How Does Local Government Financing Affect Bond Market in China: Evidence from Municipal Corporate Bond*

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Abstract

This paper studies the impact of municipal corporate bonds (MCB) in China's bond market which has developed rapidly as the second largest market globally but has limited efficient benchmark securities. We find that MCBs improve secondary corporate bond market quality by facilitating price discovery and expanding the investment opportunity sets. The enhancement of MCBs is more prounounced for corporate bonds from the same region and same trading market. Besides, when there is lacking of sufficient short-term treasuries, MCBs contribute to lower the short-term bond spreads. Along the maturity dimension, the supply of long-term MCBs also encourages non-financial corporations to issue long-term bonds. The implicit government guarantee behind municipal corporate bonds enables them to fill in the gap of benchmark functions in the bond market.

Keywords: Municipal corporate bond; Spanning enhancement; Price discovery; Maturity impact.

1 Introduction

China's corporate bond market achieves remarkable growth over the past decade and ranks the second largest only to the U.S.. A series of market-opening programs have made the market more accessible and attractive to international investors. However, compared with developed bond markets, the bond market in China is still immature - suffers from market segmentation, extremely low default rates, as well as unreliable domestic ratings. The treasuries, which are supposed to provide a benchmark for fixed-income asset pricing, are also critized by the problems of low efficiency, low liquidity, incomplete maturity structure, etc.

Though treasuries play a relatively weak role in China's corporate bond market, another debt instrument, municipal corporate bonds, have experienced tremendous growth since 2008. By the end of year 2018, the outstanding amount of municipal corporate bonds is RMB 7.7 trillion, accounting for 36% of all debt securities issued by non-financial corporations in China. Municipal corporate bonds are generally perceived as quasi-municipal debts. They are issued by local government financial vehicles (LGFVs), which are corporate bonds in a legal sense, but enjoy implicit guarantee from local and even central governments. LGFVs are usually supported by local governments with land-use right transferring and other kinds of capital injection. And central government takes the final responsibility for the revenues and deficits of local government, therefore indirectly supporting the municipal corporate bonds. This is different from other credit instruments issued by non-financial firms, which are exposed to more firm-specific risks.

The distinctive features may enable municipal corporate bonds to play a special role in the immature corporate bond market. According to Yuan (2005) and Dittmar and Yuan (2008), the addition of benchmark securities will benefit the emerging market by allowing investors to hedge against systematic risk, thus completing an incomplete market; and hedge against adverse selection cost, thus encouraging investors to obtain more firm-specific information and promoting price discovery. Municipal corporate bonds capture the systematic risk and are sensitive to the national solvency risk due to their close relation with local and central government (Ang, Bai, and Zhou (2019)). We would like to investigate whether municipal corporate bond brings some positive impact on corporate bond, like the function of benchmark security. [1]

[1] The former director of finance department of the National Development and Reform Commission has evaluated the

We explore the interaction between municipal corporate bonds and other debt securities issued by non-financial firms by analyzing the price discovery, spanning enhancement, as well as the impact of municipal corporate bond supply on yield spreads and corporate bond maturity choice. We focus on the main types of corporate bonds in China: enterprise bonds, and regular corporate bonds (consisting of exchange-traded corporate bonds and mid-term notes). Frist, municipal corporate bonds contribute to the process of price discovery. The variability in enterprise bond yield spreads attributable to municipal corporate bonds ranges from 27% to 36%, and ranges from 6% to 20% for regular corporate bonds. Information appears to flow from municipal corporate bonds to existing bond securities. A variety of heterogeneity tests based on issuers' or bonds' characteristics further confirm the price discovery impact. Notably, the explanatory power of municipal corporate bonds which are issued in high fiscal surplus areas or provincial level cities perform better, indicating that the higher degree of government guarantee strengthens the benchmark ability of municipal corporate bonds. We also find that the information from municipal corporate bonds flows to other bonds along industry and location channel.

We attribute the price discovery of municipal corporate bonds to their ability of spanning systematic risk and then encouraging investors to more actively acquire firm-specific information, but the high correlations among bond spreads may also drive the results. To address this concern, we conduct placebo tests by examining the price discovery impact of enterprise bonds. The results show that the maximum information share in regular corporate bonds attributable to enterprise bonds makes up less than 3% during the full sample, much lower than the information share attributable to municipal corporate bonds. The placebo tests imply that only municipal corporate bonds substantially enhance the price discovery, therefore, excluding the influence of bond spread correlations.

Second, from the perspective of investors, we examine whether investors can benefit from the introduction of municipal corporate bonds. Six spanning tests show that the municipal corporate bonds enrich the investment opportunity sets relative to enterprise bonds and regular corporate bonds alone. Both the tangency portfolio and the minimum variance portfolio in the efficient frontier are improved, indicating that investors can realize a higher Sharpe ratio or hold a better

role of municipal corporate bond, "On the one hand, municipal corporate bonds serve as standardized and transparent financing channels for urban infrastructure construction, one the other hand, they enrich the fixed-income products for institutional investors." Source: https://www.ndrc.gov.cn/xxgk/jd/jd/201108/t20110829_1183127.html global minimum variance portfolio with the addition of municipal corporate bonds.

Third, municipal corporate bonds not only benefit investors through spanning enhancement, promote the overall market through price discovery, but also affect the corporate bonds along the maturity spectrum. Absent from sufficient high-quality short-term treasuries, the supply of short-term municipal corporate bonds reduces the yield spreads of corporate bonds that are due in less than one year. The reduction is more significant when the level of short-term treasuries is low. Besides the pricing impact on short term, the supply of long-term municipal corporate bonds encourages non-financial corporations to issue long-term bonds. The increase in the long-term municipal corporate bonds could release positive signals for the economy and the demand for long-term debts, and therefore non-financial corporations will choose to issue more long-term bonds.

Many studies have discussed the negative externalities of government debt.Graham, Leary, and Roberts (2014) show that government debt will crowd out corporate debt and investment by affecting investors' choices and the relative price of assets in the US. Huang, Pagano, and Panizza (2019) and Liang, Shi, Wang, and Xu (2017) provide similar evidence that local government debt crowds out private investment and leverage in China. Based on the cross-country data, Demirci, Huang, and Sialm (2019) show that corporate leverage is lower in countries with higher government debt. Greenwood, Hanson, and Stein (2010), Greenwood, Hanson, and Stein (2015), Badoer and James (2016), Krishnamurthy and Vissing-Jorgensen (2012), and Krishnamurthy and Vissing-Jorgensen (2015) show the substitution effect between corporate debt and government debt in terms of maturity.

But in an incomplete market, where investors face severe adverse selection and inefficient benchmark rates, government debt can benefit the bond market (Dittmar and Yuan (2008)). Flannery, Hong, and Wang (2019) analyze the benchmark role of sovereign bonds in China's offshore market and find that USD-denominated Chinese corporate bonds experience a decline in yield spreads, bid-ask spreads, and price volatility after the announcement of sovereign issues. van Bekkum, Grundy, and Verwijmeren (2019) show that government bonds will improve corporate issues by offering a high-quality reference rate. Our research complements the literature by showing that bonds issued by local government financial vehicles can also benefit the emerging market where treasuries cannot provide efficient pricing information. Municipal corporate bonds not only meet the demand of investor asset allocations, but also promote price informativeness. Though the oversupply of local government debts crowds out private credit in terms of quantity, it could generate favourable pricing and maturity impacts on the corporate bond market. Our study comprehensively evaluates the role of municipal corporate bonds.

Our paper also makes contributions to the burgeoning literature on China's bond market. Hu, Pan, and Wang (2018) and Amstad and He (2019) offer an overview of the rapidly growing market. Liu, Lyu, and Yu (2017) and Ang et al. (2019) investigate the pricing determinants in municipal corporate bond spreads. Chen, He, and Liu (2020) link the shadow banking activities with municipal corporate bond issuances. Several papers analyze the characteristics of China's corporate bonds, such as the market segmentation, implicit guarantees, etc. Liu, Wang, Wei, and Zhong (2019) show that the demand from yield-chasing investors causes the pricing wedge between interbank and exchange markets for dual-listed bonds. Chen, Chen, He, Liu, and Xie (2019) use the market segmentation of one of the markets and a policy shock to estimate the pledgeability premium. Geng and Pan (2019) show the low price discovery in China's corporate bond market, and demonstrate the significant segmentation between SOE and non-SOE issuers due to government support for SOEs. Mo and Subrahmanyam (2020) investigate the corporate bond liquidity. Huang, Liu, and Shi (2020) analyze the risk characteristics in commercial paper. Ding, Xiong, and Zhang (2020) uncover the issuance overpricing in China's corporate bond market. Our paper complements all this research by highlighting the functions of municipal corporate bonds for investors, bond market as well as corporate bond maturity.

The remainder of the article is organized as follows: section 2 introduces institutional backgroud; section 3 summarizes the data; section 4 investigates the price discovery; section 5 investigates the spanning enhancement of municipal corporate bonds; section 6 analyzes the influence of MCBs on yield spreads and corporate bond maturity; and section 7 concludes the paper.

2 Institutional Background

In this section, we give an overview of the institutional background of the bond market in China, focusing on the risk-free benchmark bonds such as Treasury bonds and the non-financial corporate bonds.

2.1 Treasury market

Compared with the developed economies, the treasury market in China has a shorter history and is smaller in size when scaled to GDP or the amount of outstanding corporate bonds. After reopened in 1981, China's treasury bonds gradually grow to be one of the most important asset classes in the world. At the end of year 2018, the outstanding amount of treasuries reaches RMB 14.88 trillion (about USD 2.16 trillion), about 16.19% of GDP.[2] However, the market size is still much smaller relative to that in the U.S., which is USD 15.61 trillion, over 7 times of China's treasury market. Moreover, the outstanding U.S. treasuries accounts for a large fraction of GDP of 75.84%, as shown in Panel A of Figure 1.[3] Besides, as the bonds issued by non-financial corporations in China have increased dramatically during recent years, it seems that treasury market cannot keep pace with fast growing corporate bonds. The ratio of outstanding treasuries over non-financial corporate bonds decreases from 174.13% in 2010 to 65.84% in 2018. In contrast, the ratio of U.S. treasuries over non-financial corporate bonds is nearly 200%.

[Place Figure 1 about here]

The maturity of China's treasuries ranges from 3 months to 50 years. As shown in Figure 2, compared with the maturity structure in the U.S., China's treasury market has a higher proportion of long-term bonds, and lower proportion of short-term bonds. At the end of year 2018, treasuries due in less than one year accounts for 13.5% of the total outstanding treasuries in China, half of the ratio of 27.6% in the U.S.. Short-term government bonds usually facilitate secondary market trading and reflect short-term monetary policy information. Lacking of them will weaken the benchmark function of treasury yield curve.

[Place Figure 2 about here]

The problems of low liquidity of China's treasuries have been documented in Bai, Fleming, and Horan (2013) and Amstad and He (2019). According to Panel A in Figure 3, the monthly turnover rate in June 2019 is 0.13, much lower than that of 0.83 in the U.S..[4] Besides, China's

[2] Data source: WIND.

[3] Data source: U.S. treasury outstanding: SIFMA U.S. Bond Market Issuance and Outstanding (`www.sifma.org/resources/research/us-bond-market-issuance-and-outstanding/`). GDP and China bond data: WIND.

[4] U.S. treasury data: TreasuryDirect (`https://www.treasurydirect.gov/govt/reports/pd/mspd/mspd.htm`) and Federal Reserve Bank of New York. China treasury data: WIND.

bond market is highly segmented, with trading split among stock exchanges, interbank market and OTC market. Panel B in Figure 3 show that the turnover is always higher in the interbank market than the exchange market, which is due to that institutional investors dominate in the interbank market.

[Place Figure 3 about here]

Even though the government bond market in China is small in size and illiquid, there are two classes of bonds that are quasi-government in nature, municipal corporate bonds (MCBs) and enterprise bonds. Both are categorized, surprisingly, as corporate bonds, which we turn to next.

2.2 Non-financial corporate bond

Non-financial corporate bonds in China have different categories: enterprise bonds, exchange-traded corporate bonds, medium-term notes, commercial papers, and other bond products (e.g., asset-backed securities, private placement notes). Among them, one important category is municipal corporate bond (MCBs), as we described earlier, which are quasi-government bonds. They are issued by local government financial vehicles (LGFVs), which are corporate bonds in a legal sense, but enjoy implicit guarantee from local and even central governments. The outstanding amount of MCBs have tremendous growth from year 2010 to 2018, making up 36% of total market by the end of 2018. Figure 4 summarizes the market share of each bond type.

[Place Figure 4 about here]

Enterprise bonds (EBs) are also quasi-government bonds that are mainly issued by large state-owned enterprises (SOEs), such as institutions affiliated with central government ministries, enterprises solely funded by the state, or state-controlled enterprises. Their issuances are subject to administrative approval from the National Development and Reform Commission (NDRC). The economic function of enterprise bonds has some similarities with municipal corporate bonds. The raised funds are generally used for infrastructure construction, fixed asset investment, and technological innovation.[5] With the development of municipal corporate bonds, the proportion of pure enterprise bonds in the credit market decreases from 21% in 2010 to 3% in 2018.

[5]Some EBs are sometimes issued by LGFVs, which are classified as MCBs. To distinguish these EBs from MCBs, we define EBs in our paper as enterprise bonds issued by non-LGFVs.

We define regular corporate bonds (RCBs) as exchange-traded bonds and mid-term notes only issued by non-LGFVs. They differ from MCBs and EBs in many aspects. First, their issuance is mainly for financing corporate operations, as opposed to the administratively oriented features of EBs or MCBs. Second, while most enterprise bonds are issued by state-owned enterprises with strong government guarantees, and MCBs are backed by local and sometime central governments, regular corporate bonds are backed by corporate revenue (and may also have certain implicit guarantees if issued by SOEs). Furthermore, they are also regulated by different institutions.

3 Data and Tests

3.1 Data

We focus on fixed-rate bonds in our analysis. Consistent with Ang et al. (2019), to obtain accurate bond pricing information, we only include bonds that are matured or listed in the interbank or exchange markets and exclude bonds with special terms such as being callable.

The sample period is from January 2010 to June 2019. Data are from Wind database, which provides bond characteristics and trading variables. For each bond, we can observe the basic information, such as maturity, issuance, rating at issue, issuers' industry and province, and trading information, such as daily price and rating.

We compute weekly returns for each bond using the standard method:

$$r_t = \frac{P_t + AI_t + C_t}{P_{t-1} + AI_{t-1}} - 1 \tag{1}$$

where r_t is weekly return, P_t is the clean price at the end of each week, AI_t is accrued interest, and C_t is the coupon payment, if any, in week t.

Bond spreads are calculated relative to the (synthetic) matching central government bond yields following the procedure in Ang et al. (2019), Liu et al. (2017), and Chen et al. (2019). First, we fit the zero-bond yield curve using the Svensson model. Second, we compute the implied government bond price $P_{i,t}^{CGB}$ for each municipal corporate bond, enterprise bond and regular corporate bond using the same cash flow structure. Third, we calculate the matching central government bond yield $y_{i,t}^{CGB}$ using the implied price $P_{i,t}^{CGB}$. Finally, we obtain bond spread as: $ys_{i,t} = y_{i,t} - y_{i,t}^{CGB}$.

Table 1 presents the summary statistics of daily spreads, weekly returns and bond characteristics. Though the mean value of bond rating at issue for MCBs is lower than RCBs, but MCBs have lower yield spread than RCBs on average, implying the impact of government guarantees. As EBs are issued for social economic development by government agencies, hence they enjoy the lowest yield spreads. EBs are generally issued with long maturities and in large amounts, whereas RCBs have short maturities and are issued in relatively small amounts. The maturity of MCBs is also longer than RCBs.

[Place Table 1 about here]

3.2 Tests

As we discussed in the introduction, the literature is split on the impact of government debt on corporate debt. On the one hand, there is plenty of evidence supporting its substitution role: government debts are shown to crowd out the corporate debts. This is shown in two negative relations: one is between the amount of government debts and corporate leverage and the other is between corporate debt and government debt maturities. The latter is referred to as the gap-filling phenomenon by Greenwood et al. (2010). Both indicate that as borrowers, government and private firms are substitutes. This substitution role of the government debt for corporate debt is shown more pronounced in the economies with more developed financial market such as US and the EU countries Demirci et al. (2019). One interpretation is that in an economy with developed financial markets corporations can easily switch from issuing debt to equity when government issues more debt, resulting in a financial crowding out. Another interpretation is that too much government debt might prevent corporations from accessing the debt market resulting in a real crowding out. For example, it has been shown that in Chinese cities where there are more MCBs, firms rely less on external financing for investment, indicating that from the borrowers perspective, government might have crowded out corporation in the primary market for debt Huang et al. (2019).

On the other hand, there is also solid evidence supporting the complementary role of government debt for corporate debt, especially in terms of secondary market quality in economies with developing financial markets. A liquid government debt market is shown to help building the secondary market infrastructure for servicing the trading of fixed income securities. These services could be order execution, unified custodian systems, clearing and settlement schemes. Furthermore, a deep and liquid government debt market is shown theoretically help with price discovery, increases investment portfolio frontier for investors by spanning the systematic risk in the economy, allows better hedging strategies, and sets a reference yield curve for pricing risky corporate bonds Yuan (2005). Hence more government bonds may stimulate the development of a secondary corporate bond market. This indicates that government and corporate bonds might be complements from the perspective of secondary market quality. This complementary role of government bonds for corporate bonds for secondary market quality should be more pronounced for economies with less developed financial market, which have been shown in Dittmar and Yuan (2008). An improved secondary market quality for corporate bonds can, in turn, promote more corporate borrowing and hence mitigate the crowding out impact of government debt mentioned earlier.

In this paper, we focus on examining the impact of government bonds on the market quality of corporate bonds. Therefore, we conjecture that in the context of Chinese bond markets, since treasury bonds are limited in supply, quasi-government bonds such as MCBs complement treasury bonds and act together as benchmark or reference securities for corporate bonds. In particular, we examine whether MCBs affect the price discovery, spanning opportunities in the corporate bond markets, issue spread of corporate bonds. We also examine whether there is a negative relationship between government and corporate bond maturity, a testable hypothesis on the crowding out role of government debt.

We utilize a few special features about MCBs. First, MCBs are issued by regional governments and hence reflect systemic risks in the corresponding region. Therefore, the complementary roles of MCBs, in terms of price discovery, spanning enhancement, and price impact, should be more pronounced for corporate bonds from the same region. Second, bonds are traded either in interbank markets by largely institutional investors or exchanges by both institutional and retail investors. Therefore we should see the impact of government bonds on price discovery and spanning enhancement of corporate bonds in the corresponding trading platform. Finally, EBs are also quasi-government liabilities but they do not reflect regional systemic risks. Hence they are poor benchmark securities for corporate bonds in individual regions and better served as benchmark securities for country-level aggregate risks. However, due to the fact that EBs command a very small market share and are illiquid themselves, their benchmark role is limited. Therefore, we examine the impact of EBs on corporate bonds as placebo tests.

4 The Impact of MCBs on the Market Quality of Corporate Bonds

4.1 Price Discovery

4.1.1 Empirical methodology. In this section we examine whether MCBs promotes price discovery in RCBs. As in Hasbrouck (1995), Hasbrouck (2003), and Dittmar and Yuan (2008), we use variance decompositions from a vector autoregression representation of the yield spreads on EBs, RCBs and MCBs to evaluate the contribution of MCBs to price discovery. To explore the price discovery beyond the impact of government bond such as treasuries and CDBs, we first form equal weighted portfolio for EBs, RCBs, and MCBs, and then obtain the orthogonalized yield spreads for each bond portfolio as the residuals in the following regression:

$$ys_{\{MCB,EB,RCB\},t} = \delta_0 + \beta' X_t + ys^{\perp}_{\{MCB,EB,RCB\},t} \tag{2}$$

where X_t denotes the vector of three principal components (level, slope, curvature) extracted from the on-the-run treasuries and CDBs closest to 90 days, 1 year, 2 years, 5 years, 7 years, and 10 years. The residuals, $ys^{\perp}_{\{MCB,EB,RCB\},t}$, represent the orthogonalized yield spreads of bond portfolios.

Based on the residual spreads, we can conduct variance decomposition via VAR system. . Hasbrouck (1995; 2003) refers to the portion of the unconditional variance attributable to an element of the VAR as the "information share" of the market, since innovations in the series represent unanticipated news. We report the fraction of the unconditional variance in RCB yield spreads that can be attributed to orthogonalized variations in MCBs yield spreads and interpret this quantity as a measure of how much of corporate market-relevant information is discovered in the MCB market.

We place the bounds on the variance contribution by reordering the variables in the VAR. When the MCB portfolio is the first variable in the VAR, an upper bound on the proportion of volatility in RCBs attributable to MCBs can be obtained. The lower bound is estimated when RCB portfolio is the first variable. The lag length in the VAR is determined via BIC statistics. In most of our analyses, it is 6, slightly over a week. The results are not affected by increasing the number of lags.

To analyze the impact of MCBs on price discovery, we also examine the cumulative impulse response functions for the vector autoregressions. These response functions represent the long-run impact of a shock in MCBs on pricing in RCBs. They indicate the eventual impact of a shock in MCBs on the yield spread in the corporate market if there are no shocks to the corporate market, and no new information arrives in the market. That is, the impulse response functions indicate the eventual impact of discovery of information in the MCBs on pricing in the corporate market.

4.2 Empirical results

We report the bounds on the information share of EBs in Panel A and RCBs in Panel B attributable to MCBs, respectively, for the whole sample, and two subsamples in Table 2

[Place Table 2 about here]

According to the first row of each panel, MCBs can explain the variations in the yield spreads of EB and RCB. The information share in EBs attributable to MCBs is substantial, accounting for at least 25%. The explanatory power of MCBs for RCBs is a little weaker than EBs, but still significant, with information share ranging from 5.58% to 19.46%. The results are intuitive since EBs are similar to MCBs as quasi-government bonds.

Impulse response functions in Figure 6 present the cumulative impact of a standard-deviation change – which is about 30 basis points – in the spread of MCBs on the spread of EBs and RCBs. Both EBs and RCBs react slowly to the shock and fully respond after a period of about 100 days. As shown in the figure, the long-run impact of the MCBs shock on EBs and RCBs are significant: 2% for EBs and 1% for RCBs. These magnitudes are large since the sample standard deviation of residual EBs is , of residual RCB is 22 basis points.

[Place Figure 6 about here]

The last two rows of each panel in Table 2 presents the variance decompositions for two sub periods. The results show that the price discovery impact of MCBs on both EBs and RCBs is stronger during 2010-2014 than 2015-2019. The maximum information share from MCBs in RCBs reaches 36.93% for the first sub period, and decreases to 9.36% for the second sub period. The drop in the information share for the second sub period for the EB market is less severe. This might reflects a fundamental change in the corporate bond markets. According to Geng and Pan (2019), corporate bond pricing becomes more informative about issuers' fundamentals after 2014 when a wave of bond default occurs. With the improved price discovery within the corporate bond market during this period, the fraction of unconditional variance in RCBs attributed to the shocks in MCBs becomes smaller.

4.2.1 Placebo test with EBs. There is usually a high correlation among bond price movements, which may be the main drivers for the information contribution of MCBs, thus weakening our argument that MCBs improve price discovery in RCBs by allowing investors to better understand systematic and firm-specific risk. To examine this alternative explanation, we conduct placebo test that replaces MCBs with EBs to analyze the price discovery impact of EBs in RCBs. If it is due to bond spreads correlation, we should observe that the magnitude of information share from EBs is similar to that from MCBs in the corporate bond market. We report the results in Figure 7. We can easily find that when explaining the variations in RCBs spreads, MCBs perform much better than EBs even though both are quasi-government bonds. Therefore, MCBs play a distinctive role in explaining the variation in corporate debt instruments, which might reflects that the importance of the regional systemic risk embedded in MCBs in aiding the price discovery in the corresponding regional corporate bonds.

[**Place Figure 7 about here**]

4.2.2 Sources of the price discovery impact of MCB and EBs. Next we utilise the difference in information content between MCBs and EBs in pinpoint the source of the price discovery roles of these quasi-government instruments. Our hypothesis is that EBs, typically issued to promote national industrial policies, may contain significant pricing information along industry lines, and therefore, can explain the variations in the spread of RCBs in the same industries. By contrast, MCBs, issued by LGFVs and mainly for local investment, may contribute to more price discovery along location lines since they reflect locational systematic risks. We follow the convention and divide China into seven geographical regions: North China, East China, South China, Central China, Northeast, Northwest, and Southwest.

Referring to Huang et al. (2019), we identify the industries that are directly affected by LFGVs, and construct equal-weighted portfolios of RCBs and MCBs whose issuers belong to these industries. Column 2 to Column 4 in Panel A of Table 3 reports the information share in RCBs attributable to MCBs in the same industry. Similarly, portfolios of RCBs and EBs are constructed using the bonds whose issuers are in the industries directly affected by EBs. The last three columns in Panel A of Table 3 reports the information share in RCBs attributable to EBs in the same industry. The results indicate that EBs contain more pricing information for RCBs than MCBs along industry lines.

Panel C of Table 3 presents the number of bonds in the industries identified in Panel A in each area. Based on the bonds in the same industries and location, we construct equal weighted portfolios for MCBs, EBs and RCBs. Portfolio Obs. denotes the number of portfolio observations available for VAR estimation after merging MCBs or EBs with RCBs. As the number of bonds and portfolio observations in Centra China, Northeast, Northwest, and Southwest is too small for statistical estimation efficiency, we only examine the variance decompositions for North China, East China, South China. Panel B of Table 3 compares the price discovery impact of MCBs and EBs on RCBs in these three areas and the same industries. MCBs outperform EBs in two of three region-industry samples, consistent with our intuition that the source of the price discovery role of MCBs comes from the fact they represent locational risks.

[Place Table 3 about here]

Next we zero in on the regional price discovery role of MCBs and conduct the information share analysis for each of the seven regions. In Table 4, we find overwhelming evidence that MCBs contributes to the price discovery in RCB market located in the same region, stronger than that of EBs. XXXX The relative low information share of MCBs in central, Northwest, and Southwest regions might be due to the fact that there are major cities such as Beijing, Shanghai, Shenzhen which by themselves, could constitute an economic region.

[Place Table 4 about here]

4.2.3 Robustness tests. We perform a number of robustness tests in this subsection. The results confirm the price discovery impact of MCBs and help further identify the source of the gains.

We first examine whether trading platforms affect MCBs's price discovery role. There are primarily two platforms for trading bonds in China: interbank market (IB) and exchanges (EX). EBs can be traded on both interbank market and exchange market. Exchange-traded corporate bonds are only allowed to be traded on the exchange market. Medium-term notes are only allowed to be traded on the interbank market. MCBs be traded in both or one of the platforms.

Previous studies have documented the significant segmentation between interbank and exchange market. Investors in the two markets may face different pricing kernels. Also, the type of participants in the two markets are different. All institutions (except for commercial banks, which can only trade in the interbank market) are allowed to trade in both the exchange market and the interbank market, while retail investors can only trade in the exchange market. Hence, we expect MCBs contribute more information discovery to RCBs traded in the same platform rather than those in a difference platform. We report the finding in Table 5. Indeed, we find MCBs contributes more to the price discovery of RCBs traded in the same platform and this average impact is larger in the exchange market where retail investors are allowed to participate. The exchange market is characterized by more information asymmetry since retail investors are less informed. Hence, it is reasonable to observe that benchmark securities contribute more to the information dissemination process in this market.

[Place Table 5 about here]

Next, we examine if larger regional political risks contribute to larger information share of MCBs. Areas with high fiscal surplus and high administration level are expected to be able to provide more implicit guarantees for MCBs and able to spend more on local infrastructure projects, which enables MCBs to better span the regional systemic risks. Therefore, MCBs should present higher price discovery in areas with stronger implicit guarantees. To examine this hypothesis, we use fiscal surplus (the difference of revenue and expenditure scaled by local GDP), and the administration level of MCBs issuers to measure the degree of implicit guarantee in MCBs.

Specifically, we identify the bonds issuers' provinces, and calculate the average annual fiscal surplus over 2010-2019. We sort all bonds into three groups based on the average fiscal surplus, construct equal-weighted portfolios for RCBs, and MCBs within each group. Then, variance decompositions are conducted in each group as previous procedures. The analysis based on city administration level is similar, except that the administration level is divided into: provincial level, prefecture-level, and county level cities.

Panel A and Panel B in Table 6 presents the maximum and minimum information share from MCBs in each sub sample. The results are consistent with our expectation that MCBs with stronger implicit government guarantees have more explanatory power for RCBs. For example, the maximum information share attributable to MCBs in RCBs reaches 17.70% in provincial-level cities, but only makes up 0.95% in county-level cities.

[**Place Table 6 about here**]

We also examine the price discovery of MCBs in subsamples divided by issues' and bonds' characteristics, including issuers' attribute, bond rating, maturity, and issuance [6]. Findings are presented in Panel C, D, E, and F inTable 6: the price discovery of MCBs in RCBs is robust across different subsamples divided by the bonds' characteristics, and especially larger in RCBs issued by SOEs, or with AAA rating, long-term maturities, large issuances.

4.3 Spanning Enhancement

4.3.1 Spanning test. Spanning test answers the question whether an investor, conditional on having a portfolio of K existing assets, can benefit by investing in a new set of N assets. In other words, it tests the hypothesis of whether N test assets can be spanned or replicated in the mean-variance space by a set of K existing assets. In this paper, the test asset are MCBs and the existing assets are EBs and RCBs. We examine whether the MCBs contain important pricing information for EBs and RCBs.

We construct equally weighted bond portfolios for each type. Then, we regress the portfolio return of MCBs on the portfolio return of EBs and RCBs:

[6]Issuer' attribute: We sort the bonds into "SOEs" and "Non-SOEs" according to their issuers' attribute. Note that almost all the municipal corporate bonds are issued by SOEs. So MCBs only have the category of "SOEs". Bond rating: all bonds are divided into two rating groups by bond type: AAA, and below AAA. Maturity: all bonds are divided into two maturity groups by bond type: (0,5), [5,...). Bond issuance: all bonds are divided into "Small" and "Large" groups according to the median issuance within each bond type each year.

$$r_{MCB} = \alpha + \beta_1 r_{EB} + \beta_2 r_{RCB} + \epsilon_t \tag{3}$$

where $r_{MCB,t}$, $r_{EB,t}$, $r_{RCB,t}$ are the portfolio returns of MCBs, EBs and RCBs, respectively. The spanning hypothesis is:

$$H_0 : \alpha = 0, \delta = 0 \tag{4}$$

where $\delta = \beta_1 + \beta_2 - 1$. Rejecting the null hypothesis indicates that MCBs cannot be fully replicated by EBs and RCBs, and hence, MCBs can improve the investment opportunity set relative to existing bonds.

Santis (1993), Bekaert and Urias (1996), and Dittmar and Yuan (2008) provide another framework to investigate the same issue. Denote the gross returns on the EBs portfolio and RCBs portfolio at time t as R_t^{ECB}, and the gross return on MCBs portfolio as R_t^{MCB}. We assume two pricing kernels with different means:

$$M_{1t} = \alpha_1 + \beta_1^{ECB}(R_t^{ECB} - \mu_{ECB}) + \beta_1^{MCB}(R_t^{MCB} - \mu_{MCB}) \tag{5}$$

$$M_{2t} = \alpha_2 + \beta_2^{ECB}(R_t^{ECB} - \mu_{ECB}) + \beta_2^{MCB}(R_t^{MCB} - \mu_{MCB}) \tag{6}$$

where μ_{ECB} and μ_{MCB} are the expected gross returns of existing assets and test asset, respectively, and the means of the pricing kernels, α_1 and α_2, are constrained to differ. For a given mean of the pricing kernel, following Hansen and Jagannathan (1991), we can construct a minimum variance pricing kernel that is in the linear span of the asset payoffs. We estimate the set of parameters $\beta_1^{ECB}, \beta_1^{MCB}, \beta_2^{ECB}, \beta_2^{MCB}$ via GMM based on the moment conditions:

$$\frac{1}{T}\sum_{t=1}^{T} M_{1t}\{R_t^{ECB}; R_t^{MCB}\} - \iota = 0 \tag{7}$$

$$\frac{1}{T}\sum_{t=1}^{T} M_{2t}\{R_t^{ECB}; R_t^{MCB}\} - \iota = 0 \tag{8}$$

where ι denotes a conforming vector of ones. That is, the parameters are estimated so that the pricing kernels M_{1t} and M_{2t} satisfy the sample analog of the standard Euler equation. If we find that both pricing kernels price both ECBs and MCBs, but depends only on the payoffs of ECBs, that means that ECBs span MCBs since any two (minimum variance) pricing kernels with arbitrary (and different) means and different variances describe the frontier. Therefore, the null hypothesis is:

$$H_0 : \beta_1^{MCB} = \beta_2^{MCB} = 0 \tag{9}$$

Rejection of H_0 means that EBs and RCBs span MCBs, the information in MCBs are not important for pricing EBs and RCBs. This would demonstrate the importance of MCB in the pricing kernel and its ability to enhance the efficient frontier.

As with Kan and Zhou (2012), we carry out six spanning tests to test the null hypothesis: Wald test under conditional homoscedasticity (W); Wald test under independent and identically distributed (IID) elliptical distribution (We); Wald test under conditional heteroskedasticity (Wa); Bekerart-Urias spanning test with errors-in-variables (EIV) adjustment (J_1); Bekerart-Urias spanning test without the EIV adjustment (J_2); DeSantis spanning test (J_3). The first three are regression based and the last three are SDF based. All six tests have asymptotic chi-squared distribution with $2N$ ($N = 1$) degrees of freedom.

Following Dittmar and Yuan (2008), we also adopt the economic evaluation statistics, i.e., maximum Sharpe ratio achievable with the assets. We calculate the annualized Sharpe ratio of the pricing kernel with mean equal to the reciprocal risk-free rate and minimum variance.

Table 7 presents the spanning test results during the full sample period. In the first two rows where the existing assets are equal weighted portfolios of EBs and RCBs, all six tests are strongly rejected, indicating that MCBs expand the opportunity set relative to the existing bonds, and the annual Sharpe ratio shows some slight improvement. In the last four rows, we put the portfolio of treasuries or financial bonds issued by China Development Bank (CDB) into the set of existing assets. As discussed in Dittmar and Yuan (2008), it is possible that some of the spanning enhancement in MCBs relative to EBs and RCBs occurs because MCBs permit investors to better span risks in the default-free term structure. Both treasuries and CDBs can be regarded as risk-free securities and provide a natural way of hedging risks and spanning the existing bonds, so we control them by including them in the existing assets. As shown in the last for rows, test statistics are smaller after the inclusion of treasury and CDB portfolios, but all of them are still significantly rejected, confirming that MCBs have additional pricing information for spanning enhancement.

[Place Table 7 about here]

Hansen and Jagannathan (1991) bounds for the sets of securities in Figure 5 further support the spanning enhancement of MCBs. The bound is shifted upward after introducing MCBs into benchmark assets.

[Place Figure 5 about here]

4.3.2 Step-down test. Kan and Zhou (2012) also suggest a step-down procedure to test the spanning hypothesis, which investigates whether the spanning improvement from test asset comes from the minimum-variance portfolio or the tangency portfolio in the efficient frontier. An investor would care more about the improvement in tangency portfolio, so that they can achieve higher investment gains.

Step-down test first examines $\alpha = 0$ using F_1 test, and then examines $\delta = 0$ using F_2 test conditional on the constraint $\alpha = 0$. The rejection of F_1 will indicate that MCB statistically improves the tangency portfolios, and the rejection of F_2 indicates that MCB statistically improve the global minimum-variance portfolios. Details can be found in Kan and Zhou (2012). Table 8 reports the step-down results. The spanning enhancement of MCBs comes from the improvements in both the tangency portfolio and the global minimum-variance portfolio, and the improvement in the latter portfolio is more significant.

[Place Table 8 about here]

4.3.3 Sub-sample results. We also perform the spanning tests and step-down tests over two sub periods: January 2010 to December 2014, and January 2015 to June 2019. Several important regulations have been enacted since 2014. The objective is to slow down the growth of local government debts and ban local governments from providing guarantee for MCBs.[7] If these polices

[7]These regulations include: Document 43 in 2014, Document 88 in 2016, and Document 50 in 2017.

are effective in promoting the market quality of MCBs, MCBs might be closer to regular corporate bonds during the second sub period, and thus, their spanning enhancement will be weakened. However, a wave of corporate bond default has occurred since year 2014. With the perceived increasing credit risk in the corporate debt market, investors may flight to municipal corporate bonds, which are still relatively safe. Under this circumstance, municipal corporate bonds play a more crucial role in increasing the investor opportunity set during the second the sub period. Table 9 displays the sub sample results.

[Place Table 9 about here]

As shown in Panel A, though the magnitude of six spanning test statistics is smaller during January 2015 to June 2019, there is still significant spanning enhancement in the corporate debt market. The results suggest that MCBs remain closely related with local governments after the introduction of restrictive measures. The step-down results in Panel B further decomposes the sources of spanning. For the first sub period, the spanning enhancement mainly comes from the improvement in the global minimum-variance portfolio. For the second sub period, MCBs not only improve the global minimum-variance portfolio, but also improve the tangency portfolio, thus providing investors with more economic gains when they become more concerned with the bond default risk .

4.3.4 Robustness and source of MCBs' spanning enhancement. For robustness, we also change the way a portfolio is constructed to test the spanning impact. First, we construct face value weighted bond portfolios. The first two row in Table 10 presents the results, which are consistent with previous findings. MCBs expand the efficient frontier with the 8.63% increase in maximum Sharpe ratio.

Second, we examine the spanning power of MCBs on the interbank and exchange market separately. For investors who participate in one of the markets, they may only care about the investment opportunities in the market they are trading on. Therefore, it is necessary to analyze the spanning enhancement of MCB by market. We construct equal weighted bond portfolios of MCBs, EBs, RCBs (plus treasuries and CDBs) for each market and perform the spanning test. Row 3 to Row 6 in Table 10 show that the null hypothesis can be rejected at 1% significance level on interbank market, and rejected at 5% level on exchange market, proving the spanning enhancement of MCBs on both markets.

Third, we construct portfolios by bond characteristics: equal weighted portfolios of EBs and RCBs (plus treasuries and CDBs) with maturity less than five years or over five years ($EB_{(0,5)}, EB_{[5,...)}$, $RCB_{(0,5)}, RCB_{[5,...)}$); (3) equal weighted portfolios of EBs and RCBs (plus treasuries and CDBs) with ratings of AAA or below AAA ($EB_{AAA}, EB_{BelowAAA}, RCB_{AAA}, RCB_{BelowAAA}$), and test asset is the equal weighted portfolio of all MCBs. The results are presented last four rows in Table 10, which are basically consistent with previous findings. Notably, the maximum Sharpe ratio increases nearly 41% after putting MCBs in to rating sorted portfolio of EBs and RCBs (plus treasury and CDB).

[Place Table 10 about here]

Again since MCBs capture regional systemic risks, we conduct the spanning test at the regional level. Specifically, we form equal-weighted portfolio of RCBs, EBs, and MCBs for each region and examine whether the spanning enhancement of MCBs for RCBs versus that of EBs for MCBs. We find that for most regions, MCBs have statistically significant spanning enhance for RCBs, improving investors' investment frontier also in an economic significant manner. The exceptions are North China region, South China region, and North West China region. After removing Beijing from North China region, and Guangzhou/Shenzhen from South China region, we find MCBs' spanning power is significant again, indicating that MCBs from these big cities do not reflect the regional risk as much and hence do not serve as benchmark securities for the regional risk. MCBs underperform EB only for one region - East China – in improvising investors' opportunity set. However, this underperformance disappears after we remove Shanghai from East China region.

[Place Table 11 about here]

Finally we compare the spanning power of MCBs and EBs for RCBs at the industry level. We form equal-weighted portfolio of RCBs, EBs, and MCBs for each industry. We find that unlike the price discovery test, MCBs actually outperform EBs in improving investor's opportunity set for industry portfolios, indicating that they might span the industry risk well. This might have to do with the fact that EBs are small in size and there are fewer issues in the latter half of the sample.

For industries with more EBs, such as mining, EBs outperform MCB. This is intuitive since the primary objective of EB issuance is to promote certain industry growth.

[Place Table 12 about here]

4.4 Impact of MCBs Supply

4.4.1 Pricing impact. Previous analysis have shown the improvement from MCBs in the investors' opportunity sets and price informativeness, indicating the benefits of this type of quasi-government bonds. Considering that China lacks short-term safe assets (i.e., treasuries), we further hypothesize that MCBs will improve the market liquidity and reduce the short-term bond yield spreads. The implicit backup from central or local government enables MCBs to complement the benchmark pricing function of treasuries. To highlight the impact on bond pricing, we perform a simple OLS regression by regressing the spreads of EBs and RCBs on outstanding share of MCBs with similar maturity.

Specifically speaking, we divide the bonds into short-term, middle-term and long-term bins: (0,1), [1,5) and [5,...). For each maturity bin, we use two monthly indicators to proxy the supply of MCBs. The first variable is D_i^{MCB}/D^{MCB}, computed as the fraction of outstanding MCBs belonging to maturity bin i to the total outstanding amount of MCBs. The second variable is D_i^{MCB}/GDP, computed as the ratio of outstanding MCBs belonging to maturity bin i to annual GDP. Daily spreads of EBs and RCBs are aggregated to monthly frequency. A set of relevant factors are controlled: bond characteristics, including rating, maturity, log of issuance, turnover and trading market; issuers' characteristics, including log of asset, leverage and ROA; market conditions, including term, defined as the spread between the 10-year and 1-year treasury yield, the credit spread, defined as the 10-year AAA corporate bond yield minus treasury yield, 10-year CDB yield as well as stock market returns. Table 13 presents the regression results for each maturity bin.

[Place Table 13 about here]

Panel A is about the impact of short-term MCBs on short-term bond spreads. As shown in Column (1) and (2), the supply of MCBs significantly lowers the trading spreads of EBs with maturity less one year. 1% increase in D_S^{MCB}/D^{MCB} or D_S^{MCB}/GDP will result in 0.138% or 1.338% decrease in EBs spreads. Relative to the sample mean spread of short-term EBs that is 1.307%, the reduction is economically large. In Column (3) and (4), we also observe the negative impact of MCBs on short-term RCBs, and the coefficients of D_S^{MCB}/GDP is significant at 10% level. As for the econcomic magnitude, with 1% increase in D_S^{MCB}/GDP, the spreads of RCBs decreases 0.934%, counting 44.2% of the sample mean.

Panel B and C report the impact of MCB on middle- and long-term bonds. The results are less consistent. The coefficient in front of D_M^{MCB}/D^{MCB} and D_L^{MCB}/D^{MCB} is positive and insignificant for both middle- and long-term EBs and RCBs. D_M^{MCB}/GDP and D_L^{MCB}/GDP keeps negative sign on the yield spreads but with smaller magnitude relative to the impact on the short-term bonds in Panel A. The results suggest that MCBs contribute to decrease yield spreads, especially for bonds with maturity less than one year.

Based on the findings in Table 13, we continue to examine how treasury affects the role of MCBs. If MCBs complement short-term treasuries, they are supposed to generate more significant negative effects on short-term bond spreads when the level of outstanding short-term treasury is low. So we employ a dummy variable, $I_{D_S^{Trea}/D^{Trea}}$, which equals 1 if the outstanding share of treasury D_S^{Trea}/D^{Trea} is below the sample median for short-term maturity bin (0,1), and 0 otherwise. Dummy variable $I_{D_S^{Trea}/GDP}$ is constructed in the same way. Then, we introduce the interaction between D_S^{MCB}/D^{MCB} and $I_{D_S^{Trea}/D^{Trea}}$, D_S^{MCB}/GDP and $I_{D_S^{Trea}/GDP}$ into previous regressions. Table14 presents the results for short-term bonds. The interactions in Column (1), (3) and (4) is significantly negative, confirming the expectation that MCBs play a more important role in improving the market trading when there is a shortage of short-term treasuries.

[Place Table 14 about here]

4.4.2 Maturity impact. For long-term bonds, Table 13 show that MCBs neither consistently reduce the spreads nor increase the spreads, which maybe due to that the supply of long-term treasuries has already been adequate. Though there is weak evidence for pricing impact on long-term bonds, long-term MCBs is likely to influence corporate bond maturity choice. Under the circumstances that non-financial corporations have difficulty issuing long-term debts, the supply of long-term MCBs indicate that the economy is promising and investors are willing to hold long-term bonds. This positive signal will promote non-financial corporations to issue long-term bonds.

In this section, we focus on the impact of MCBs on the maturity choice of RCBs, as RCBs are less administratively determined relative to EBs. To ensure a clean sample, we only include corporate issuers who never issue EBs. Following Greenwood et al. (2010), we first provide a look at the maturity impact at aggregate level by separately regressing monthly long-term RCBs level share and issue share on the long-term MCBs level share. Long-term RCBs (MCBs) level share is the outstanding amount of RCBs (MCBs) due in no less than 5 years divided by total outstanding RCBs (MCBs), denoted as D_L^{RCB}/D^{RCB} (D_L^{MCB}/D^{MCB}). Similarly, we calculate the long-term RCBs issue share as the issuance of RCBs with maturity no less than 5 years divided by total amount of RCBs issuance, denoted as d_L^{RCB}/d^{RCB}. Adapted from Badoer and James (2016), we also employ weighted maturity of MCBs ($MCBmat$) as another measure for long-term MCBs. MCBmat is the average maturity of outstanding MCBs valued-weighted by outstanding principal.

Table 15 presents the estimation results. Panel A is about the impact on long-term RCB level share. As shown in Column (1), the coefficient of D_L^{MCB}/D^{MCB} is significantly positive, and the result holds after controlling relevant variables in Column (2). Long-term RCB level share also positively responds to $MCBmat$ in Column (3) and (4), supporting our argument that MCBs promote RCBs in terms of maturity. The first four columns in Panel B provide consistent evidences that long-term MCBs positively influence long-term RCBs issue share. As for economic magnitudes, according to Column (2), a 1% rise in the fraction of long-term MCBs will lead to a 0.097% increase in long-term RCBs level share and a 0.291% increase in long-term RCB issue share. To address the endogeneity problems of bond maturity, a common approach is to use the ratio of total outstanding amount MCBs to GDP as an instrument for MCBs maturity (Greenwood et al. (2010)). Column (5) and (6) report the IV regression estimates. The results are similar with the OLS regressions.

[Place Table 15 about here]

Next, we investigate the maturity impact of MCBs at individual bond level. We estimate a logit model for the likelihood of long-term regular corporate bond issuances. The dependent variable takes a value of one if the bond issue had a maturity of [5,. . .) years, and zero otherwise. Employing D_L^{MCB}/D^{MCB} to model the maturity structure of MCB, Column (1) in Table 16 show that the increase in outstanding share of long-term MCB promotes the willingness of non-financial corporations to issue long-term bonds. In Column (2), we put an interaction between long-term MCB outstanding share and *HighRating* dummy into the regression. After the addition of the interaction, D_L^{MCB}/D^{MCB} remains significantly positive. And the interaction is significantly negative, indicating that a bond with high rating, which is already easy to be issued, will benefit less from the increasing supply of MCBs.

The encouraging signal conveyed by long-term MCBs should be also observed in local areas and responded by local corporations [8]. In Column (3) to Column (6), we match the issue choice of non-financial corporations with MCBs that are in the same city, and calcuate local long-term MCB outstanding shares, $D_{L,c}^{MCB}/D_c^{MCB}$, $D_{L,c}^{MCB}/GDP_c$. The positive impact of long-term MCB on local long-term RCBs issues is significant, and the interaction between MCB outstanding share and *HighRating* dummy is still negative, supporting our argument .

[Place Table 16 about here]

5 Conclusion

In this paper, we study the impact of municipal corporate bonds in China's bond market, focusing on whether they generate benefits for this immature market. Municipal corporate bonds are distinguished from other corporate debt instruments in terms of their large scale and strong implicit government backup. When there are short of high-quality treasuries, municipal corporate bonds fill in the gap of benchmark functions.

Our empirical evidences show that investors, overall bond market as well as non-financial corporations can benefit from the introduction of municipal corporate bonds. Municipal corporate bonds contain important pricing information for enterprise bonds and regular corporate bonds, beyond the systematic information derived from treasuries and CDBs, which leads to the enhancement in efficient frontier and price discovery. Especially, municipal corporate bonds with stronger government guarantees present larger explanatory power for existing bond securities. We also find municipal corporate bonds decrease the short-term bond spreads and promote the long-term bond

[8] Table **??** show some evidences that long-term MCBs significantly decreases the spreads of long-term RCBs which are issued in the same city.

issuances. Our results highlight the positive impact of the quasi-government bond in emerging market.

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Figure 1.
China and U.S. Treasury Growth.
Panel A presents the fraction of China and U.S. outstanding treasury over GDP. Panel B presents the fraction of China and U.S. outstanding treasury over outstanding bonds issued by non-financial corporations. All numbers are as of the end of each year.

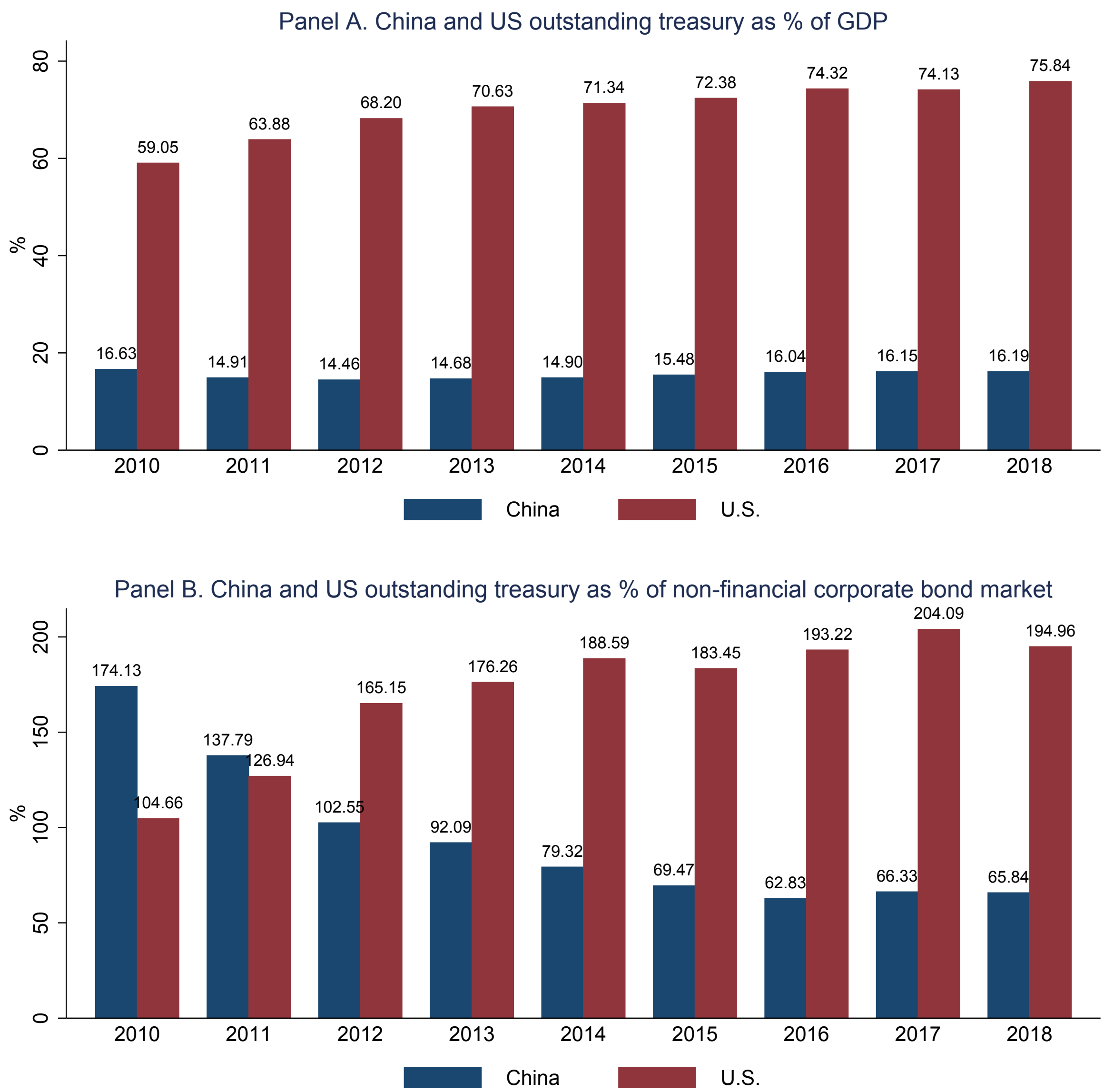

Figure 2.
China and U.S. treasury maturity structure.
This figure compares the maturity structure of China and U.S. treasury over year 2010 to 2018. y-axis represents the outstanding treasury balance.

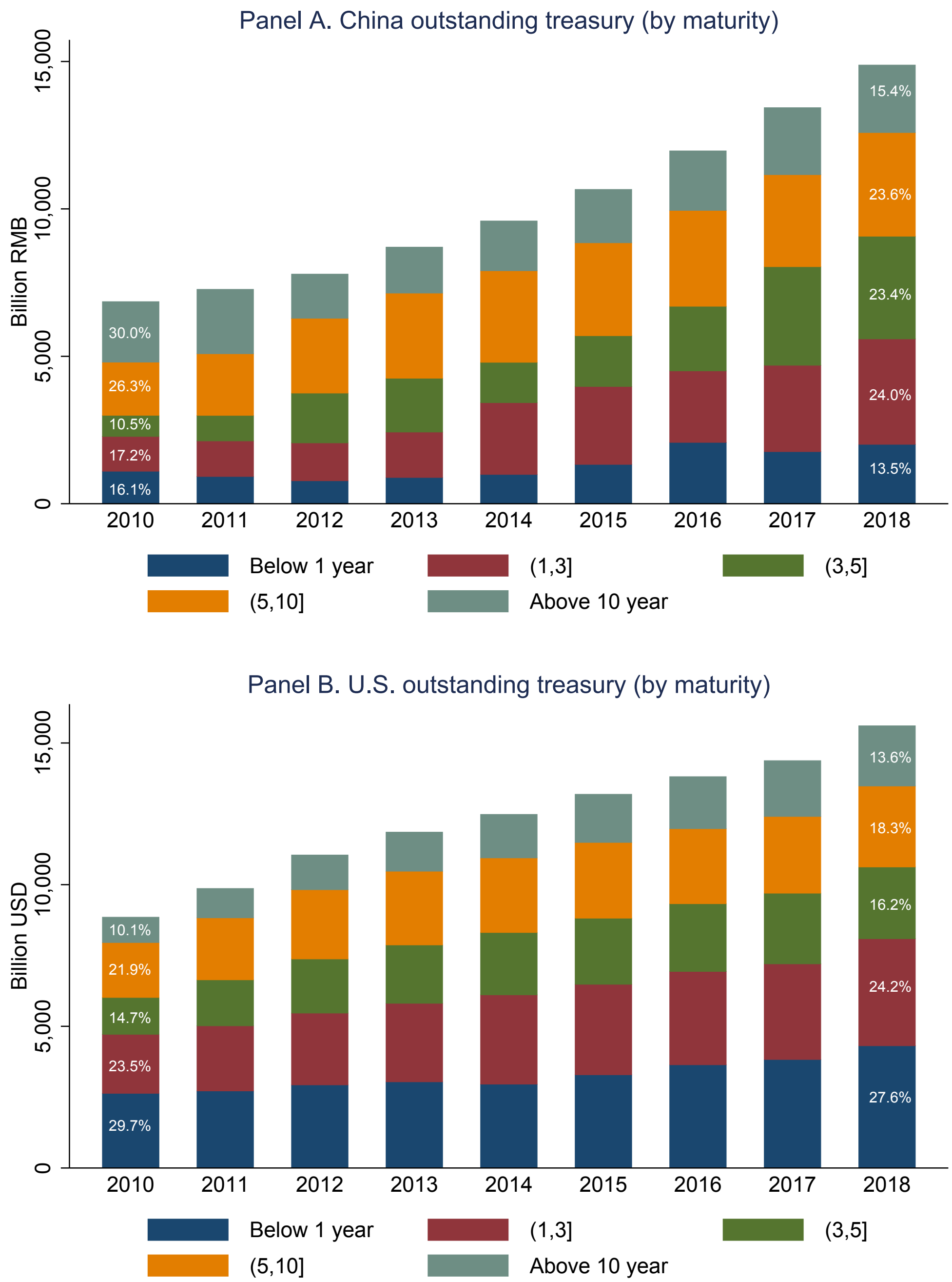

Figure 3.
Treasury turnover.
This figure presents the monthly turnover rate of China and U.S. treasuries in Panel A, turnover of treasuries trading on interbank and exchange market in Panel B. Turnover is defined as the aggregate monthly trading volume scaled by treasury outstanding amount.

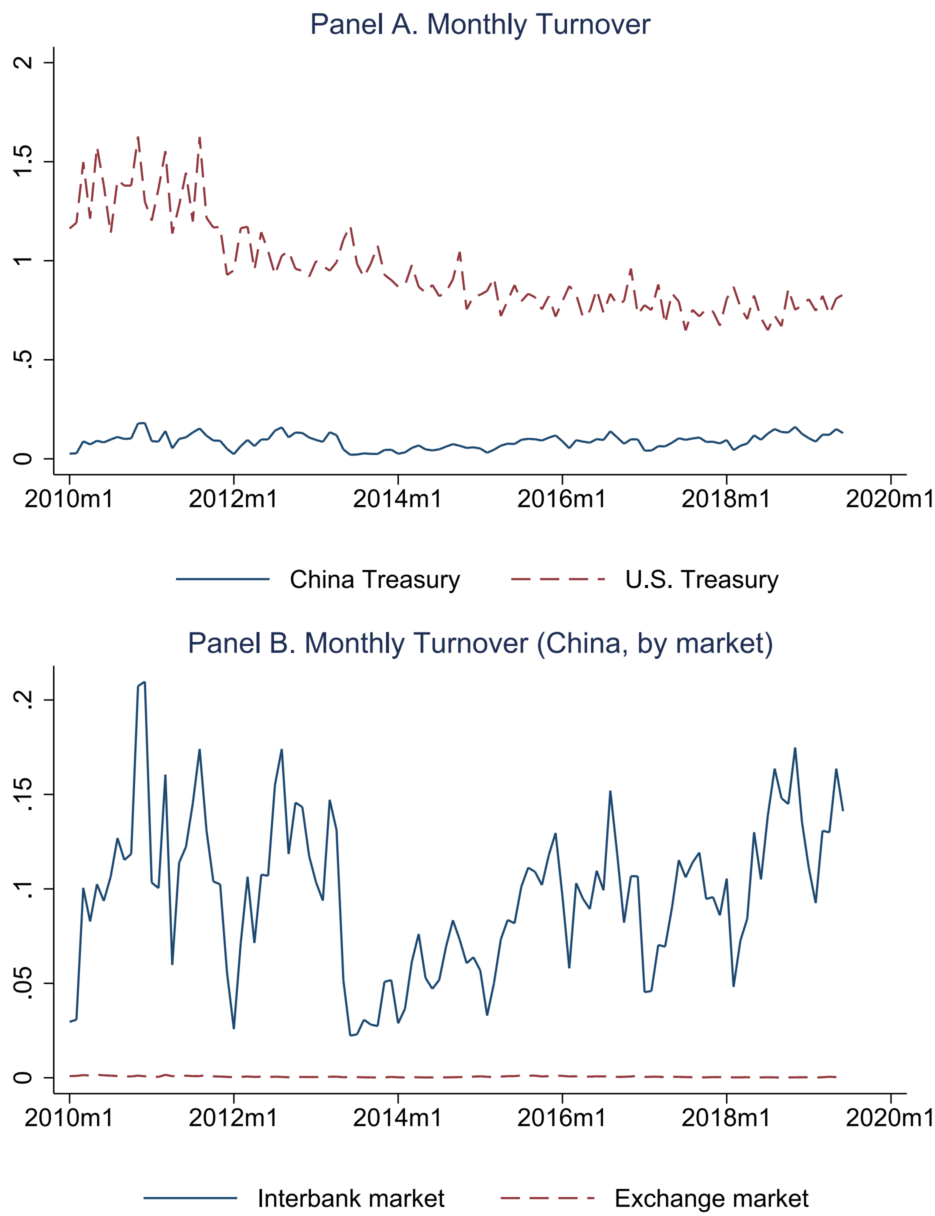

Figure 4.

Growth and component of China's corporate debt market.

This figure depicts the total amount outstanding of corporate debt in China (RMB billion, right axis) and the fraction by instrument category (left axis).

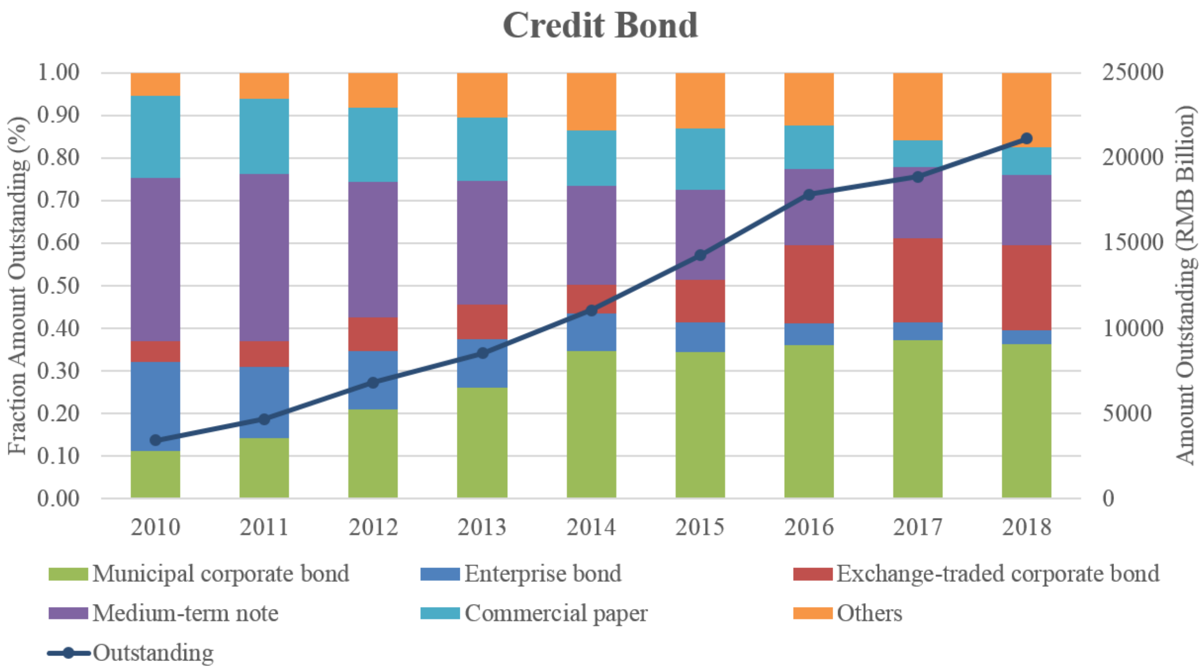

Figure 5.
Hansen-Jagannathan bounds.
This figure depicts Hansen-Jagannathan (1991) bounds on admissible pricing kernels for two asset sets: benchmark assets consisting of EBs, RCBs, CDBs and treasuries in solid blue lines, and benchmark plus test assets consisting of EBs, RCBs, CDBs, treasuries and MCBs in dotted red lines. The bounds are constructed using weekly returns on equal weighted portfolios of bonds.

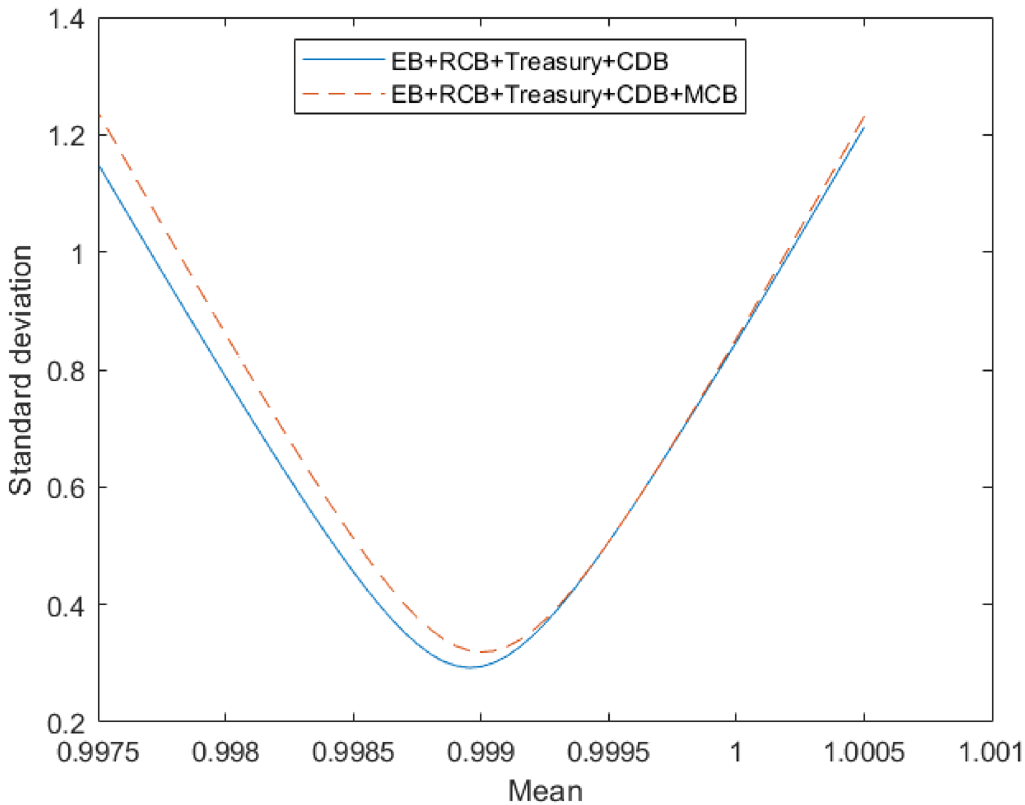

Figure 6.
Impulse response.
This figure presents impulse response functions for the effect of a one-standard-deviation shock in the residual spread of municipal corporate bond portfolio on the residual spread of enterprise bond or regular corporate bond portfolio. Shocks are orthogonalized using a Cholesky decomposition, and are based on the VAR results in Table 2. Sample period is from January 2010 to June 2019.

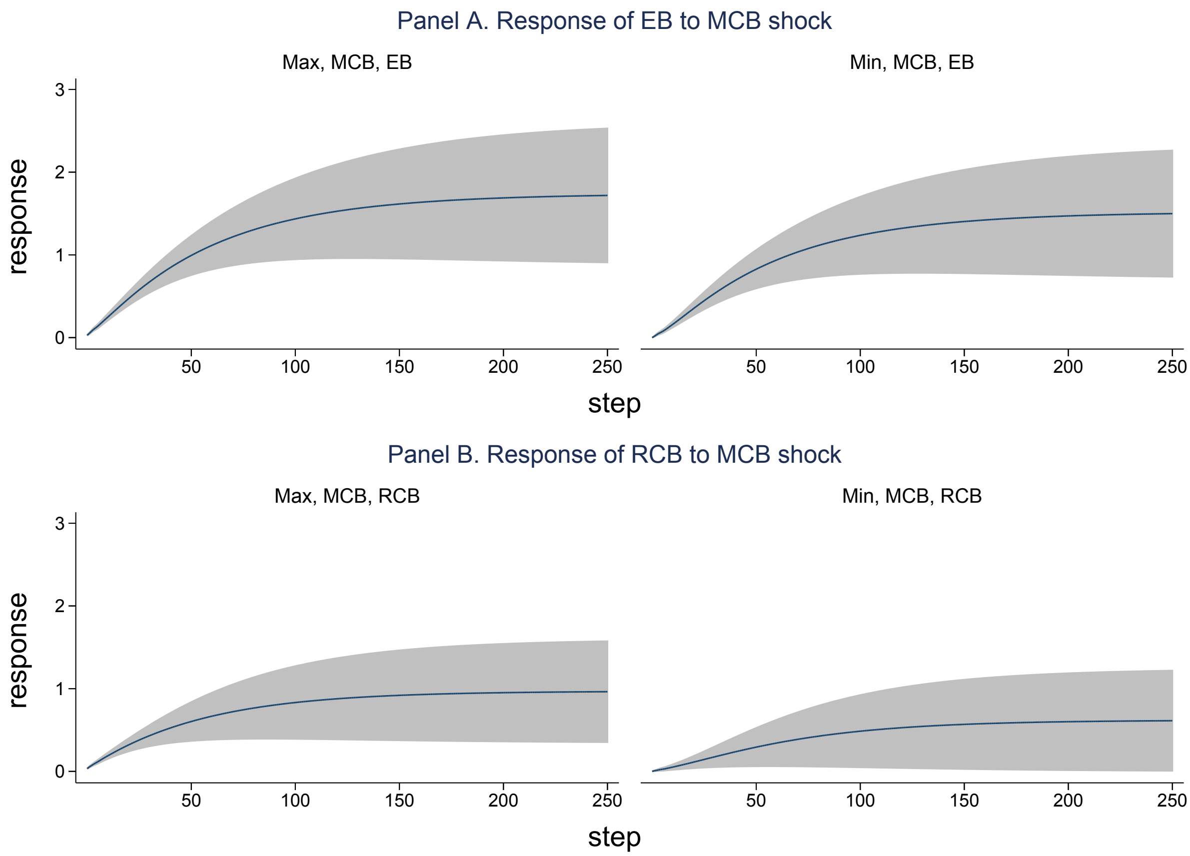

Figure 7.
Placebo test.
This figure compares the price discovery of MCBs and EBs in RCBs using the daily residual portfolio spreads.

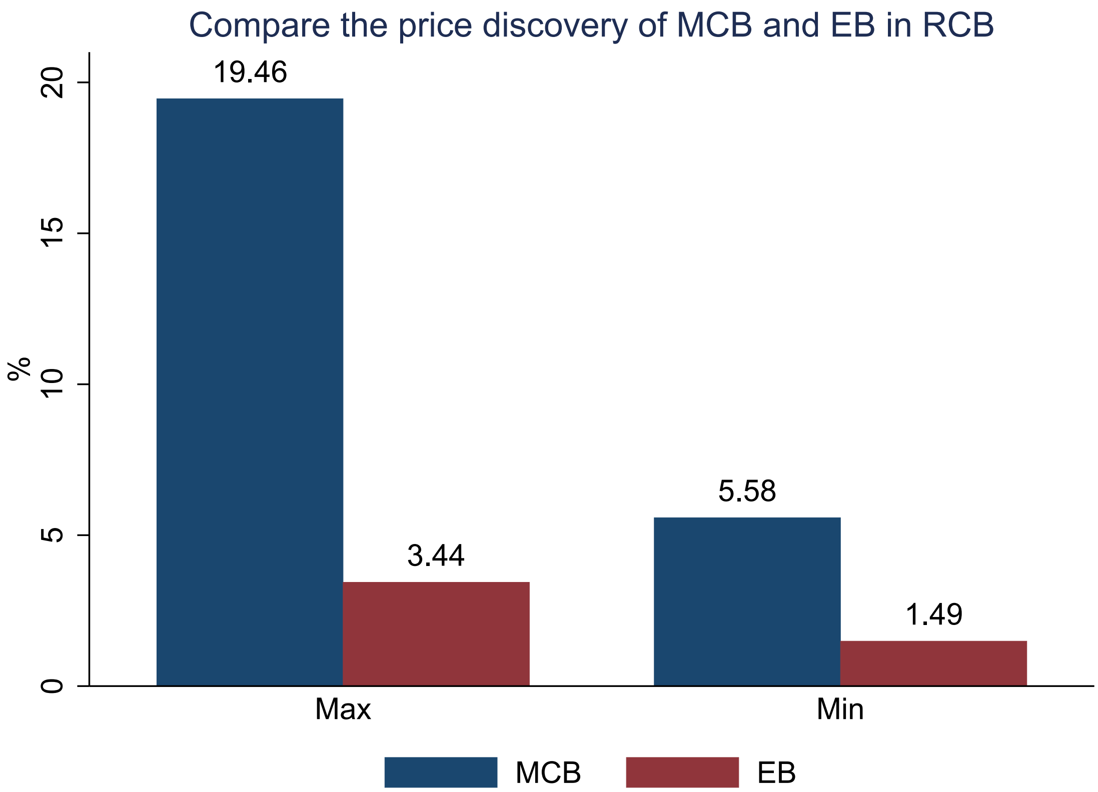

Table 1.
Summary statistics.
This table reports the summary statistics for MCBs, EBs and RCBs. Bond characteristics include: number of unique issuers, number of bonds, daily yield spread (Spread), weekly bond return (Return), spread at issue (Ispread), coupon rate, bond rating at issue (1= AAA, 2=AA+, 3=AA, etc.), maturity, issuance (Billion RMB), SOE with 1 indicating that the issuer is SOE and 0 otherwise, List with 1 indicating that the issuer is a listed firm and 0 otherwise. Distribution statistics include mean, median, standard deviation. The sample period is from January 2010 to June 2019.

Type	MCBs			EBs			RCBs		
	Mean	Median	Std	Mean	Median	Std	Mean	Median	Std
NumIssuers	745			177			1383		
NumBonds	2065			399			3962		
Spread	1.85	1.76	0.73	1.42	1.36	0.65	2.01	1.73	1.14
Return	0.13	0.10	0.63	0.12	0.09	0.87	0.12	0.09	0.60
Ispread	1.42	1.31	0.75	0.99	0.81	0.66	1.47	1.20	1.00
Coupon	5.27	5.27	1.07	4.95	4.90	0.86	5.22	5.10	1.25
Bond Rating	2.13	2.00	0.89	1.16	1.00	0.50	1.89	2.00	0.96
Maturity	4.64	5.00	1.51	9.70	10.00	4.14	4.04	3.00	1.55
Issuance	1.12	1.00	0.92	2.73	1.50	3.04	1.78	1.00	2.57
SOE	1.00	1.00	0.00	0.97	1.00	0.16	0.75	1.00	0.44

Table 2.
Price discovery.
This table reports the information share in EBs (in Panel A) and RCBs (in Panel B) attributable to MCBs using the daily orthogonalized yield spreads via VARs. The column labeled Max denotes the variance decomposition with MCBs ordered first in the system; the column labeled Min denotes the variance decomposition with MCBs ordered last in the system. N is the number of daily observations. Sample period is from January 2010 to June 2019.

VAR	Sample period	Max	Min	N
Panel A. Price discovery of MCB in EB				
VAR: MCB and EB, decompose EB	2010.1.1-2019.6.30	36.33%	26.52%	2308
	2010.1.1-2014.12.31	19.73%	15.83%	1212
	2015.1.1-2019.6.30	16.23%	13.06%	1096
Panel B. Price discovery of MCB in RCB				
VAR: MCB and RCB, decompose RCB	2010.1.1-2019.6.30	19.46%	5.58%	2313
	2010.1.1-2014.12.31	36.93%	9.36%	1212
	2015.1.1-2019.6.30	6.55%	0.11%	1101

Table 3.
Price discovery in industry and location dimension.
This table compares the price discovery impact of MCBs and EBs in RCBs. We examine the information share in RCBs attributable to MCBs through the VAR consisting of RCBs and MCBs (as shown in Column 2 to Column 4), and the information share in RCBs attributable to EBs through the VAR consisting of RCBs and EBs (as shown in Column 5 to Column 7). Panel A reports the variance decomposition results where RCBs are matched with MCBs (EBs) in the same industry. Panel B reports the results where RCBs are matched with MCBs (EBs) in the same industry and same areas. There are typically seven geographical areas in China: North China, East China, South China, Centra China, Northeast, Northwest, and Southwest. Panel C reports the number of bonds, and the number of portfolio observations for VAR estimation in the same industry and same area. The sample period is from January 2010 to June 2019.

	VAR: MCB, RCB Decompose RCB			VAR: EB, RCB Decompose RCB		
Panel A. Same industry						
	Max	Min	N	Max	Min	N
Same industry	6.57%	2.96%	2187	8.83%	6.10%	2295
Panel B. Same industry and same area						
	Max	Min	N	Max	Min	N
North China	20.50%	15.80%	2025	12.30%	8.83%	2293
East China	3.51%	3.65%	1863	0.45%	0.25%	1560
South China	2.18%	1.92%	851	9.32%	6.86%	1105
Panel C. Number of bonds and portfolio observations in the same industry and same area						
	Bonds Num. (RCB)	Bonds Num. (MCB)	Portfolio Obs.	Bonds Num. (RCB)	Bonds Num. (MCB)	Portfolio Obs.
North China	284	117	2025	536	138	2293
East China	107	306	1863	268	38	1560
South China	60	49	851	103	15	1105
Central China	28	59	608	45	6	123
Northeast	23	18	741	54	3	367
Northwest	4	53	0	47	4	74
Sourthwest	28	128	806	39	10	476

Table 4.
Price discovery in the location dimension.
This table compares the price discovery impact of MCBs and EBs in RCBs for each of the seven regions un China. We examine the information share in RCBs attributable to MCBs through the VAR consisting of RCBs and MCBs (as shown in Column 2 to Column 4), and the information share in RCBs attributable to EBs through the VAR consisting of RCBs and EBs (as shown in Column 5 to Column 7).

	Price discovery of **MCB** in RCB			Price discovery of **EB** in RCB		
	Max	Min	N	Max	Min	N
North China	13.90%	7.60%	2300	8.39%	5.62%	2308
East China	8.94%	4.59%	2292	0.36%	0.24%	1956
South China	12.50%	9.40%	2101	6.18%	4.23%	1769
Central China	0.18%	0.16%	1934	0.17%	0.16%	803
Northeast	5.77%	5.45%	2126	2.19%	1.11%	564
Northwest	1.31%	1.36%	1803	0.15%	0.01%	368
Southwest	1.77%	1.84%	2262	0.85%	0.68%	979

Table 5.
Price discovery across trading platforms.
This table reports information share in RCBs traded in each of the two trading platforms – Interbank market (IB) versus exchange market (EX) attributable to MCBs either in the same or different trading platforms.

	Price discovery of **MCB** in RCB			Price discovery of **EB** in RCB		
	Max	Min	N	Max	Min	N
IB, EX	2.46%	1.76%	2217	1.90%	0.75%	2231
IB, IB	14.90%	2.79%	2246	0.72%	0.20%	2133
EX, EX	12.10%	8.32%	2281	4.33%	2.12%	2295
EX, IB	3.27%	2.04%	2293	2.61%	1.61%	2184

Table 6.
Heterogeneity of Price discovery.
This table summarizes the heterogeneity of price discovery of MCBs in RCBs. In Panel A and Panel B, we employ two measures to proxy the degree of implicit guarantee in MCBs: province-level fiscal surplus, administration level of MCBs issuers. Panel C,D,E and F report the results in subsamples sorted by issuers and bond characteristics: attribute (SOE, Non-SOE), rating (AAA, Below AAA), maturity ((0,5), [5,...]) and issuance (small, large), respectively. The sample period is from January 2010 to June 2019.

	Max	Min	N		Max	Min	N
Panel A. Fiscal surplus				Panel B. Administration			
Low	0.55%	0.35%	2300	County	0.95%	0.16%	1755
Medium	0.64%	0.80%	2301	Perfecture-level city	9.11%	4.53%	2206
High	25.70%	12.90%	2313	Province	17.70%	5.23%	2313
Panel C. SOE				Panel D. Bond rating			
Non-SOE,SOE	7.65%	4.24%	2311	AAA,AAA	14.80%	3.87%	2305
SOE,SOE	31.20%	10.70%	2313	AAA,Below AAA	20.70%	7.33%	2311
				Below AAA,AAA	3.12%	1.24%	2304
				Below AAA,Below AAA	10.80%	5.37%	2311
Panel E. Maturity				Panel F. Issuance			
(0,5),(0,5)	21.70%	5.57%	2306	Small,Small	9.27%	4.66%	2272
(0,5),[5,...)	2.10%	1.97%	2121	Small,Large	7.99%	2.65%	2311
[5,...),(0,5)	6.69%	5.14%	2198	Large,Small	14.20%	6.53%	2272
[5,...),[5,...)	10.00%	8.15%	2051	Large,Large	19.70%	8.06%	2312

Table 7.
Spanning enhancement.
This table reports the results about whether MCBs improve the opportunity set relative to EBs and RCBs. Test asset is the equal weighted portfolio of MCBs. The constituents of existing assets are labelled in the first row. The spanning hypothesis is that benchmark asset returns span test asset returns. We employ six spanning test statistics in Kan and Zhou (2012) using the weekly bond portfolio returns. W is the Wald test under conditional homoscedasticity; We is the Wald test under the IID elliptical; Wa is the Wald test under the conditional heteroscedasticity; J_1 is the Bekaert-Urias test with the Errors-in-Variables (EIV) adjustment; J_2 is the Bekaert-Urias test without the EIV adjustment; J_3 is the DeSantis test. All six tests have an asymptotic chi-squared distribution with $2N$ ($N = 1$) degrees of freedom. We also present the annualized Sharpe ratios of portfolios of existing assets alone (λ_B) and bench assets plus test assets (λ_{B+T}), and the number of weekly observations (T). The sample period is from January 2010 to June 2019.

Existing	W	We	Wa	J_1	J_2	J_3	λ_B/λ_{B+T}	T
EB+RCB	58.202	49.399	51.370	44.666	42.542	55.199	2.501/2.521	487
p-value	0.000	0.000	0.000	0.000	0.000	0.000		
EB+RCB+Treasury	54.897	45.097	47.615	43.885	42.280	53.730	3.022/3.043	487
p-value	0.000	0.000	0.000	0.000	0.000	0.000		
EB+RCB+Treasury+CDB	49.756	41.589	40.560	39.951	38.528	48.706	3.068/3.093	487
p-value	0.000	0.000	0.000	0.000	0.000	0.000		

Table 8.
Step-down test.
This table reports the step-down test results. Test asset is the equal weighted portfolio of MCBs. The constituents of existing assets are labelled in the first row. F test examines the null hypothesis ($H_0 : \alpha = 0$ and $\delta = 0$). F_1 test examines $\alpha = 0$. The rejection of F_1 will indicate that MCBs statistically improve the tangency portfolios. F_2 test examines $\delta = 0$ conditional on the constraint $\alpha = 0$. The rejection of F_2 indicates that MCBs statistically improve the global minimum-variance portfolios. The sample period is from January 2010 to June 2019.

Existing					Step-Down Test			
	α	δ	F-test	p-value	F_1	p-value	F_2	p-value
EB+RCB	-0.000127	-0.256	28.922	0.000	3.740	0.054	53.799	0.000
EB+RCB+Treasury	-0.000124	-0.260	27.223	0.000	3.545	0.060	50.635	0.000
EB+RCB+Treasury+CDB	-0.000111	-0.248	24.623	0.000	2.790	0.096	46.285	0.000

Table 9.
Spanning enhancement in subsamples.
This table presents the spanning test results for two sub periods: January 2010 to December 2014, and January 2015 to June 2019. Test asset is the equal weighted portfolio of MCBs. Existing assets contain the equal weighted bond portfolio of EBs, RCBs, treasury and CDBs. Panel A reports the six spanning test results. Panel B reports the step-down results.

Panel A. Spanning test

Existing: EB+RCB+Treasury+CDB	W	We	Wa	J_1	J_2	J_3	λ_B/λ_{B+T}	T
2010.1.1-2014.12.31	31.639	28.381	29.180	27.772	27.166	33.384	3.101/3.138	258
	0.000	0.000	0.000	0.000	0.000	0.000		
2015.1.1-2019.6.30	24.934	16.450	20.968	19.620	17.356	25.796	5.910/5.996	229
	0.000	0.000	0.000	0.000	0.000	0.000		

Panel B. Step-down test

Existing: EB+RCB+Treasury+CDB	α	δ	F-test	p-value	F_1	p-value	F_2	p-value
2010.1.1-2014.12.31	-0.000085	-0.301	15.513	0.000	0.625	0.430	30.445	0.000
2015.1.1-2019.6.30	-0.000155	-0.194	12.195	0.000	5.469	0.020	18.552	0.000

Table 10.
Spanning enhancement in different sets of benchmarks.
This table presents the spanning enhancement of MCBs in different type of benchmark assets. Existing assets are set to be: value weighted portfolio of EBs, RCBs, treasury and CDBs (test asset is value weighted MCB portfolio); market/ maturity/ rating sorted equal weighted portfolios of EBs, RCBs, treasury and CDBs (test asset is equal weighted municipal corporate bond portfolio). Panel A reports the six spanning test results. Panel B reports the step-down results. The sample period is from January 2010 to June 2019.

Benchmark	W	We	Wa	J_1	J_2	J_3	λ_B/λ_{B+T}	T
Value weighted portfolio	10.048	9.633	10.076	10.013	10.265	10.188	2.166/2.353	487
	0.007	0.008	0.006	0.007	0.006	0.006		
Interbank market	41.242	32.001	31.235	28.688	27.960	36.018	2.637/2.703	467
	0.000	0.000	0.000	0.000	0.000	0.000		
Exchange market	8.359	8.700	7.523	7.522	7.529	7.861	2.943/3.047	487
	0.015	0.013	0.023	0.023	0.023	0.020		
Maturity sorted portfolio	41.237	31.861	26.990	28.040	27.005	39.017	3.299/3.322	478
	0.000	0.000	0.000	0.000	0.000	0.000		
Rating sorted portfolio	24.494	23.115	19.934	17.691	19.439	18.463	1.687/2.377	484
	0.000	0.000	0.000	0.000	0.000	0.000		

Table 11.
Spanning enhancement at regional level.
This table presents the spanning enhancement of MCBs and EBs for RCBs for each of the seven regions in China. Existing assets are set to be: equal weighted regional portfolio of RCBs plus treasuries and CDBs. Test assets are equal weighted regional MCB or EB portfolio. The table reports Bekerart-Urias spanning test with adjustment (J1). The sample period is from January 2010 to June 2019.

	Spanning of **MCB** in RCB			Spanning of **EB** in RCB		
	J_1	λ_B/λ_{B+T}	T	J_1	λ_B/λ_{B+T}	T
North China	1.118	3.234/3.235	487	3.102	3.234/3.267	487
North China, drop Beijing	6.603**	2.952/3.041	486	2.658	2.588/2.606	373
East China	8.867**	3.837/3.860	487	11.381***	3.796/3.919	467
East China, drop Shanghai	7.277**	3.621/3.697	486	7.274**	3.560/3.628	452
South China	3.359	2.698/2.785	469	3.525	2.573/2.591	460
South China, drop Guangzhou,Shenzhen	13.014***	2.123/2.445	432	0.750	1.532/1.615	14
Central China	8.227**	2.848/3.115	453	1.576	2.994/3.062	271
North East	11.211***	2.588/2.862	486	3.833	2.764/2.818	182
North West	2.546	3.088/3.145	414	3.703	2.043/2.235	140
South West	14.998***	2.681/3.064	487	3.088	2.378/2.465	279

Table 12.

Spanning enhancement at industry level. This table presents the spanning enhancement of MCBs and EBs for RCBs for each industry category in China. Existing assets are set to be: equal weighted industry portfolio of RCBs plus treasuries and CDBs. Test assets are equal weighted industry MCB or EB portfolio. The table reports Bekerart-Urias spanning test with adjustment (J1). The sample period is from January 2010 to June 2019.

	Spanning of **MCB** in RCB			Spanning of **EB** in RCB		
	J_1	λ_B/λ_{B+T}	T	J_1	λ_B/λ_{B+T}	T
Mining	5.395*	4.420/4.554	47	22.454***	1.787/2.340	176
Manufacture	0.479	4.067/4.070	293	0.514	4.140/4.156	242
Elec, Gas & Water	17.474***	2.126/2.534	482	5.211*	1.639/1.813	224
Construction	17.000***	2.128/2.688	481	9.670***	1.818/2.095	188
Wholesale & Retail	5.659*	2.623/2.654	392	8.103**	9.260/10.250	5
Trans	8.561**	2.209/2.556	460	2.998	2.068/2.098	417
Estate	8.616**	2.443/2.755	344	3.301	2.377/2.437	298
Social	13.871***	2.484/2.925	366	1.007	0.500/0.799	62
Comprehensive	13.456***	2.512/2.888	479	7.227**	2.562/2.736	404

Table 13.
Pricing impact of MCBs.
This table reports the estimated results of regressing monthly EBs and RCBs spreads on MCBs outstanding share for each maturity bin. MCBs outstanding share is measured by D_i^{MCB}/D^{MCB} or D_i^{MCB}/GDP, where i indicates the maturity bin: (0,1), [1,5), [5,...). Spreads of EBs and RCBs are matched with MCBs outstanding share by maturity. Industry and year fixed effects are included. Standard errors are clustered at industry and year-month level. *p <0.10,**p <0.05,***p <0.01.

	(1)	(2)	(3)	(4)
	EB		RCB	
Panel A. (0,1)				
D_S^{MCB}/D^{MCB}	-0.138***		-0.086	
	(-4.62)		(-1.65)	
D_S^{MCB}/GDP		-1.338**		-0.934*
		(-3.62)		(-2.27)
Rating	0.348***	0.347***	0.637***	0.637***
	(4.49)	(4.38)	(11.69)	(11.78)
Remain	0.073	0.078	0.152*	0.157
	(0.37)	(0.42)	(2.06)	(1.81)
Log(Issuance)	0.001	0.008	-0.047	-0.048
	(0.02)	(0.13)	(-1.48)	(-1.46)
Turnover	0.574	0.625	0.074	0.069
	(1.03)	(0.86)	(1.31)	(1.33)
Market	0.064	0.064	-0.290**	-0.290**
	(1.07)	(1.00)	(-2.67)	(-2.67)
SOE	-1.313***	-1.313***	-0.792***	-0.792***
	(-7.95)	(-9.42)	(-4.56)	(-4.55)
Log(Asset)	-0.075*	-0.075*	-0.020	-0.019
	(-2.44)	(-2.21)	(-0.54)	(-0.51)
Leverage	0.481*	0.485*	0.286	0.290
	(2.31)	(2.24)	(1.20)	(1.21)
ROA	-0.010	-0.009	-0.093***	-0.092***
	(-0.53)	(-0.45)	(-5.95)	(-6.07)
$yield_{10yr}^{CDB}$	0.075	0.123	0.159	0.171
	(0.63)	(1.19)	(1.75)	(1.51)
Term	-0.283**	-0.283**	0.051	0.059
	(-2.67)	(-2.61)	(0.48)	(0.59)
Credit spread	0.246	0.470	0.167	0.329*
	(0.60)	(0.99)	(0.84)	(2.27)
Stockret	0.001	0.001	0.001	0.002
	(0.22)	(0.25)	(0.44)	(0.68)
Constant	3.420*	2.116	1.794	1.121
	(2.22)	(1.41)	(1.84)	(1.24)
Ind/Year FE	Yes	Yes	Yes	Yes
Observations	519	519	12,396	12,396
Adjusted R-squared	0.539	0.545	0.444	0.445
Panel B. [1,5)				
D_M^{MCB}/D^{MCB}	0.006		0.010	
	(0.38)		(0.62)	
D_M^{MCB}/GDP		-0.288*		-0.250***
		(-2.25)		(-3.70)
Control	Yes	Yes	Yes	Yes
Observations	3,277	3,277	57,037	57,037
Adjusted R-squared	0.580	0.589	0.532	0.537
Panel C. [5,...)				
D_L^{MCB}/D^{MCB}	0.013		0.011	
	(1.37)		(0.75)	
D_L^{MCB}/GDP		-0.127		-0.248**
		(-1.00)		(-2.62)
Control	Yes	Yes	Yes	Yes
Observations	2,320	2,320	2,725	2,725
Adjusted R-squared	0.639	0.637	0.527	0.528

Table 14.
Pricing impact of MCBs: time-series variation.
This table reports how the pricing impact of short-term MCBs on short-term bond pricing interacts with the supply of short-term treasuries. $I_{D_S^{Trea}/D^{Trea}}$ equals 1 if D_S^{Trea}/D^{Trea} is lower than the sample median, and 0 otherwise. $I_{D_S^{Trea}/GDP}$ equals 1 if D_S^{Trea}/GDP is lower than the sample median, and 0 otherwise. Control variables are the same with those in Table 13. *p <0.10,**p <0.05,***p <0.01.

	(1)	(2)	(3)	(4)
	EB		RCB	
D_S^{MCB}/D^{MCB}	-0.113**		-0.029	
	(-2.89)		(-0.98)	
$D_S^{MCB}/D^{MCB} \times I_{D_S^{Trea}/D^{Trea}}$	-0.073**		-0.119***	
	(-2.95)		(-5.06)	
D_S^{MCB}/GDP		-0.892**		-0.402
		(-3.10)		(-1.55)
$D_S^{MCB}/GDP \times I_{D_S^{Trea}/GDP}$		-0.617		-0.948***
		(-1.61)		(-5.24)
Control	Yes	Yes	Yes	Yes
Observations	519	519	12,396	12,396
Adjusted R-squared	0.550	0.549	0.447	0.448

Table 15.
Maturity impact of MCBs.
This table presents the OLS regression results of regressing monthly long-term MCBs on long-term RCBs. Long-term RCBs is measured by long-term RCBs level share (D_L^{RCB}/D^{RCB}) or long-term RCBs issue share (d_L^{RCB}/d^{RCB}). Long-term MCBs is measured by long-term MCBs level share (D_L^{MCB}/D^{MCB}), face-value weighted maturity of principal (MCBmat). We also instrument MCB maturity using the ratio of all municipal corporate bonds to GDP. t-statistics are adjusted based on Newey and West (1987) standard errors. *p <0.10,**p <0.05,***p <0.01.

			Panel A. D_L^{RCB}/D^{RCB}			
	(1)	(2)	(3)	(4)	(5)	(6)
D_L^{MCB}/D^{MCB}	0.120***	0.097***				
	(8.25)	(3.70)				
MCBmat			2.339***	2.152***		
			(9.08)	(5.04)		
D_L^{MCB}/GDP					0.134***	0.180***
					(9.17)	(4.70)
$yield_{10yr}^{CDB}$		-1.126***		-0.724*		-0.817**
		(-2.93)		(-1.96)		(-2.06)
Term		-2.071***		-1.964***		-2.784***
		(-5.44)		(-5.66)		(-4.84)
Credit spread		0.368		0.575		2.185**
		(0.57)		(1.01)		(2.39)
Constant	1.932***	9.836***	-3.831***	1.548	1.389***	1.763
	(4.18)	(2.89)	(-3.82)	(0.38)	(3.40)	(0.44)
5-Year FE	No	Yes	No	Yes	No	Yes
Observations	114	114	114	114	114	114
R^2	0.74	0.88	0.79	0.90	0.73	0.84

			Panel B. d_L^{RCB}/d^{RCB}			
	(1)	(2)	(3)	(4)	(5)	(6)
D_L^{MCB}/D^{MCB}	0.095*	0.291**				
	(1.68)	(2.13)				
MCBmat			2.075*	5.973**		
			(1.95)	(2.57)		
D_L^{MCB}/GDP					0.104*	0.434***
					(1.80)	(2.82)
$yield_{10yr}^{CDB}$		-7.915***		-6.882***		-7.385***
		(-4.13)		(-3.52)		(-3.67)
Term		-6.914**		-6.429**		-8.138***
		(-2.59)		(-2.53)		(-2.77)
Credit spread		7.821		7.912		10.941**
		(1.50)		(1.64)		(2.01)
Constant	19.837***	38.273**	14.278***	17.418	19.487***	24.411
	(8.82)	(2.18)	(3.12)	(0.80)	(8.49)	(1.28)
5-Year FE	No	Yes	No	Yes	No	Yes
Observations	114	114	114	114	114	114
R^2	0.05	0.24	0.07	0.25	0.05	0.22

Table 16.
Logit models of long-term RCB issues.
This table presents logit models of long-term RCB issues where the dependent variable takes a value of one if the bond has a maturity of [5,...) years, and zero otherwise. In Column (1) and (2), RCB issues are matched with Outstanding MCB shares by maturity. In Column (3) to (6), RCB issues are matched with Outstanding MCB shares by city and maturity. HighRating equals to 1 if the bond rating belongs AAA, and 0 otherwise. Control variables include SOE, log of issuer's size, issuer's leverage, ROA, term, credit spread, 10-year CDB yield spread, and GDP growth. t-statistics are in parentheses below the corresponding coefficient estimates. *p <0.10,**p <0.05,***p <0.01.

	(1)	(2)	(3)	(4)	(5)	(6)
D_L^{MCB}/D^{MCB}	0.028***	0.036***				
	(6.78)	(6.55)				
$D_L^{MCB}/D^{MCB} \times HighRating$		-0.043***				
		(-13.52)				
$D_{L,c}^{MCB}/D_c^{MCB}$			0.005***	0.008***		
			(4.48)	(5.35)		
$D_{L,c}^{MCB}/D_c^{MCB} \times HighRating$				-0.021***		
				(-9.93)		
$D_{L,c}^{MCB}/GDP_c$					0.125***	0.080**
					(5.98)	(2.41)
$D_{L,c}^{MCB}/GDP_c \times HighRating$						-0.051
						(-0.95)
HighRating		-0.526***		-0.912***		-1.552***
		(-4.99)		(-9.93)		(-15.94)
SOE	0.333***	0.792***	0.322***	0.805***	0.283***	0.813***
	(7.50)	(14.32)	(6.78)	(13.63)	(5.96)	(13.77)
Log(Size)	-0.006	0.329***	0.011	0.337***	0.015	0.364***
	(-0.38)	(14.32)	(0.62)	(13.89)	(0.91)	(15.04)
Lev	-0.417***	-0.723***	-0.395***	-0.755***	-0.411***	-0.802***
	(-4.79)	(-6.86)	(-4.31)	(-6.80)	(-4.48)	(-7.21)
ROA	0.023***	0.046***	0.030***	0.049***	0.034***	0.054***
	(3.45)	(5.62)	(4.18)	(5.58)	(4.77)	(6.32)
$yield_{10yr}^{CDB}$	-0.340***	-0.407***	-0.411***	-0.469***	-0.417***	-0.433***
	(-7.46)	(-7.10)	(-8.87)	(-8.10)	(-9.08)	(-7.55)
Term	-0.105	-0.289***	-0.059	-0.255***	-0.027	-0.218**
	(-1.57)	(-3.37)	(-0.81)	(-2.81)	(-0.37)	(-2.43)
Credit spread	0.350***	0.149	-0.095	-0.170*	-0.248***	-0.121
	(2.93)	(1.01)	(-1.21)	(-1.80)	(-3.33)	(-1.38)
GDPgrowth	0.740***	0.187	1.045***	0.708**	1.215***	0.608**
	(3.26)	(0.66)	(4.18)	(2.36)	(4.87)	(2.10)
Constant	-1.906***	-0.832	-0.060	0.818**	0.258	0.638*
	(-4.02)	(-1.39)	(-0.19)	(2.11)	(0.88)	(1.77)
5-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16,809	9,489	14,602	8,090	14,599	8,087
Pseudo R-squared	0.020	0.149	0.020	0.131	0.021	0.121