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Study on the Impact of ESG Ratings on Bond Issuance Credit Spreads in China

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Abstract:

With the increasing severity of global environmental issues and challenges, investors are increasingly recognizing the importance of non-financial factors such as corporate social responsibility and environmental impact in sustainable investment strategies. ESG (Environmental, Social, and Governance) investment strategies have therefore become mainstream in international markets. This study constructs a multiple linear regression model to analyze the effect of ESG evaluations on bond issuance credit spreads, utilizing data from China's credit bond market from 2021 to 2024. The paper further investigates the mediating effects of return on equity (ROE) and credit ratings by applying a two-step regression analysis to explore the pathways through which ESG evaluations impact credit bond spreads in China. The findings indicate a significant negative relationship between ESG evaluations and credit spreads, with ROE performance and institutional credit ratings acting as mediators.

Keywords: Environmental, Social and Governance (ESG), Spread Credit, Bond Pricing, China Credit Bond Market, Multivariate Linear Regression

1. Introduction

As economies continue to grow rapidly around the world, the environmental issues associated with the traditional model of economic growth have become more noticeable, especially in the wake of economic expansion. Since the early 1970s, when developed countries in Europe first introduced the concept of a green economy, there has been significant progress in economic theory through years of exploration and practice. Investors are increasingly recognising and incorporating concepts like green finance and green investment into their investment activities.

Focusing on sustainable investment, ESG assists investors in identifying companies that have promising long-term growth potential. It also encourages businesses to prioritize social responsibility, aligning with investor preferences. ESG provides a structured framework and methodology, focusing on environmental impact, social responsibility, and corporate governance in order to encourage and support sustainable business practices.

Therefore, enhancing the theoretical foundation of ESG in the bond sector is highly relevant. Through analysis of bond credit spreads, investors can accurately assess the true valuation range of bonds and

develop appropriate investment strategies. Therefore, the research question in this study is: The impact of ESG evaluations on bond credit spreads in China.

2. Literature review

This study summarizes the literature on two aspects: The factors influencing credit spreads, and the relationship between ESG and credit spreads.

2.1 . Factors influencing credit spreads

2.1.1 . Credit Ratings and Credit Spreads

Studies have examined the credit ratings influencing credit spreads, which have been shown to have both positive and negative effects on credit spreads. For instance, studies by Blume Metal (1991), Qian Kai (2010), and Moon & Stotsky (1993) indicate a positive correlation between bond maturity and credit spreads, meaning that bonds with longer maturity periods tend to have higher credit spreads. Conversely, research by Dai Guoqiang & Song Xinbao (2011) and Shen Zhonghua (2018) found that higher credit ratings and improvements in governance tend to reduce credit spreads.

2.1.2 . Company Financial Performance and Credit Spreads

Company financial performance also plays a significant role in influencing credit spreads. Shimko (1993) and Zhao Xiaoqin & Wan Difang (2011) found a negative association between corporate financial health indicators such as leverage and liquidity, and credit spreads, suggesting that stronger financial performance leads to lower credit spreads. On the other hand, Luo Shiguang (2011) observed a positive relationship, suggesting that firms with more severe financial issues have higher credit spreads.

2.1.3 . ESG Factors and Credit Spreads

Another important factor is the impact of ESG factors on credit spreads. Recent research include studies by Zhang Yihong (2018) and Oikonomou (2014), indicates that strong ESG performance, especially in areas like corporate governance and social responsibility, leads to lower credit spreads.

2.2 . The relationship between ESG and credit spreads

2.2.1 . Environmental Impact (E)

A number of studies have specifically explored the relationship between different components of ESG and credit spreads. With respect to environmental factors, Lu and Abeysekera (2017) found that green information disclosure effectively reduces information asymmetry, thus lowering corporate credit spreads. Wu Hengguang and Wang Qinghai (2016) also analyzed highly polluting companies and found that those with better environmental transparency enjoyed lower credit spreads. Similarly, Chang Chenggui and Zeng Xian (2019) conducted research on Chinese listed companies and discovered a negative relationship between environmental information transparency and credit spreads, with greater transparency leading to lower credit spreads (not ratings).

2.2.2 . Social Responsibility (S)

In terms of social responsibility, Oikonomou (2014) examined U.S. corporate bonds and found that companies with better social responsibility practices benefited from reduced credit risk, which in turn lowered their credit spreads. Xianghong and Mingfang (2013) reported similar findings, noting that improved corporate social responsibility is associated with greater creditworthiness, which results in lower credit spreads. Xu Lijie, Liu Yajie, and Zhang Xiaowen (2020) also found that enhanced social responsibility reduces corporate credit spreads in the Chinese market.

2.2.3 . Corporate Governance (G)

Corporate governance is another critical factor influencing credit spreads. Liu and Jiraporn (2010) focused on CEO power and discovered a significant negative relationship between CEO power and credit spreads. Zhang Hong and Zhou Hong (2018) expanded on this by applying unbalanced theory and finding that stronger corporate governance is associated with lower credit spreads. Similarly, Ye Chunhua and Xu Zeping (2020) concluded that higher governance levels lead to reduced credit spreads.

Based on a review of literature, this study conducts research from overall ESG rating perspective. By combining data from China's credit bond market, the study delves deeply into the impact of ESG evaluations on credit spreads in China. The research enhances the practical applicability of the findings and contributes to enriching the quantitative research literature on ESG in China.

3. Research Hypothesis

Based on the theoretical analysis in the previous section, first, disclosing ESG evaluations can effectively reduce the information asymmetry between smaller firms and investors, helping investors make more accurate decisions regarding credit spreads. Good ESG ratings also serve as a "positive indicator," enhancing investor confidence in the company and thereby reducing the company's risk

premium and, consequently, credit spreads. On the other hand, disclosure of ESG evaluations provides insight into a company's financial performance and capital usage, attracting more attention from the market and increasing the company's visibility. This, in turn, helps reduce the cost of issuing bonds by lowering the company's credit risk. Therefore, this study proposes the following hypothesis regarding the impact of ESG evaluations on credit spreads:

H1: There is a negative relationship between ESG evaluations and credit spreads—specifically, higher ESG ratings lead to lower credit spreads.

Additionally, this study aims to further explore the mechanisms through which ESG evaluations influence bond credit spreads. Based on a review of related literature and theoretical research, this study hypothesizes that ROE performance and credit ratings play a mediating role in this relationship. The pathway through which ESG influences bond credit spreads is illustrated in Figure 1 below:

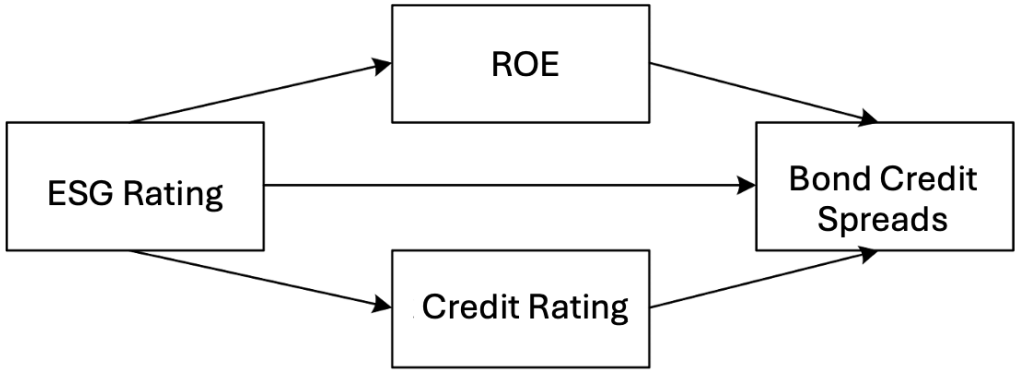

Figure1: ESG Impact Pathway on Credit Spread

Return on equity (ROE) performance is regarded as a key factor influencing bond credit spreads, with many scholars believing that better ROE performance leads to smaller credit spreads. Therefore, this study proposes the following hypothesis:

H2: ESG evaluations will reduce bond credit spreads by influencing ROE performance.

Chang Chenggui and Zeng Xian (2019) believe that there is a significant positive relationship between corporate environmental information and credit ratings. As a used reference in evaluating corporate credit risk, credit ratings have a significant impact on bond credit spreads. Therefore, the following hypothesis is proposed:

H3: ESG evaluations will reduce bond credit spreads by influencing corporate credit ratings.

4. Research Method

4.1 . Data sources and sample selection

Given the relatively recent expansion of China's ESG evaluations starting in 2017, this study specifically examines credit bonds issued between year 2021 and 2024 for research.

ESG ratings are sourced from the ESG Rating Database provided by WIND, with industry classifications following WIND's primary industry categories. Benchmark bond yield is obtained from the Bond Valuation Center's daily data. Other relevant data such as Green bond, ROE, Property, Credit rating and Maturity are sourced from the WIND database.

This study selects 2, 091 credit bonds issued between January 1, 2024, and Aug 31, 2024. During the data processing, bonds with missing data (especially those lacking ESG ratings) were excluded from the sample. After filtering for missing data and further removing subordinate bonds and perpetual bonds with valuation mismatches, the final sample consisted of 1,210 bonds, covering 5 different properties classified by WIND.

4.2 . Variable description

Table 1 provides a detailed summary of the variables involved in the analysis. It includes the dependent variable (Credit Spread), the independent variable (ESG Rating), and the control variables (Bond Maturity, Ownership Type, Bond Characteristics, Return on Equity, and Credit Rating). The table outlines the unit of measurement for each variable and explains how each variable is defined or transformed for the analysis. The ESG and Credit Ratings are based on commercial Wind ESG ratings, while bond maturity and ROE are log-transformed to account for their distribution properties. Ownership and bond characteris-

tics are coded based on predefined categories.

Table 1 Summary table of variables

Variable Category	Variable Name	Unit	Explanation
Dependent Variable	Credit Spread	%	Credit spread = Bond coupon rate - Same-day corresponding term national bond yield rate
Independent Variable	ESG Rating	NO.	Using the commercial Wind ESG rating, with corresponding scores ranging from 1 to 7
	Bond Maturity	No./year	Logarithmic transformation of bond maturity
	Ownership Type	NO.	N0. represent each property
	Bond Characteristics	NO.	Green bonds are coded as 1, non-green bonds are coded as 0
	Return on equity (ROE)	%	Logarithmic transformation of ROE
	Credit Rating	NO.	Using the commercial Wind ESG rating, with corresponding scores ranging from 1 to 6

4.3 . Model explanation

4.3.1 . Multiple Linear Regression

This study utilizes data from 2021 to 2024 to conduct multiple linear regression analysis, aiming to establish a clear relationship between the dependent and independent variables. The multiple linear regression model as showed below:

Model 1

$$CreditSpread = \alpha + \beta 1\} ESG + \beta 2 CreditRating + \beta 3 Maturity + \beta 4 ROE + \beta 5 GreenBond + \beta 6\backslash mathit\{Property + \epsilon i$$

Model 1 tests the relationship between bond credit spread and ESG rating, with the latter being the primary factor considered. The study incorporates control variables including institutional credit rating, bond maturity, ROE, Green bond rating and ownership type (property).

4.3.2 . Mediating Effect

Paper uses the two-step regression method to test the mediating effects of ROE and credit ratings. In the first step, the dependent variable is set as the mediating variable, with ESG rating as the independent variable. In the second step, the dependent variable is bond credit spread, and the independent variables include ESG ratings and the mediating variables. The specific forms of the two-step regression Model 2 and Model 3 testing the mediating effect of ROE are as follows:

Model 2

$$ROE = \alpha + \beta 1\} ESG + \beta 2 CreditRating + \beta 3 ln\left(Maturity\right) + + \beta 4 GreenBond + \beta 5\backslash mathit\{Property + \epsilon i$$

Model 3

$$CreditSpread = \alpha + \beta 1\} ESG + \beta 2 CreditRating + \beta 3 Maturity + \beta 4 ROE + \beta 5 GreenBond + \beta 6\backslash mathit\{Property + \epsilon i$$

To test the mediating effect of credit ratings, the specific forms of the two-step regression Model 4 and Model 5 are as follows:

Model 4

$$CreditRating = \alpha + \beta 1\} ESG + \beta 2\backslash mathit\{ln\left(Maturity\right) + \beta 3 GreenBond + \beta 4 ROE + \beta 5 Property + \epsilon i$$

Model 5

$$CreditSpread = \alpha + \beta 1\} ESG + \beta 2 CreditRating + \beta 3 Maturity + \beta 4 ROE + \beta 5 GreenBond + \beta 6\backslash mathit\{Property + \epsilon i$$

5. Result and Analysis

To test the three hypotheses proposed earlier, this study uses Python to perform regression analysis on the models. The results are as follows:

5.1 . Multiple Linear Regression between ESG and Credit spread

Model1 examines the overall bond sample and analyzes the relationship between ESG ratings and credit spreads. The results are shown in Table 2 below. The regression results show that the coefficient between ESG rating (ESG) and bond credit spreads is -1.636, which is significant at the 1% level. This indicates that in the full sample, there

is a significant negative relationship between ESG ratings and bond credit spreads, meaning that as ESG ratings improve, bond credit spreads decrease. Under the condition that other factors remain the same, each increase in the ESG rating reduces the credit spread by 1.64% which the relationship is statistically significant at the 1% level.

Other control variables, such as institutional credit rating (CR), also show a significant negative relationship with credit spreads at the 1% level. On the other hand, bond maturity at the 0.2121 positively affect credit spreads, confirming that longer-term bonds and those with higher credit ratings typically require a higher premium. While Green Bonds (GB) had a positive coefficient (0.3272), this result was not statistically significant.

Table 2 Results of the OLS regression analysis examining the relationship between credit spreads and ESG with added control variables

Variable	Coefficient	Std Error	z	P>|z|	[0.023	0.975]
Intercept	7.4515	0.680	10.955	0.000	6.118	8.785
ESG	-1.1636	0.068	-17.131	0.000	-1.297	-1.030
ROE	-0.0181	0.006\	-2.893	0.004	-0.030	-0.006
Property	-0.1660	0.042	-3.935	0.000	-0.249	0.083
GB	0.3272	0.364	0.898	0.000	-0.387	1.041
Maturity	0.2121	0.020	-3.024	0.002	-0.102	-0.022
CR	-0.1547	0.073	2.134	0.033	0.013	0.297

Overall, the model explains 60.9% of the variation in credit spreads (R-squared = 0.609) as showed in Table 3 below, and the results indicate that companies with strong ESG performance, good financial returns, are reflected better credit spread performance. These results confirm the validity of H1.

Table 3 Summary of R-squared, F-statistic, and Model Fit Criteria for ESG, ROE, and Credit Rating Regression Analyses

Variable	R-square	F-statistic	Prob (F)	Log	AIC	BIC	Observation
ESG	0.609	11.60	1.44e-10	-570.66	-2.6	0.4	1210
ROE	0.581	5.459	6.82e-05	-1672.7	0.9	4.2	1210
CR	0.601	11.60	1.44e-10	-570.66	-2.3	5.6	1210

5.2 . Intermediary Effect

5.2.1 . The mediating effect of ROE

The analysis examines the mediating effect of Return on equity (ROE) between ESG evaluations and credit spreads. Using a two-step regression approach, as shown in Model 2, In the first step of regression model as showed Table 4 below, with ROE as the dependent variable, the coefficient for ESG is 1.9249, which is statistically significant at the 1% level (p-value = 0.006). This positive relationship suggests that firms with higher ESG ratings tend to have higher returns on equity, likely due to operational efficiencies, enhanced reputation, and better management practices driven by ESG initiatives. This increase in ROE for firms with better ESG performance may be attributed to higher profitability and better access to resources, ultimately enhancing their financial health.

Additionally, the coefficients for Greenbond and Property are -3.2631 and -0.9297, respectively, both statistically significant at the 1% level (p-values of 0.020 and 0.032). These results indicate that both green bond issuance and higher property holdings are associated with lower ROE. These findings indicate that companies with significant property assets and green bond issuances tend to exhibit lower ROE due to high capital and maintenance costs in asset-heavy industries (Property coefficient: -0.9297) and additional compliance and operational expenses associated with sustainable projects (Greenbond coefficient: -3.2631). Nonetheless, some high-ROE companies strategically issue green bonds to enhance their ESG standing and attract socially responsible investors, thus balancing short-term profitability with long-term sustainability goals. This approach reflects a commitment to corporate social responsibility.

Table 4 Results of the OLS regression analysis examining the relationship between ESG and ROE

Variable	Coefficient	Std Error	z	P>|z|	[0.023	0.975]
Intercept	3.3224	7.033	0.472	0.637	-10.462	17.107
ESG	1.9249	0.695	2.771	0.006	0.564	3.286
Property	-0.9297	0.434	-2.141	0.032	-1.781	-0.078
GB	-3.2631	1.407	-2.319	0.020	-6.021	-0.505
Maturity	-0.2988	0.182	-1.640	0.101	-0.656	0.058
CR	0.1323	0.852	0.155	0.877	-1.537	1.801

The second step of the mediating effect test for ROE demonstrates that both ESG and ROE significantly impact credit spreads. Table 2 illustrates the coefficient for ESG is -1.1636, indicating that as a company's ESG rating increases, its credit spread decreases, even when ROE is included in the model. ROE has a negative coefficient at -0.0181 and is statistically significant, confirming that higher financial performance, as measured by ROE, contributes to lower credit spreads. This suggests that ROE partially mediates the relationship between ESG and credit spreads, where companies with better ESG ratings tend to have stronger financial performance, which confirm the H2 and H3 mentioned before.

5.2.2 . The mediating effect of Credit rating

In the first step, the relationship between ESG scores and credit ratings (CR) with CR as the dependent variable in Table 5. The R-squared value of 0.601 indicates that approximately 60.1% of the variation in CR is explained by ESG and other control variables. ESG exhibits a positive coefficient of 0.0631 and is statistically significant with a p-value of 0.000. This suggests that companies with higher ESG scores are associated with better credit ratings.
Additionally, the coefficients for Property are -0.3045, statistically significant (p-values of 0.000). This indicates that companies with substantial property holdings show lower credit ratings, possibly due to the high capital and maintenance costs of asset-heavy structures, which strain financial flexibility and increase perceived risk.

Table 5 Results of the OLS regression analysis examining the relationship between ESG and credit rating

Variable	Coefficient	Std Error	z	P>|z|	[0.023	0.975]
Intercept	7.3753	0.258	28.532	0.000	6.869	7.882
ESG	0.0631	0.051	-5.128	0.000	-0.361	-0.161
ROE	0.0012	0.007	0.155	0.877	-0.013	0.016
Property	-0.3045	0.056	-5.403	0.000	-0.415	-0.194
GB	0.0274	0.196	0.140	0.889	-0.356	0.411
Maturity	-0.1060	-0.021	-5.093	0.000	-0.147	-0.065

In the second step in Table 2, the regression model incorporates CR as a mediator to examine the relationship between ESG scores and credit spreads (Spread), with Spread as the dependent variable. The R-squared value of 0.609 suggests that 60.9% of the variation in credit spreads is explained by ESG, CR, and other control variables. The coefficient for CR is -0.1547 and statistically significant with a p-value of 0.033, indicating that improved credit ratings lead to reduced credit spreads. This two-step analysis highlights the significant role that credit ratings play as a mediator in the relationship between ESG performance and credit spreads. And the overall result corresponds the H4 and H5 stated before.

6. Conclusion

This study utilized a dataset of 1,210 credit bonds issued between 2021 and 2024 that disclosed ESG ratings, aiming to explore the relationship between ESG ratings and credit bond issuance spreads in China. Initially, a multiple linear regression model was used to examine the overall sample, investigating the effects of ESG ratings on credit spreads while controlling for various variables. Additionally, a two-step regression method analysis was applied to test the mediating effects of Return on Equity (ROE) and credit ratings.

(1) ESG ratings have a significant and negative relationship with credit spreads. As a company's ESG rating increases, the credit spread decreases, indicating that

higher ESG ratings lead to lower borrowing costs. The transparency and information provided by ESG ratings help reduce the information asymmetry between firms and investors, allowing for more accurate risk assessments. As a result, higher ESG ratings signal reduced risk to investors, leading to lower risk premiums and borrowing costs for companies.

(2) The mediating effects of both ROE and credit ratings play a modest role in explaining the impact of ESG ratings on credit spreads. These two intermediary factors impact the relationship between ESG ratings and credit spreads. Overall, the study highlights the significance of ESG ratings in reducing credit spreads and contributing to lower borrowing costs for companies.

(3) Furthermore, green bond issuance and higher property holdings are linked to lower ROE, investors should consider the high costs associated with asset-heavy sectors and sustainable projects, which can impact profitability. However, green bonds tend to boost credit ratings by enhancing ESG standing, while large property holdings may require careful risk assessment. Overall, green bonds can improve credit ratings and appeal to ESG-focused investors, whereas extensive property investments may reduce both creditworthiness and profitability.

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