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The influence of bond prospectus sentiment on credit risk premium

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Abstract

Bond prospectus is one of the important information sources for bond investors. This paper innovatively studies the relationship between the sentiment index of bond prospectus and bond risk premium from the perspective of tone. We construct a regression model and further study the moderating effect of the two variables based on 5194 prospectuses of the bonds of Chinese listed companies. The results show that (1) the positive sentiment of corporate bond prospectus has a positive impact on corporate bond credit risk premium; (2) When the bond issuing enterprise is a state-owned enterprise, the positive influence of the positive emotion in the bond offering prospectus text on the credit risk premium will be intensified; (3) The better the operating performance of the bond issuing enterprise, the weaker the positive impact of the positive sentiment of the bond. This paper comes to a very interesting conclusion: investors may not believe the prospectus issuer's positive description of the risks because they may have other sources of information.

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1. Introduction

By 2022, the total size of China's bond market has exceeded 130 trillion yuan, which has exceeded the total GDP of 1.2 million yuan in 2022. This shows that China's bond market occupies a very important position in the financial market of China and even the world. Bond as a very important financial instrument, its risk has naturally become the focus of attention [1,2]. In recent years, frequent bond defaults have made investors pay more attention to the credit risk in the corporate bond market.

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Traditional research on the bond risk premium usually uses corporate financial data and bond market transaction data. Many scholars choose financial data of companies as variables for risk assessment to study its impact on the credit risk premium of bonds [3, 4]. Zhou and Wei [5] investigate the effect of liquidity on bond risk premium in a model of endogenous debt maturity. Ge and Zhang [6] study the determinants of cross-border bond risk premia.

However, unstructured text data such as bond prospectuses contain rich incremental information and are a good complement to financial data [7]. In recent years, some scholars have begun to study the impact of bond text information on bond risk premium [8, 9]. Compared with other markets, the research on bond text is very rare due to some restrictions of bond market. However, the importance of bond text has been proved by some scholars. They have studied the relationship between the readability of bond text and bond rating and bond cost [10].

Therefore, this paper innovatively takes bond offering prospectus as textual data and mainly studies the impact of risk disclosure sentiment in bond offering prospectus on corporate bond credit risk premium. In the empirical test, a total of 5194 valid text data were obtained from the bond solicitation prospectus of listed corporate bonds from 2006 to 2021 on the website of Cninfo. Then we merge two financial sentiment dictionary and use it to construct sentiment index. Then a fixed effect regression model is constructed to test the influence of risk disclosure sentiment on credit risk premium. On this basis, the moderating effects of state-owned bond issuers and bond issuers' performance on the relationship between risk disclosure sentiment and credit risk premium are further studied.

The remainder of this paper is organized as follows. Section 2 mainly introduces the research method. Section 3 introduces the data used in this paper. Section 4 is the empirical analysis. Section 5 concludes this paper.

2. Methodology

2.1. Construction method of sentiment index

An important feature of a text is its emotional orientation, which reflects the positive or negative tone of the writer. To conduct sentiment analysis, previous research measured the tone of a text based on a dictionary with positive and negative word lists [11]. In terms of dictionary selection, most of the current Chinese emotional dictionaries are general emotional dictionaries, which omit many financial words and are not applicable in the financial context. This paper refers to the Chinese financial emotion dictionary constructed by Jiang et al. [12], a newly constructed and published professional emotion dictionary for the Chinese financial and economic field. This dictionary converts the English LM dictionary [13] into the Chinese version, and selects words suitable for financial context from the existing Chinese general sentiment dictionary. Finally, word2vec algorithm is used to mine words from the corpus that are highly related to the first two parts of the words and have appropriate emotional tendencies. So, it is a relatively mature and comprehensive financial emotional dictionary at present. The dictionary contains 9,228 words, of which 5,890 are negative and 3,338 are positive. Then, on the basis of this dictionary, the formal term emotional dictionary of Yao et al. [14] is integrated to obtain the final emotional dictionary of this paper.

The text sentiment index is calculated as follows:

$$Index_i = \frac{positive_i - negative_i}{positive_i + negative_i} \quad (1)$$

Where, $positive_i$ and $negative_i$ respectively represent the count of positive words and negative words in the text i . Therefore, the larger the index is, the more positive the text's sentiment is.

2.2. Construction of regression model

The baseline regression model constructed in this paper is as follows.

$$\begin{aligned}
 Riskrate_i = & \alpha_0 + \alpha_1 Index_i + \alpha_2 Size_i + \alpha_3 ROE_i + \alpha_4 Lev_i + \alpha_5 Currentratio_i + \alpha_6 Cashflow_i \\
 & + \alpha_7 Tang_i + \alpha_8 Maturity_i + \alpha_9 Volume_i + \alpha_{10} Convert_i + \alpha_{11} SOE_i + \sum Industry \\
 & + \sum Year + \sum Province + \varepsilon_i
 \end{aligned} \quad (2)$$

Where, α_i is the regressive coefficient and ε_i is the error term. $Riskrate_i$ is the dependent variable and represents the credit risk premium of bond i . In general, the risk premium is equal to the difference between the coupon rate at issue and the risk-free rate. In China's financial market, it is generally considered that the yield to maturity of national bonds or policy-based financial bonds with the same maturity issued by China Development Bank is the proxy indicator of the risk-free interest rate. Therefore, two types of credit risk premium are calculated and used. $Index$ is the independent variable, representing the emotional index of the text.

Other variables are control variables, among which the fixed effects on industry, year and province are respectively recorded as $\sum Industry$, $\sum Year$ and $\sum Province$ in order to eliminate the influence of some difficult to observe factors. According to previous studies on bond credit risk premium [15, 16], we choose 10 control variables from the perspective of financial indicators and bond characteristic. $Size$ represents the total assets of the enterprise, ROE represents the return on net assets, Lev represents the asset-liability ratio, $Current_ratio$ represents the current ratio, $Cashflow$ represents the cash flow ratio, and $Tang$ represents the tangible assets ratio. These are all important items in the accounting statements. $Maturity$ represents the maturity of the bond, $Volume$ represents the size of the bond issued, SOE represents whether the company is state-owned, and $Convert$ represents whether the bond contains options.

Table 1. Description of variables.

Variables type	Variables	Unit	Description
Dependent variables	Riskrate1	%	The risk premium calculated using yield to maturity of national debt as the risk-free interest rate
	Riskrate2	%	The risk premium calculated using yield to maturity of policy financial bonds issued by China Development Bank as the risk-free interest rate
Independent variables	Index	1	Prospectus sentiment index
Financial indicators control variables	Size	ln(yuan)	The natural log of total assets
	ROE	%	Return on equity, net profit/net assets
	Lev	1	Asset-liability ratio, total liabilities/total assets
	Currentratio	1	Current ratio, current assets divided by current liabilities
	Cashflow	1	Ratio of net cash flow from operating activities to operating income
	Tang	1	The ratio of tangible assets to total assets
Bond characteristic control variables	Maturity	1	Maturity of bond
	SOE	1	Property right nature. When the bond issuing enterprise is state-owned enterprise is 1, the rest is 0
	Convert	1	Bond properties. Take 1 when the bond has options and 0 when the rest
	Volume	1	The natural logarithm of a firm's issuance size
Fixed effect variables	Industry	1	The industry of the issuing enterprise
	Year	1	Year of issue
	Province	1	The province to which the bond issuing enterprise belongs

3. Data

The sample covers corporate bonds listed on the Shanghai Stock Exchange or Shenzhen Stock Exchange from early 2006 to the end of 2021. Data consists of text data and structured data. The text data is the enterprise bond offering prospectus from the Cninfo website. The original format of each bond prospectus is pdf after it is obtained through crawler. First transcode it into editable text file. Then, the regular expression method is used to extract the risk disclosure chapter from the bond prospectus. Structured financial data come from Wind. After eliminating the samples with missing structured data or failed format transcoding, 5194 valid samples were obtained.

Descriptive statistical analysis of each variable is as follows.

Table 2. Descriptive statistical analysis.

Variables	N	Mean	Sd.	Min	Max
Riskrate1	5194	1.844	1.195	-2.796	6.914
Riskrate2	5194	1.412	1.152	-3.350	6.568
Index	5194	-0.018	0.161	-0.467	0.624
Size	5194	25.211	1.582	18.922	30.101
ROE	5194	5.427	7.000	89.943	77.193
Lev	5194	0.620	0.140	0.060	0.952
Currentratio	5194	2.530	3.751	0.136	103.416
Cashflow	5194	-0.131	1.757	34.552	25.847
Tang	5194	0.261	0.191	-0.468	0.940
Maturity	5194	5.182	2.538	1.000	30.000
Volume	5194	20.673	0.758	17.130	23.719

Table 1 presents descriptive statistics of continuous variables. Since the coupon rate of the bond containing the option is lower than the risk-free rate, the minimum values of Riskrate1 and Riskrate2 are both less than 0. The minimum value of Tang is negative, indicating that some bond issuing enterprises have a low proportion of shareholders' equity, resulting in a negative balance after deducting related accounting items such as intangible assets and goodwill.

4. Empirical analysis

4.1. The influence of textual sentiment on corporate bond credit risk premium

Prospectus is an important source of information for investors. The sentiment conveyed by the prospectus can affect investors' behavior and thus the risk premium on bonds. Based on this, we propose hypothesis 1 of this paper.

Hypothesis 1: The sentiment conveyed by the prospectus can affect the risk premium on bonds.

Table 3 lists the regression results of Equation (2).

Table 3. Regression result.

	Riskrate1	Riskrate2
Index	0.717*** (8.062)	0.720*** (8.078)
Size	-0.177*** (-14.56)	-0.174*** (-14.23)
ROE	-0.0186*** (-10.05)	-0.0190*** (-10.26)
Lev	1.116***	1.150***

	(7.444)	(7.649)
Currentratio	0.0262***	0.0257***
	(6.854)	(6.723)
Cashflow	-0.0158**	-0.0161**
	(-2.347)	(-2.380)
Tang	0.341***	0.370***
	(2.914)	(3.154)
Maturity	0.000163	-0.00972*
	(0.0311)	(-1.849)
Volume	-0.242***	-0.240***
	(-12.75)	(-12.63)
Convert	0.269***	0.246***
	(9.694)	(8.832)
SOE	-1.330***	-1.338***
	(-32.45)	(-32.57)
Industry	YES	YES
Year	YES	YES
Province	YES	YES

Notes: The *t* statistics in parentheses.

*, **, *** imply significance at the 10%, 5%, and 1% levels, respectively.

As can be seen from Table 3, the first row is the regression result with the credit risk premium calculated by the yield to maturity of national debt as the dependent variable, and the second row is the regression result with the credit risk premium calculated by the yield to maturity of policy financial bonds issued by China Development Bank as the dependent variable. The results of the second line show that the coefficients of risk disclosure sentiment indicators in the regression equation are all positive numbers, and there is a significant difference at the significance level of 1%. Therefore, the more positive the sentiment of the prospectus, the higher the credit risk premium of the bond. The empirical results are consistent with hypothesis 1. Through empirical analysis, it can be understood that when a company conveys positive information to investors through positive emotions in the bond offering prospectus, investors may have doubts about the positive emotions in the bond offering prospectus because of various information channels. The preliminary results verify the mechanism of the influence of risk text sentiment on corporate bond credit risk premium.

4.2. The moderating effect of the nature of bond issuing enterprise

When state-owned enterprises are at risk of defaulting on their bonds, the local or central government may provide the necessary financial support. From this perspective, the implicit government guarantee of state-owned company may affect investors' expectations of losses from bond defaults, thus affecting credit risk premiums. In order to prove that the government's implicit guarantee ability has a moderating effect in the process of influencing the risk text sentiment of bond prospectus on the credit risk premium of corporate bonds, the following hypothesis is proposed.

Hypothesis 2: Under the condition that other conditions remain unchanged, when the bond issuing enterprise is a state-owned enterprise, the impact of the positive sentiment in the bond offering prospectus text on the credit risk premium will be affected.

In order to verify this hypothesis, the interaction term of Index and SOE was added into Equation (2) of the original fixed effects regression model, and the following model was obtained:

$$\begin{aligned}
 Riskrate_{it} = & \alpha_0 + \alpha_1 Index_{it} \cdot SOE_{it} + \alpha_2 Index_{it} + \alpha_3 Size_{it} + \alpha_4 ROE_{it} + \alpha_5 Lev_{it} + \alpha_6 Currentratio_{it} \\
 & + \alpha_7 Cashflow_{it} + \alpha_8 Tang_{it} + \alpha_9 Maturity_{it} + \alpha_{10} Volume_{it} + \alpha_{11} Convert_{it} + \alpha_{12} SOE_{it} \\
 & + \sum Industry + \sum Year + \sum Province + \varepsilon_{it}
 \end{aligned} \quad (3)$$

Table 4 shows the regulating effects of ROE and SOE on sentiment index. The first two columns in the table are regression results of the moderating effect of SOE on Index. As shown in Table 4, the results show that the interaction coefficient of the regression equation is positive and has a significant difference from 0 at the significance level of 1% . This indicates that when the bond issuing enterprise is a state-owned enterprise, the positive influence of the positive emotion in the bond offering prospectus text on the credit risk premium is intensified. The reason for this phenomenon may be that investors may have high expectations for low risks of state-owned enterprises, so they may be more sensitive to the difference between risk information obtained from other information sources and the disclosure of enterprises themselves. The hypothesis 2 is supported.

Table 4. Interaction of Index and SOE and ROE regression result.

	Riskrate1	Riskrate2	Riskrate1	Riskrate2
Index_SOE	0.797*** (2.829)	0.755*** (2.674)		
Index_ROE			-0.0926*** (-7.236)	-0.0956*** (-7.452)
Index	-0.00688 (-0.0254)	0.0343 (0.126)	1.138*** (10.74)	1.154*** (10.88)
Size	-0.175*** (-14.29)	-0.171*** (-13.97)	-0.175*** (-14.45)	-0.171*** (-14.11)
ROE	-0.0181*** (-9.777)	-0.0186*** (-9.996)	-0.0240*** (-12.09)	-0.0246*** (-12.37)
Lev	1.108*** (7.396)	1.142*** (7.604)	1.108*** (7.427)	1.141*** (7.634)
Currentratio	0.0262*** (6.869)	0.0258*** (6.737)	0.0256*** (6.723)	0.0251*** (6.588)
Cashflow	-0.0162** (-2.402)	-0.0164** (-2.432)	-0.0147** (-2.189)	-0.0149** (-2.218)
Tang	0.324*** (2.764)	0.354*** (3.012)	0.319*** (2.738)	0.347*** (2.974)
Maturity	-0.000649 (-0.124)	-0.0105** (-1.994)	-0.00235 (-0.449)	-0.0123** (-2.349)
Volume	-0.240*** (-12.68)	-0.239*** (-12.57)	-0.243*** (-12.87)	-0.242*** (-12.77)
Convert	0.271*** (9.747)	0.247*** (8.881)	0.265*** (9.594)	0.242*** (8.726)
SOE	-1.292*** (-29.98)	-1.302*** (-30.14)	-1.357*** (-33.13)	-1.365*** (-33.27)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
Province	YES	YES	YES	YES

Notes: The *t* statistics in parentheses.

*, **, *** imply significance at the 10%, 5%, and 1% levels, respectively.

4.3. The moderating effect of business performance of bond issuing enterprises

The good business performance of bond issuing enterprises is usually associated with a lower probability of bond default and investors' increased confidence in future investment returns, so the credit risk premium is relatively low. Less risky corporate bonds tend to attract more risk-averse investors because they are more willing to lower their expectations of future investment returns. Conversely, investors with low risk aversion are more inclined to invest in corporate bonds with poor operating performance but higher interest rates in order to strive for greater profits. Therefore, the following hypothesis is proposed:

Hypothesis 3: under the condition that other conditions remain unchanged, the better the operating performance of the bond issuing enterprise, the weaker the positive impact of the positive sentiment of the bond offering prospectus text on the credit risk premium.

In order to verify this hypothesis, the interaction term between Index and ROE was added to Formula (2) of the original fixed effects regression model, and the following model was obtained:

$$\begin{aligned} Riskrate_{it} = & \alpha_0 + \alpha_1 Index_{it} \cdot ROE_{it} + \alpha_2 Index_{it} + \alpha_3 Size_{it} + \alpha_4 ROE_{it} + \alpha_5 Lev_{it} + \alpha_6 Currentratio_{it} \\ & + \alpha_7 Cashflow_{it} + \alpha_8 Tang_{it} + \alpha_9 Maturity_{it} + \alpha_{10} Volume_{it} + \alpha_{11} Convert_{it} + \alpha_{12} SOE_{it} \\ & + \sum Industry + \sum Year + \sum Province + \varepsilon_{it} \end{aligned} \quad (4)$$

The last two columns of Table 3 show the regression result. The first is the regression result with the credit risk premium calculated by the yield to maturity of national debt as the dependent variable; the second is the regression result with the credit risk premium calculated by the yield to maturity of policy financial bonds issued by China Development Bank as the dependent variable. The results show that the interaction coefficients of the regression equation are all negative, while the coefficients of the emotion index are positive, and all have significant differences with 0 at the significance level of 1%. It indicates that the better the operating performance of the bond issuing enterprise, the weaker the positive impact of the positive sentiment of the bond offering prospectus text on the credit risk premium, so hypothesis 3 is supported.

5. Conclusion

This paper studies for the first time the relationship between the emotional tone of bond prospectus and the credit risk premium of bonds. We select 5194 sample data of bonds issued by listed companies from 2006 to 2021, as well as structured data related to financial data and bond characteristics of corresponding bond issuing companies. In the empirical analysis, we built a regression model and studied the moderating effects of ROE and SOE on the affective index. The results show that: First, when the text sentiment of bond prospectus is more positive, the credit risk premium of bonds is higher. Second, when the bond issuer is a state-owned enterprise, the positive effect of the positive sentiment in the bond prospectus on the credit risk premium is intensified. Third, when the business performance of bond issuing enterprises is better, the positive sentiment of bond offering prospectus text has a weaker positive impact on credit risk premium. Enterprises with good business performance usually have a lower default probability, and investors have more confidence in future investment returns, so the credit risk premium is relatively low. At the same time, investors of companies with good performance account for a higher proportion of risk aversion, while investors of companies with poor performance have a lower degree of risk aversion, but they will require higher risk premium as compensation when investing.

Although this paper is a pioneering study of the relationship between prospectus intonation and bond risk premium, it also has some limitations. Since intonation can be divided into normal intonation and abnormal intonation, this paper can further explore the relationship between intonation and risk premium after enterprise split on the basis of existing studies.

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References

- [1] Chen, X., Wang, J., & Wu, C. (2022). Jump and volatility risk in the cross-section of corporate bond returns. *Journal of Financial Markets*, 60, 100733.
- [2] Guo, B., Huang, F., & Li, K. (2020). Time to build and bond risk premia. *Journal of Economic Dynamics and Control*, 121, 104024.
- [3] Zhang, H., Guo, B., & Liu, L. (2022). The time-varying bond risk premia in China. *Journal of Empirical Finance*, 65, 51–76.
- [4] Corradin, S., & Schwaab, B. (2023). Euro area sovereign bond risk premia before and during the Covid-19 pandemic. *European Economic Review*, 153, 104402.
- [5] Zhou, Y., & Wei, X. (2023). Bond liquidity, debt maturity and bond risk premium. *Finance Research Letters*, 54, 103716.
- [6] Ge, F., & Zhang, W. (2022). The determinants of cross-border bond risk premia. *Journal of International Financial Markets, Institutions and Money*, 81, 101680.
- [7] Gentzkow, M., Kelly, B., & Taddy, M. (2019). Text as data. *Journal of Economic Literature*, 57(3), 535-74.
- [8] Gore, A. K., Sachs, K., & Trzcinka, C. (2004). Financial disclosure and bond insurance. *The Journal of Law and Economics*, 47(1), 275-306.
- [9] Bonsall, S. B., & Miller, B. P. (2017). The impact of narrative disclosure readability on bond ratings and the cost of debt. *Review of Accounting Studies*, 22(2), 608–643.
- [10] Fang-Klingler, J. (2019). Impact of readability on corporate bond market. *Journal of Risk and Financial Management*, 12(4), 184.
- [11] Agarwal, S., Chen, V. Y., & Zhang, W. (2016). The information value of credit rating action reports: A textual analysis. *Management Science*, 62(8), 2218-2240.
- [12] Jiang Fuwei, Meng Lingchao & Tang Guohao. (2021). Media text sentiment and stock return Prediction. *Economics (Quarterly Journal)*(04),1323-1344.
- [13] Loughran, T., & McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks. *The Journal of Finance*, 66(1), 35–65.
- [14] Yao Zhixin, Feng Xu, Wang Zanjun, Ji Rongrong & Zhang Wei. (2021). Tone, sentiment and market impact: A dictionary of financial sentiment. *Journal of management science* (05), 26-46.
- [15] Jin, J. D. (1992). The relationship between accounting earnings and bond returns. *Journal of Accounting and Public Policy*, 11(3), 245-267.
- [16] Lagazio, C., Persico, L., & Querci, F. (2021). Public guarantees to SME lending: Do broader eligibility criteria pay off?. *Journal of Banking & Finance*, 133, 106287.