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Markets Price Politicians:

Evidence from China's Municipal Bond Markets

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Abstract

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JEL classification: G12, H11, P43

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1. Introduction

One of the channels for the market to efficiently allocate resources is to reward the more competent market participants. Politicians directly or indirectly participate in the market. Some politicians are more able than others to grow the local economy because they have higher levels of human capital, such as better aptitudes, better education, better inter-personal skills (including better leadership), and more appropriate job experiences. A natural question is: Does the market evaluate such human capital and reward politicians' competence?

That question is the most pertinent to municipal bond (MB) markets, where municipal governments are the direct suppliers of bonds. The existing literature, though, has focused on how national and subnational institutions and political risks affect the prices of MBs (Duyvesteyn, Martens, and Verwijmeren 2016, Gao, Murphy, and Qi 2019, Huang, Pagano, and Panizza 2019, Gao, Lee, and Murphy 2020). But municipal executives are the main decision makers in cities, and their human capital may play an important role in creating or mitigating local risks. With that idea in mind, this paper studies China's MB markets to explore whether investors take into consideration mayors' abilities to develop the local economy when they bid for MBs.

In addition to assessing the market's ability to recognize politicians' human capital, studying China's MB markets has merit in its own right. In the first two decades of this century, debt securities have grown rapidly in China. By the end of 2019, China already had the second-largest market of corporate debt securities in the world. MBs account for a large share of that market. However, it is often found that China's bond markets are inefficient and that bonds are generally overpriced (Ding, Xiong, and Zhang 2021). Research has found that political promotion provides a strong incentive for government officials to deliver economic growth (Yao and Zhang 2015). Studying investors' pricing strategy will reveal whether the bond market can efficiently evaluate the role of mayors and, thus, provide similar incentives to mayors.

Measuring politicians' abilities is challenging. Our paper uses a unique feature of the Chinese political system in which government officials are regularly rotated among positions in different cities. This feature

allows us to build a connected sample of cities and government officials and back out mayors' abilities from their cities' economic performance. More specifically, we adopt the method introduced by Yao and Zhang (2015) to define a mayor's ability by his or her fixed effect in a city-year growth regression after controlling for city fixed effects, year fixed effects, and local economic conditions.

Matching mayors with the MBs issued during their terms, we then study China's primary MB markets.[2] We estimate the pricing function of investors in the primary market and study how mayors' abilities affect investors' bidding prices. Those prices are not directly observable. What we can observe are the equilibrium yields that are jointly determined by the demand of market investors and the supply of local governments. To identify how a mayor's ability affects investors' demand, we estimate investors' pricing function with MB issuance as one of the regressors. Obviously, MB issuance is endogenous because of the simultaneity problem. We use the incidence of floods that a city experienced in the previous year and the amount of its maturing MBs around the time of a bond's issuance to instrument its MB issuance. Floods cause damages to infrastructure and other public properties and may raise the need for a city to borrow more from the market. Thanks to effective government intervention, most floods nowadays do not have long-term impacts on the economy. Therefore, floods are not likely to directly affect investors' pricing strategy. However, floods alone may not be an effective instrument, which is why we add the amount of maturing MBs as another instrument. Paying back maturing MBs may put pressure on the municipal budget and, thus, force the city to borrow more. In the meantime, the fact that a city can pay back maturing bonds indicates that it has no immediate risk of default, so the amount of maturing bonds is not likely to have direct impacts on investors' pricing strategy. But to control any of such impacts, we add in investors' pricing function the city's stock of outstanding bonds that are likely to supersede the amount of maturing bonds to affect investors' evaluation of the default risk.

Our baseline results show that a one standard deviation increase of a mayor's ability will reduce investors' bidding price by 11.4 basis points, which is equivalent to 4.5 percent of the average MB yield spread over the risk-free rate of central government bonds. Considering the large stock of MBs (more than 8

[2] In this paper, MBs refer to bonds issued by local government financing vehicles (LGFVs). MBs are issued by LGFVs and implicitly guaranteed by local government (Luo and She 2015; Bai, Hsieh, and Song 2016; Liu, Lyu, and Yu 2017). Since mayors are directly engaged in MB issuances, investors are likely to evaluate mayors' profiles and performances before they buy MBs. Section 2 provides more comprehensive details of this market.

trillion yuan outstanding at the end of 2019), this could save 9.5 billion yuan in total government debt services or 36 million yuan during an average mayor's tenure.

A study of the secondary market further supports our baseline results. We also estimate a simultaneous equation system of the investors' pricing function and the municipal government's issuance function in the primary market and find that mayors' abilities only affect investors' pricing decisions, not governments' issuance decisions. Placebo tests using city party secretaries and corporate bonds issued by private companies have lent further support to our main results.

We find interesting heterogeneous effects of mayors' abilities that support our main results. Ability has stronger impacts on MB yields for MBs with longer maturity terms, issued by lower-rating issuers, or issued in the market with more informative investors. We also find the same result for MBs issued in mayors' first year of tenure or by economically or financially less developed cities.

We conduct several tests for the measure of ability. We include mayors' political connections to their superiors when their abilities are estimated, permute mayors' terms, and replace estimated ability by various types of average growth rates and years of education. Those tests show that our measure of ability does capture mayors' intrinsic abilities.

Our study complements the institutional view of political risks in the MB market (Duyvesteyn, Martens, and Verwijmeren 2016, Gao, Murphy, and Qi 2019, Huang, Pagano, and Panizza 2019, Gao, Lee and Murphy 2020). Institutions are important, but they are constructed and implemented by human actors among which politicians are arguably the most important. Our study makes a tangible contribution by highlighting the role of political human capital—mayors' individual abilities to manage the local economy—in reducing the default risk of MBs. With that, our contribution also extends to the debate about the role of market disciplines imposed on the government. In an interesting paper, Purnanandam and Weagley (2016) find that the introduction of weather derivative contracts by the Chicago Mercantile Exchange has significantly improved the accuracy of the National Weather Service's temperature forecasts. Our study complements that result by finding that market investors recognize politicians' abilities to improve local economic performance.

In addition, our paper contributes to two strands of literature on China. One is the literature studying the recent development of China's financial system (Allen, Qian, and Qian 2005; Piotroski and Zhang 2014; Liu, Shu, and Wei 2017; Xiong 2018; Amstad, Sun, and Xiong 2020). Contrary to the view that China's

financial markets are inefficient, our results imply that investors rationally evaluate the risks associated with the government even in the highly distorted MB market. As shown by Liu, Lyu, and Yu (2017), MB yields reflect local economic conditions. Our findings further show that MB yields reflect local politicians' human capital. By rewarding more capable (and punishing less capable) mayors, investors in the MB market can align risks with the cost of finance and, thus, can ultimately place discipline on local politicians.

The other is the literature studying China's political selection. In a democratic society, politicians' personal abilities within public service are recognized by voters and rewarded by winning elections (Besley 2005; Dal Bo et al. 2017). In a nondemocratic society, however, it is not obvious how politicians are evaluated. The political economy literature on China has focused on politicians' promotion incentives that take their performance into consideration (Li and Zhou 2005; Yao and Zhang 2015; Jia, Kudamatsu, and Seim 2015) but has largely ignored other constraints and incentives placed on them. Because governments in China actively participate in the market, a natural question is whether the market places any discipline on government officials. Providing a positive answer to that question, the results of our paper present a piece of evidence for the efficiency of China's financial markets in evaluating politicians.

We organize the rest of this paper as follows. Section 2 introduces the institutional background of MB issuance in China. Section 3 describes the data sources, key variables, and some descriptive evidence. Section 4 introduces the empirical strategy. Section 5 presents the main empirical results for the impacts of mayors' abilities on bond yields, and Section 6 explores the heterogeneous effects to buttress our main results. Section 7 provides further robustness tests. Section 8 concludes the paper.

2. Background

The emergence of China's MB market was closely linked to China's 4 trillion yuan fiscal stimulus package implemented in 2008–2009 in response to the global financial crisis (Bai, Hsieh, and Xiong 2016). In the early 2000s, local governments relied heavily on bank loans to finance local infrastructure projects. The stimulus package led to a shift from bank loans to the less-regulated sectors of shadow banking in which the bond markets were a major component (Chen, He, and Liu 2020). In fact, the central government implicitly relaxed the restrictions placed on local governments' bond financing to speed up the

implementation of the stimulus package.[3] Consequently, monthly MB issuances grew to more than 200 billion yuan in 2016 (Figure 1). To contain the fast-growing local government debt risks, China introduced a series of laws and regulations on local government borrowing, including the revised Budget Law in 2014, which entitled local governments to run deficits in their budgets while curbing their borrowing through local government financing vehicles (LGFVs). By the end of 2019, MBs accounted for about 10 percent of total bonds outstanding in the market. MB issuance increased dramatically again in 2020 to help combat the economic downturn caused by COVID-19. LGFVs raised 4.39 trillion yuan in the bond markets, and the stock of outstanding MBs reached 10.8 trillion yuan (Ouyang 2020).

[Figure 1 is here]

MB issuance reflects China's government-centered regulatory framework. Local governments (representing one of their LGFVs) need to get approval from the National Development and Reform Commission (NDRC) to issue a bond. When a bond is to be issued, a proposal submitted to the NDRC specifies the amount of issuance and its purpose. After obtaining the NDRC's permission, bonds can be sold in two markets. One is the interbank market and the other is the exchange bond market managed by the Shanghai and Shenzhen stock exchanges. The interbank market is a quote-driven over-the-counter (OTC) market, where bonds are sold to investors on a one-to-one basis. Investors in this market are large financial institutions. Investors in the exchange bond market include private funds and individuals in addition to large financial institutions. Bond sales in this market take the form of open tendering in which market investors bid both yields and amounts of purchase (Mu 2006).

The interbank market is much larger than the exchange market, mostly because the interbank market offers more tools for local governments to raise debts.[4] At the end of 2020, the interbank market accounted for 63.5 percent of all MBs outstanding.[5] Accordingly, the primary MB holders are large financial institutions, such as commercial banks, securities companies, and insurance companies. For example, in 2014,

[3] See People's Bank of China and China Banking Regulatory Commission, *Guidance on further strengthening the adjustment of credit structure and promoting steady and fast development of national economy*, March 2009.

[4] In the interbank market, local governments can issue short- and medium-term notes, private placement notes, and enterprise bonds. They are all included in the category of MBs labelled by WIND.

[5] https://www.sohu.com/a/454077701_611449. Retrieved on November 19, 2021.

the shares of bonds held by those types of investors were 31.0 percent, 24.8 percent, and 21.4 percent, respectively (Ang et al. 2018).

In China's political system, two main officials are assigned to each level of the government: the party secretary and the executive (governor for the province and mayor for the city). The party secretary is the number one person in a city, but his or her responsibility rests more in the political arena and deciding the major directions of the city's development. The mayor is more responsible for the city's economic and social development. Studies (for example, Yao and Zhang 2015) have found that economic performance matters for mayors' promotions to higher positions, but not for party secretaries'. Municipal bonds are tools for city development. While the party secretary may dominate a city's overall development strategy, the issuance of a particular bond falls in the decision realm of the mayor. As part of investors' due diligence, they need to check the track records of the mayor as well as the economic conditions of the issuing city. In our paper, a mayor's long-term economic performance, or ability, is among the indicators that investors use to evaluate the default risk of a municipal bond.

Technically, municipal bonds are corporate bonds and subject to default risks. MB issuers, the LGFVs, are legally defined as government-owned commercial entities whose budgets are independent of the government budget. The default risks of MBs come from the mismatch between public purposes and commercial means of finance in addition to the conventional sources for ordinary corporate bonds. While it is not uncommon for governments in other countries to issue commercial debts to finance public projects, two factors exacerbate the risks in China. One is that the public projects financed by MBs often do not generate enough cash flows, and the other is that local governments seldom use regular tax revenue to repay MBs.[6] As a matter of fact, out of the 2,380 LGFVs existing at the end of 2019, only one-fourth generated enough cash flows to cover the interest services of their debts (Ouyang 2020).

There are growing concerns that the guaranteed repayment on MBs will eventually be removed. In the past, when a MB issuer was about to default on its debt, the relevant local government always provided or

[6] A large part of the funds raised by MBs has been used for infrastructural buildup and land development. Except for a few items, infrastructure projects do not generate enough cash flows. Land development generates extra-budgetary land sales income for the government. But much of the income is diverted to cover governments' other expenditures, such as subsidies to infrastructural building and operations.

arranged financial support, although such government bailout is not required by law.[7] In fact, China's regulatory authorities have long aimed at removing guaranteed repayment to strengthen discipline in bond markets. In the corporate bond market, Shanghai Chaori Technologies Inc., a private company, announced the first-ever default in China's domestic bond market in 2014. Several central and local state-owned enterprises have also defaulted since 2014 (Amstad and He 2019). LGFVs are state-owned enterprises as well, so their default is not beyond imagination, although LGFVs have never defaulted on their bonds (as of the writing of this paper).[8]

The market has priced in this risk. Figure 2 shows the yield spreads between MBs and government bonds with the same maturity. The average yield of central government bonds between January 2008 and January 2017 was 5.6 percent. The interest rate of MBs was substantially higher and fluctuated over time. In the same period, the average spread in each month ranged from less than 2 percentage points to around 5 percentage points.

[Figure 2 is here]

There were large geographic variations in terms of both the amount of MBs and their yield spreads. As shown in Figure 3, coastal cities in the southeast tended to issue larger quantities, but they enjoyed lower yield spreads than inland cities. This variation shows that local factors did affect MB prices. In addition to the local economic growth prospect, the abilities of politicians might matter as well. To assess the role of politicians, we need to create a measure of ability that is comparable across cities and time.

[Figure 3 is here]

3. Data and suggestive evidence

In this section, we first introduce how we measure politicians' abilities with the decomposition of local

[7] For example, Yunnan Province Roads Development Corporation, an LGFV, could not meet the payment date in June 2011, but it was later bailed out by the Yunnan provincial government (http://www.chinadaily.com.cn/bizchina/2011-07/29/content_13010196.htm).

[8] In 2020, many more state-owned enterprises defaulted on their bonds and went bankrupt. These defaults were speculated by the market as a prelude to defaults of MBs.

economic growth. Then we make a summary of the MB data and local economy data that we use in regressions. As suggestive evidence, we present the simple distribution of bond yields by mayors' abilities in the last part of this section.

3.1 Data for officials and the measure of their abilities

Data on mayors and other politicians are from the Chinese Officials Database collected by the China Center for Economic Research (hereinafter CCER-COD). CCER-COD documents detailed bio data for almost all officials at or above the municipal level during 1994–2017.[9]

We follow the method developed by Yao and Zhang (2015) to measure politicians' abilities. This method involves estimating the following city-year growth equation:

$$growth_{(i)ct} = \omega_i + \gamma_1 \ln GDPpc_{ct} + \gamma_2 \ln pop_{ct} + \tau_t + \delta_c + \varepsilon_{(i)ct}. \quad (1)$$

The left-hand side variable $growth_{(i)ct}$ is the real gross domestic product (GDP) growth rate of city c in year t under the tenure of politician i. After controlling GDP per capita (log) and population (log), together with year fixed effects τ_t and city fixed effects δ_c, politician i's fixed effect ω_i is his or her ability. The key challenge is to disentangle ω_i from δ_c. Because those two parameters share the same city-year cell, they are not readily identifiable. Yao and Zhang (2015) show that the parameters can be identified relative to their respective means in a connected sample—that is, a sample in which every city has had at least one official moving in from or moving out to another city. One of the unique features of China's political system is that officials are frequently shuffled between cities. Thus, such connected samples do exist. To increase the size of the largest connected sample, we mix mayors and party secretaries together. The largest connected sample for 1994–2017 contains 2,741 mayors and party secretaries (more than 80 percent of the population) in 272 cities. We estimate Equation (1) with that sample. When we perform the estimation, we stack mayors and party secretaries to preserve the size of the largest connected sample.[10] Because ω_i can only be estimated relative to its mean, we subtract the mean after ω_i is estimated. Figure 4 presents the distribution of the estimated ability, which is close to a normal distribution.

[9] For more details, see Yao et al. (2020).

[10] Yao and Zhang (2015) also estimate a system of equations with separate equations for mayors and party secretaries. The results are comparable to those obtained by the method introduced here.

[Figure 4 is here]

Essentially, ability is estimated from a politician's average growth rate during his or her tenure in one or more cities. It then begs this question: Why do we not directly use the average growth rate? The reason is that Equation (1) controls city and time factors that may confound mayors' contributions to local growth. So, our measure of ability contains less noise than the average growth rate. Yao and Zhang (2015) discussed and tested the potential problems raised by the estimated ability and found that the problems do not pose serious threats to the baseline results. We will not repeat all their robustness exercises in this paper; instead, we will conduct some of the more significant checks in Section 7 to show that our baseline results are also robust.

3.2 Bond and economic data

We obtain data on MBs from WIND, which records MB yield, the quantity of issuance, maturity, issuance date, rating of the issuer (LGFV), city of the issuer, and more. We can directly identify an MB with a specific marker "whether the bond is a municipal investment bond (*Cheng-tou-zhai*)" recorded by WIND. To match CCER-COD, we restrict our sample to bonds issued by prefecture-level municipal governments from January 2008 to December 2016. The number of officials in this sample is considerably smaller than the sample we used to estimate Equation (1). We exclude MBs issued by provincial governments or county-level city governments.

The unit of our empirical analysis is the individual bond. We match each MB with the corresponding mayor who worked in the city at the time of the issuance. There are also cities that have issued MBs but are not in the largest connected sample introduced in the previous subsection. After matching the bond sample with the largest connected sample, we have 4,154 MBs issued by 1,025 LGFVs under 541 mayors in 239 prefectural-level cities during 2008–2016.

[Table 1 is here]

As shown in Table 1, the average MB yield was 5.60 percent, and the average spread over the central government bond was 2.51 percent. The average issuance was 929 million yuan (around US$130 million), or 0.38 percent of local GDP, and 5.12 percent of local fiscal revenue. The mean maturity was 4.45 years.

Around 11 percent of bonds had additional guarantees or credit enhancements by other companies. Bonds issued by AAA-rated issuers were relatively rare—only 7.6 percent of the total. The shares from issuers with an AA+, AA, AA-, and lower rating were 25.7 percent, 55.1 percent, 8.2 percent, and 3.5 percent, respectively. In general, an issuer with an AAA or AA+ rating is viewed as low risk and would be more trusted by investors. City-level economic data are drawn from the CEIC database, which reports each city's annual economic and demographic data. The summary statistics of the variables used in our analysis are reported in Table 1.

3.3 Suggestive evidence

Before applying rigorous empirical analysis, we first present suggestive evidence for the impact of mayors' abilities on MB yields. In Figure 5, we divide mayors into two groups by their abilities using the median as the cutoff. Then we calculate the mean of bond yields in each mayor tenure and plot the distribution of yields by high-ability and low-ability mayors. To control for regional variations, we first regress MB yields on provincial dummies and then add the residuals back to the average yield. The figure shows that the yield distribution of bonds issued by high-ability mayors almost uniformly shifts left compared with the yield distribution of bonds issued by low-ability mayors. This result provides a hint for our regression analysis.

[Figure 5 is here]

4. Empirical Strategies

The key idea of this paper is that investors in the MB market would like to reduce their bidding prices on the bonds issued by more competent mayors. Reduced-form analysis based on observed yields is inadequate because they may also reflect mayors' abilities to manage their cities' financing strategy. For example, a more competent mayor may be able to rely less on MBs to finance the city's growth, so given investors' demand for bonds, the mayor enjoys a lower MB yield. Thus, a simultaneous problem emerges between MB yields and MB issuance, and the instrumental variable (IV) approach is needed. In Appendix A2.1, we provide a theoretical model for the simultaneous determination of issuance and prices.

Before applying the IV approach, we first estimate the following reduced-form equation by the ordinary least square (OLS) method:

$$r_{ij(k)t} = a + \theta A_{ij(k)t} + X'_{ij(k)t}\phi + u_{ij(k)t} \quad . \tag{2}$$

In the equation, the subscripts *i*, *j*, *k*, and *t* represent bond, city, mayor, and year-month, respectively. The dependent variable $\boldsymbol{r_{ij(k)t}}$ is the MB yield in the primary market. $\boldsymbol{A_{ij(k)t}}$ is the key explanatory variable, the ability of the incumbent mayor when the bond was issued. According to the theoretic model presented in A2.1, ability reduces investors' bidding yields, so $\boldsymbol{\theta}$ is expected to be negative. The vector $\boldsymbol{X_{ij(k)t}}$ contains four groups of variables that affect MB yields. The first category is the yield of central government bonds with comparable maturity. Central government bonds are risk-free assets, which provide the benchmark for the market.[11] The second category includes bond-specific variables: maturity, whether having a guarantee or credit enhancement offered by other companies, and a set of dummies that indicate the rating of the issuer (ratings below AA- are treated as the omitted group). The third category contains variables that describe the issuing city's local economic conditions, including the ratio bonds outstanding/GDP, fiscal revenue (log), GDP per capita (log), and annual growth rate. The last three variables are lagged by one year. The fourth category consists of two sets of dummy variables: one for year-months and the other for issuers (LGFVs). The year-month dummies allow us to control for nationwide macroeconomic fluctuations, and the issuer dummies allow us to control for time-invariant issuer characteristics. LGFVs are often specialized in different businesses, such as road building, industrial park development, and financial investment. Therefore, the issuer fixed effects capture the type of projects financed by MBs. Because one city may have more than one issuer, this control is stricter than controlling city fixed effects. Standard errors are clustered at the city-mayor level, as the variation of the key explanatory variable, mayors' abilities, comes from the turnovers of incumbent mayors within a city.

However, a simple OLS estimation of Equation (2) cannot disentangle whether mayors' abilities affect investors' bidding yields and/or whether the abilities alter municipal governments' issuance plans. Ability may affect borrowing decisions that in turn affect equilibrium MB yields. To deal with this problem, we augment Equation (2) with the amount of MB issuance:

$$r_{ij(k)t} = a + \alpha q_{ij(k)t} + \theta A_{ij(k)t} + X'_{ij(k)t}\phi + u_{ij(k)t} \quad . \tag{3}$$

Here, $\boldsymbol{q_{ij(k)t}}$ is the amount of bond $\boldsymbol{i}$, scaled by local GDP in the year of issuance,[12] and the other variables

[11] After controlling for government bonds' yields, this is equivalent to the specification in which the dependent variable is MB yield spread over government bonds.

[12] As our theory shows, debts can be normalized by a city's size of economy in investors' pricing function.

are the same as the ones in Equation (2). Obviously, $q_{ij(k)t}$ is an endogenous variable because of the simultaneity problem. We choose two IVs for it: an indicator of floods in a city in the last year and the amount of MBs that reached maturity in the city when the new bond was issued.

Floods are defined by the excess precipitation in a rainy season. To be specific, if a city experiences twice higher monthly precipitation than the 1900–2017 historical average in any month of the last rainy season (June to August), the variable *floods* equals one, otherwise it is zero. Data for the monthly precipitation in each city are from Matsuura and Willmott (2018). The original data records global monthly precipitation in $\mathbf{0.5 \times 0.5}$ degree grids from 1900 to 2017. The area of a prefectural-level city may fully or partially cover several $\mathbf{0.5 \times 0.5}$ degree grids on the map.[13] To calculate the precipitation of a city, we take the weighted average precipitation of all grids that intersect with the city, where the weight is the area of the intersected grids. The variable *floods* affects a city's decision of borrowings but not necessarily the investors' decision of pricing. Floods are exogenous shocks that bring damages to infrastructure and endanger people's lives. However, a municipal government may not have contingent funds to repair the damaged infrastructure or to give people relief, thus the government may have to borrow from the market. However, the impacts of floods on the economy do not last for long nowadays (except for rare and large floods), so the city's ability to repay debt is not likely to be impaired. Results of regressions given in Table A1 show that when we regress a city's GDP growth rate on *floods* in the previous year and control for city and year fixed effects, *floods* has no effect on the growth rate. As a result, floods are not likely to affect investors' pricing decisions.

Another instrument is the amount of maturing MBs, defined as the amount of MBs of a specific issuer that were due in the current or the last two months around a particular issuance. The amount is scaled by city GDP in the year of issuance to make it consistent with other quantities in the equation. As argued in the introduction, a larger amount of maturing MBs could lead to the issuance of more new debts. It is a valid instrument for two reasons. One is that it is completely predetermined, so neither simultaneity nor reverse causality exists. The other is that because it is a short-term quantity and we have controlled the amount of outstanding bonds, it should not directly affect investors' evaluation of the sustainability of a city's debts.

[13] The geographical range of 0.5 degree along longitude and latitude corresponds to 55 km and 40–50 km, respectively, in China. The median area of a prefectural city is about 10,000 km^2, equivalent to the area of four to five 0.5 × 0.5 degree grids.

In Appendix A2.2, we present a simultaneous equation system and its empirical results based on the theoretic model presented in Appendix A2.1. In the remaining main text, we will focus on Equation (3) instead.

5. Main results for the impacts of mayors' abilities

In this section, we present the regression results for Equations (2) and (3) using data from the primary MB market. The IV approach based on Equation (3) provides consistent estimates for the impact of mayors' abilities on investors' pricing strategy, and we will treat the results as our baseline results. To support those results, we will provide two sets of additional results: (a) a robustness check by replacing GDP by fiscal revenue as the nominator of quantities and (b) a study of the secondary market.

5.1 OLS estimations

We first present and discuss the estimation results of Equation (2), the reduced-form specification, in Table 2. For ease of interpretation, we convert abilities into z-scores by subtracting their mean and dividing the difference by their standard deviation in the regression sample. Column (1) contains the main explanatory variable (ability) and the first group of control variables (the yield of central government bonds) described in Section 4, as well as year-month fixed effects and issuer fixed effects. The coefficient of ability is significantly negative, suggesting that a mayor's higher ability is correlated with lower MB yields. An increase of ability by one standard deviation is associated with a decrease in MB yield by 12.8 basis points. The coefficient of central government bond yields is significant and close to 1, indicating a co-movement between MB yields and central government bond yields.

[Table 2 is here]

Columns (2) and (3) add the second and third groups of control variables: bond characteristics and local economic conditions, respectively. The effect of a mayor's ability is still significantly negative and with similar magnitudes as shown in Column (1). The coefficients of the control variables are as expected. MB yields fall when MB maturity is shorter, bonds have guarantees, or issuers have higher ratings (Column (2)). Those characteristics are associated with better credit conditions and lower default risks of bonds. Local

economic variables also affect bond prices. Higher fiscal revenues and lower levels of outstanding MBs suggest more solid fiscal standing of local governments and, hence, contribute to lower risks of MB defaults (Column (3)).

We control local GDP growth rates in Column (4) to disentangle the effect of ability from local economic growth. The coefficient of ability is still significantly negative, but its magnitude slightly decreases. An increase in ability by one standard deviation is associated with a drop in MB yields by 9.7 basis points. The coefficient of growth rates is negative but insignificant. When we remove ability in Column (5), the coefficient of local GDP growth rates becomes significantly negative. This suggests that while local GDP growth has explanatory power, as implied by the theoretical model in Appendix A2.1, its impacts are superseded by mayors' personal abilities. Our measure of abilities captures mayors' long-term economic performance. Therefore, it is different from short-term local GDP growth and contains more information on mayors' personal profiles that the market values.

5.2 IV estimations

Before applying the IV strategy, as a contrast, we first estimate Equation (3) by the plain OLS method and present the results in Column (1) of Panel A in Table 3. The coefficient of mayors' ability is –0.099 and highly significant. The coefficient of MB issuance is positive and significant. However, as we pointed out before, those results are subject to simultaneity biases.

[Table 3 is here]

The IV results are shown in Columns (2)–(4) in Table 3. Panel A presents the second-stage results and Panel B presents the corresponding first-stage results. Column (2) uses the first IV, the dummy of floods, to instrument the amount of MB issuance over GDP. The first-stage results show a significantly positive correlation between floods and MB issuance, confirming our hypothesis that floods lead to a larger MB issuance. In the second-stage regression, the coefficient of MB issuance is positive but insignificant, different from the plain OLS result. However, the effect of ability is still significantly negative. Its magnitude is –0.127. Column (3) uses the second IV, the amount of a city's maturing MBs over GDP, to replace the first IV. The first-stage results show that the amount of maturing MBs is positively correlated with MB issuance,

consistent with our initial conjectures. The coefficient of ability in the second-stage regression is –0.109 and is statistically significant. Again, the coefficient of MB issuance is positive but insignificant.

In Column (4), we use the two IVs jointly to instrument MB issuance. As we have two instruments, we run an over-identification test and get a J-statistic of 0.59, with a *p*-value of 0.44. So, the hypothesis that all instruments are exogenous is not rejected. In the first-stage regression, the coefficients of the two IVs are both significant. The *p*-value is 0.003, smaller than the *p*-value when one IV is used. Therefore, using two IVs is more efficient and overcomes the concern of weak instruments when only one IV is used. The ratio MB issuance /GDP in the second stage is still positive but not significant, which is similar to the results in Columns (2) and (3).

The point estimate of ability in the second-stage regression in Column (4) is –0.114, larger than the corresponding OLS estimate of –0.097 in Column (4) of Table 2. This result is understandable. The IV estimate measures ability's effect on investors' pricing strategy, and the OLS estimate—if correctly estimated—measures its effect on the equilibrium yield. Because city governments' issuance function is likely to be downward sloping with respect to the bond yield, which is shown to be true by the simultaneous analysis presented in Appendix A2.2, the first effect is mitigated and the effect on the equilibrium yield becomes smaller.

By the IV estimate, an increase in a mayor's ability by one standard deviation reduces investors' bidding yields by 11.4 basis points, which is equivalent to 4.6 percent of the average MB yield spread. To put this effect in perspective, consider an average MB in our sample with a size of 929 million yuan and a maturity of 4.4 years. An increase of one standard deviation in a mayor's ability would reduce debt services by 4.7 million yuan on each bond. On average, 7.7 bonds were issued during a mayor's tenure. A mayor would save around 36 million yuan on debt services if his or her ability were increased by one standard deviation. Given the size of outstanding MBs (8.3 trillion yuan), this implies a total reduction of 9.5 billion yuan in cities' annual interest payments at the end of 2019.

5.3 GDP replaced by fiscal revenues as the nominator

In the model presented in Appendix A2.1, we normalize all the quantities by a city's GDP. There is an argument, though, that fiscal revenue is an alternative because it directly affects a city's capacity for debt

services. We have used GDP because the boundary of a city's fiscal revenue is murky and only regular revenues are recorded. Nevertheless, we replace GDP by regular fiscal revenues and estimate Equation (3) again using the same IVs. The results are presented in the first two columns of Table A2. They are virtually the same as our baseline results.

5.4 Secondary markets

Until now, we have been studying the investors in the primary market of municipal bonds. To provide further support to our baseline results, we turn to the secondary market to see whether bond prices in this market respond to the abilities of the concurrent mayors. After an MB is issued, the incumbent mayor may be moved to another city, promoted, or retired, and the next mayor will inherit debt services. If the market responds to the ability of the original mayor, we reasonably assume that it also responds to the ability of the succeeding mayor who is now responsible to service the debts.

There are several advantages of studying the secondary market. First, the quantity of bonds is predetermined, so we do not need to worry about mayors' effects on issuance decisions. Price volatility purely reflects investors' evaluation of the default risk when it comes to their concern about the issuer. That is, the secondary market provides a good opportunity to study how investors price in the current mayor's ability to repay the debts when they evaluate the debts' default risks. In addition, bonds are traded in the market so we can move the unit of study down to the trade level. This allows exploring within-bond variations so we can avoid bond-level omitted variables. Thus, we can obtain more precise estimates for the impact of mayors' abilities by the simple OLS estimation. The downside, though, is that because the comparison is narrowed down to variations within specific bonds, the effect of mayors' abilities may be underestimated.

The sample of bonds in the secondary market is a subsample of our original sample in the primary market because we cannot find secondary market data for the bonds issued privately to specific investors. In total, we study 2,769 bonds, which are 67 percent of our original sample. The secondary MB market in our sample period was relatively illiquid, and the median length between two trades of a single MB was 15 days. On average, each bond was traded 63 times within the time window of our data (January 1, 2008 to December 31, 2016). In total, we have a sample of 175,651 trades. Each trade is matched to the mayor who was in office at the time of the trade.

Column (3) of Table A2 presents the results. Instead of controlling the issuer fixed effects, we have controlled bond fixed effects. We can then estimate the within-bond effect for mayors' abilities. It turns out that the effect of ability is still highly significant. Although the coefficient, 0.035, is around one-third of the baseline estimate, it still accounts for 3.3 percent of the variation of the yield spreads over the risk-free rate in the secondary market.[14] Overall, the bond fixed effects place a strong control on the nature and characteristics of specific bonds, particularly the type of projects mayors were financing. As a result, the estimated effect reflects a pure value created by more competent mayors in the secondary market.

5.5 Placebo tests

As a last exercise to verify our main results, we present two placebo tests in this subsection. One is to replace the abilities of mayors with that of party secretaries. As we discussed in Section 2, party secretaries do not directly manage a city's economy. As a result, their abilities should not enter investors pricing decisions. Another placebo test is to look at whether mayors' abilities affect corporate bonds issued by private companies located in their cities. While mayors do play a role in the local economy, there is not much reason for investors to link the creditworthiness of a specific private bond to the ability of its city's mayor.

Remember we have obtained party secretaries' abilities together with those of the mayors. Because the terms of party secretaries and the terms of mayors did not overlap much in our sample, party secretaries' estimated abilities are sufficiently different from the mayors'. Table A3 presents the results of the placebo test for party secretaries. Columns (1) and (2) are, respectively, the OLS and IV results obtained directly from Equation (3) in which mayors are replaced by party secretaries. The ability of party secretaries has the right sign but is highly insignificant. Columns (3) and (4) present the OLS and IV results, respectively, for a horse-run model when mayors' abilities and party secretaries' abilities are put together. The effect of mayors' abilities are still significant, and its magnitudes are similar to their counterparts in our baseline results. Party secretaries' abilities are still insignificant. Those results provide confidence for our baseline results.

The source of information for corporate bonds issued by private companies is also WIND. The time span is also 2008–2016. In this period, the number of private bonds was smaller than the number of MBs.

[14] The mean and standard deviation of MB yield spreads in the secondary market were 2.346 and 1.056 percentage points, respectively.

Table A4 presents the results for this sample of private bonds. Because the government does not control the issuance of those bonds, we do not need to include the quantity of issuance in our regressions. The table presents results of four regressions that have different set of controls. None of them has found a significant effect for a mayor's ability. Again, this result reinforces our baseline results.

6. Heterogeneous effects

In this section, we conduct several studies for the heterogeneous effects of mayors' abilities in both OLS and IV estimations. Those studies are intended to provide extra support for our main results. The factors we consider fall in two groups. One is concerned with the characteristics of the bonds, including term, the issuer's rating, and the market of issuance. And the other is concerned with the worthiness of mayors' abilities, including their age and tenure, their city's per-capita GDP, and the city's level of financial development.

6.1 Bond characteristics

The main thrust of our paper is that a mayor's ability serves as a substitute for the creditworthiness of an MB. Therefore, it is natural to envision that MBs with longer terms or lower ratings would benefit more from mayors with higher abilities. In addition, the market where the bond is issued may also matter. As revealed by Section 2, MBs are issued in two markets, the interbank market and the exchange bond market. Market participants of the interbank market are large financial institutions. They tend to do better due diligence and, thus, are more informed. In addition, their number is small. On average, the market participants in the exchange market are less informative than those in the interbank market and their number is larger. As a result, one would expect that mayors' abilities matters more in the exchange market.

[Table 4 is here]

Table 4 reports the heterogeneous effects of ability with respect to the above three bond characteristics. Columns (1) and (2) presents the OLS and IV results for terms. In the regressions, we interact ability with (maturity - 5). So the coefficient of ability is interpreted as ability's impact when maturity is five years, which is the median of maturity in the regression sample. While the magnitudes of this coefficient are about the same, as shown by Table 3, the coefficients of the interaction term are negative and significant, which implies

that ability has larger impacts for bonds with longer terms. That result is consistent with our expectations.

For the issuer's rating, we divide MBs in our sample into three categories according to their respective issuer's rating: (a) AAA or AA+ (33 percent), (b) AA (55 percent), and (c) AA- or below (12 percent). Treating the third group as the omitted group, we interact the dummies of the other two groups with mayors' abilities. Columns (3) and (4) in Table 4 present the results of OLS and IV estimations, respectively. Both the OLS and IV regressions show that issuers with AA- ratings significantly benefit from more competent mayors. There is no significant gap between AA bonds and AA- bonds, but the IV regression finds a significant gap between the best-rated group of bonds and AA- bonds. Therefore, at least for the worst-rated bonds, mayors' abilities have a significantly larger impact than for the best-rated bonds.

The last two columns report the OLS and IV results of the two different markets. The omitted category is the exchange bond market. Mayors' abilities are found to be highly significant in this market. The IV regression, though, finds that the effect of mayors' abilities are significantly smaller in the interbank market. This result is consistent with the fact that investors in this market are more informative, and their number is smaller than those in the exchange bond market. All in all, the results of Table 4 reinforce our main hypothesis that mayors' abilities substitute for MBs' creditworthiness.

6.2 Mayors' incentives

Like all other politicians in China, a major concern for mayors is their chances of promotion. They tend to work hard when their chances of promotion are large and tend to relax when those chances diminish. Age is an important factor for a politician's career because China's political system implements a strict retirement rule. For city-level officials, the retirement age is 60 years old. The chance of promotion becomes virtually zero after a mayor or city party secretary reaches 57 years old. Studies have found that the incentive of city officials diminishes significantly after that age (Yao and Zhang 2015; Xi, Yao, and Zhang 2018). Aware of this issue, market investors would be less enthusiastic about an older mayor's ability to develop the local economy.

Tenure may also affect investors' pricing decisions, but for different reasons. The regular term of an official is five years, which corresponds to the cycle of the party's congress. There are political business cycles, and city officials take riskier projects to boost growth in years moving toward the next party congress (Xi, Yao, and Zhang 2018). Projects may not be finished by the time the current mayor finishes his or her

term, and the new mayor may not honor the old debts. Therefore, investors have reasons to value mayors' abilities less when mayors are in the final years of their tenures.

[Table 5 is here]

Table 5 presents the heterogeneous effects of ability with respect to mayors' age (Columns (1) and (2)) and tenure (Columns (3) and (4)). Columns (1) and (3) are OLS results estimated from Equation (2), and Columns (2) and (4) are IV results estimated from Equation (3). In Columns (1) and (2), mayors are divided into four age groups: 55 and younger, 56 and 57, 58, and 59 and older. We group ages 56 and 57 together because they form the transition period in a mayor's career. The results are very telling. For mayors 55 and younger, ability has a strong effect on the yield. As mayors approach the retirement age of 60, their impact on yields decreases—mayors at 59 and older hardly affect yields. In Columns (3) and (4), mayors are identified by the year of their terms: the first year, the second year, and the third year or beyond. The market gives first-year mayors a significant reward for their abilities. The gaps between later years and the first year in the OLS estimation are positive but not significant (Column (3)). The IV estimation, though, does show a significant gap between the first year and the third year or beyond.

6.3 Per-capita GDP and financial development

In general, the role of politicians affecting the economy is smaller in countries or regions with higher income because affluence is often associated with better self-organization of the market and society. Mapped to our case, this means that mayors' abilities would have smaller impacts on MB yields in more affluent cities than in poorer cities. Columns (1) and (2) in Table 6 show the OLS and IV results, respectively, when mayors' abilities are interacted with log GDP per capita of a city. The OLS and IV regressions show similar results. While ability is still significantly negative, the interaction term is significantly positive. The impact of mayors' abilities will decline by 11.5 basis points when a city's GDP per capita is doubled. In China, the gap of income between cities can easily reach three- to fourfold. So the impact of mayors' abilities varies significantly across cities.

[Table 6 is here]

A mayor's role also depends on the development of local financial markets. With a more developed financial market, LGFVs can find alternative financial resources to supplement their borrowings from the MB market. In addition, a more developed financial market is often associated with a better rule of law and less government interference. MB investors have reasons to discount the role played by competent mayors in cities with more developed financial markets. The last two columns in Table 6 show the OLS and IV results when we interact mayors' abilities with the ratio of total social financing over GDP. Total social financing is an official statistic that sums up the volumes of funds provided by banks and nonbank financial institutions to the real economy. Thus, the ratio is an indicator for the depth of financial markets. Again, the OLS results and the IV results are qualitatively the same. While total social financing over GDP itself is insignificant, the interaction term is significant and positive, which indicates that investors discount mayors' abilities in cities with more sophisticated financial markets.

In sum, the heterogeneous effects found in this section are consistent with our theoretical argument that mayors' abilities enhance the creditworthiness of the municipal bonds issued by their cities. Investors reward ability less on municipal bonds with longer terms or better ratings or those issued in the market with more informative investors. They discount the role of mayors' abilities when mayors are later in their careers or are in the later years of their current terms because mayors are less incentivized at those stages. They also rightly cut the reward to ability on bonds issued by more affluent or financially more developed cities because the performance of MBs in those cities depends less on their mayors' abilities.

7. Robustness Checks for the measure of ability

We obtained mayors' abilities by estimating their fixed effects in the city growth equation. This estimation faces several challenges. The most serious challenge is that the estimated ability may be incidental in the sense that it either reflects cities' intrinsic growth potentials in specific periods or merely picks up heteroscedastic shocks that cities received when individual mayors served there. Another challenge is that our estimation relies on the largest connected sample, which was created by lateral moves of officials. However, those moves are not random because they are often signs of future promotion. The third challenge is that city officials have heterogeneous personal connections to the provincial party secretary who may support affiliated mayors. In that case, politicians' fixed effects in the growth regression may pick up their

connections to the party secretary. The last challenge is that there is an econometric issue associated with our estimation strategy. Using the estimated ability in other regressions may introduce biases to its coefficients and standard errors. Yao and Zhang (2015) have dealt with each of those challenges and found that they do not pose serious threats to their main results.

For the first challenge, we will follow Yao and Zhang (2015) to provide a permutation test to show that our measure of ability is not incidental. The second challenge is less a problem because our largest connected sample is large enough and the impacts of nonrandom moves are minimized. Then we deal with the third challenge by considering personal connections in the growth equation. For the fourth challenge, we adopt several measures to mitigate the problem or to validate our baseline results. The first measure is to convert the estimated ability into a dichotomous measure of low and high ability so as to reduce the correlation between the estimated abilities and the errors in the investors' pricing function. The second measure is to directly use the average growth rate to replace the estimated ability. The growth rates are the basis for us to estimate abilities. Using them will avoid the issue associated with estimated abilities, but the downside is that they contain more noises and may arrive at less robust results. The last measure is to use years of education to approximate ability.

As we alluded to in Section 2, a city's party secretary should not be on the investors' radar screen when they evaluate the default risk of a particular bond. As the last step to validate the measure of ability, we will then replace mayors by party secretaries to conduct a placebo test.

7.1 Permutation of tenures

To address the issue of ability incidentally measured, we perform a placebo test by randomly permuting mayors' tenures within a city. Specifically, within each city, we randomly split 1994–2017 into subperiods with their number equaling the number of actual tenures of mayors who served in the city in our sample periods. We then randomly assign a mayor to each sub-period. That is, we randomize mayors' tenures within a city. In effect, we have created a set of counterfactual mayors. We then estimate a new set of "abilities" for those counterfactual mayors by the "tenures" they have been assigned to, and we match the counterfactual mayors' abilities to bonds issued during those tenures. If the ability we estimate is only incidental to the respective sub-periods that individual mayors have served and, thus, not intrinsic to individual mayors, then

we should still find a significant correlation between the "abilities" of the counterfactual mayors and the yield of bonds issued in their fake "tenures."

We have performed 999 rounds of permutations. In each round, we estimate the growth equation, Equation (1), and the OLS specification of yields as presented in Column (4) of Table 3. It is possible that yields are incidentally correlated with the abilities of the counterfactual mayors. Our purpose is to see where the magnitude and significance of our original estimate are situated. Figure 6 presents the results in two panels. In Panel A, we sort the 999 point estimates together with our original estimate by their magnitudes and present their 99 percent confidence intervals. Our original estimate is located at the 6.3 highest percentile. In Panel B, we present the distribution of the *t*-statistics. It is close to normal with a mean between –1 and 0. The *t*-statistic of our original estimate is located at the 2.0 highest percentile. Less than 10 percent of the counterfactual mayors' abilities have significant effects on MB yields in the OLS specification. Those results buttress our confidence that our measure of ability is not incidental.

[Figure 6 is here]

7.2 Personal connections

To address the concern of personal connections, we re-estimate Equation (1), the city growth equation, by adding a set of dummy variables that indicate mayors' personal connections to the current provincial party secretary. The definitions of those variables are similar to those in Landry, Lü, and Duan (2018). The first dummy is whether the mayor and the provincial party secretary were born in the same city, the second dummy is whether they went to the same university, and the third dummy is whether they had worked in the same city at the same time. Column (1) of Table 7 presents the IV results of the new set of estimated ability. The coefficient of ability, –0.115, has virtually the same magnitude as our baseline estimates, –0.114 in Column (4) of Table 3, and remains statistically significant. Therefore, we conclude that our main results are robust to taking care of personal connections.

[Table 7 is here]

7.3 Replacing the estimated ability by alternative measures

The abilities we have used in the regressions are parameters estimated from the growth equation, which could contain measurement errors and, thus, bias the estimation of standard errors. Yao and Zhang (2015) deal with this issue by conducting a joint estimation. But to ensure accurate estimates for ability, the sample we have used for the city growth equation is much larger than the sample we have used for the bond pricing equation. Therefore, a joint estimation is not feasible. Here we adopt another approach to replace the estimated abilities by alternative measures of ability. There are three sets of alternative measures.

First, we convert the estimated ability into a dichotomous variable of low and high ability. The cutoff is the sample median. This coarser measure reduces the correlation between the estimated ability and the error term in the investors' pricing function, but it also contains less information than the continuous measure of ability, which could reduce the efficiency of estimation. Column (2) of Table 7 shows that a high-ability mayor enjoys a yield premium of 9.9 basis points than a low-ability mayor.

Then, we replace the estimated ability by the growth rates that we have used to estimate them. It is very common in the literature to use the average growth rate to measure politicians' economic performance (Li and Zhou 2005; Jia, Kudamatsu, and Seim 2015; Landry, Lü, and Duan 2018). But directly using the growth rates will introduce noises into the estimation. The ability estimated from Equation (1) controls the city and time factors that may confound mayors' contributions to local growth. If we still obtain significant results with the growth rates, then we can be more assured that our results with the estimated abilities are robust.

We adopt two types of average growth rate: (a) career average, which is the mean of annual GDP growth rate in all the years when the current mayor served as either a mayor or a city party secretary in the current city or other cities, and (b) current city average, which is the average GDP growth rate in the mayor's current city that issued the specific bond. To make the growth rates comparable across years and provinces, we have subtracted the provincial mean in each year before we calculate the averages. The idea of the career average is very close to our measure of ability that considers a mayor's economic performance in his or her career as a city leader. The current city average takes out a mayor's performance in other cities, so it is more relevant to the yields of MBs issued in the current city.

Columns (3) and (4) of Table 7 present the results. The coefficients of the two average growth rates remain significant although their magnitudes become smaller, and their statistical significance is weaker than

the coefficient of ability. This probably reflects that the averages contain more noises than the estimated ability. However, to the extent that they avoid the mechanical correlation that possibly exists in the regressions involving the estimated ability, the present exercise does buttress our baseline results.

We then use years of education as a substitute for ability.[15] Education is a key component in human capital. And it is a very pronounced signal that investors will probably consider when they evaluate a politician's ability. One good thing is that there is almost no measurement error in the years of education. In addition, years of education may reflect different dimensions of ability than the growth-related measures, so it can serve as a cross-test of the previous results. Column (5) reports the results of years of education. As we expected, more educated mayors enjoy lower bond yields.

8. Conclusion

In this paper, we try to answer the question of whether market investors reward more competent mayors who bring faster economic growth to their cities. Combining data from China's municipal bond markets and data on officials from CCER-COD, we find that a mayor's ability is a significant factor in determining investors' bidding yields in the MB market. An increase of one standard deviation in a mayor's ability reduces investors' bidding yields by 11.4 basis points in the primary market, which is equivalent to saving 36 million yuan during an average mayor's tenure. We have conducted heterogeneous and robustness analyses to support our baseline results. In addition to contributing to the literature on China's financial development and political selection, our paper makes a broader contribution to the literature on the relationship between market and government.

The received wisdom among social scientists is that institutions are more important than the quality of officials for good governance. However, institutions are incomplete, just like any other social contract. Even under the best-designed institutions, officials have sizable discretionary power. As a result, their quality matters and, in critical junctures, often plays a critical role. While the market is often a source of corrupt politicians (see, for example, Chen and Kung 2019), this paper shows that the market also recognizes and rewards more competent ones. This may not immediately eliminate incompetent politicians, but in the long

[15] As many politicians have part-time education experiences after they took a local leader position, we only count the highest education achievement before they became government officials.

run, it creates more opportunities for more competent politicians to emerge. As revealed by several studies reviewed in the introduction, more competent politicians are more likely to be promoted in the Chinese political hierarchy. The MB market plays a role in revealing individual mayors' abilities and, for that, contributes to good governance.

Our results, though, may be specific to China's unique political system; it remains a question whether the market also rewards or punishes politicians in a democracy. The hard part is how to come up with a uniform measure for politicians' personal abilities. This paper takes advantage of one of the unique features of China's political system, namely, lateral moves of officials, and we can construct a ranking for all the officials in different localities. Lateral moves are rare in a democracy. Researchers need to find other ways to measure politicians' abilities in democracies.

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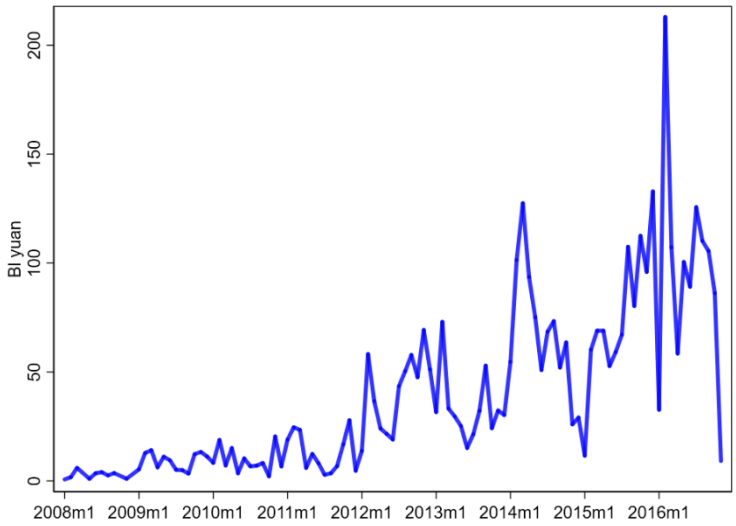
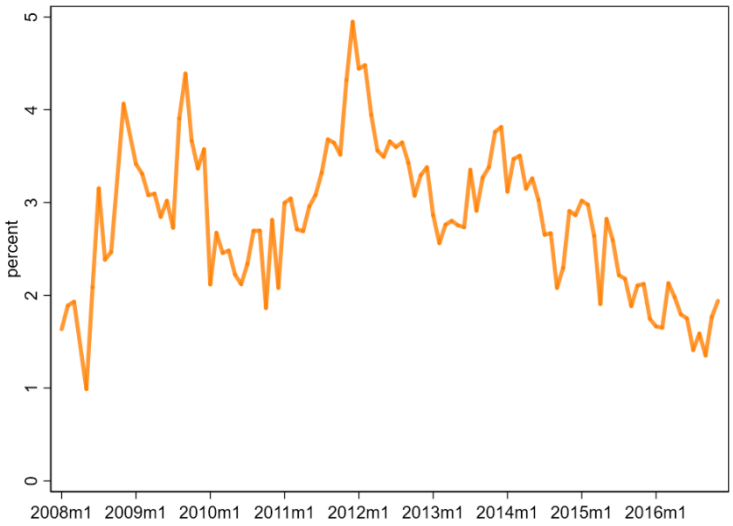
Figures

Figure 1. Monthly issuance of MBs, 2008–2016



Note: MBs issued by provincial governments and county-level city governments are not included.

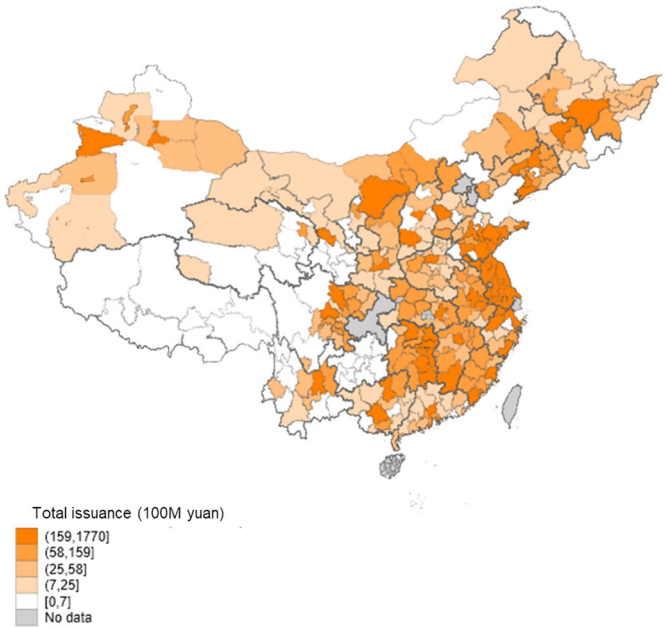
Figure 2. Average yield spread of MBs by month, 2008–2016



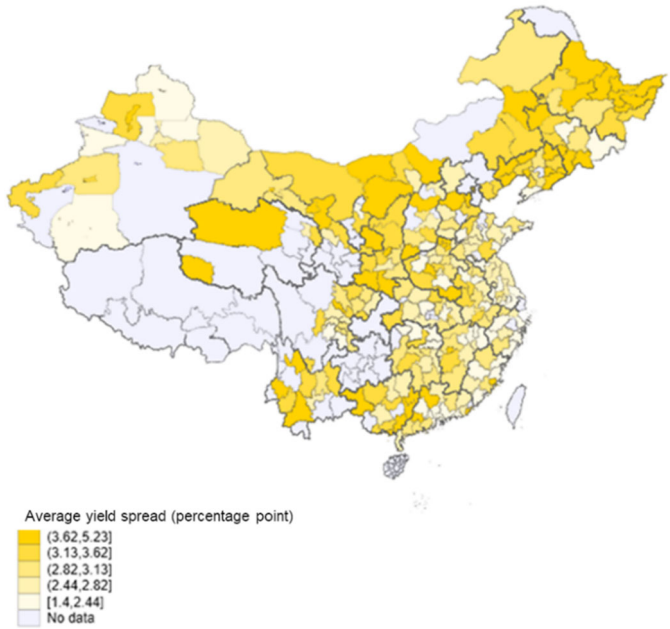
Note: MBs issued by provincial governments and county-level city governments are not included.

Figure 3. Geographic distribution: MB issuance and their average yield spreads, 2008–2016

A. Outstanding MBs

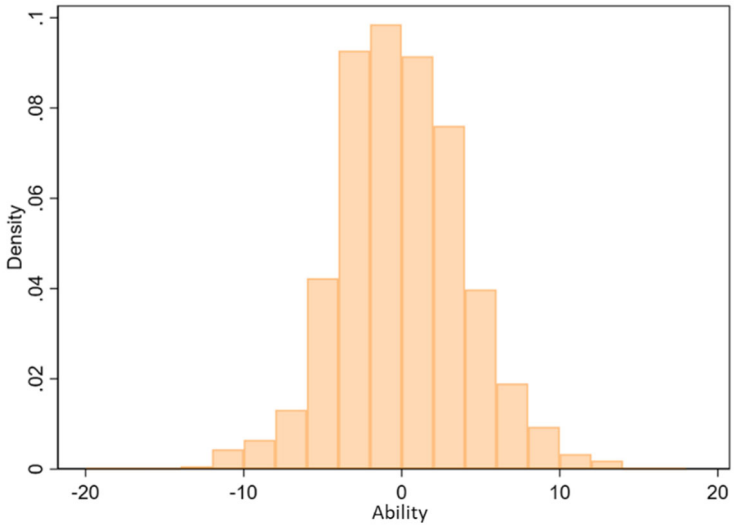


B. Average yield spreads



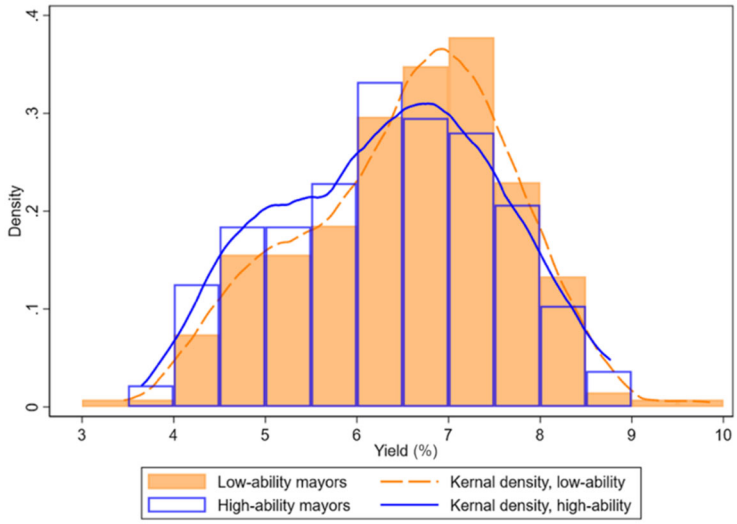
Note: MBs issued by provincial governments and county-level city governments are not included.

Figure 4. Distribution of politicians' abilities



Note: This figure shows the distribution of abilities in the largest connected sample of mayors and party secretaries in CCER-COD.

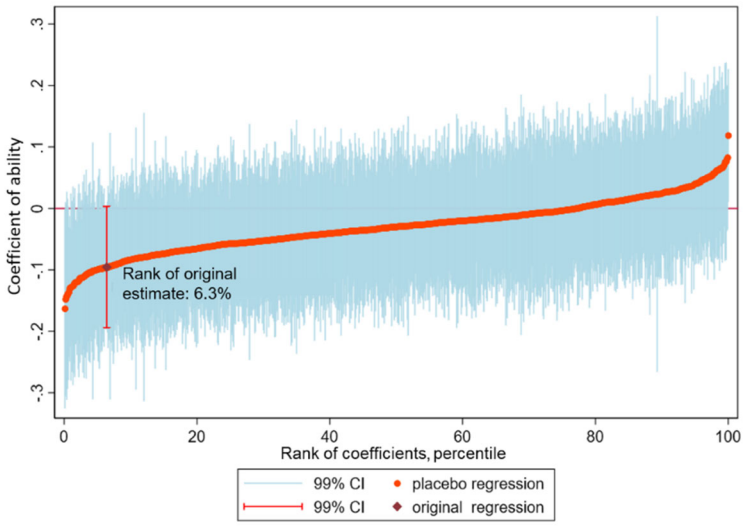
Figure 5. Distributions of bond yields by mayors' abilities



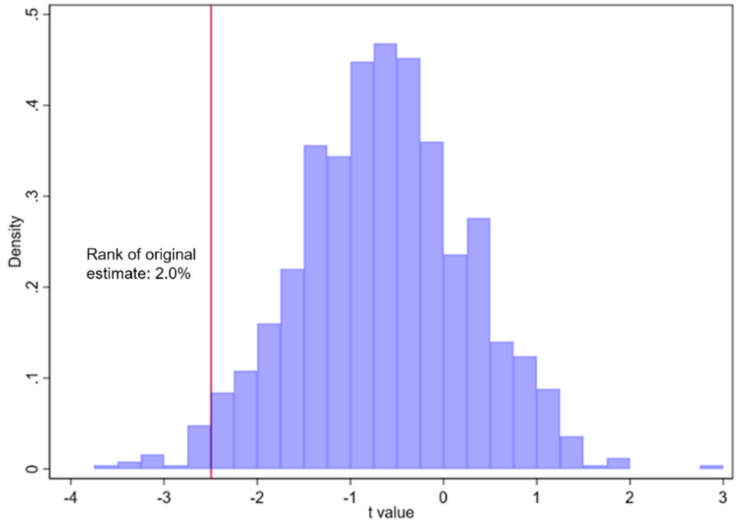
Note: The figure shows the distributions of the means of bond yields in each mayor tenure. Low- (high-) ability mayors have abilities below (above) the sample median. To take out the regional effects, we first regress yields on provincial dummies and add the residuals back to the average yield.

Figure 6. Results of mayor term permutations

Panel A: Distribution of point estimates



Panel B: Distribution of *t*-statistics



Note: The figures show the distribution of coefficients and *t*-statistics of the counterfactual mayors' abilities in MB yield regressions. To address the issue of ability incidentally measured, we perform a placebo test by randomly permuting mayors' tenures within a city. We have performed 999 rounds of random permutations of mayor terms. In each round, we estimate the growth equation, Equation (1), and the OLS specification of yields as presented in Column (4) of Table 3. Our original estimate and its *t*-statistic is located at the 6.3 and 2.0 highest percentile, respectively.

Tables

Table 1. Summary statistics

Variable	N	Mean	S.D.	Min	Max
Bond level					
Yield (%)	4,154	5.597	1.518	1.890	10.50
Yield spread (%)	4,154	2.513	1.131	0.252	7.027
Amount (100 million yuan)	4,154	9.286	6.290	0.500	75.00
% Amount as GDP	4,154	0.385	0.488	0.006	6.958
% Amount as fiscal revenue	4,154	5.122	7.970	0.055	204.7
% Outstanding bonds as GDP	4,154	4.766	3.898	0.000	19.94
Maturity (years)	4,154	4.451	2.509	0.085	20.02
Guaranteed (= 1)	4,154	0.109	0.311	0.000	1.000
Interbank market (=1)	4,154	0.616	0.486	0.000	1.000
Issuer: AAA	4,154	0.076	0.264	0.000	1.000
Issuer: AA+	4,154	0.257	0.437	0.000	1.000
Issuer: AA	4,154	0.551	0.497	0.000	1.000
Issuer: AA-	4,154	0.082	0.274	0.000	1.000
Issuer: other ratings	4,154	0.035	0.184	0.000	1.000
Issuance of corporate bonds, current month (100 million yuan)	4,154	1,143	1,294	0.000	4,465
Flood in the last rainy season (= 1)	4,154	0.206	0.405	0.000	1.000
% Bonds due in the last 3 months as GDP	4,154	0.157	0.331	0.000	2.800
Mayor's tenure at the time of issuance (years)	4,154	2.535	1.369	1.000	7.000
City-year level					
GDP growth rate (%)	1,004	10.10	3.23	-8.80	20.00
GDP (100 million yuan)	1,004	2,698	2,733	172	19,547
GDP per capita (10,000 yuan)	1,004	5.871	5.482	0.713	48.67
Population (million)	1,004	4.812	2.480	0.202	13.99
Fiscal revenue (100 million yuan)	1,004	234.6	295.1	5.86	3,134
Total social financing/GDP	1,004	0.937	0.513	0.168	3.566
Mayor's age	1,004	51.0	3.7	37.0	61.0
Connection to provincial PS: college classmates	1,004	0.134	0.341	0.000	1.000
Connection to provincial PS: same hometown	1,004	0.011	0.104	0.000	1.000
Connection to provincial PS: colleagueship	1,004	0.011	0.104	0.000	1.000
Official level					
Local leader ability (all officials in 1994–2017)	2,401	0.00	4.07	-28.08	16.70
Mayor's ability in the regression sample	541	0.20	3.42	-8.96	10.80

Table 2. Effects of mayors' abilities on MB yields: OLS estimations

	(1)	(2)	(3)	(4)	(5)
Dependent variable	Yield (%)	Yield (%)	Yield (%)	Yield (%)	Yield (%)
Mayors' ability (z-score)	-0.128***	-0.157***	-0.117***	-0.097***	
	(0.039)	(0.039)	(0.034)	(0.038)	
Interest rate of government bonds (%)	1.233***	1.067***	1.050***	1.052***	1.048***
	(0.047)	(0.073)	(0.073)	(0.073)	(0.073)
Maturity (years)		0.039***	0.042***	0.042***	0.043***
		(0.010)	(0.010)	(0.010)	(0.010)
Interbank market (yes = 1, no = 0)		-0.030	-0.008	-0.008	-0.006
		(0.033)	(0.032)	(0.032)	(0.032)
Guaranteed (yes = 1, no = 0)		-0.333***	-0.300***	-0.304***	-0.299***
		(0.055)	(0.055)	(0.055)	(0.055)
Issuer: AAA		-1.285***	-1.289***	-1.286***	-1.273***
		(0.143)	(0.143)	(0.143)	(0.143)
Issuer: AA+		-1.069***	-1.036***	-1.036***	-1.027***
		(0.121)	(0.122)	(0.122)	(0.122)
Issuer: AA		-0.820***	-0.775***	-0.781***	-0.772***
		(0.115)	(0.117)	(0.117)	(0.117)
Issuer: AA-		-0.386***	-0.364***	-0.366***	-0.359***
		(0.124)	(0.124)	(0.124)	(0.124)
ln(Lagged fiscal revenue)			-0.836***	-0.804***	-0.790***
			(0.155)	(0.155)	(0.153)
ln(Lagged GDP per capita)			-0.308	-0.224	-0.254
			(0.330)	(0.333)	(0.332)
ln(Lagged population)			0.257	0.307	0.295
			(0.419)	(0.422)	(0.425)
Bonds outstanding/GDP (%)			0.018**	0.018**	0.020**
			(0.008)	(0.008)	(0.008)
Lagged annual growth rate				-0.015	-0.024**
				(0.010)	(0.009)
Year-month FEs	Yes	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes	Yes
Observations	4154	4154	4154	4154	4154
Adjusted R^2	0.855	0.864	0.868	0.868	0.867

Note: Results are estimated from Equation (2). Robust standard errors are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3. Effects of mayors' abilities on MB yields: IV estimations

	(1)	(2)	(3)	(4)
Panel A: Second-stage results	OLS	2SLS		
Dependent variable	Yield (%)	Yield (%)	Yield (%)	Yield (%)
Mayors' ability (z-score)	-0.099***	-0.127***	-0.109***	-0.114***
	(0.037)	(0.047)	(0.036)	(0.037)
MB issuance/GDP (%)	0.107*	1.787	0.691	1.033
	(0.057)	(1.240)	(0.825)	(0.699)
ln(Lagged fiscal revenue)	-0.770***	-0.238	-0.585**	-0.477*
	(0.156)	(0.432)	(0.283)	(0.255)
ln(Lagged GDP per capita)	-0.229	-0.312	-0.258	-0.275
	(0.332)	(0.378)	(0.293)	(0.311)
ln(Lagged population)	0.237	-0.860	-0.144	-0.368
	(0.426)	(0.979)	(0.662)	(0.630)
Bond outstanding/GDP (%)	0.020**	0.047**	0.030**	0.035***
	(0.008)	(0.022)	(0.015)	(0.013)
Lagged annual growth rate	-0.016	-0.041*	-0.025	-0.030**
	(0.010)	(0.022)	(0.015)	(0.015)
Panel B: First-stage results		MB Issuance/	MB Issuance/	MB Issuance/
Dependent variable		GDP (%)	GDP (%)	GDP (%)
IV1: floods (yes = 1, no = 0)		0.027**		0.024**
		(0.012)		(0.012)
IV2: Bond matured/GDP (%)			0.049**	0.047**
			(0.020)	(0.020)
Mayors' ability (z-score)		0.018	0.016	0.017
		(0.022)	(0.022)	(0.022)
ln(Lagged fiscal revenue)		-0.315***	-0.310***	-0.309***
		(0.082)	(0.082)	(0.082)
ln(Lagged GDP per capita)		0.050	0.036	0.038
		(0.179)	(0.180)	(0.180)
ln(Lagged population)		0.650**	0.612**	0.611**
		(0.310)	(0.309)	(0.309)
Bond outstanding/GDP (%)		-0.016***	-0.018***	-0.018***
		(0.004)	(0.004)	(0.004)
Lagged annual growth rate		0.014***	0.014***	0.014***
		(0.005)	(0.005)	(0.005)
Year-month FEs	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
F-statistics for instruments		5.237	6.089	5.678
p-value		0.022	0.014	0.003
Observations	4154	4154	4154	4154
Adjusted R^2	0.868	0.817	0.862	0.852

Note: Results are estimated from Equation (3). Robust standard errors are in parentheses. Other variables controlled but not shown in this table include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), and issuer rating dummies. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Heterogeneous effects of mayors' abilities by bond characteristic

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
	Yield (%)	Yield (%)	Yield (%)	Yield (%)	Yield (%)	Yield (%)
Mayors' ability (z-score)	-0.099***	-0.118***	-0.106**	-0.144**	-0.120***	-0.171***
	(0.038)	(0.038)	(0.054)	(0.059)	(0.041)	(0.053)
Mayors' ability × (Maturity-5)	-0.010*	-0.018**				
	(0.006)	(0.008)				
Mayors' ability × Issuer: AA			0.000	0.027		
			(0.047)	(0.050)		
Mayors' ability × Issuer: AA+, AAA			0.091	0.117*		
			(0.073)	(0.070)		
Mayors' ability × Inter-bank market					0.036	0.088*
					(0.029)	(0.046)
MB issuance/GDP (%)		1.071		1.020		1.055
		(0.727)		(0.706)		(0.717)
Year-month FEs	Yes	Yes	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Omitted group			Issuer: AA- or below		Exchange bond market	
F-statistics for instruments		5.337		5.358		5.640
p-value		0.005		0.005		0.004
Observations	4154	4154	4154	4154	4154	4154
Adjusted R^2	0.868	0.852	0.868	0.853	0.868	0.852

Note: OLS results are estimated from Equation (2), and IV results are estimated from Equation (3). MB issuance/GDP (%) is instrumented by *floods* and bond matured/GDP (%) in Columns (2), (4), and (6). Robust standard errors are in parentheses. Other variables controlled but not shown in this table include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), issuer rating dummies, ln(Lagged fiscal revenue), ln(Lagged GDP per capita), ln(Lagged population), Bond outstanding/GDP (%), and Lagged annual growth rate. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Heterogeneous effects of mayors' abilities by mayors' age and tenure

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Dependent variable	Yield (%)	Yield (%)	Yield (%)	Yield (%)
Mayors' ability (z-score)	-0.120***	-0.133***	-0.101**	-0.119***
	(0.043)	(0.044)	(0.044)	(0.042)
Mayors' ability × Age: 56-57	0.047	0.018		
	(0.040)	(0.050)		
Mayors' ability × Age: 58	0.006	0.032		
	(0.055)	(0.071)		
Mayors' ability × Age: 59 and older	0.137**	0.141**		
	(0.059)	(0.056)		
Mayors' ability × Tenure: 2nd year			0.029	0.037
			(0.034)	(0.030)
Mayors' ability × Tenure: 3rd+ year			0.040	0.048*
			(0.031)	(0.028)
MB issuance/GDP (%)		1.335*		0.986
		(0.742)		(0.686)
Year-month FEs	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Omitted group	Age: 55 and younger		Tenure: 1st year	
F-statistics for instruments		5.270		5.625
p-value		0.005		0.004
Observations	4154	4154	4154	4154
Adjusted R^2	0.868	0.842	0.868	0.855

Note: OLS results are estimated from Equation (2), and IV results are estimated from Equation (3). MB issuance/GDP (%) is instrumented by *floods* and bond matured/GDP (%) in Columns (2) and (4). Robust standard errors are in parentheses. Other variables controlled but not shown in this table include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), issuer rating dummies, ln(Lagged fiscal revenue), ln(Lagged GDP per capita), ln(Lagged population), Bond outstanding/GDP (%), and Lagged annual growth rate. Age dummies and tenure year dummies are controlled in Columns (1)–(2) and (3)–(4), respectively. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6. Heterogeneous effects of mayors' abilities by cities' per-capita GDP and financial development

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Dependent variable	Yield (%)	Yield (%)	Yield (%)	Yield (%)
Mayors' ability (z-score)	-0.240***	-0.294***	-0.278***	-0.340***
	(0.072)	(0.083)	(0.075)	(0.082)
Mayors' ability × ln(GDP per capita)	0.091**	0.115***		
	(0.041)	(0.044)		
Mayors' ability × Total social financing/GDP			0.177***	0.218***
			(0.059)	(0.061)
Total social financing/GDP (%)			-0.056	-0.074
			(0.143)	(0.141)
MB issuance/GDP (%)		1.094		1.250*
		(0.714)		(0.738)
Year-month FEs	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
F-statistics for instruments		5.445		5.405
p-value		0.004		0.005
Observations	4154	4154	4154	4154
Adjusted R^2	0.868	0.850	0.868	0.845

Note: OLS results are estimated from Equation (2), and IV results are estimated from Equation (3). MB issuance/GDP (%) is instrumented by *floods* and bond matured/GDP (%) in Columns (2) and (4). Robust standard errors are in parentheses. Other variables controlled but not shown in this table include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), issuer rating dummies, ln(Lagged fiscal revenue), ln(Lagged GDP per capita), ln(Lagged population), Bond outstanding/GDP (%), and Lagged annual growth rate. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Robustness checks: alternative measures of ability

	(1)	(2)	(3)	(4)	(5)
	IV	IV	IV	IV	IV
	Political connections controlled	High/low ability dummy	Career average growth	Current city growth	Years of education
Dependent variable	Yield (%)	Yield (%)	Yield (%)	Yield (%)	Yield (%)
Mayors' ability (connections controlled, z-score)	-0.115***				
	(0.038)				
Mayor: high ability (yes=1, no=0)		-0.099*			
		(0.059)			
Mayor: career average growth rate			-0.047***		
			(0.018)		
Mayor: current city growth rate				-0.043**	
				(0.017)	
Mayor: years of education					-0.011*
					(0.006)
MB issuance/GDP (%)	1.058	1.067	0.965	0.919	1.026
	(0.691)	(0.698)	(0.677)	(0.687)	(0.689)
Year-month FEs	Yes	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes
F statistics for instruments	5.654	5.577	5.687	5.411	5.679
p-value	0.004	0.004	0.003	0.005	0.003
Observations	4154	4154	4154	4154	4154
Adjusted R^2	0.855	0.854	0.858	0.859	0.856

Note: The table presents the second-stage results estimated from Equation (3). MB issuance/GDP (%) is instrumented by *floods* and bond matured/GDP (%) as Column (4) of Table 3. Robust standard errors are in parentheses. Other variables controlled but not shown in Columns (1)–(5) include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), issuer rating dummies, ln(Lagged fiscal revenue), ln(Lagged GDP per capita), ln(Lagged population), Bond outstanding/GDP (%), and Lagged annual growth rate. Mayors' ability in Column (1) is the politicians fixed effects in the growth equation with additional political connection dummies controlled. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Appendices

A1. Additional tables

Table A1. Floods and economic growth

	(1)	(2)
Dependent variable	Growth rate	Growth rate
Floods in the previous year	0.241	-0.014
	(0.194)	(0.179)
ln(GDP per capita)		9.812***
		(0.550)
ln(Population)		11.908***
		(1.210)
Year FEs	Yes	Yes
City FEs	Yes	Yes
Observations	2,151	2,151
Adjusted R^2	0.593	0.655

Note: Standard errors are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A2. Robustness checks: issuance/fiscal revenue replacing issuance/GDP and secondary market pricing

	(1)	(2)	(3)
Sample	Primary market		Secondary market
	OLS	IV	OLS
Dependent variable	Yield (%)	Yield (%)	Yield(%)
Mayors' ability (z-score)	-0.093**	-0.090**	-0.035**
	(0.038)	(0.036)	(0.018)
MB issuance/Fiscal revenue (%)	0.007**	0.042	
	(0.003)	(0.036)	
ln(Lagged fiscal revenue)	-0.770***	-0.494	-0.309***
	(0.160)	(0.311)	(0.072)
ln(Lagged GDP per capita)	-0.262	-0.445	-0.049
	(0.338)	(0.356)	(0.160)
ln(Lagged population)	0.271	-0.369	0.562**
	(0.426)	(0.770)	(0.256)
Bond outstanding/Fiscal revenue (%)	0.002**	0.002***	0.702
	(0.001)	(0.001)	(0.703)
Lagged annual growth rate	-0.017*	-0.028*	0.006
	(0.010)	(0.015)	(0.005)
Year-month FEs	Yes	Yes	Yes
Issuer/bond FEs	Yes	Yes	Yes
Other controls	Yes	Yes	Yes
F statistics for instruments		7.026	
p-value		0.001	
Observations	4154	4154	175,651
Adjusted R^2	0.868	0.862	0.808

Note: Columns (1) and (2) are OLS and second-stage results, respectively, based on Equation (3) using data from the primary market, and Column (3) is OLS results based on Equation (2) using data from the secondary market. MB issuance/Fiscal Revenue (%) is instrumented by *floods* and bond matured/GDP (%) in the IV regression. Robust standard errors are in parentheses. Other variables controlled but not shown in Columns (1) and (2) include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), and issuer rating dummies. Other variables controlled but not shown in Column (3) include Interest rate of government bonds (%) and bond rating dummies. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. The effects of city party secretaries' abilities on MB yields

	(1)	(2)	(3)	(4)
	OLS	IV	OLS	IV
Dependent variable	Yield (%)	Yield (%)	Yield (%)	Yield (%)
PSs' ability (z-score)	-0.063	-0.055	-0.040	-0.025
	(0.040)	(0.038)	(0.042)	(0.040)
Mayors' ability (z-score)			-0.090**	-0.109***
			(0.039)	(0.039)
MB issuance/GDP (%)	0.104*	1.082	0.107*	1.058
	(0.057)	(0.707)	(0.057)	(0.695)
Lagged annual growth rate	-0.021**	-0.038**	-0.015	-0.029**
	(0.010)	(0.016)	(0.010)	(0.015)
Year-month FEs	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
F statistics for instruments		5.691		5.825
p-value		0.003		0.003
Observations	4154	4154	4154	4154
Adjusted R^2	0.868	0.852	0.868	0.853

Note: The table shows the OLS and second-stage results based on Equation (3). MB issuance/GDP (%) is instrumented by *floods* and bond matured/GDP (%) in the IV regressions. Robust standard errors are in parentheses. Other variables controlled but not shown in this table include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), issuer rating dummies, ln(Lagged fiscal revenue), ln(Lagged GDP per capita), ln(Lagged population), and Bond outstanding/GDP (%). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A4. Mayors' abilities and the yields of private bonds

	(1) Yield (%)	(2) Yield (%)	(3) Yield (%)	(4) Yield (%)
Mayors' ability (z-score)	0.057	-0.102	0.038	0.060
	(0.275)	(0.267)	(0.263)	(0.259)
Interest rate of government bonds (%)	1.029***	0.645***	0.645***	0.634***
	(0.140)	(0.188)	(0.189)	(0.189)
Maturity (years)		0.099***	0.101***	0.100***
		(0.031)	(0.031)	(0.031)
Guaranteed (yes = 1, no = 0)		-0.524**	-0.495**	-0.491**
		(0.214)	(0.212)	(0.211)
Interbank market (yes = 1, no = 0)		-0.134	-0.154	-0.154
		(0.174)	(0.174)	(0.173)
Issuer: AA		-0.217**	-0.237**	-0.234**
		(0.103)	(0.104)	(0.104)
Issuer: AA+		-1.091***	-1.053***	-1.057***
		(0.168)	(0.167)	(0.166)
Issuer: AAA		-1.413***	-1.375***	-1.344***
		(0.420)	(0.419)	(0.420)
ln(Fiscal revenue)			-0.540	-0.370
			(0.463)	(0.479)
ln(GDP per capita)			-1.172*	-1.061
			(0.638)	(0.654)
ln(Population)			-0.080	0.054
			(1.253)	(1.255)
Annual growth rate				-0.047*
				(0.025)
Year-month FEs	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes
Observations	2577	2577	2577	2577
Adjusted R^2	0.815	0.826	0.827	0.827

Note: The regressions are conducted on Equation (1). Robust standard errors are in parentheses. * $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

A2. Simultaneous equation estimations

Our IV approach in the main text has already dealt with the possible simultaneity problem of MB issuance and the bidding price. In this appendix, we present a theoretical framework and empirical results for the simultaneous equation estimation.

A2.1 The theoretical framework

We start with the demand for funds (or equivalently, the supply of bonds) by thinking about a municipal government (MG) that is about to issue a one-period MB in a competitive MB market. The MG is a price taker, and the mayor's decision is to decide the size of the MB, B, given its real interest rate r. The purpose of this borrowing is twofold. One is to facilitate growth in the city, and the other is to meet emergent spending on unexpected shocks, such as natural disasters and epidemic outbreaks. Let the former part be denoted by B_v and the latter part be denoted by B_0. Naturally, $B = B_0 + B_v$. Let Y_1 and Y_2 be the tax revenues in the current period (the issuing period) and the next period (the repayment period), respectively. Y_1 is given when an MB is issued. In addition to B_v, Y_2 depends on the mayor's ability A and local conditions M. Y_2 is also subject to a zero-mean random shock E. In addition to contributing to revenue, higher ability indirectly affects revenue through more access to alternative financing to substitute B_v. Formally,

$$Y_2 = Y(K; A, M) + E,\ K = B_v + \alpha A,\ \alpha > 0.$$

Naturally, Y_K', $Y_A' > 0$, and $Y_K'' < 0$. In addition, we assume that K and A complement each other. That is, $Y_{KA}'' > 0$.

We assume that B_0 is predetermined. The mayor decides B_v to maximize the city's expected net return of borrowing:

$$\pi = \mathbb{E}Y_2 - (1 + r)B_v.$$

Given the revenue in the current period Y_1, the mayor's task is equivalent to maximizing the following:

$$\pi/Y_1 = \mathbb{E}c - (1 + r)b_v,$$

where $c = c^e + \varepsilon$, in which $c^e = Y_2/Y_1$ is the expected growth rate, $\varepsilon = E/Y_1$ is the random shock to the growth rate, and $b_v = B_v/Y_1$ is the amount of variable debts normalized by the

current revenue. Let $F(\varepsilon)$ be the cumulative distribution function for ε. It is easy to see that c^e increases in A.

The solution to the maximization problem is straightforward. Let $b_v^d = B(r; A, M)$ be the solution to b_v. Define $b^d = b_0 + b_v^d$, where $b_0 = B_0/Y_1$. Because b_0 is invariant to the mayor's decision, it is easy to get the following:

$$\frac{\partial b^d}{\partial r} = \left(\frac{1}{\mathbb{E}Y_K''}\right)\frac{1}{Y_1} < 0, \tag{A1}$$

and

$$\frac{\partial b^d}{\partial A} = -\left(\alpha + \frac{\mathbb{E}Y_{KA}''}{\mathbb{E}Y_K''}\right)\frac{1}{Y_1}. \tag{A2}$$

It is an expected result in Equation (A1) for a demand function that b^d declines in r. However, the impact of ability on b^d in Equation (A2) is undetermined because ability both substitutes (by increasing *K*) and complements (by the complementarity between *A* and *K*) debts to increase revenue.

With that, we now turn to the supply of funds (or equivalently, the demand for bonds). We adopt the model from Capeci (1994) for the relationship between yields of MBs and their default risks. We extend the model by adding mayors' abilities. To start, we assume that investors are risk neutral. Each investor submits a quantity of fund that he or she is willing to supply and a corresponding offering price. Because investors are risk neutral, their bids can be linearly added up. As a result, we can treat all investors as one bidder whose bidding price depends on the amount of purchase. In equilibrium, the amount of fund supplied equals the fund demanded. Therefore, the remaining task of the supposed bidder is to set the offering price for the given quantity of MBs.

Specifically, investors (as a whole) compare the expected return of an MB with the risk-free real interest rate *R*, which is the opportunity cost of this investment. The MG has other spending commitments (such as social assistance and social security), S, with a higher payment priority than MBs. Therefore, an MG will default on its MB when

$$Y_2 - S < (1 + r)B. \tag{A3}$$

If default happens, investors receive the remaining fiscal revenue after paying the senior obligations. Therefore, their return is $max\{\mathbb{E}Y_2 - S, 0\}$ when there is default.

Consistent with the demand side, we normalize default condition, shown as Equation (A3)

by Y_1 and get the following:

$c - s < (1 + r)b$,

where $s = \frac{S}{Y_1}$. When the growth rate c is no less than $\underline{c} \equiv s + (1 + r)b$, investors receive all their returns $(1 + r)B$. When c is between $\underline{c}$ and s, investors take $Y_2 - S$. When c is lower than s, investors lose the entire principal. Therefore, the investors' expected net gain from b is

$$G = Pr(c > \underline{c}) \cdot (1 + r)b + Pr(s < c \leq \underline{c}) \cdot \mathbb{E}[c - s | s < c \leq \underline{c}] + Pr(c < s) \cdot 0.$$

Their expected rate of return is

$$g(r, b) = \frac{G}{b} = [1 - F(\underline{c} - c^e)](1 + r) + \frac{[F(\underline{c} - c^e) - F(s - c^e)]\mathbb{E}[c - s | s < c \leq \underline{c}]}{b}. \quad \text{(A4)}$$

Given the normalized quantity b, the investors' bidding price of an MB, r, is then determined by the following non-arbitrage condition:

$$g(r, b) = 1 + R.$$

When we solve that equation, we then get the investors' bidding price r^s as a function of b, as well as R, the mayor's ability A, and local conditions M. Formally, $r^s = r(b; R, A, M)$.

We need first the sign of $\frac{\partial r^s}{\partial b}$. It can be shown that given b, the first part of $g(r^s, b)$, $[1 - F(\underline{c} - c^e)](1 + r)$, increases in r^s when b is not large, and the second part of it definitely increases in r^s. That is, when the MG's borrowing is not large relative to the city's GDP, the investors' expected rate of return increases in their bidding prices. In our data, the average MB was 0.39 percent of GDP. So it is safe to conclude that $g(r^s, b)$ increases in r^s for given b. In turn, for given r^s, it is straightforward to show that the first part of $g(r^s, b)$ decreases in b. The change of the second part is complicated, but, in general, it is dominated by the change of $1/b$, so it also decreases in b. Therefore, $g(r^s, b)$ decreases in b. Added to the result that $g(r^s, b)$ increases in r^s, we conclude that $\frac{\partial r^s}{\partial b} > 0$ in the range of b considered by our empirical analysis. This, of course, is a standard result of supply when adverse selection is absent. In addition, given r and b, $g(r^s, b)$ increases in A. Therefore, given b, r^s decreases in A. That is, investors are willing to take a lower yield on the MB issued by a more competent mayor given its normalized quantity b.

Finally, the equilibrium values of b and r, b^* and r^*, are determined by the market clearing condition. They are functions of the mayor's ability A, local conditions M, emergency

borrowing b_0, and the expected average interest rate in the market R. Figure A1 shows an illustration. The total effects of the mayor's ability on b^* and r^* are undetermined because the impacts on the demand curve are not determined. Given the demand curve, however, we clearly see that b^* increases and r^* decreases in the mayor's ability because the latter moves the supply curve outward.

A2.2 Empirical results

Based on the theoretical framework, we estimate the following simultaneous equation system:

$$\begin{cases} r_{ij(k)t} = \alpha q_{ij(k)t} + \theta A_{ij(k)t} + X_{ij(k)t}{}'\phi + W_{ijt}\kappa + u_{ij(k)t} & \text{(A5a)} \\ q_{ij(k)t} = \beta r_{ij(k)t} + \rho A_{ij(k)t} + X_{ij(k)t}{}'\psi + Z'_{ijt}\pi + v_{ij(k)t} & \text{(A5b)} \end{cases}$$

Equation (A5a) is the investors' bidding function, and Equation (A5b) is the MG's issuance decision function. Therefore, $\boldsymbol{\alpha}$ should be positive and $\boldsymbol{\beta}$ should be negative according to our theory. In the equation system, $\boldsymbol{v_{ij(k)t}}$ and $\boldsymbol{u_{ij(k)t}}$ are two zero-mean random variables that share a joint normal distribution.

The two equations share several sets of common variables. The first set has one variable, mayor *k*'s ability $\boldsymbol{A_k}$. By our theory, its coefficient in Equation (A5a) $\boldsymbol{\theta}$ is expected to be negative. In contrast, its impact on the MG's borrowing decision is undetermined. That is, the sign of $\boldsymbol{\rho}$ in Equation (A5b) is not determined. The second set, $\boldsymbol{X_{ij(k)t}}$, contains other variables that may affect both investors' pricing and the MG's issuance.

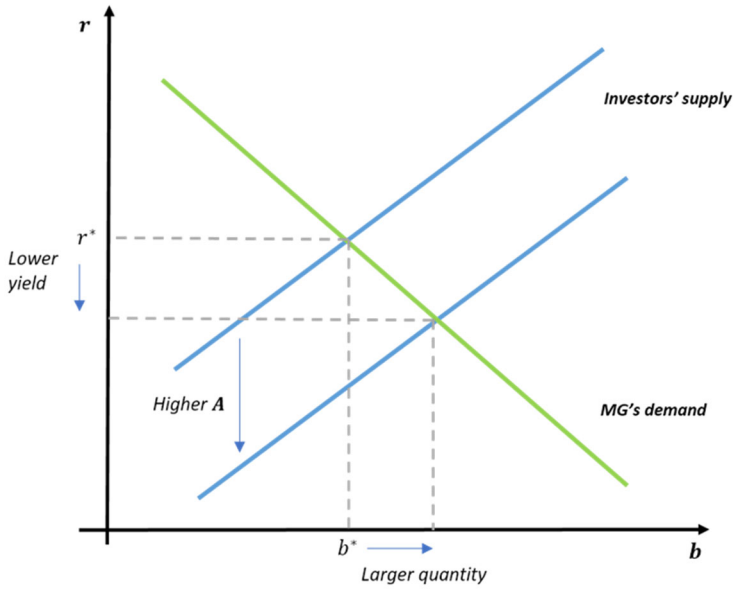
To identify the demand-supply system specified by Equations (A5a) and (A5b), each equation needs at least one variable that can be reasonably excluded from the other equation. Specifically, to identify Equation (A5a), we need exclusive variables as instruments in Equation (A5b)—represented by a vector $\boldsymbol{Z_{ijt}}$—which affect the MG's borrowing decision but not the investors' pricing decisions. As in the main text, $\boldsymbol{Z_{ijt}}$ are floods and the amount of maturing bonds. The pricing function needs a variable, denoted by $\boldsymbol{W_{ijt}}$ in Equation (A5a), which affects the investors' bidding price but not the MG's borrowing decision. For that purpose, we explore the interbond variations in the investors' responses to alternative financial products in the market. Supposedly, the demand for MBs would decline when there were more other

financial products in bond markets. Here we use the amount of corporate bonds issued by all non-LGFVs in a month to capture the alternative investment opportunities for investors. To match this country-level variable to individual MBs, we turn to the ratings of MB issuers. When there were more non-LGFV bonds in the market, the demand for MBs would decline, but the decline would be uneven—issuers with a higher rating would face less pressure. Hence, we use the interaction between non-LGFV corporate bond issuance and an individual MB's rating as the exclusion variable for the investors' bidding function. Our identification assumption is that the ratings per se affect both the investors' pricing decisions and the MGs' borrowing decisions (a city with lower rating LGFVs would naturally tend to borrow less), but their interaction with non-LGFV bonds only captures the investors' diverse responses to the general market conditions. With the ratings already appearing in Equations (A5a) and (A5b), the interaction term becomes a reasonable exclusion variable.

We estimate the equation system (A5a) and (A5b) by the three-stage least squares (3SLS) method (Greene 2011). The results are presented in Columns (1) and (2) in Table A5. The results of the pricing function (Column (1)) are quantitatively similar to the results of our baseline IV estimation. The instrument is significant, and its sign is consistent with our reasoning. In the issuance function (Column (2)), a mayor's ability is insignificant, which indicates that ability indeed has cancelling effects (substitution and complementarity) on issuance. But issuance does respond negatively to higher issuance costs as the coefficient of yields is significantly negative. Finally, the performance of the two instruments agrees with their performance in the first-stage regressions in the IV estimation.

Columns (3) and (4) present the results of the reduced-form estimation deducted from the system of equations. They show how equilibrium yields and issuance decisions perform. The equilibrium yield declines in mayors' abilities, but the magnitude is smaller than in the pricing function. This result is expected because the issuance function is downward sloping. The equilibrium amount of issuance responds positively to mayors' abilities, but the effect is highly insignificant. This is caused by the indeterminacy of ability's impacts on issuance.

Figure A1. Market equilibrium



Note: In this figure, we assume that the MG's demand curve does not move as the ability changes, because the direction of the impact of a mayor's ability on MG's demand of funds is unambiguous.

Table A5. Results of simultaneous equation estimation

	(1)	(2)	(3)	(4)
	3SLS		Reduced-form	
Dependent variable	Yield (%)	MB issuance/ GDP (%)	Yield (%)	MB issuance/ GDP (%)
Mayors' ability (z-score)	-0.116***	-0.007	-0.094***	0.017
	(0.036)	(0.018)	(0.037)	(0.022)
MB issuance/GDP (%)	1.203*			
	(0.657)			
Yield (%)		-0.254**		
		(0.101)		
ln(Market corporate bond issuance)	-0.083***		-0.063***	0.016***
× Issuer: AAA or AA+	(0.019)		(0.017)	(0.006)
floods (yes = 1, no = 0)		0.035***	0.047	0.024**
		(0.013)	(0.035)	(0.012)
Bond matured/GDP (%)		0.056***	0.038	0.045**
		(0.016)	(0.045)	(0.020)
Year-Month FEs	Yes	Yes	Yes	Yes
Issuer FEs	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes
Observations	4154	4154	4154	4154
Adjusted R^2	-	-	0.868	0.827

Notes: Robust standard errors are in parentheses. MB issuance/GDP (%) is instrumented by *floods* and Bond matured/GDP (%), and Yield (%) is instrumented by [ln(Market corporate bond issuance) × Issuer: AAA or AA+]. Other variables controlled but not shown in this table include Interest rate of government bonds (%), Maturity (years), Interbank market (yes = 1), Guaranteed (yes = 1), issuer rating dummies, ln(Lagged fiscal revenue), ln(Lagged GDP per capita), ln(Lagged population), Bond outstanding/GDP (%), and Lagged annual growth rate. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.