The Impact of ESG Performance on the Green Premium: Evidence from the Chinese Bond Market

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Abstract: This paper selects 139 pairs of green bonds and matched non-green bonds from 2016 to 2023 as samples and employs a two-way fixed-effects model and a multi-time-point DID model to analyze the impact of Environmental, Social and Governance (ESG) performance on green premium and bond spreads. The study finds that the spread of green bonds is about 15 basis points lower than that of non-green bonds. The higher the ESG rating, the lower the bond spread and the green premium, indicating that a high ESG rating brings significant financing advantages to issuers. When the ESG rating improves positively, the bond spread decreases significantly, but the effect on the green premium is not obvious. When the ESG rating declines negatively, neither shows a significant response. This study verifies the existence of the green premium in China's bond market and confirms that ESG ratings have a signaling function, providing references for understanding investors' green preferences and formulating green financial policies.

Keywords: Green Premium; Bond Spread; ESG; Multi-time-point DID Model

1. Introduction

Faced with the severe challenge of global climate change, China is accelerating the transformation of its economy and society towards green and low-carbon development. Strengthening carbon emission regulation and improving the green financial system have become key tasks. As an important tool of green finance, green bonds provide a low-cost financing channel for green projects. The "green premium" has become an important indicator for measuring the efficiency of the green bond market and the degree of green financial development. The green premium refers to the difference in bond spreads between green bonds and non-green bonds under the same conditions, reflecting the financing cost advantage of green bonds [1]. In recent years, with the rise of the concept of environmental, social, and corporate governance (ESG), the importance of ESG information disclosure has become increasingly prominent. However, the green financial market still faces many challenges, such as insufficient information disclosure and an imperfect market mechanism [2]. This makes an in-depth study of the relationship between ESG ratings and the green premium of great significance.

The development of China's green bond market has been significantly driven by policies, forming a top-down development model with clear national standards and high issuance convenience. However, there is still controversy in academia about whether green bonds truly reduce corporate financing costs. On the one hand, some studies have shown that green bonds have a significant financing cost advantage [3] and can effectively enhance corporate value [4].On the other hand, other studies have pointed out that due to the existence of "greenwashing," the financing cost of green bonds has not been reduced as expected [5] In addition, the imperfection of ESG information disclosure may lead to adverse selection in the market, affecting the pricing mechanism of green bonds. This study aims to verify whether a green premium exists in China, that is, whether green bonds have a lower financing cost than traditional bonds; to explore the impact of ESG performance on the green premium; and to analyze the mechanism of the effect of ESG rating changes on the green premium. Using empirical analysis methods and data from China's bond market, this paper will construct econometric models to explore the potential link between ESG

ratings and the green premium.

This study has important theoretical and practical significance. Theoretically, an in-depth exploration of the relationship between ESG ratings and the green premium will help enrich academic research in the field of green finance and provide a new perspective for understanding the mechanism of the green bond market. Practically, the results of this study can provide data support and decision-making references for policy-making and market regulation, promoting the healthy development of the green bond market and the green transformation of the capital market. The content of this study includes: verifying the financing cost advantage of green bonds, analyzing the spread difference between green bonds and non-green bonds; exploring the impact of ESG performance on the green premium, and analyzing the changes in the green premium under different ESG rating levels; and studying the mechanism of the effect of ESG rating changes on the green premium, revealing the guiding role of ESG information disclosure in the green bond market. The innovation of this study lies in: combining ESG ratings with the green premium to explore the impact of ESG information disclosure on the efficiency of the green bond market; using the latest data from China's bond market to provide rich empirical evidence for the study; and analyzing the mechanism of the effect of ESG rating changes on the green premium from multiple dimensions to provide more targeted policy recommendations.

2. Relative Theories and Research Hypotheses

2.1 Bond Pricing Theory and the Existence of the Green Premium

Bond pricing theory indicates that bond spreads reflect the compensation investors demand for bearing additional risks, such as credit risk and liquidity risk[6]. Green bonds, which finance green projects with lower environmental risks, are likely to be perceived by investors as having lower risk premiums. Consequently, this may result in lower spreads for green bonds compared to non-green bonds. Additionally, the theory of information asymmetry suggests that transparent information disclosure and third-party certification can reduce investors' risk expectations for green bonds, thereby further lowering financing costs [7]. Based on bond pricing theory and the theory of information asymmetry, this paper proposes the first hypothesis:

Hypothesis 1: There exists a green premium in China's bond market [8,9]. That is, the spread of green bonds is significantly lower than that of non-green bonds, indicating that green bonds have a financing cost advantage.

2.2 Stakeholder Theory and the Impact of ESG Performance

Stakeholder theory emphasizes that companies should not only focus on the interests of shareholders but also take into account the interests of employees, customers, communities, and the environment. Good ESG performance helps companies win the trust and support of stakeholders, thereby reducing financing costs. Meanwhile, the theory of information asymmetry suggests that the transparency of ESG information disclosure can reduce investors' risk perception and enhance market recognition of green bonds [10]. Based on stakeholder theory and the theory of information asymmetry, this paper proposes the second hypothesis:

Hypothesis 2: ESG performance has a significant impact on the green premium. That is, the higher the ESG rating of a company, the lower the green premium of the green bonds it issues, indicating that good ESG performance can enhance the financing cost advantage of green bonds.

2.3 Dynamic Impact: The Role of ESG Rating Changes

A company's ESG performance is not static, and changes in its ESG rating can have important implications for investors' decision-making. According to bond pricing theory, an improvement in ESG rating may be perceived as a signal of better environmental and social performance, thereby reducing investors' risk expectations and further lowering the spread of green bonds. Conversely, a decline in ESG rating may increase investors' risk perception, leading to a higher spread. Based on bond pricing theory, this paper proposes the third hypothesis:

Hypothesis 3: Changes in ESG ratings have a

dynamic impact on the green premium. That is, an increase in ESG rating will lower the green premium, while a decrease in ESG rating will have an insignificant impact on the green premium.

3. Variable Selection and Model

3.1 Variable Selection

This paper focuses on three core variables: ESG rating, green premium, and bond spread, to analyze the performance of the green bond market and its driving factors.

(1) Dependent Variables:

The bond spread is defined as the difference between the bond yield and the yield of a government bond with the same maturity, used to measure the excess return of the bond. The green premium is defined as the difference between the spread of green bonds and the spread of matched conventional bonds, used to detect whether green bonds enjoy a market premium. Additionally, a dummy variable for green bonds (Greenbond) is introduced as the core explanatory variable to verify the existence of the green premium.

(2) Explanatory Variables:

ESG rating (ESGrate) is used as the key explanatory variable to measure the ESG performance of the bond issuer. Additionally, an ESG rating dummy variable (ESGdummy) is introduced to indicate whether the issuer has disclosed an ESG rating, used to examine the impact of ESG information disclosure.

To deeply test Hypothesis 3, which examines how changes in ESG ratings dynamically affect the green premium, this paper employs a time-varying Difference-in-Differences (DID) model. In this model, a monthly dummy variable D is specifically set as the core variable to distinguish between periods before and after changes in ESG ratings. When the observation is in the nth period of the change, Dn takes the value of 1, and 0 otherwise.

(3) Control Variables:

To exclude other potential influencing factors, this paper selects bond intrinsic attributes (bond rating (Rating), time to maturity (Term), issuance scale (Logsca), bond age (Age)) and issuer financial indicators (asset size (Logta), debt level (Lev), return on equity (Roe), operating profit margin (Profit), and revenue growth rate (Growth)) as control variables to ensure the accuracy and theoretical significance of the regression results. Specific variable definitions are shown in Table 1.

Table 1. Definition and Description of Variables

Variable names	Variable symbol	Variable meaning and treatment
Bond spreads	Spread	The monthly yield difference between a bond and a Treasury bond with the same maturity structure
Green premium	Greenium	Greenium is measured by the spread difference between a green bond and a matching regular bond
Green bond dummy variable	Greenbond	1 if the sample is green bonds and 0 otherwise
ESG rating dummy variable	ESGdummy	This variable takes the value of 1 if the issuer announces an ESG rating in current year; Otherwise, it is 0
ESG rating	ESGrate	Issuer ESG rating. There are seven grades from A- to C-, corresponding to the number 7-1
Debt rating	Rating	There are 4 grades from AAA to A-, corresponding to the numbers 4-1. Debt rating is preferred, otherwise principal rating is used.
Maturity of bonds	Term	The total length of time from the date of issue to the maturity date of the bond. Unit: Year
Bond age	Age	Age of the bond. The amount of time that has elapsed since the bond was issued to the end of the current period. Unit: Year
Size of bond issue	Logsca	Natural logarithm of the size of the bond issue.
Total assets	Logta	Total assets in year t − 1, take the logarithm.
Leverage ratio	Lev	Leverage in year t-1, is the ratio between total liabilities and total assets.
Return on equity	Roe	Return on equity in year t-1. It is the value of net profit divided by average shareholders' equity, which is an indication of profitability.
Operating profit margin	Profit	Operating margin in year t-1. It is equal to the ratio of operating profit to operating revenue, which is the embodiment of corporate profitability and operating efficiency.
Growth rate of operating income	Growth	The growth rate of operating income in year t-1 is the value obtained by subtracting operating income in year t-1 from operating income in year t-2 and dividing by operating income in year t-2. This value reflects the historical growth of the issuer.
ESG rating change dummy variable	Dn	The value is D_6-D6, and Dn is 1 when the observed value is in the NTH period when the change occurs.

3.2 Model Settings

3.2.1 Panel Model

Hypothesis 1 Model

$$Spread_{it} = \alpha_0 + \alpha_1 Greenbond_i + Controls_{it} + \gamma_t + \delta_j + \phi_h + \varepsilon_{it} \quad (1)$$

Equation (1) aims to verify whether there is a green premium in the bond market. The core variable Greenbond (green bond dummy variable) is introduced. If the spread of green bond is significantly lower than that of ordinary bond, the coefficient of Greenbond should be significantly negative. The model also controls the characteristics of bonds and the financial status of issuers to ensure the comprehensiveness of the analysis results.

Hypothesis 2: Model:

$$Spread_{it} = \rho_0 + \rho_1 ESGdummy_{it} + Controls_{it} + \gamma_t + \delta_j + \phi_h + \varepsilon_{it} \quad (2)$$

$$Greenium_{it} = \rho_0 + \rho_1 ESGdummy_{it} + Controls_{it} + \gamma_t + \delta_j + \phi_h + \varepsilon_{it} \quad (3)$$

$$Spread_{it} = \omega_0 + \omega_1 ESGrate_{it} + Controls_{it} + \gamma_t + \delta_j + \phi_h + \varepsilon_{it} \quad (4)$$

$$Greenium_{it} = \omega_0 + \omega_1 ESGrate_{it} + Controls_{it} + \gamma_t + \delta_j + \phi_h + \varepsilon_{it} \quad (5)$$

Models (2) to (5) explore the impact of ESG performance on bond spreads and green premium from two dimensions. In models (2) and (3), the dummy variable ESGdummy was used to test the impact of ESG rating issuance or not. Models (4) and (5) further analyze the impact of ESG rating (ESGrate). If ESG performance has a significant impact on bond spreads and green premium, the correlation coefficient should be significant.

3.2.2 Multi-period DID Model

In order to explore the causal relationship between ESG rating changes and bond spreads and green premium, this paper introduces a multi-time differential intervention model (DID). **(Hypothesis 3 model)**:

$$Spread_{it} = \alpha + \beta_1 D_{-6it} + \beta_2 D_{-5it} + \ldots + \beta_7 D_{0it} + \ldots + \beta_{13} D_{6it} + Contrals_{it} \quad (6)$$

$$Greenmium_{it} = \rho + \omega_1 D_{-6it} + \omega_2 D_{-5it} + \ldots + \omega_7 D_{0it} + \ldots + \omega_{13} D_{6it} + Contrals_{it} \quad (7)$$

(1) Variable setting: the time-varying treatment effect dummy variable D is introduced to identify the Nth period of ESG rating change (n=-6 to 6). The regression model was constructed by collecting the data of the first six periods, the current period and the last six periods of the change. If ESG rating changes have significant influence on bond spreads or green premium, the n p 0, Dn in at least one variable coefficient should be significantly different from zero.

(2) Sample grouping: Samples with ESG rating changes were divided into treatment group, and those without ESG rating changes were divided into control group. The treatment group was further subdivided into rating increase and rating decrease. 278 bonds are covered in the bond spread study and only 139 green bonds are retained in the green premium study.

Before applying the DID model, the parallel trend hypothesis test and the randomness test of intervention time should be carried out. Parallel trend hypothesis ensures ESG rating changes, treatment group and control group have similar trends in bond spreads or green premium; The randomness test of intervention time verified that the change of ESG rating was not caused by other non-random factors.

4. Empirical Analysis

4.1 Data Collection and Processing

4.1.1 Data Sources

To calculate the greenium, this paper sets an important condition: the issuer of green bonds must have issued conventional bonds with the same characteristics within one year before and after the issuance of green bonds as a reference. Through strict screening and comparison, 139 green bonds that meet the criteria were identified. The data for green corporate bonds, corporate bonds, financial bonds, and medium-term notes were collected as the analysis sample. The monthly closing data for these bonds from January 2016 to December 2023, totaling 96 periods, were gathered. The ESG rating data, published by Shangdao Ronglu, covers the period from 2016 to 2023 and was obtained through the Wind Data Platform. The basic information of the sample bonds and the risk-free government bond yields were sourced from the iFIND Financial Terminal and the Choice Financial

Terminal.

4.1.2 Data Processing

The matching method (Zerbib, 2019) was employed to construct the research sample for this paper [11]. Based on the 96 monthly transaction data from January 2016 to December 2023, each green bond was matched with conventional bonds that have similar maturity (within one year), issued by the same entity, and with the same term, interest rate type, interest payment method, and currency.

The bond spread was calculated by subtracting the yield to maturity of government bonds with the same term structure from the yield to maturity derived from the bond's end-of-month closing price. The difference is denoted as Spread. On the basis of the bond spread, the greenium was calculated as the difference in bond spreads between green bonds and their corresponding matched conventional bonds. This difference is defined as the variable Greenium. Two key variables were introduced: ESGdummy (a 0/1 variable indicating whether the bond issuer has an ESG rating) and ESGrate (an ordinal variable representing the ESG rating level, ranging from 7 to 1, corresponding to A- to C-). These variables are used to analyze the impact of the presence and level of ESG ratings on bond performance.

The full sample descriptive statistics of Table 2 demonstrate multiple key features of the green bond market.

Table 2. Descriptive Statistics for the Full Sample

Variable names	Sample size	Mean	Standard deviation	Minimum	Maximum
Spread	7818	0.93	1.335	-19.442	23.488
Greenium	6600	0	1.288	-11.456	19.718
Greenbond	26688	0.5	0.5	0	1
ESGdummy	26688	0.184	0.388	0	1
ESGrate	4920	3.951	1.134	1	6
Term	26688	4.036	2.239	1	20
Scale	26688	28.321	50.561	1.69	300
Toasset	26592	9242.95	20133.493	33.185	129924.19
Lev	26592	69.802	20.206	12.983	94.768
Roe	26592	6.105	5.493	-9.319	26.297
Profit	26592	22.818	30.343	-129.413	422.867
Growth	26208	15.447	36.523	-99.991	380.784
Age	20832	0.479	0.269	0.016	-.975
Rating	26688	3.73	0.602	1	4

4.2 Empirical Testing

4.2.1 Test on the Existence of Green Premium

The regression analysis is used to test whether the Greenbond affects the bond Spread. The regression results are shown in Table 3. The two-way fixed effect panel regression model is used, and columns (1) and (2) are the regression results with the whole sample as the data. The fixed effect method is used to test whether the green premium exists in the overall bond market, so as to verify Hypothesis 1. In this paper, the whole sample is further subdivided into commercial bank bonds, corporate bonds, corporate bonds and medium-term notes according to the types of bonds and the scope of receipt data, namely columns (3) - (6) in the table, for regression. The results are shown in Tables 3.

It can be seen from columns (1) and (2) of Table 3 that when the regression is conducted with the whole sample as the benchmark data, the coefficient of Greenbond is significantly negative with or without control variables, which indicates the significant existence of green premium. Meanwhile, it can be seen that the yield level of green bonds is about 15 basis points lower than that of non-green bonds. Further observing the regression of bonds by type in columns (2) - (6), it can be seen that all the coefficients before Greenbond are negative, which is significant at the level of 5% in medium-term notes. This result is basically consistent with the expectation, indicating that there is a green premium even in different types of bonds, and this premium is more obvious in medium-term notes. By observing the coefficient estimation results of the control variables, we can see that the Logta and pre-growth coefficients are negative and significant, indicating that the larger the total assets, the stronger the economic strength and

the better the growth of bond issuers, they can enjoy lower financing costs. Leverage ratio (Lev) is significantly positive in corporate bonds, indicating that high leverage increases financing costs. The coefficient of Logsca is significantly positive, which indicates higher bond financing costs. The negative coefficient of Rating is significant, indicating that the higher the rating, the lower the financing cost.

Table 3. The Regression Results of Bond Spreads in the Secondary Market Sample

	(1) Full sample	(2) Full sample	(3) Commercial bank debt	(4) Corporate bonds	(5) Enterprise bonds	(6) Medium-term notes
	Spread	Spread	Spread	Spread	Spread	Spread
Greenbond	-0.155**	-0.162*	-0.008	-0.047	-0.219	-0.280**
	(0.073)	(0.098)	(0.025)	(0.112)	(0.229)	(0.126)
Rating	-0.563***		-0.075**	-1.678***	-0.402***	2.108***
	(0.077)		(0.033)	(0.150)	(0.146)	(0.161)
Term	0.027		0.173***	0.011	0.055	0.082
	(0.016)		(0.009)	(0.019)	(0.064)	(0.059)
Logsca	0.202***		-0.031	0.217*	-0.262	0.021
	(0.049)		(0.022)	(0.119)	(0.323)	(0.118)
Logta	-0.376***		-0.036**	0.050	-0.576***	-0.938***
	(0.032)		(0.017)	(0.060)	(0.116)	(0.070)
Lev	-0.004**		-0.002	0.015***	0.006	0.003
	(0.002)		(0.009)	(0.004)	(0.006)	(0.005)
Roe	0.010***		0.006	-0.003	0.009	0.007
	(0.004)		(0.009)	(0.007)	(0.064)	(0.004)
Profit	-0.000		-0.012***	0.015***	-0.001	0.003**
	(0.001)		(0.004)	(0.002)	(0.002)	(0.001)
Growth	-0.001***		-0.005***	0.001***	-0.000	-0.001***
	(0.000)		(0.001)	(0.000)	(0.001)	(0.000)
Age	0.075		-0.076*	0.673***	0.337	-0.733***
	(0.139)		(0.041)	(0.227)	(0.435)	(0.252)
_cons	5.770***	0.923***	1.327	4.854***	6.781***	0.000
	(0.329)	(0.069)	(0.866)	(0.504)	(0.953)	(.)
N	4969.00	7598.00	970.00	1145.00	1259.00	1539.00

4.2.2 Impact of ESG Performance on Green Bond Yield and Premium

Focus on how ESG rating variables (ESGdummy and ESGrate) affect bond Spread (Spread) and green premium (Greenium). The significant ESGdummy coefficient indicates that the presence or absence of ESG rating affects the green premium; The significant ESGrate coefficient reflects the effect of ESG rating level.

In the left Table 4, after comparing the two sets of regression models with control variables, the data in column (1) show that the public disclosure of ESG ratings has a significant impact on bond spreads, which is reflected in a reduction in bond spreads of roughly 7 to 8 basis points. The results in column (1) show that issuers that publish ESG ratings enjoy a significant financing advantage when issuing green bonds compared to issuers that do not publish ratings, with green bond premiums being on average 11 to 12 basis points lower.

This shows the market recognition of companies with good ESG performance and the competitiveness of these companies in the green financing market. The empirical results show that the publication of ESG ratings has a significant effect on reducing the financing cost of issuers.

Column (1) of the right Table 4 shows that the increase of ESG rating significantly reduces bond spreads, which is significantly negative at the significance level of 1%. When ESG rating increases by one notch, bond spreads will decrease by about 23 to 24 basis points. Column (2) shows that the increase of ESG rating has a negative impact on the green premium, which is significant at the level of 10%. ESG rating has a significant impact on

bond spreads and green premium. The improvement of ESG rating can not only reduce the financing cost of bonds, but also improve the competitiveness of issuers in the green bond market.

Table 4. The Impact of ESG Rating/ESG Rating Score on Bond Spreads and Green Premium

	(1) Spread	(2) Greenium		(1) Spread	(2) Greenium
ESGdummy	-0.078*	0.115 *	ESGrate	-0.233***	-0.022*
	(0.044)	(0.069)		(0.019)	(0.011)
Rating	-0.575***	-0.001	Term	-0.017	0.027
	(0.077)	(0.064)		(0.052)	(0.022)
Term	0.025	-0.062***	Logsca	-0.105**	0.005
	(0.017)	(0.017)		(0.052)	(0.021)
Logsca	0.216***	0.041	Logta	-0.108**	-0.026
	(0.049)	(0.048)		(0.054)	(0.023)
Logta	-0.368***	-0.053	Lev	0.012***	-0.002
	(0.033)	(0.035)		(0.004)	(0.002)
Lev	-0.004**	0.002	Roe	0.011**	0.013***
	(0.002)	(0.002)		(0.004)	(0.003)
Roe	0.009**	0.005	Profit	0.005	0.002
	(0.004)	(0.007)		(0.004)	(0.002)
Profit	0.000	-0.000	Growth	-0.004**	-0.005***
	(0.001)	(0.002)		(0.002)	(0.002)
Growth	-0.001***	-0.002***	Age	-0.239*	-0.141**
	(0.000)	(0.001)		(0.143)	(0.057)
Age	0.105	-0.071	_cons	1.840***	0.337*
	(0.139)	(0.121)		(0.432)	(0.181)
_cons	5.635***	0.438	N	1274.000	1106.000
	(0.330)	(0.309)			
N	4969.000	4123.000			

4.2.3 Analysis of The Results of The Impact of ESG Rating Changes on Green Premium

Considering the quarterly update frequency of ESG rating of China Securities Co., LTD., in addition to replacing the above data, we also adjust the setting of time dummy variable in the robustness test of the hypothesis: Setting D only includes the three periods before and after the change and the current period of the change, a total of seven periods, respectively to explore the impact of rating rise and decline, and to test the multi-period DID model of ESG rating change as a whole. The results are shown in Table 5.

Table 5. Test Results of Multi-Periods DID Regression Results of ESG Rating Changes

	(1) Rating upswing Spread	(2) Rating up Greenium	(3) Ratings down Spread	(4) Ratings drop Greenium
D_3	0.099	-0.022	-0.070	0.135***
	(0.060)	(0.055)	(0.057)	(0.050)
D_2	-0.034	0.002	-0.031	0.156***
	(0.048)	(0.043)	(0.046)	(0.040)
D_1	-0.013	-0.005	-0.106**	0.094**
	(0.041)	(0.035)	(0.043)	(0.037)
D0	-0.048	-0.027	-0.060	0.128***
	(0.041)	(0.035)	(0.043)	(0.037)
D1	-0.036	0.077**	-0.156***	0.095***
	(0.041)	(0.034)	(0.040)	(0.035)
D2	-0.084**	0.050	0.068*	-0.100***
	(0.041)	(0.035)	(0.039)	(0.034)
D3	-0.304***	0.098**	-0.065	-0.010
	(0.088)	(0.047)	(0.045)	(0.038)

Term	-0.026	-0.019	-0.023	-0.046**
	(0.020)	(0.015)	(0.018)	(0.019)
Logsca	-0.025	-0.029*	-0.022	-0.058***
	(0.020)	(0.016)	(0.019)	(0.021)
Logta	-0.111***	0.004	-0.098***	0.011
	(0.023)	(0.017)	(0.021)	(0.023)
Lev	0.005***	-0.005***	0.006***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Roe	0.023***	0.008***	0.017***	0.009***
	(0.004)	(0.003)	(0.003)	(0.003)
Profit	-0.004**	0.005***	-0.003**	0.004**
	(0.002)	(0.001)	(0.002)	(0.002)
Growth	-0.001	-0.005***	-0.001	-0.004**
	(0.001)	(0.001)	(0.001)	(0.001)
Age	-0.261***	-0.133***	-0.236***	-0.173***
	(0.060)	(0.040)	(0.054)	(0.053)
_cons	1.142***	0.458***	0.895***	0.553***
	(0.186)	(0.129)	(0.169)	(0.173)
N	467.000	397.000	550.000	456.000

4.2.4 Analysis and Discussions of Empirical Results

Through the verification of a series of hypotheses, we have explored in depth the role of ESG ratings in China's bond market and their impact on bond spreads and the greenium.

Hypothesis 1 verifies the existence of the greenium phenomenon in China's bond market. Using the key variable Greenbond as the core of the analysis, this paper concludes that green bonds enjoy a lower spread compared to non-green bonds in terms of financing costs by comparing the bond spreads between green and non-green bonds.

Hypothesis 2 explores the impact of ESG ratings, which is divided into two parts: the existence of ESG ratings and the level of ESG ratings. By setting the core variable ESGdummy, this paper finds that issuers who disclose ESG ratings show a significant reduction in bond spreads and the greenium compared to those who do not disclose. This reveals that the public disclosure of ESG ratings plays a positive role in reducing financing costs. Specifically, on average, issuers who disclose ESG ratings have bond spreads that are 7 to 20 basis points lower than those who do not disclose, and the greenium is 11 to 12 basis points lower. Further exploration of the impact of ESG rating levels, with ESGrate as the core variable and its coefficient significantly negative, indicates that higher ESG ratings are associated with greater financing advantages for bonds, whether in absolute or relative terms.

Hypothesis 3 examines the impact of changes in ESG ratings on bond financing costs using a multi-period DID model. It reveals a negative impact of an upward change in ESG ratings on bond spreads, while the impact is insignificant when ratings decline. For the greenium, changes in ESG ratings, whether upward or downward, have no significant impact. This provides a new perspective on understanding the role of ESG ratings in the bond market.

Based on the results of Hypotheses 1 and 2, it is evident that China's bond market exhibits a green preference, as evidenced by the significant existence of the greenium. Moreover, the disclosure of ESG ratings and an increase in ESG ratings further reduce bond financing costs, indicating that ESG ratings have a certain market transmission effect in China's bond market.

Through the analysis using the Difference-in-Differences (DID) model, it is found that the signaling role of ESG ratings in the bond market is mainly reflected in the reduction of bond spreads when ratings increase. In contrast to this positive effect, no significant impact on bond spreads is observed when ratings decline. This may be because the market is relatively tolerant of declines in ESG ratings, or because rating declines themselves may be influenced by a variety of complex factors, such as economic fluctuations and industry changes, which to some extent mask

the direct impact of rating declines on bond spreads.

As for the greenium, it is found that changes in ESG ratings do not show a clear signaling effect. This may be because the formation of the greenium is influenced by a combination of factors, such as the quality of the issuer's green projects and investors' green preferences, and changes in ESG ratings may only be one of the influencing factors, with a relatively small impact.

Therefore, when ESG ratings increase, the market responds positively, leading to a decrease in bond spreads. However, the overall signaling effect of ESG rating changes is not significant, which may also be due to the fact that China's green bond market is still in its developmental stage, and the transmission mechanism of ESG ratings in the green bond market has not yet been perfected.

5. Conclusion

Firstly, this study confirms the significant existence of the greenium in China's bond market. The issuance of green bonds not only signifies a company's proactive attitude towards fulfilling its social responsibilities but also requires issuers to disclose information at a high level. This reduction in information asymmetry results in lower risks for green bonds compared to conventional bonds. Secondly, investors with a preference for green bonds are willing to accept lower yields, thereby leading to lower financing costs for green bonds. The research findings indicate that companies with higher ESG scores typically demonstrate greater initiative in voluntarily disclosing information and actively assuming social responsibilities. This proactive approach in information disclosure and social responsibility provides investors with an intangible assurance of confidence, which is reflected in the bond market as lower financing costs, that is, lower bond spreads and greeniums. Lastly, the study also finds a significant negative correlation between ESG ratings and bond financing costs. Specifically, entities with higher ESG ratings tend to have lower bond spreads and greeniums. This suggests that ESG performance not only reflects a company's ability for long-term and stable development but also serves as a key factor in attracting investor confidence and eliciting positive market feedback.

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