compared to creditors, and this information asymmetry makes it possible for firms to hide unfavorable information

from stakeholders, such as creditors, which can lead to creditors being exposed to the risk of the firm's debt default.

2.1.2 Signaling Theory

Signaling theory suggests that education level can serve as a signal of a job applicant's competence, helping information disadvantaged employers to better recognize the real situation of job applicants. Corporate ESG disclosure can signal non-financial aspects and reduce information asymmetry, thereby increasing investor confidence and seeking developmental advantages for the company, which in turn reduces financial distress and default risk.

2.1.3 Reputation Theory

Reputation theory believes that the behavior of the enterprise can be transmitted to all stakeholders, and slowly form a reputation, and this corporate reputation can also affect the attitude and decision-making of all parties to the enterprise, and a good reputation can form a kind of protection for the development of the enterprise. In addition, reputation has heterogeneity, good reputation of the enterprise can better avoid the impact of negative events, minimize the risk,

2.2 Prior Research

2.2.1 Influencing Factors of Enterprise Debt Default Risk

The relevant studies are mainly carried out at both the micro and macro levels. At the macro level, Zhang et al. (2020)[1] found that interest rates also affect the default risk of enterprises. At the micro level, Lee(2010)[2] studied Korean listed companies in the manufacturing industry and found that corporate innovation activities can reduce default risk by improving firms' profitability. Feng et al.(2016)[3] found that firms' active fulfillment of social responsibility can improve operational capacity and information quality, thereby reducing debt default risk.

2.2.2 The concept of corporate ESG performance and the economic consequences

About ESG Concept. According to the existing related research, the main definition of ESG in this paper is that a company, in order to achieve the goal of sustainable development, improves its economic behavior in environmental, social and corporate governance aspects, establishes a good social image and obtains the strategic resources needed for the company's development. Improve its economic behavior, establish a good social image and obtain strategic resources for the company's development. Improve its economic behavior in environmental, social, and corporate governance aspects to build a good social image and obtain strategic resources for the company's development.

The existing literature on the economic consequences of firms' ESG performance mainly deals with the impact of ESG performance on firm performance and firm value aspects. Wang et al. (2022)[4] pointed out that ESG performance has the function of value creation, and better ESG performance of listed companies helps to reduce financing costs, improve enterprise operating efficiency, and increase innovation investment to enhance enterprise value; Yang et al.(2023)[5] found that ESG performance of listed companies during the epidemic period has the same positive effect on the enhancement of company value; Ruan et al. (2022)[6] companies actively Improving ESG performance reduces corporate risk, enhances corporate sustainability, wins the recognition of the government and stakeholders, and thus improves corporate performance.

2.2.3 Literature Review

Reputation theory suggests that a firm's behavior can be transmitted to all stakeholders, slowly forming a reputation, and a good reputation can form a kind of protection for the development of the enterprise. Companies with good reputations are better able to

avoid the impact of negative events and minimize risks,

3. Research Design

3.1 Research Hypotheses

3.1.1 ESG Performance and Debt Default Risk

From the perspective of reputation theory, good ESG performance can accumulate reputational capital and reduce the risk of corporate default. In addition, the disclosure of ESG information by heavy polluters can convey specific non-financial information about the company to stakeholders, improve the quality of disclosure and transparency of information, and help to reduce the information asymmetry between stakeholders and the company, which can enhance investor confidence and thus reduce the risk of financial distress and default. Accordingly, the paper proposes the following hypotheses:

H1: ESG performance of heavy polluters has a positive effect on reducing default risk

3.1.2 The Mechanism of ESG Performance on Debt Default Risk

From the perspective of resource support, ESG performance can help enterprises reduce financing costs and broaden financing channels, thus alleviating the financing constraints faced by enterprises. Heavily polluting enterprises have accumulated "reputation capital" through ESG performance, and a good reputation can help attract potential investors, alleviate the enterprise's financial pressure, and thus reduce the risk of debt default. Accordingly, this paper proposes the following hypotheses:

H2: The ESG performance of heavily polluting enterprises has a significant positive effect on reducing financing constraints.

H3: The reduction of financing constraints in heavy polluting enterprises has a significant positive effect on reducing default risk

H4: Financing constraints mediate the relationship between ESG performance and default risk of heavily polluting firms.

The study model diagram is shown in Figure 1 :

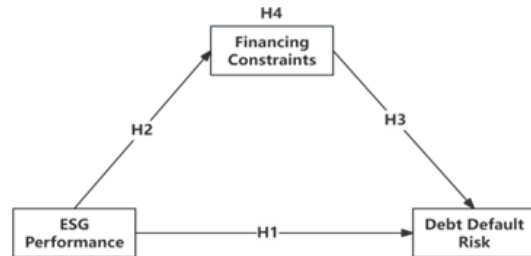


Fig. 1. Research model

3.2 Sample Selection and Data Source

This paper takes the listed heavy pollution industry companies in Shanghai and Shenzhen A-shares as the research object from 2012 to 2022, and processes the raw data according to the following methods: data does, financial, ST, and *ST companies are excluded; and the variables are reduced by the first and last 1%. Finally, 7,811 observations were screened out, and the raw data such as financial and debt default risk were obtained from Cathay Pacific database (CSMAR), and ESG performance data were obtained from CSI rating index data.

3.3 Selection of Research Variables and Indicators

3.3.1 Dependent Variable

The dependent variable of this paper is corporate debt default risk. This paper draws on the research of scholars such as Zhang and Altman (2010)[7] and chooses Z-score as a measure of corporate default risk. The formula is as follows.

$$Z=0.517-0.460x_1+9.320x_2+0.388x_3+1.158x_4 \quad (1)$$

Where X_1 denotes the ratio of total liabilities to

total assets, X_2 denotes the ratio of net profit to average total assets, X_3 denotes the ratio of working capital to total assets and X_4 denotes the ratio of retained earnings to total assets. If Z is greater than 0.9, the overall default risk of the enterprise is considered to be at a low level; if Z is between 0.5 and 0.9, the potential default risk needs to be paid close attention to; and if Z is less than 0.5, the enterprise has a high risk of default, the higher the value of Z , the lower the risk of defaulting on the debt faced by the enterprise.

3.3.2 Independent Variables

The dependent variable in this paper is ESG performance (ESG). This paper chooses to use the ESG scores of each firm provided by China's third-party rating agency, CSI ESG Ratings, as the dependent variable.

3.3.3 Mediating Variables

Drawing on Kaplan and Zingales[8](1997), the KZ index is constructed by taking A-share heavily polluted listed companies as samples, and the larger the KZ index is, the higher the degree of financing constraints faced by listed companies.

3.3.4 Control Variables

In this paper, this paper refers to Atif and Ali (2021)[9] and selects the following control variables: firm size (SIZE), return on assets (ROA), gearing ratio (LEV), current ratio (LIQ), fixed asset ratio (FIXED), total asset turnover (ASSTURN), market value (TOBINQ), in addition to controlling for Individual and year factors, i.e., individual effect (STOCK) and year effect (YEAR). The types, names, symbols of the relevant variables and the explanations of the variables are shown in detail in Table 1:

3.4 Model Design

To test the effect of firms' ESG performance on customers' default risk, the following linear regression model is constructed:

$$Z_{i,t} = \alpha_0 + \beta_1 ESG_{i,t} + \beta_{2-8} Controls_{i,t} + STOCK_{i,t} + YEAR_t + \varepsilon_{i,t} \quad (2)$$

Where $Controls_{i,t}$ is the set of control variables, α_0 is a constant term; β_1-8 are the coefficients of each explanatory variable, $Stock_{i,t}$ is an individual fixed effect; $YEAR_t$ is a year fixed effect; and $\varepsilon_{i,t}$ is a random

Table 1 Statistics of the Variables

Type of Variable	Variable Name	Variable-Definition	Variable Declaration
Dependent variable	Debt Default Risk	Z	Zhang, Altman, etc. (2010) design Zchina-score
Independent variable	ESG Performance	ESG	Chinese ESG evaluation score
Metavariable	Financing constraints	KZ	KZ index number
	Company size	SIZE	Natural logarithm of the total assets at the end of the year
	Return on assets	ROA	Net profit / average total assets
	Asset-liability ratio	LEV	Year-end liabilities / year-end total assets
	Current ratio	LIQ	Current assets / current liabilities
Controlled variable	Fixed assets ratio	FIXED	Fixed assets / total assets
	Turnover of total capital	ASSTURN	Sales revenue / total assets
	Vendibility	TOBINQ	Total market value / assets
	Individual effect	STOCK	Enterprise individual fixed effect
	Year effect	YEAR	Year fixed effect

disturbance term,

statistics of the variables. Among them, the mean value of debt default risk (Z) is 1,047, the median is 1,065, the standard deviation is 0,958, the minimum value is -2,487, and the maximum value is 3,529, which shows that the risk of debt default among the listed companies in China is large and the difference is more obvious. From the point of view of enterprise ESG performance

4. Empirical Analysis

4.1 Descriptive Statistics

the minimum value of ESG is 55.110, the maximum value is 84.400, indicating that there are large differences in ESG performance among listed companies of heavy pollution enterprises. The distribution of the rest of the variables is reasonable and there are no extreme outliers.

Table 2 Descriptive Statistics of Variables

Var Name	Obs	Mean	SD	Min	Median	Max
z	7811	1.047	0.958	-2.487	1.065	3.529
ESG	7811	72.765	5.658	55.110	73.170	84.400
size	7811	22.371	1.348	19.967	22.152	26.326
tobinq	7811	1.963	1.281	0.819	1.527	8.143
lev	7811	40.243	20.688	4.846	38.744	92.330
roa	7811	4.771	6.964	-21.739	4.316	26.196
liq	7811	0.025	0.028	0.003	0.016	0.182
fixed	7811	0.288	0.160	0.023	0.262	0.703
assturn	7811	0.654	0.370	0.117	0.580	2.261
kz	7811	0.974	2.279	-6.611	1.154	6.356

4.2 Regression Analysis

4.2.1 Main Effect Test of ESG Compliance on Corporate Debt Default Risk

To enhance the reliability of the results, stepwise regression is used to test the hypotheses and Table 3 reports the regression results of firms' ESG

Table 3 Benchmark Regression

VARIABLES	(1) Z (dependent)	(2) Z (dependent)
ESG (independent variable)	0.0232*** (10.53)	0.0030*** (4.18)
size		0.1685*** (11.29)
tobinq		-0.0387*** (-6.72)
lev		-0.0127*** (-24.85)
roa		0.0991*** (99.22)
liq		-0.0041 (-0.02)
fixed		0.0043 (0.09)
assturn		0.0130 (0.61)
Constant	-0.6450*** (-4.00)	-2.8365*** (-8.31)
Observations	7,739	7,739
R-squared	0.630	0.972
Stock	YES	YES
year	YES	YES

t-statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

performance and debt default risk. Column (1) represents that the independent variable ESG is significantly and positively correlated with the dependent variable Z at the 1% significance level, with a coefficient magnitude of 0.0232 meaning that for every 1 unit increase in ESG, z increases by 0.0232 units on average, all else being equal. Column (2) shows the regression results after adding control variables and controlling for individual and year fixed effects, the results show that the regression coefficient between firms' ESG performance and debt default risk is 0.0030, which is still significant at the 1% level. In addition, the R-squared of the equation is also above 0.6, which shows that the model fits well and has strong explanatory power. The above

results indicate that the better the ESG performance of enterprises, the lower the risk of debt default they face, and H1 is verified.

4.2.2 Testing the mechanism of ESG compliance on corporate debt default Risk

Financing constraint refers to the fact that when an enterprise needs financing for investment, the cost of exogenous financing is too high due to the lack of market completeness, which makes it difficult for credit financing to meet the requirements of investment level. When firms face lower financing constraints, it is relatively easier for them to obtain sufficient credit facilities from external sources such as financial institutions to meet their operational and investment needs, and the risk of default is relatively low.

In this paper, we refer to Baron and Kenny (1986)[10] to verify the mediating effect of financing constraints kz variable by using step wise method, firstly, the first step is to verify the relationship between the independent variable ESG and the dependent variable Z, which has already been proved in the previous baseline regression, i.e., ESG is positively correlated with Z at the 1% level of significance. In the second step, the dependent variable is replaced with the mediator variable to investigate whether there is a significant correlation between the independent variable and the mediator variable, and the results are shown in Table 4, as shown in Column(1), the coefficient of ESG is -0.0054, which indicates that ESG is negatively correlated with kz at 0% significance level, and the significant relationship is established. The third step, on the basis of the first step to add the mediating variable KZ regression again, if the mediating variable is significant, it indicates that there is a mediating effect, the results as shown in column(2) kz coefficient of -0.0045, at 1% significance level and z is negatively correlated, so the mediating effect exists, and is part of the mediating effect. The above results show that the good

performance of corporate ESG can reduce the risk of corporate debt default by alleviating the corporate financing constraints, i.e, the financing constraints have a partial mediating effect in the reduction of corporate default risk by ESG.

Table 4 Mechanism Tests

VARIABLES	(1) Kz (intermediary variable)	(2) Z (dependent)
kz		-0.0045** (-2.22)
ESG	-0.0054* (-1.71)	0.0030*** (5.66)
size	-0.1363*** (-3.74)	0.1679*** (27.69)
tobinq	0.4589*** (27.78)	-0.0367*** (-12.66)
lev	0.0467*** (31.85)	-0.0125*** (-47.88)
roa	-0.1077*** (-39.44)	0.0986*** (196.00)
liq	-13.8928*** (-16.04)	-0.0663 (-0.45)
fixed	1.0608*** (6.53)	0.0090 (0.33)
assturn	-0.4366*** (-6.59)	0.0110 (1.00)
Constant	2.4909*** (2.98)	-2.8254*** (-20.29)
Observations	7,739	7,739
R-squared	0.817	0.972
Stock	YES	YES
year	YES	YES

t-statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4.2.3 Robustness Test

In order to avoid the problem of endogeneity due to two-way causality and to explore the possible time lag of the independent variables on the dependent

variable, this paper carried out the 1st order and 2nd order lag processing of all explanatory variables, and the results of the regression are shown in Table 6, the coefficients of the independent variable esg are 0.0108 and 0.0121 respectively, and they are still significantly and positively correlated with the dependent variable at the 1% level of significance.

Table 5 Robustness Tests

VARIABLES	1st order lag Z (dependent)	2nd order lag Z (dependent)
ESG (independent variable)	0.0108***	0.0121***
	(5.23)	(4.98)
size	-0.0542 (-1.64)	-0.2256*** (-5.97)
tobinq	0.0242* (1.85)	-0.0152 (-1.06)
lev	-0.0070*** (-5.33)	-0.0025* (-1.69)
roa	0.0350*** (13.08)	0.0128*** (4.56)
liq	1.4752*** (2.77)	1.9969*** (3.04)
fixed	0.4058*** (3.25)	0.6434*** (4.46)
assturn	0.2322*** (4.55)	0.1097* (1.91)
Constant	1.1983* (1.66)	4.9155*** (5.86)
Observations	6,638	5,729
R-squared	0.699	0.654
Stock	YES	YES
year	YES	YES

t-statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5. Conclusions

5.1 Research Conclusion

First, this study focuses on the ESG performance of firms based on a sample of A-share listed heavy

polluters in China from 2012 to 2022, and second, it proposes the hypothesis that ESG performance of heavy polluters has a positive impact on reducing default risk and that financing constraints play an intermediary role in it. Finally, the results of the study show that good ESG performance can effectively reduce the debt default risk of firms, and the ESG performance of firms reduces the debt default risk by mitigating the impact of financing constraints.

The reason is that ESG, as a supplement to corporate non-financial indicators, reflects the contribution of companies in green investment, responsible investment and ethical investment, etc. Therefore, better ESG performance of a company establishes a good reputation, reduces the information asymmetry between creditors and the company, and sends out a signal of excellent business conditions; improves the level of corporate governance, and all of these alleviate the financing constraints of the company, reduce the financing costs, and improve profitability, thus reducing the risk of default.

5.2 Policy Implications

ESG performance is an important way for enterprises to transmit favorable signals to the outside world and alleviate financing constraints. In order to give full play to the role of ESG performance in reducing the risk of debt default and encourage more enterprises to create good ESG performance, this paper puts forward the following suggestions: first, government level. The government should further improve ESG-related policies and regulations as well as reward and punishment systems. At present, the level of ESG performance of enterprises in China is uneven, and the government should further establish and improve ESG performance-related laws and regulations to guide and support enterprises in ESG performance. Second, at the enterprise level, given the role of ESG performance in reducing the risk of debt default, enterprises should proactively disclose

ESG information to attract market attention, improve financing efficiency, and utilize ESG performance to establish a good image, increase corporate cash flow, and reduce the risk of debt default.

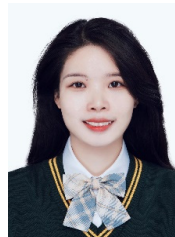
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