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Are Credit Ratings Relevant in China's Corporate Bond Market?

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While China may imitate the United States in establishing and regulating its nascent credit rating industry, the reputation and influence of the rating agencies may take years to develop. This observation has led to suggestions that investors have largely discounted the opinions of Chinese credit rating agencies. Using post-2005 data, we find that credit spreads and bond ratings in China display a similar relation to that found in the United States. In particular, this relation remains significant after controlling for bond-level and firm-level characteristics. This suggests that investors indeed use credit ratings to determine the risk premiums on Chinese corporate bonds.

Keywords: corporate bonds, credit ratings, China, risk premiums

INTRODUCTION

An effective and well-regarded credit rating system is important to the growth of the corporate bond market. In the United States, ratings issued by credit rating agencies play a central role in the decision making of investors and the returns they require on corporate bonds (Kaplan and Urwitz 1979). The credit rating industry in the United States consists of a few powerful and reputable rating agencies. Moody's and Standard & Poor's, the oldest agencies, dominate the market for credit ratings. Ten agencies are specially designated as Nationally Recognized Statistical Rating Organizations (NRSROs).[1] There are many regulatory restrictions that afford these NRSROs' special consideration. The Securities and Exchange Commission (SEC) first applied the NRSRO designation in 1975 to agencies whose credit ratings could be used to determine net capital requirements for broker-dealers (Cantor and Packer 1995, 1997). Importantly, many institutional investors, such as pension funds subject to the Employee Retirement Income Security Act, are only allowed to purchase investment-grade bonds—bonds that have received a

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rating of BBB or higher by one of the NRSROs. This dynamic affords credit rating agencies considerable importance. Investors and issuers are forced to pay attention. Additionally, the largest rating agencies have forged reputations over decades as trusted experts on the default risk of firms.

In contrast, the regulatory environment in China has forced the rating agencies to fight for relevance. Chinese legislation from the late 1980s played a large part in rendering them powerless. The People's Bank of China (PBOC), the central bank and the nation's principal financial regulator, only began permitting local enterprises to issue bonds in 1984. Initially, these bonds had to be guaranteed by a state bank. This requirement meant there was virtually no default risk borne by investors as the guarantor—a large national bank—was liable for the bond payments if the issuer defaulted. This prescreening of bond issues by a state-backed guarantor meant there was little left for China's rating agencies to do but rubber stamp the bond issues with their highest ratings. Credit ratings were purely "ornamental" (Qing 2002). In 2005, the PBOC created an important new instrument: commercial papers. These papers were unguaranteed bonds with maturities of one year or less. Commercial paper could only be brought to the market if it received strong credit ratings. This requirement echoes the rules for investment-grade bonds in the United States. For the first time, investors had a reason to worry about default risks because there was no guarantor, and China's credit rating agencies had a regulatory role. As in the United States, the PBOC authorized only a handful of credit rating agencies with licenses that allowed them to fill these regulatory requirements.[2] These changes produced a substantial increase in bond issues.

Even with this transformation of the bond market, the influence of Chinese credit rating agencies remains uncertain. There have been reports of corruption and concerns that rating agencies have been willing to award firms with inappropriately high ratings to generate business (Kennedy 2008). On the other hand, research has shown that rating downgrades do have an effect on China's stock markets (Poon and Chan 2008a, 2008b). Empirically, it is difficult to directly assess the quality of ratings—how closely they correspond to the default risk to which investors are exposed. This is because the earliest bond issuers were typically firms with the highest quality debt and defaults have been nonexistent so far. Whether Chinese credit rating agencies have become independent and trusted authorities on credit risk is an important question that has significant implications for the future of the Chinese bond market.

To shed light on this question, we aim to examine whether credit ratings help explain the yields demanded by investors on corporate bonds in China. Using data from 2005 to 2010, we find that among medium-term notes, whose rating distribution is reasonably dispersed across three rating classes, bonds rated AA+ have yield spreads relative to Chinese government bonds that are 21 basis points higher than their AAA counterparts. Bonds rated AA have yield spreads that are 88 basis points higher than their AAA counterparts. These estimates remain statistically significant when controlling for common issuer and issue characteristics and time fixed effects. In light of the narrow range of credit ratings in China (only AAA, AA+, and AA are observed in our sample), it is perhaps instructive to compare our results with Elton et al. (2001), who estimate a five-year yield spread for A-rated (BBB-rated) bonds that is 25 (72) basis points higher than that of AA-rated bonds. Thus, the dispersions of yield spreads in China and the U.S. are quite similar even though the ranges of commonly used credit ratings in these two countries are drastically different (AAA/AA+/AA vs. AA/A/BBB).[3]

Another category of Chinese corporate bonds includes enterprise bonds and listed company bonds, and has a rating distribution severely skewed toward the highest credit rating. In this

case, we still find that both AA+ and AA-rated bonds have significantly higher yield spreads than AAA-rated bonds, although the difference in yields between bonds rated AA and AA+ is no longer distinguishable from zero. Overall, in spite of the Chinese credit ratings being concentrated at the very top, our findings suggest that investors do consider and value the information content of credit ratings when determining their risk premium on Chinese bonds.

METHODOLOGY

The approach in this study models the yield spread on bonds as a function of credit rating dummies, bond characteristics, and firm features, where the yield spread refers to the yield on the bond beyond the yield on a Chinese government bond with approximately the same maturity.[4] The general form of this model is as follows:

$$\begin{aligned} Yield\ Spread_i = {} & \beta_0 + \beta_1 Rating1_i + \beta_2 Rating2_i + \cdots \\ & + \beta_{k+1} BondCharacteristic1_i + \beta_{k+2} BondCharacteristic2_i + \cdots \\ & + \beta_{m+1} FirmFeature1_i + \beta_{m+2} FirmFeature2_i + \cdots + \varepsilon_i. \end{aligned}$$

A secondary model includes quarterly dummies intended to capture, in part, the effect of time-varying common factors, such as macroeconomic influences, on risk premiums. The coefficients of interest are on the dummy variables representing discrete credit ratings. These dummies indicate a departure from the default credit rating. In a linear regression with yield spread as the dependent variable, the coefficients on the dummies estimate the impact each credit rating has, beyond the default rating, on the risk premiums of investors. Distinct types of bonds (medium-term notes and long-term corporate bonds) are treated separately. For each type of bond, the default rating is the highest credit rating of AAA. As such, the dummy variables refer to lower rating levels such as AA+ and AA.

In order to avoid the omitted variables bias, we include certain bond characteristics and firm features that might help explain credit rating changes or predict default. Although researchers have dealt with varying samples and tested different firm characteristics, the literature repeatedly points to measures of scale, leverage, coverage, and profitability—typically, net income/total assets—as important predictors of default risk and credit rating.[5] More detail on these controls is provided in the data section.

The literature shows that lower credit ratings imply higher yields, indicating that credit ratings are important to investors.[6] We hypothesize that this result also holds for the Chinese corporate bond market. The linear regression tests this hypothesis against the null hypothesis that there is no relation between credit ratings and yield spreads by testing that the coefficients on the credit rating dummies are not zero. Statistically significant and positive coefficients on these dummies would partly verify the hypothesis. This result would mean that the lower credit rating specified by the dummy variable implies a higher yield spread than the default (highest) rating. However, the yield spreads on bonds with a particular rating should also be statistically different from the yield spreads on bonds with any other rating—not only those with the default (highest) rating. The confidence intervals on the coefficients of interest allow the comparison of yield spreads between any two credit ratings. These coefficients can also be compared by using a Wald test to verify that their difference is not zero.

DATA

The Chinese corporate bond market generally includes three types of bonds: commercial paper with maturities of one year or less, medium-term notes with maturities between three to five years, and corporate bonds with longer maturities, which include enterprise bonds and listed company bonds. The regulatory oversight of these bonds is fragmented, with the National Development and Reform Commission (NDRC) supervising enterprise bond issuance, the Chinese Securities Regulatory Commission (CSRC) supervising listed company bond issuance, and the People's Bank of China (PBOC) supervising the issuance of commercial paper and medium-term notes. While the issuance of commercial paper, medium-term notes, and listed company bonds began only after 2005, the history of enterprise bonds goes back much further and they are issued primarily by state-owned enterprises.[7]

Figure 1 shows the quarterly amount of bonds issued as well as the number of bonds issued for the three categories of Chinese corporate bonds. The total issuance of Chinese corporate bonds grew from under 300 billion RMB in the second quarter of 2005 to over 1 trillion RMB in the first quarter of 2013. Out of the three forms of corporate debt financing, commercial paper has consistently ranked first in terms of both amount and number issued since its

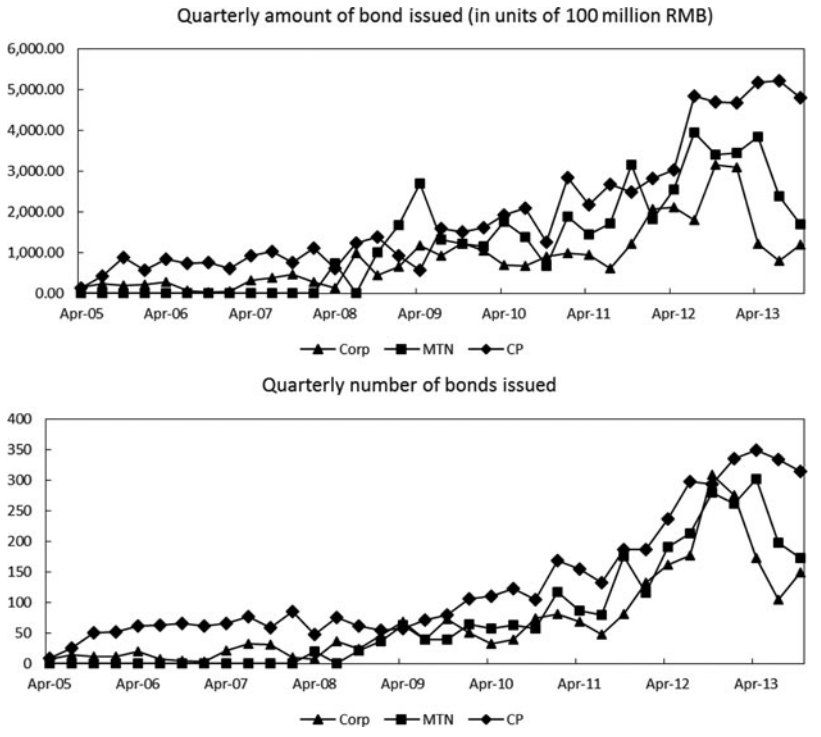

FIGURE 1 Quarterly issuance of chinese corporate bonds, 2005–2013.
The source of the data is WIND.

creation by the PBOC in 2005, followed by medium-term notes and long-term corporate bonds, in that order. This suggests that commercial paper has become a dominant source of financing for nonfinancial Chinese firms, similar to its role in the U.S. market.[8]

The main data used in this study are hand-collected from bond issue summaries and reports drafted by China Chengxin International Credit Rating Co. Ltd. (CCXI). CCXI was launched as a joint venture in 1999 between China Chengxin and Fitch Rating. This arrangement collapsed in 2003, but CCXI has been affiliated with Moody's since 2006. Moody's currently has a 49 percent stake in CCXI. Along with Lianhe, CCXI is one of the two largest and most recognized credit rating agencies in China and one of five licensed rating agencies (Kennedy 2008). As such, CCXI's ratings should reasonably reflect the importance Chinese investors attribute to credit ratings. This importance is consistent with the literature; many studies of the U.S. bond market focus on either of the leading raters, Moody's or Standard & Poor's, as illustrative of the general role credit rating agencies have in the market (Jewell and Livingston 1998).

CCXI rates all three types of bonds: commercial paper, medium-term notes, and long-term corporate bonds. Data for each of these types of bonds are gathered from bond issue summary reports downloaded from the CCXI website. Typically, they include descriptive characteristics of the bond: issuing date, maturity date, issue size, coupon rate, initial credit rating, and the pricing of the bond at the time of issuance, along with a few years of company financial information. In our empirical analysis, we use the most recent financial information available at the time of bond issuance. For commercial paper, the sample begins in May 2005; for medium-term notes, April 2008; for corporate bonds, August 2005. All samples end after February 2010.

To compute corporate bond yield spreads, we make use of daily constant maturity government bond yields quoted in the Chinese interbank market (obtained from WIND). Specifically, we subtract from the corporate bond yield a government bond yield whose maturity most closely matches that of the corporate bond.

Commercial Paper

Unfortunately, although CCXI has rated 442 commercial paper issues during the sample period, each one has received a rating of A-1, CCXI's highest rating for commercial paper. Since there is no variation of credit ratings, it is impossible to look for an effect on yield spreads. This problem is not unique to commercial paper rated by CCXI; of the nearly 3,000 commercial paper issues since 2010, only one received a rating of A-2. Nevertheless, this does not imply a lack of variation in the pricing of commercial paper. Figure 2 shows that the distribution of commercial paper yield spreads peaks near the average of 1.72 percent, with a fatter right tail that indicates more cases of unusually high yield spreads than unusually low yield spreads. Clearly, Chinese rating agencies have collectively shirked their responsibilities when it comes to providing useful information on the credit quality of commercial paper.

Medium-Term Notes

The pool of medium-term notes displays some variation in credit ratings, but this range is still narrow. There are only three ratings in the sample: AAA (49 issues), AA+ (19 issues), and AA (10 issues). AAA is the highest credit rating and should correspond to the lowest default risk.

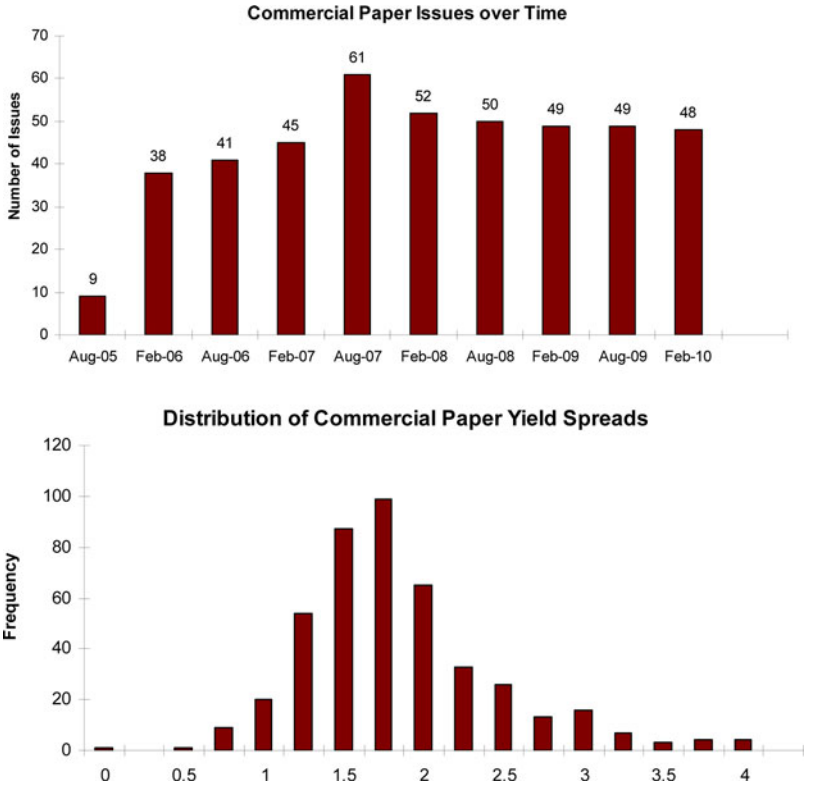

FIGURE 2 Summary of commercial paper data, 2005–2010.
442 issues rated by CCXI were included. All had a rating of A-1.

Medium-term notes with floating and progressive coupon rates are excluded from the sample, because it is unclear how the coupon payments are structured in these cases, and there are too few such issues to test properly the effect of varying coupon rate types on the yield spread. As such, only medium-term notes with fixed coupon rates are considered. Figure 3 illustrates the distribution of bond yield spreads for each credit rating. Higher-rated bonds appear to be concentrated at lower yield spreads, but there is a considerable range of yield spreads at each rating. Although the graph offers a preliminary look at the relation between credit rating and yield spread for medium-term notes, it is unclear whether the correlation is statistically significant and persists when other factors are controlled for.

For these issues, data are collected on two bond characteristics besides the yield spread: maturity and issuing amount. Additionally, there are four firm features that are consistently mentioned in the literature as important and statistically significant indicators of credit rating and default risk: size, profitability, coverage, and leverage. Due to constraints on data availability, no measure of interest coverage is included. Size is measured by total assets, leverage by total liabilities as a fraction of total assets, and profitability by earnings before interest and taxes (EBIT) as a fraction of total assets. In the literature, profitability is most often represented

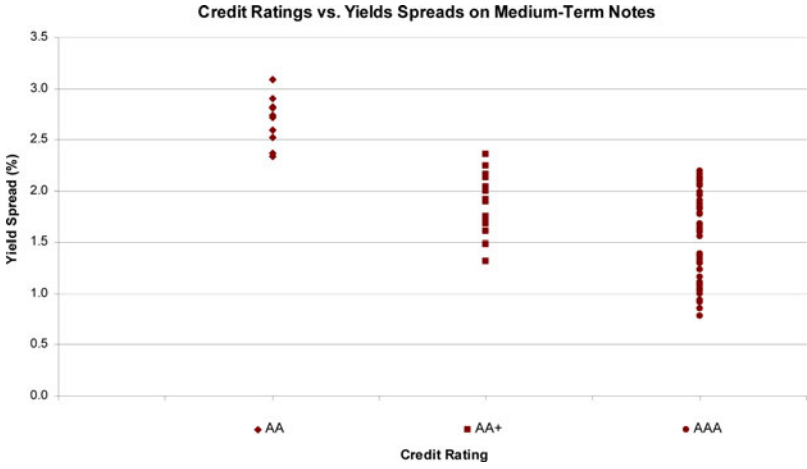

FIGURE 3 Credit rating versus yield spread on medium-term notes, 2008–2010. 78 issues rated by CCXI were included.

by net income as a fraction of total assets. However, the CCXI reports do not include net income, and EBIT is the closest available approximation. Controlling for these five variables—two bond characteristics and three firm features—should reduce the omitted variable bias in the analysis and improve the estimates of the dummy variable coefficients.

Filtering the available medium-term notes for fixed coupon rates and available firm features reduces the sample to 78 issues. Table 1 summarizes the variables collected as well as their pairwise correlations. The average issuer in our medium-term note sample has total assets just in

TABLE 1
Summary Statistics and Correlations for Variables Used to Explain the Yield Spreads on Medium-term Notes

Variable	*Mean*	*Stdev*	*Min*	*Max*		
Yield spread	1.76%	0.54%	0.78%	3.09%		
Issuing amount (RMB million)	29.9	28.1	2	200		
Maturity (years)	4.08	1.16	2	8		
Total assets (RMB million)	1,003	885	85	3,837		
Total liabilities/Total assets	58.4%	15.9%	14.9%	90.5%		
EBIT/Total assets	7.4%	6.2%	1%	33.7%		
	Yield spread	*Issuing amount*	*Maturity*	*Total assets*	*TL/TA*	*EBIT/TA*
Yield spread	1.00					
Issuing amount	−0.40	1.00				
Maturity	−0.27	0.25	1.00			
Total assets	−0.46	0.34	0.14	1.00		
TL/TA	0.10	−0.06	0.07	0.33	1.00	
EBIT/TA	0.18	−0.05	0.03	−0.21	−0.41	1.00

excess of 1 billion RMB, a liability/assets ratio of 58 percent, and a profitability ratio of 7.4 percent. The average medium-term note has a maturity just over four years, an issue size of 29.9 million RMB, and a yield spread of 176 basis points over constant maturity government bond yields. Table 1 also shows that the yield spread is negatively correlated with total assets, issue size, and bond maturity.

Corporate Bonds

The data collection for corporate bonds is similar to that for medium-term notes. The sample, again, excludes any bonds without fixed coupon rate structures. The range of ratings is the same as that of medium-term notes. The overwhelming majority of corporate bonds—92 of the 102 issues in the sample—receive the highest rating available: AAA. This is not entirely unexpected for such a young bond market. It is possible that, initially, only the firms with the least default risk would seek or be allowed to raise money in the debt market. Additionally, credit rating agencies may be reluctant to award poor ratings as they work to establish their business. Rating agencies earn revenues from client firms seeking ratings for their bond issues and from investors subscribing to rating publications and databases (Allen and Dudney 2008). These mutually exclusive sets of clients create conflicting incentives. In the long-run, rating agencies are best served by assigning credit ratings most appropriate to the firm's default risk on the bond. This activity develops a reputation and regard among investors that ensures client firms continue to seek the services of the agency. However, in the earliest stages, credit rating agencies have no reputation with which to attract client firms (Allen and Dudney 2008). This situation could result in awarding inappropriately high credit ratings to build a base of client firms and may help explain the extremely disproportional distribution of ratings. Figure 4 depicts the distribution of yield spreads for each credit rating.

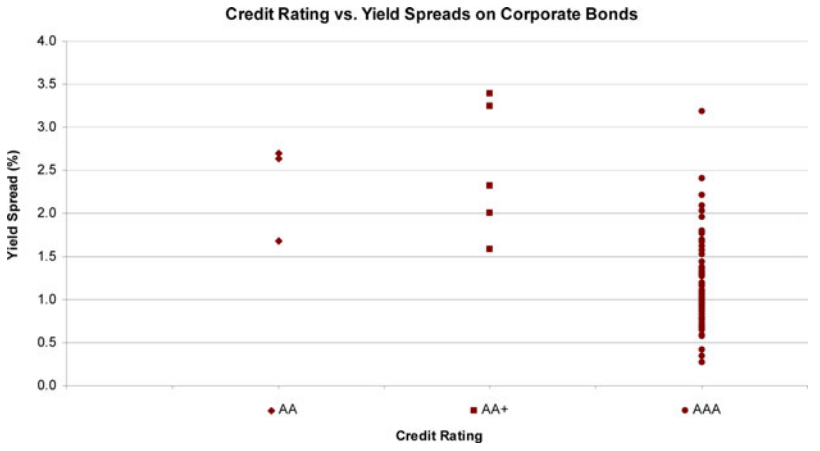

FIGURE 4 Credit rating versus yield spread on corporate bonds, 2005–2010.
102 issues rated by CCXI were included.

As with the medium-term notes, the AAA bonds appear to be concentrated at yield spreads below those on bonds with poorer ratings. However, this correlation—better ratings implying lower yield spreads—does not seem to hold between AA and AA+ bonds. To investigate the relation between ratings and yield spreads more closely, other bond and firm features need to be controlled for. In addition to issuing amount and maturity, data are collected on which bonds are guaranteed. Unlike commercial paper and medium-term notes, which are unguaranteed instruments, the majority of the corporate bonds in the sample are guaranteed in the form of collateral or joint liability agreements. The data on firm features also differ slightly from the medium-term notes, largely because of discrepancies in the reporting in CCXI bond summaries. Instead of listing the total liabilities for firms issuing corporate bonds, only total debt—excluding nondebt liabilities—is available. Additionally, the CCXI reports for corporate bonds do not specify net income or EBIT; the closest available measure is the earnings before interest, taxes, depreciation, and amortization (EBITDA). Filtering the available bond issues to include only corporate bonds, where these data are available, results in a sample size of 102 issues, 87 of which have some type of guarantee.

The sample, with relevant units, is summarized in Table 2. The average issuer in our corporate bond sample has total assets of 4.6 billion RMB, a leverage ratio of 35 percent (somewhat less than the average leverage ratio for the medium-term note sample because the latter uses total liabilities, while total debt is used here), and a profitability ratio of 8.1 percent. The average corporate bond has a maturity of 10.3 years, an issue size of 37.2 million RMB, and a yield spread of 134 basis points. About 84 percent of the bonds have some form of explicit guarantee. Compared to the medium-term note sample, the issuers in the corporate bond sample are clearly larger in size. Table 2 also shows that the yield spread is positively correlated with leverage and negatively correlated with total assets, issue size, bond maturity, and profitability.

TABLE 2
Summary Statistics and Correlations for Variables Used to Explain the Yield Spreads on Corporate bonds

Variable	*Mean*	*Stdev*	*Min*	*Max*
Yield spread	1.34%	0.64%	0.27%	3.39%
Guarantee	0.84	0.37	0	1
Issuing amount (RMB million)	37.2	45.7	5	260
Maturity (years)	10.31	4.85	3	30
Total assets (RMB million)	4,578	6,488	51	18,533
Total debt/Total assets	34.7%	14.3%	8.8%	69.4%
EBITDA/Total assets	8.1%	5.1%	0.5%	27.6%

	Yield spread	*Guarantee*	*Issuing amount*	*Maturity*	*Total assets*	*Total debt/TA*	*EBITDA/TA*
Yield spread	1.00						
Guarantee	−0.09	1.00					
Issuing amount	−0.29	0.07	1.00				
Maturity	−0.54	0.20	0.04	1.00			
Total assets	−0.39	0.21	0.69	0.28	1.00		
Total debt/TA	0.41	0.00	−0.21	−0.25	−0.29	1.00	
EBITDA/TA	−0.19	−0.29	0.02	−0.10	−0.12	−0.03	1.00

EMPIRICAL ANALYSIS

Specification Search

The dependent variable for similar studies has been widely specified as a yield spread. However, some authors favor using relative yield spreads.[9] Still others denote their dependent variable as the absolute bond yield and include a government bond yield as a control variable. Although this study focuses on the impact of credit ratings on yield spreads, supplementary regression results using these alternative dependent variable specifications are available upon request.

The explanatory (control) variables are individually examined to determine which functional form best explains yield spreads. The choice between specifications is determined by applying the Bayesian Information Criterion (BIC) on univariate regressions of the yield spread on each of the control variables.[10] First, the BIC is minimized across polynomial forms. The preferred polynomial form varies among the set of controls from linear to cubic. The favored polynomial form is then compared to a log specification of the variable using, again, the BIC. This process is followed separately for the distinct samples of medium-term notes and corporate bonds, producing very similar specifications. For issuing amount, maturity, and total size, the log functional form produces a lower BIC than the most suitable polynomial form in both samples. The log of the leverage ratio best explains the variation in yield spreads for medium-term notes, but a linear specification is superior for corporate bonds. These results are reversed for the profitability ratio; its chosen specifications are linear for medium-term notes and log for corporate bonds. Interestingly, as noted earlier, the leverage and profitability ratios are the only control variables that are defined slightly differently across samples.

Medium-Term Note Results

The results of the linear regression for medium-term notes are presented in Table 3. Three sets of regressions are conducted on some combination of the credit rating dummies and the five control variables. The final regression adds a set of quarterly dummies, designed to control for broad macroeconomic influences over yield spreads or economy-wide variations of the risk premium.

For each version of the regression, the coefficients on the dummy variables representing AA+ and AA ratings are statistically significant at the 1 percent level in almost all cases. This finding suggests that credit ratings do matter in the determination of bond yield spreads. The model based only on credit ratings explains 52.3 percent of the variation in the sample, while the model based on bond characteristics and firm features alone explains 41.9 percent of the variation in the sample. When using both ratings and underlying factors, the model explains 57.9 percent of the variation. This difference appears to be only a marginal improvement in the overall explanatory power of the model. Additionally, the coefficients on the rating dummies in the third regression are substantially different than those in the first regression. All of these findings suggest that the ability of credit ratings and the underlying factors to explain the variation in yield spreads overlap. As such, it is important to control for these underlying factors to avoid the omitted variable bias. The improved estimates on the credit rating dummy variables from the third regression will be the focus of our discussion.

TABLE 3
Regression Results for Medium-term Notes

	(1)	(2)	(3)	(4)
VARIABLES	*Yield spread*	*Yield spread*	*Yield spread*	*Yield spread*
AAplus	0.350*** (0.0861)		0.214** (0.0978)	0.300*** (0.0949)
AA	1.168*** (0.0953)		0.877*** (0.166)	0.971*** (0.143)
Log(Issuing Amount)		−0.0156 (0.140)	−0.0167 (0.105)	−0.0618 (0.0638)
Log(Maturity)		−0.448*** (0.161)	−0.264* (0.154)	−0.0330 (0.139)
Log(TotalAssets)		−0.335*** (0.101)	−0.151* (0.0846)	−0.0684 (0.0552)
Log(DebtFrac)		0.711*** (0.173)	0.320* (0.176)	0.118 (0.151)
EBITFrac		1.293* (0.713)	0.0449 (0.738)	−0.00608 (0.687)
Quarter 2				−0.482* (0.252)
Quarter 3				−0.000654 (0.112)
Quarter 4				−0.463*** (0.0910)
Quarter 5				−0.164 (0.107)
Quarter 6				0.0591 (0.101)
Constant	1.522*** (0.0621)	4.931*** (0.485)	3.178*** (0.523)	2.490*** (0.435)
Observations	78	78	78	78
R-squared	0.523	0.419	0.579	0.707

As defined earlier, the yield spread refers to the yield on the corporate bond beyond the yield on a Chinese government bond with approximately the same maturity. The coefficient on the AA+ dummy variable in the third regression indicates that the yield spread on an AA+-rated bond is estimated to be 21 basis points greater than an AAA-rated bond, holding all other underlying factors constant. This coefficient is significant at the 5 percent significance level. The yield spread on AA-rated bonds is estimated to be 88 basis points greater than AAA-rated bonds, and this coefficient is significant at the 1 percent significance level. Additionally, the 95 percent confidence intervals on the credit rating dummies' coefficients do not overlap. More formally, a Wald test on the difference between the coefficients produces a test statistic of 19.7. The probability of observing such an extreme test statistic if the coefficients were the same is close to zero. This allows a reasonable ranking of the yield spread on AA+ bonds below the yield spread on AA bonds. Using the sample average bond characteristics and firm features, the third model predicts the following yield spreads for each credit rating: 154 basis points (AAA), 175 basis points (AA+), and 242 basis points (AA).

Among the included control variables (third regression), the coefficients on bond maturity, firm size, and leverage ratio are significant at the 10 percent level. The coefficient on bond maturity is less than zero, indicating that bonds with longer maturities have lower credit spreads. This could mean that the term structure of credit spreads is downward-sloping, or it could indicate a sample selection bias associated with maturity choice—among firms with the same credit rating, the safer ones are more likely to issue longer-dated bonds (Helwege and Turner 1999). Given their log specification, the coefficients on these variables can be used to approximate closely the estimated change in the yield spread for very small percentage changes in the explanatory variables. For example, the model's estimated effect of a 10 percent increase in the maturity of a bond on its yield spread can be approximated as 10 percent of the relevant coefficient, or −2.6 basis points. Similarly, a 10 percent increase in the firm's total

assets will reduce the yield spread on a bond issued by that firm by 1.5 basis points. Finally, a 10 percent increase in the firm's leverage ratio (this refers to, say, the leverage ratio moving from 0.1 to 0.11) will raise the yield spread on that firm's bonds by 3.2 basis points. The two remaining control variables, issuing amount and profitability, do not have statistical significance when the rating dummy variables are also included.

Regression four includes quarterly time dummies to capture market-level changes in the risk premium that investors demand for holding Chinese corporate bonds. The coefficients on the dummy variables indicate that such variations are, indeed, present in the sample. After taking into account this effect, the coefficients on the five firm-level and bond-level characteristics are no longer statistically significant, presumably because most of the power for identifying their effects on the yield spread comes from time-series variations. Nevertheless, the coefficients on the rating dummies remain significant at the 1 percent level and are similar in magnitude to those in Regression three. Therefore, the monotonic relation between credit ratings and credit spreads appears robust.

In sum, the regression analysis consistently calculates statistically significant coefficient estimates on the credit rating dummy variables. Furthermore, the analysis suggests a strictly decreasing relation between yield spreads and credit ratings—as credit ratings rise, yield spreads fall. Additionally, the model estimates the decline in yield spreads from AA to AA+ bonds to be more than three times the decline in yield spreads from AA+ to AAA bonds. This discrepancy implies that the ratings are not uniformly spaced. The distances between ratings are unequal in terms of the impact of moving from one rating to an adjacent rating on yield spreads.[11] The statistical significance of the coefficients of interest is evidence that credit ratings matter, and investors rely on them to determine their risk premiums.

Corporate Bond Results

The analysis using the sample of corporate bond issues offers less convincing results about the role of credit ratings than was true for medium-term notes. These results are presented in Table 4. As before, the first three regressions models yield spreads as some combination of credit ratings, bond characteristics, and firm features. The fourth regression includes a set of quarterly time dummies to control for broad macroeconomic factors whose influence on bond yields changes over time.

In general, the models for the sample of corporate bonds explain more of the variation in yield spreads than those for medium-term notes. Modeling yield spreads on only credit ratings explains 33.5 percent of the variation in yield spreads, while the model based solely on bond characteristics and firm features explains 51.6 percent of the variation. In this case, the second model outperforms the first one; for medium-term notes, the reverse is true. Including both credit ratings and other underlying factors, as in the third regression, improves the model's explanatory power to 62.6 percent. Although the coefficients on the credit rating dummies are statistically significant in each version of the regression, the focus of the analysis is, again, on the third model.

Specifically, the coefficient on the AA+ dummy variable is significant at the 1 percent level and estimates the yield spreads on these bonds to be 92 basis points greater than the yield spreads on AAA bonds. Oddly, the coefficient on the AA dummy estimates a smaller difference

TABLE 4
Regression Results for Corporate Bonds

	(1)	(2)	(3)	(4)
VARIABLES	*Yield spread*	*Yield spread*	*Yield spread*	*Yield spread*
AAplus	1.263*** (0.272)		0.924*** (0.217)	0.697*** (0.229)
AA	1.216*** (0.227)		0.600** (0.239)	0.479** (0.209)
Guarantee		−0.00625 (0.114)	0.145 (0.103)	0.240** (0.0913)
Log(Issuing Amount)		−0.0753 (0.0568)	−0.0275 (0.0467)	−0.103* (0.0537)
Log(Maturity)		−0.707*** (0.0994)	−0.565*** (0.0909)	−0.282*** (0.0912)
Log(TotalAssets)		−0.0531* (0.0272)	−0.0472** (0.0214)	−0.0566** (0.0225)
DebtFrac		0.849** (0.348)	0.973*** (0.338)	0.957*** (0.312)
Log(EBITDA Frac)		−0.111 (0.0978)	−0.0448 (0.0846)	−0.0196 (0.0681)
Quarter 2				0.0734 (0.137)
Quarter 3				0.109 (0.109)
Quarter 4				−0.524*** (0.0819)
Quarter 5				−0.390*** (0.122)
Quarter 6				0.0884 (0.111)
Quarter 7				0.575*** (0.194)
Quarter 8				0.483*** (0.138)
Quarter 9				0.482** (0.190)
Quarter 10				0.508*** (0.154)
Quarter 11				0.577*** (0.154)
Quarter 12				0.327** (0.126)
Constant	1.214*** (0.0546)	2.923*** (0.396)	2.349*** (0.351)	1.785*** (0.363)
Observations	102	102	102	102
R-squared	0.335	0.516	0.626	0.766

of 60 basis points between the yield spreads on AA and AAA corporate bonds. This coefficient is significant at the 5 percent level. Using the sample average firm features and bond characteristics, the third model implies the following credit spreads for the three rating categories: 111 basis points (AAA), 203 basis points (AA+), and 171 basis points (AA). While these estimates indicate that AA+ bonds are expected to command a higher risk premium than AA bonds, this interpretation is misleading. The 95 percent confidence intervals for the coefficients of these two dummies (0.49%, 1.35% and 0.13%, 1.08%, respectively) overlap substantially. The corresponding Wald test returns a statistic of 1.22. This means that if the coefficients were the same, the probability of observing a sample at least as extreme as this one is 27 percent. Consequently, the difference between the coefficients is not statistically significant at any conventional significance level. This model does not allow the conclusion that yield spreads are a strictly decreasing function of credit ratings. This is, at best, tepid evidence that credit ratings matter to investors. The result speaks to the weakness of the sample identified earlier: the distribution of ratings is hugely disproportional with relatively few bonds rated lower than AAA.

The models for the corporate bond sample add a dummy variable to control for whether or not the bond issue carries some sort of guarantee (1 if there is a guarantee and 0 if there is not). In the second model, including only bond characteristics and firm features, the coefficient on this variable is negative. However, the sign of this coefficient reverses in the third and fourth regressions, when credit ratings are included. This indicates that guaranteed bonds have lower

yield spreads than unguaranteed ones, controlling for bond characteristics and firm features. However, after controlling for credit rating, they have higher yield spreads. This finding suggests that investors are more confident in unguaranteed bonds that earn their credit ratings by merit than guaranteed bonds that receive the same ratings as a result of the accompanying guarantee. Such an outcome is possible if just enough guarantee is provided for a bond issue to clear the bar for a specific rating category. In any case, the coefficient is not significant in Regressions 2 and 3 and is positive and significant in Regression 4.

The negative relation between the bond's maturity and yield spread found for medium-term notes is amplified for corporate bonds. The coefficient on the maturity variable is statistically significant at the 1 percent level in all three regressions where it is included. The direction of the relation between the remaining explanatory variables and yield spreads is consistent with what one would expect: smaller firm size, smaller issue size, higher leverage ratio, and less profitability—all correspond to higher yield spreads. Several of the coefficients are statistically significant at some level. Specifically, the coefficients on the maturity and leverage ratio variables are statistically significant at the 1 percent level, while firm size is statistically significant at the 5 percent level. Interestingly, each of these controls is more significant in this model than the model for medium-term notes. This finding suggests that investors consider underlying factors more seriously when determining their risk premiums on corporate bonds. The interpretation of the coefficients on variables with log forms is the same as outlined earlier for medium-term notes. The model estimates a 5.7 basis point decline in the yield spread for a 10 percent increase in the maturity of the bond, and a 0.47 basis point decline in the yield spread for a 10 percent increase in the firm's total assets. The interpretation of the coefficient on the leverage ratio is different because its functional form is linear. In this case, a 10 percentage point increase—for example, from 0.1 to 0.2—in the leverage ratio corresponds to a 9.7 basis point increase in the yield spread.

In contrast to the results on medium-term notes, the control variables retain their statistical significance when quarterly time dummies are included in Regression 4. This is, again, consistent with investors paying attention to the underlying firm-level conditions when demanding compensations for investing in corporate bonds. Similar to the results on medium-term notes, however, the coefficients on the credit rating dummies remain statistically significant, and their magnitudes do not seem to change.

In summary, the regression analysis suggests the following three conclusions about the coefficients of interest. First, the yield spreads on AA+-rated corporate bonds are greater than the yield spreads on AAA bonds, and the difference between the yield spreads is statistically significant at the 1 percent level. Similarly, the yield spreads on AA bond are greater than those on AAA bonds. The difference between the yield spreads is statistically significant at the 5 percent level. Finally, there is no statistically significant difference between the yield spreads on AA+ and AA bonds.

CONCLUSION

As of the end of 2013, the size of China's stock and corporate bond markets stands at approximately 25 trillion RMB and 11 trillion RMB, respectively.[12] The corporate bond market has clearly come a long way since 2005–2008, when the PBOC and CSRC created new instruments such as commercial paper, medium-term notes, and listed company bonds to open up the source of funding for China's corporate sector. Yet, when compared to more developed markets in the

United States, Europe, and Japan, China's corporate bond market still appears small and immature.

One key distinction of the more mature bond markets is that the distribution of credit ratings on Chinese corporate bonds, in particular commercial paper and long-term corporate bonds, remains extremely skewed toward the top. Making matters worse, commercial paper yield spreads vary substantially in the cross-section in spite of a complete absence of ratings variation, suggesting a total failure by the rating agencies to provide useful information about the credit quality of commercial paper. How investor perception of credit ratings might change as agencies award more varied ratings in the future is still unclear.

Notwithstanding the limited amount of rating variations, this study produces several important insights into the developing Chinese corporate bond market. Many of the central conclusions of this investigation apply to both medium-term notes and corporate bonds. Most importantly, the coefficients on the credit rating dummies in the yield spread regressions are consistently statistically significant in both samples. This result is evidence in favor of the hypothesis that credit ratings help explain yield spreads in the Chinese bond market. The evidence is more convincing for medium-term notes where statistically significant yield spread differences are found between intermediate credit ratings as well. We also find that bond maturity, firm size, and firm leverage are persistent determinants of yield spreads in the corporate bond sample. Even when controlling for such underlying firm factors and issue characteristics, credit ratings still exert an important influence on yield spreads. This discovery suggests that investors consider and value credit ratings when determining their risk premiums on Chinese bonds. This important finding goes against previous research documenting the irrelevance of Chinese rating agencies. It seems to us, though, that the logical next step is for Chinese regulators to allow lower quality bonds to come to the market and for credit rating agencies to show that they can accurately rate these bonds as well.

NOTES

1. They are A.M. Best, DBRS, Egan-Jones, Fitch, HR Ratings de Mexico, Japan Credit Rating, Kroll, Moody's, Morningstar, and S&P's. See http://www.sec.gov/about/offices/ocr.shtml for details.

2. As of 2013, the four major Chinese domestic rating agencies were China Chenxin International Credit Rating, Dagong Global Credit Rating, Lianhe Credit Rating, and Shanghai Brilliance Credit Rating.

3. While this casual comparison might suggest that Chinese bonds with nominally higher ratings (say AA) have the same default risk as U.S. bonds with nominally lower ratings (say BBB), we note that the yield spread reflects both the level of default risk and investors' risk premium toward default, as well as other factors such as liquidity and tax effects (Elton et al. 2001).

4. It is common in the literature to measure the risk premium of corporate bonds using the yield spread, e.g., Fisher (1959), Campbell (1980), Kidwell et al. (1985), and Fung and Rudd (1986).

5. See, for example, Altman (1968), Pogue and Soldofsky (1969), Horrigan (1966), and Ederington (1986).

6. See, for example, Hickman (1958), West (1973), Liu and Thakor (1984), Ederington (1986), and Kao and Wu (1990).

7. A colorful account of how the tension between the various regulators has come to shape the Chinese corporate bond market can be found in Kennedy (2008).

8. In 2013, around $1.3 trillion of corporate bonds were issued in the U.S. (http://www.sifma.org/research/statistics.aspx), and the average daily issuance of commercial paper in the U.S. was about $78 billion, for a total of $2.8 trillion issued for the year (http://www.federalreserve.gov/releases/cp/volumestats.htm).

9. See, for example, Bierman and Haas (1975) and Lamy and Thompson (1988).

10. Other model selection techniques can also be used, e.g., the Akaike Information Criterion (AIC).
11. This is true in studies that use U.S. data as well (e.g., Elton et al. 2001).
12. These market statistics come from WIND. China's corporate bonds include commercial paper, medium-term notes, long-term corporate bonds, and bonds issued by various financial institutions excluding the major policy banks.

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