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DOES BANK CONCENTRATION AFFECT DEBT MATURITY?

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Abstract

This study investigates whether bank concentration affects firms' debt maturity and how firm size and firm government ownership impact the effect of bank concentration in China during the period 1998-2013. We find robust evidence that bank concentration reduces firms' debt maturity. As regards the role of firm size and firm ownership variables, the results show that the negative effect of bank concentration on firms' debt maturity weakens with firm size and firm government ownership. The negative influence of bank concentration strengthens for SMEs and non-SOEs than large-sized firms and SOEs, respectively. The debt maturity of SOEs decreased less than the debt maturity of non-SOEs in regions where bank concentration is higher. These findings are robust to several checks, including using alternative variables and alternative regression frameworks. These results reveal that privatizing state-owned banks and SOEs and reducing governments' interventions would be effective ways to reduce debt risks and credit discrimination. The study provides light on the reforms of SOEs and the marketization of economy.

Keywords: bank concentration; state-owned banks; government ownership; debt maturity

JEL Classification: G20; G32; E52

1. Introduction

In the context of the Chinese government supervises and controls the risk of firm debt, financial leverage attracts the attention of the academia. Banking sector plays a dominant role as the main source of financing for firms in the Chinese financial system. Although China has been experiencing a successive economic boom for more than 30 years, its banking system is dominated by the Big Four state-owned banks by which the government can influence firms of access to credit. The market shares of these banks by total assets have experienced a decline from 63% to 35% between 1995 and 2017. However, the progress of the banking system has not effectively alleviated financial constraints of small and medium-

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sized enterprises (SMEs) and non-state-owned enterprises (non-SOEs). The Chinese government has acknowledged that SMEs face more obstacles than large-sized firms and SOEs in getting financing and has taken steps to help SMEs and non-SOEs for their access to credit. For instance, “SMEs Promotion law” was launched to improve the operating environment of SMEs in 2002. There is no sign that these policies have eased financial constraints of SMEs. Indeed, empirical research shows there are negative effects of bank concentration on China’s economic growth, which reveals that the dominance of the Big Four state-owned banks may contribute to financial resources misallocation and non-performing loans in China (Kerr and Nanda, 2009). Thus, verifying the role of bank concentration in firms’ debt maturity is important for relieving the capital constraints of SMEs and non-SOEs and enhancing capital allocation efficiency. The phenomenon makes an example for verifying the effects of bank concentration on firms’ debt maturity.

How to understand the relationship between bank concentration and firms financing? There are two arguments focus on two different concentration problems result from the dominance of the Big Four state-owned banks. Specifically, we refer to the first view as the size-competition view that emphasizes the inappropriate dominance of large-sized banks. The view considers that unreasonable size competition in the banking sector results in a credit to be disproportionately allocated to large-sized firms. Others hold the ownership-competition view which considers that state-owned banks and improper interventions of governments result in ownership bias of credit between SOEs and non-SOEs. Banks, especially state-owned banks, prefer to provide credit for SOEs rather than non-SOEs. According to the size-competition view and the ownership-competition view, the dominance of the Big Four state-owned banks contributes to financial resources misallocation of China’s banking system. As the Big Four state-owned banks are both the largest banks and state-owned in China, measuring the Big Four state-owned banks would simultaneously capture the effects of both size competition and ownership competition. Therefore, the argument about the puzzling relationship between bank concentration and firms’ debt financing remains inconclusive, and the effects of size competition and ownership competition are intertwined in the existing research.

This paper uses data sets which include prefecture-level bank concentration and 201353 firms across China during the period 1998-2013 to improve our understanding about the relationship between bank concentration and debt maturity by investigating: (1) how bank concentration impacts firms’ debt maturity, (2) how firm size modifies the effect of bank concentration on firms’ debt maturity, and (3) how firm government ownership modifies the effect of bank concentration on firms’ debt maturity. Our results show that bank concentration is negatively associated with debt maturity and the effect weakens with firm size and firm government ownership. SOEs are associated with a longer debt maturity than non-SOEs.

This study contributes to broad research on the relationship between banking development and economic growth. First, our article contributes to the emerging literature on the relationship between bank concentration and debt maturity. The prior studies neglect the roles of firm size and firm ownership in bank concentration influencing financing activities. The paper improves the understanding of bank concentration via investigating the changes of the effect of bank concentration on firms’ debt maturity with differences of firm size and firm ownership. We note that bank concentration causes a decrease in the firm debt maturity and this effect is highly heterogeneous. We add to this evidence via not only finding that bank concentration is negatively associated with debt maturity, but also through highlighting new channels behind these results, i.e., the effect of bank concentration on debt maturity differs depending on firm size and firm ownership. Second, our study is related to three contemporaneous papers (Ben-Nasr, Boubaker, and Rouatbi, 2015; González, 2017; Orman

and Köksal, 2017). Unlike these studies that examine the effects of firm characteristics on debt maturity, the purpose of our study is to check the influences of bank concentration. The objective of this study is China, which is the biggest emerging market, while previous studies pay more attention to cross countries and few on a specific country. Third, this study provides a microeconomic foundation of the current literature on finance-financing nexus through building the causal effects of bank concentration on debt maturity. In particular, the negative effect of bank concentration on debt maturity is weak for firms operating with larger size and higher state shares. This study provides new insights into the impacts of bank concentration on debt financing and policy implications for developing economies in transition.

2. Theoretical Background and Hypotheses

2.1 Bank Concentration and Debt Maturity

The information hypothesis predicts that bank competition is negatively associated with access to credit since competition lowers the incentives of banks to invest in soft information and relationship lending. Information hypothesis argues that harsher banking competition makes it uneasy for banks to internalize the benefit of assisting opaque firms that results in more financial constraints (Petersen and Rajan, 1995). Lenders prefer to extend debt maturity where the concentration of bank credit market is high (González, 2017). Moreover, the studies on bank concentration reveal that the effect of bank concentration on obtaining loans by changes of market concentration depends on the condition of informational asymmetries. If there is asymmetric information in the market, an increase in banking competition lowers banks' incentives to invest in the acquisition of soft information by establishing close relationships with firms (González and González, 2014).

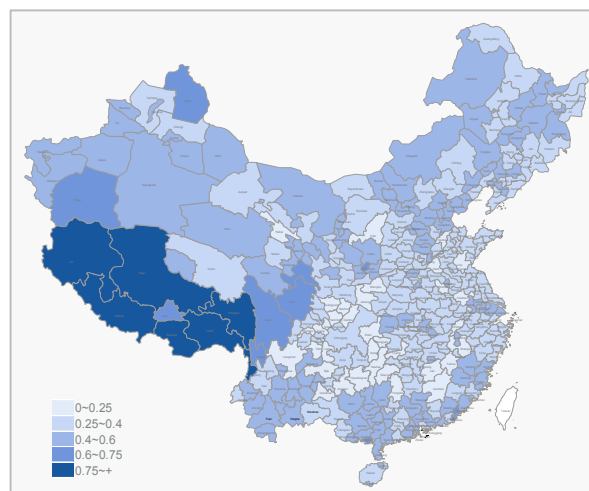
The market hypothesis, in contrast, expects a positive relationship between bank competition and financing, since the increase in bank competition enhances the market power of banks. According to the market power hypothesis, the increase of bank concentration decreases access to financing. The potential effect of bank concentration is associated with banking liberalization changes. Rice and Strahan (2010) observe that the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (IBBEA) relaxes bank branching restrictions and increases the number of bank branches. Thus banks compete with one another and expand the availability of loan within an area.

The China's banking system has been impressive reform over the past 30 years, but it remains dominated by the Big Four state-owned commercial banks, such as the Industrial and Commercial Bank of China (ICBC), the Bank of China (BOC), the Construction Bank of China (CBC), and the Agriculture Bank of China (ABC). As shown in Figure 1, the ratio of branch offices for the Big Four state-owned banks to total bank offices for all commercial banks is high in many prefecture-level cities in 2016. However, state-owned banks have become more inefficient in allocating credit since the middle of the 1990s, because state-owned banks have been forced to bail out more and more poorly performing SOEs (Park and Sehn, 2001). In addition to state-owned commercial banks, there are other financial institutions, such as joint-stock commercial banks, city commercial banks, rural commercial banks, foreign banks, and policy banks, which play minor roles in China's banking sector. The development of city commercial banks and joint-stock banks pose a positive influence on alleviating SMEs' financial constraints than state-owned banks (Chong, Lu, and Ongena, 2013). We expect intense bank concentration may reduce long-term loans. Our first hypothesis is stated as follows:

Hypothesis 1. Bank concentration is negatively associated with firms' debt maturity.

Figure 1

**In 2016, the Ratio of Branch Offices to Total Bank Offices
of the Big Four State-owned Banks in China**



2.2 Firm Size and Debt Maturity

Some people emphasize the inappropriate dominance of the Big Four state-owned banks as the largest banks in the banking sector, which results in a credit to be disproportionately allocated to large-sized firms. The size and quality of firms play important roles in influencing firms' debt maturity structure (Stohs and Mauer, 1996). It is usual for banks to collect firm soft information when these banks plan to provide credit for firms. SMEs are more opaque in soft information than large-sized firms which always have complete information and accounting records (Stein, 2002). Small banks have advantages in forming strong relationships with informational opaque small firms that use more soft information (Berger, Frame, and Miller, 2005). Therefore, small regional banks have advantages in collecting SMEs' soft information and offering financial support. Moreover, financial frictions that result from information asymmetries which surround SMEs restrict these firms' ability to obtain long-term financing (Orman and Köksal, 2017). In countries where banks are dominant in the financial market, SMEs' debt maturity decreases more as the result of the financial crisis than large firms' debt maturity (González, 2015).

Due to more assets in place and greater opportunities for economies of scale, large firms are generally considered to be less risky (Carey *et al.*, 1993). Large-sized firms have more chances of access to the lending market, so they are less dependent on financing from bank and less influenced by banks' preferences (González, 2017). Large-sized firms with low cash flow show intense desire to obtain long-term financing (Liem, Diep, and Nguyen, 2018). These studies show that SMEs have a smaller pool of banks to obtain financing than large-sized firms. Banking institutions cannot meet SMEs' capital demand at China's current development stage, while these firms are consistent with comparative advantages.

Size-competition view suggests that it is necessary for governments to encourage small and medium-sized banks to occupy a dominant position in the financial system (Acharya, Imbs, and Sturgess, 2010). In other words, non-state-owned banks should play a dominant role in

the banking system since these banks have advantages in providing financing services for SMEs. Following the above arguments, our second hypothesis is:

Hypothesis 2. The effect of bank concentration on debt maturity is weaker for large-sized firms than SMEs and weakens with firm size.

2.3 Firm Ownership and Debt Maturity

Others attribute the key capital misallocation to the Big Four state-owned banks and government ownership, since lending by these banks is biased against non-SOEs and in favor of SOEs that are low efficiency (Lin, Sun, and Wu, 2015). Banks may make a lending decision based on political, ideological or bank managers' personal objectives rather than the banks' profits. Governments have incentives to interfere with firms' finance policies (Fan, Titman, and Twite, 2011). Central and local governments have a powerful influence on SOEs and banking sectors, such as allocating loans through state-owned banks. The level of banks loan discrimination is strengthened in the regions with lower financial development, or in the regions where the intervention of government is higher (Jiang and Li, 2006). Governments' intervention is positively related to long-term bank debt and long-term bank debt maturity structure, and the lower of government intervention is a benefit for non-SOEs to obtain long-term debt (Liu, Bian, and Gan, 2018).

Some studies show that SOEs are generally considered safer, at least partially due to implicit government guarantees. Since governments provide an implicit guarantee for SOEs' debt, it is a low probability that firms with state ownership are allowed to default or go bankruptcy compared to non-SOEs (Borisova *et al.*, 2015). Therefore, the perceived higher fail risk of non-SOEs lead banks to prefer SOEs. Many banks strive to build up political connections with governments and politicians through providing favorable credit terms for SOEs, which is helpful for these banks to get lucrative contracts (Butler, Fauver, and Mortal, 2009). The domination of the Big Four state-owned banks provides opportunities for SOEs with central or local governments' help to access long-term credit through their political connection. Firms with multiple large shareholders result in shorter maturity debt, but controlling owners prefer to reduce monitoring by choosing long-term debt (Ben-Nasr, Boubaker, and Rouatbi, 2015). Thus, SOEs access credit with longer debt maturity easily in prefecture-level cities where the Big Four state-owned banks occupy more market compared to non-SOEs.

Consequently, we expect a positive relationship between government ownership and debt maturity, particularly for SOEs, since the government guarantee enables banks to lend on a longer-term basis. Our third hypothesis can, therefore, be stated as follows:

Hypothesis 3. The effect of bank concentration on debt maturity is weaker for SOEs than non-SOEs and weakens with firm government ownership.

3. Methodology and Data

3.1 Empirical Methodology

While verifying those hypotheses is important, few empirical studies have tried to address these issues. As the Big Four state-owned banks are both the largest banks and state-owned in China, the measurement of these banks would capture the effects of both size competition and ownership competition. Therefore, the effects of size competition and ownership competition are noticeably intertwined among the existing research and the argument about the relationship between bank concentration and firms' debt maturity remains inconclusive. To fill this gap, we construct two interaction terms: the interaction between bank concentration and firm size, and the interaction between bank concentration and firm

government ownership. The first interaction captures size competition effect, and the second interaction captures ownership competition effect.

Based on previous studies (González and González, 2014; González, 2015; Orman and Köksal, 2017), we investigate the aggregate effect of bank concentration on debt maturity with a different level of firm size and firm government ownership by estimating the following benchmark model:

$$Debtmat_{j,i,t+1} = \beta_0 + \beta_1 CR4_{i,t} + \beta_2 Employee_{j,i,t} + \beta_3 Gov_{j,i,t} + \beta_4 F_{j,i,t} + \eta_{i,t+1} + \mu_k + \varepsilon_{j,i,t+1} \quad (1)$$

$Debtmat_{j,i,t}$ is dependent variable and denotes the debt maturity of firm j in prefecture-level city i in year t , which is measured as the ratio of long-term debt to total debt. Following prior studies (Carlson and Mitchener, 2006; Temesvary, 2015; Degl'Innocenti, Mishra, and Wolfe, 2017), we construct an index of prefecture-level bank concentration, $CR4_{i,t}$. This variable uses the ratio of branch offices for the Big Four state-owned banks to total bank offices for all commercial banks to measure banking sector concentration in prefecture-level city i in year t , with higher values indicating more concentrated banking sector. $Employee$ is firm size which measured as the logarithm of employees. Gov is firm government ownership. Firm government ownership has two measured variables. $Gov1$ defined as the percentage of firms' shares held by the state and $Gov2$ takes a value of one if the state is the ultimate controlling shareholder and zero otherwise.

Following existing literature (Chong, Lu, and Ongena, 2013), we control for prefecture-level characteristics and firm characteristics that may influence debt maturity. The control variable $F_{j,i,t}$ includes firm characteristics, such as assets, age, capital-to-labor ratio, leverage ratio, return on assets and government subsidy. We include fixed effects in the baseline regression. The three-dimensional (region-time-industry) panel enables us to use fixed effects to control for a wide array of omitted variables. Persistent diversities across prefecture-level cities and industries could be stripped out when model include prefecture-level fixed effects and industry fixed effects, then we control for prefecture-specific and industry-specific characteristics to avoid criticism on omitted variables. $\eta_{i,t}$ is the prefecture-year fixed effects which absorb timing-varying prefecture-level characteristics, such as the overall level of economic growth, prefecture-wide policies, and reforms. μ_k captures industry fixed effects which absorbs the effects of industry characteristics. $\varepsilon_{j,i,t}$ is an error term.

To control potential endogeneity problems, independent variables are lagged by one year when we perform the estimations. Also, it is unlikely that firms' debt maturity measures can impact bank concentration. Utilizing a cluster-robust estimator may be incorrect when cluster size is unbalanced and the number of clusters is low (Cameron and Miller, 2015). Therefore, we use a standard error estimation methodology adjusted for double clustering on our panel data to account for time series dependence and control heteroskedasticity. Specifically, we cluster standard errors at prefecture-level cities and industry.

3.2 Variable Definitions and Data Sources

We use both firm-level individual and prefecture-level aggregate data sets of China. The source of firm data is Annual Report of Industrial Enterprise by National Statistic Bureau of China (NSBC), which comprises 201353 firms and 1164699 firm-year observations for China during the period 1998-2013. We obtain prefecture-specific characteristics information from the website of China Banking Regulatory Commission (<http://www.cbrc.gov.cn>). The observations constitute an unbalanced panel. Table 1 and Table 2 report the definitions and descriptive statistics of all variables used in this article, respectively.

Table 1

Definitions of Variables

Variables	Definition
<i>Debtmat</i>	The ratio of long-term debt to total debt. (%)
<i>Longdebt</i>	The logarithm of one plus firms' long-term debt. (Thousand China Yuan)
<i>Size</i>	The logarithm of firms' total assets. (Thousand China Yuan)
<i>Age</i>	The number of years a firm has existed since the founding year.
<i>K-L</i>	The logarithm of the capital-to-labor ratio, where capital is represented by firms' fixed assets, and labor is the number of firms' employees. (Thousand China Yuan per person)
<i>Leverage</i>	Leverage ratio, defined as debt divided by total assets.
<i>ROA</i>	The ratio of profit to total assets.
<i>Subsidy</i>	The logarithm of one plus subsidy in the regression procedure. (Thousand China Yuan)
<i>Tangibility</i>	The ratio of tangible fixed assets divided by total assets.
<i>Industry-HHI</i>	The Herfindahl-Hirschman index of sales, computed as the sum of squared market shares of all firms, based on sales, in a given four-digit SIC industry in each year.
<i>CR4</i>	The ratio of branch offices for the Big Four state-owned banks to total bank offices for all commercial banks.
<i>Bank-HHI</i>	The Herfindahl-Hirschman index of branch offices for the Big Four state-owned banks to total bank offices for all commercial banks.
<i>City-cross</i>	The ratio of city commercial banks' branch offices outside the head office to total bank offices for all commercial banks.
<i>Employee</i>	The number of firms' employees. Taking the logarithm of firms' employees in the regression procedure.
<i>Large-firm</i>	Setting equal to one if firms' employees more than 250 and set to zero otherwise.
<i>Gov1</i>	The percentage of firms' shares held by the state shareholders.
<i>Gov2</i>	Taking a value of one if the state is the ultimate controlling shareholder and zero otherwise.

Table 2

Descriptive Statistics

Variables	Min	P25	Median	Mean	P75	Max	S.D	Obs.
<i>Debtmat</i>	0.00	0.00	0.00	8.01	4.72	100	17.54	1164699
<i>Longdebt</i>	0.00	0.00	0.00	10870.95	544.00	3.15×10 ⁷	192081.00	1164699
<i>Size</i>	18.00	9070.00	21337.00	127756.60	60318.00	2.40×10 ⁸	1218949	1164699
<i>Age</i>	1.00	5.00	8.00	11.09	13.00	113.00	10.11	1164699
<i>K-L</i>	0.00	3.07	3.88	3.88	4.67	14.07	1.23	1164699
<i>Leverage</i>	0.00	0.36	0.56	0.54	0.73	0.99	0.24	1164699
<i>ROA</i>	-0.39	0.01	0.04	0.08	0.11	1.00	0.15	1164699
<i>Subsidy</i>	0.00	0.00	0.00	307.12	0.00	4811285.00	9122.95	1164699
<i>Tangibility</i>	0.00	0.18	0.32	0.35	0.48	1.00	0.21	1164699
<i>Industry-HHI</i>	0.00	0.01	0.01	0.04	0.04	0.99	0.07	1164699
<i>CR4</i>	0.00	0.41	0.55	0.58	0.77	1.00	0.25	1164699
<i>Bank-HHI</i>	0.00	0.05	0.09	0.14	0.19	1.00	0.14	1164699
<i>City-cross</i>	0.00	0.00	0.00	0.01	0.00	1.00	0.03	1164699
<i>Employee</i>	8.00	70.00	140.00	329.00	297.00	198971.00	1218.46	1164699
<i>Large-firm</i>	0.00	0.00	0.00	0.30	1.00	1.00	0.46	1164699
<i>Gov1</i>	0.00	0.00	0.00	0.05	0.00	1.00	0.21	1164699
<i>Gov2</i>	0.00	0.00	0.00	0.05	0.00	1.00	0.23	1164699

4. Empirical Results and Discussion

4.1 Baseline Specification and Robustness Results

Table 3 presents the test results for Eq. (1). Column 1 in Table 3 shows the result as only including bank concentration variable.

Table 3

Baseline Regressions and Robustness Examination

Variables	1	2	3	4	5	6	7	8
Size		1.235*** (0.035)	0.817*** (0.009)	1.235*** (0.035)	1.229*** (0.035)	1.235*** (0.035)	0.487*** (0.038)	1.235*** (0.037)
Age		0.374*** (0.043)	0.248*** (0.009)	0.375*** (0.043)	0.369*** (0.043)	0.374*** (0.043)	-0.440*** (0.039)	0.374*** (0.045)
K-L		0.164*** (0.036)	-0.055*** (0.008)	0.164*** (0.036)	0.171*** (0.036)	0.164*** (0.036)	-0.042 (0.031)	0.164*** (0.038)
Leverage		2.991*** (0.115)	1.155*** (0.022)	2.988*** (0.115)	3.008*** (0.115)	2.991*** (0.115)	2.357*** (0.099)	2.991*** (0.120)
ROA		1.053*** (0.192)	0.174*** (0.032)	1.048*** (0.192)	1.079*** (0.194)	1.053*** (0.192)	2.002*** (0.170)	1.053*** (0.188)
Subsidy		0.013 (0.009)	0.044*** (0.002)	0.014 (0.009)	0.015 (0.009)	0.013 (0.009)	-0.042*** (0.008)	0.013 (0.010)
Tangibility		5.426*** (0.187)	1.322*** (0.036)	5.424*** (0.187)	5.455*** (0.188)	5.426*** (0.187)	4.135*** (0.161)	5.426*** (0.196)
Industry-HHI		0.308 (0.307)	0.045 (0.049)	0.309 (0.306)	0.306 (0.303)	0.311 (0.307)	0.869*** (0.278)	0.308 (0.322)
CR4	-0.635*** (0.206)	-0.423** (0.201)	-0.214*** (0.037)			-0.801* (0.419)	-0.165* (0.096)	-0.423*** (0.159)
Bank-HHI				-0.961*** (0.336)				
City-cross					5.403*** (1.345)			
CR4 ²						0.359 (0.378)		
Region fixed effects	YES	YES	YES	YES	YES	YES	NO	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES	NO	YES
Time fixed effects	YES	YES	YES	YES	YES	YES	NO	YES
Firm fixed effects	NO	NO	NO	NO	NO	NO	YES	NO
Obs.	1164699	1164699	1164699	1164699	1164699	1164699	1164699	1164699
Adj. R ²	0.581	0.582	0.679	0.582	0.582	0.582	0.574	0.582

Notes: The dependent variables in columns 1 to 2 and 4 to 8 are *Debtmat*. The dependent variable in column 3 is *Longdebt*. The statistical inferences are based on robust standard errors (reported in brackets) clustered at the prefecture-level city and industry in columns 1 to 7 and clustered at the firm level in column 8. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

Does Bank Concentration Affect Debt Maturity?

The significant and negative coefficient of *CR4* reveals that bank concentration is negatively related to firms' debt maturity. In fact, debt maturity decreases 0.635 basis points (bps) on average when bank concentration increases one standard deviation (column 1). Controlling for firm characteristics, the negative effect of bank concentration is lower in column 2 than it is in column 1. These results prove that higher bank concentration decreases lender incentives to build relationships with firms over time and enables firms to suffer more stringent restriction on debt maturity, supporting Hypothesis 1. The coefficient of *Size* is positive and significant at the 1% level, revealing that larger firms have longer debt maturity than smaller firms (column 2). This result is in line with the view that smaller firms with more agency problems tend to use short-term debt to alleviate financial constraints. Coefficient estimates reveal that government subsidy and industry concentration are unimportant for firms' debt maturity.

We use a different measure of variables to check the robustness of our major findings. The columns 3 to 8 in Table 3 report the results of robustness tests. Specifically, we first examine whether our results are robust to alternative proxies for debt maturity and bank concentration. We use the logarithm of one plus firms' long-term debt, *Longdebt*, as an alternative proxy for firms' debt maturity (column 3). We use the Herfindahl Hirschman index of branch offices for the Big Four state-owned banks to total bank offices, *Bank-HHI*, as an alternative proxy for bank concentration (column 4). We use the ratio of city commercial banks' branch offices outside the head office to total bank offices, *City-cross*, as an alternative proxy for bank competition (column 5). These alternative proxies present in Table 1. We also include the square term for bank concentration measure in the estimations to consider possible nonlinearity relationship between bank concentration and firms' debt maturity (column 6).

Compared to the results in columns 1 and 2, the magnitudes of the coefficient estimates of the main independent variables in columns 3 and 4 change to some extent but their signs and significance remain unchanged. Because *City-cross* variable with higher values indicating lower bank concentration and higher bank competition, the coefficient of *City-cross* has opposite sign when compared to the coefficients of bank concentration in columns 1 to 4 (column 5). The coefficient estimate for the squared term is not significant for bank concentration measure, while the coefficient estimate of *CR4* is negative and significant. This result does not support a nonlinear relationship between bank concentration and firms' debt maturity (column 6).

Next, we study whether the documented impacts of bank concentration on debt maturity are robust to alternative specification of the main model. Specifically, in column 7, we check whether the main results are robust when we only control for firm fixed effects. In column 8, we study whether the main results are robust when we estimate robust standard errors only with clustered at the firm level. The coefficient estimates of *CR4* are negative and significant, which consistent with baseline results and earlier findings (columns 7 and 8).

4.2 Large-sized Firms versus SMEs

We further check whether the relationship between bank concentration and debt maturity differs with firm size. Small firms face a shortage of external financing and severe information frictions than large firms. SMEs are more opaque than large-sized firms, and thus the information hypothesis should play a more significant role for SMEs (Berger and Udell, 1995). If the information hypothesis applies, we expect a negative and significant coefficient for the interaction term between bank concentration and firm size.

First, we estimate the equation (1) via considering groups of firm separately by the size of employee: SMEs (i.e., firms with fewer than 250 employees) and large-sized firms (i.e., firms with 250 and more employees). Second, we construct two interaction terms: the interaction term between *CR4* and *Employee* and the interaction term between *CR4* and *Large-firm*. The estimations results are reported in Table 4.

The coefficient estimate of bank concentration is not significant for large-sized firms (column 1), while its coefficient is negative and significant at the 5% level for SMEs (column 2). This result proves that a shorter debt maturity in more concentration areas for SMEs. Specifically, we observe that SMEs' debt maturity is more sensitive than large-sized firms to bank concentration.

In column 3, the coefficient of bank concentration demonstrates that each extra proportion of bank concentration decreases debt maturity by 0.409 bps when firm size is equal to the mean of *Employee*. The significant and positive coefficient on $CR4 \times Employee$ implies that larger scales of firms can be seen to result in a decrease in the negative effect of bank concentration on debt maturity. In column 4, the positive coefficient on $CR4 \times Large-firm$ is significant at the 1% level, which reveals that the negative effect of bank concentration on debt maturity weakens 0.767 bps for large-sized firms compared to SMEs. Specifically, each extra proportion of bank concentration results in 0.114 bps increase in debt maturity for large-sized firms and 0.653 bps decrease in debt maturity for SMEs, which reveal that the negative influence of bank concentration on debt maturity is weaker for large-sized firms compared to SMEs. These results support Hypothesis 2 and show that the different role of bank concentration depending on firm size.

Table 4

Large-sized Firms versus SMEs

Variables	1	2	3	4
	Large-sized firms	SMEs	All Sample	All Sample
Size	1.491*** (0.071)	0.823*** (0.048)	1.234*** (0.066)	1.220*** (0.039)
Age	0.389*** (0.084)	0.229*** (0.052)	0.368*** (0.043)	0.370*** (0.043)
K-L	0.217*** (0.074)	0.236*** (0.044)	0.161*** (0.060)	0.176*** (0.039)
Leverage	3.272*** (0.218)	2.533*** (0.138)	2.991*** (0.115)	2.991*** (0.115)
ROA	0.956*** (0.356)	0.986*** (0.217)	1.054*** (0.192)	1.052*** (0.191)
Subsidy	0.024 (0.015)	-0.008 (0.013)	0.014 (0.009)	0.014 (0.009)
Tangibility	6.602*** (0.374)	3.867*** (0.225)	5.428*** (0.268)	5.386*** (0.194)
Industry-HHI	-0.496 (0.548)	0.793** (0.370)	0.314 (0.307)	0.309 (0.307)
CR4	-0.070 (0.268)	-0.607** (0.260)	-0.409** (0.199)	-0.653*** (0.217)
Employee			-0.017 (0.065)	
CR4 × Employee			0.499*** (0.109)	

Variables	1	2	3	4
	Large-sized firms	SMEs	All Sample	All Sample
Large-firm				0.028 (0.069)
CR4 × Large-firm				0.767*** (0.213)
Region fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES
Obs.	357033	807666	1164699	1164699
Adj. R ²	0.654	0.592	0.582	0.582

Notes: Employee is a continuous variable. Large-firm is a dummy variable. In column 3, CR4 and Employee are mean centered when we construct CR4 × Employee interaction term. In column 4, CR4 is mean centered when we construct CR4 × Large-firm interaction term. The statistical inferences are based on robust standard errors (reported in brackets) clustered at the prefecture-level city and industry. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

4.3 SOEs versus Non-SOEs

The results in Table 3 show that bank concentration exerts a negative impact on debt maturity through firms in the prefecture level, while the negative influence could be different for SOEs and non-SOEs. SOEs have less financial constraints as they can obtain loans via loan guarantees of governments. The benefits of implicit government guarantees may be higher in regions with higher bank concentration. To investigate possible heterogeneity in the causal effects of bank concentration on debt maturity across firm ownership, we decompose sample into SOEs (*i.e.*, the government is the ultimate controlling shareholder) and non-SOEs. We then estimate equation (1) for SOEs and non-SOEs, respectively (columns 1 and 2 of Table 5). We also construct two interaction terms: the interaction term between CR4 and Gov1 and the interaction term between CR4 and Gov2 (columns 3 and 4 of Table 5). The estimations results are reported in Table 5.

The coefficient estimate of CR4 is not significant for SOEs (column 1), while its coefficient is negative and significant at the 5% level for non-SOEs (column 2). These results show that a shorter debt maturity in more concentration areas for non-SOEs and SOEs is less sensitive than non-SOEs to banking concentration.

In column 3, the coefficient of CR4 shows that each extra proportion of bank concentration decreases debt maturity by 0.363 bps when government ownership of a firm is equal to the mean of Gov1. The significant and positive coefficient on CR4 × Gov1 proves that each extra proportion of government ownership weakens the effect of bank concentration on debt maturity by 1.411 bps. These results show that the negative effect of bank concentration weakens with government ownership and the value of government ownership as a way to improve the financing conditions of firms. The coefficient estimate for Gov1 is positive and significant at the 5% level, which implies that government ownership has a positive effect on firms' debt maturity.

In column 4, the positive coefficient on CR4 × Gov2 is significant at the 5% level, which shows that the negative effect of bank concentration on debt maturity weakens 1.156 bps for SOEs compared to non-SOEs. Specifically, each extra proportion of bank concentration leads to 0.727 bps increase in debt maturity for SOEs and 0.429 bps decrease in debt maturity for non-SOEs. The significant and positive coefficient of Gov2 demonstrates that SOEs are associated with longer debt maturity than non-SOEs. These results suggest that

the negative effect of bank concentration on debt maturity is weaker for SOEs compared to non-SOEs. The debt maturity of non-SOEs is more sensitive to the ratio of branch offices to total bank offices of the Big Four state-owned banks than SOEs. Those results are consistent with Hypothesis 3.

Table 5

SOEs versus Non-SOEs

Variables	1	2	3	4
	SOEs	Non-SOEs	All Sample	All Sample
Size	2.218*** (0.190)	1.106*** (0.036)	1.216*** (0.035)	1.217*** (0.035)
Age	0.708*** (0.211)	0.258*** (0.044)	0.331*** (0.043)	0.336*** (0.043)
K-L	-0.240 (0.169)	0.179*** (0.036)	0.175*** (0.036)	0.175*** (0.036)
Leverage	5.941*** (0.720)	2.826*** (0.115)	2.993*** (0.115)	2.993*** (0.115)
ROA	0.251 (1.096)	1.008*** (0.187)	1.046*** (0.196)	1.043*** (0.196)
Subsidy	-0.014 (0.036)	0.012 (0.010)	0.013 (0.009)	0.013 (0.009)
Tangibility	8.388*** (0.949)	4.975*** (0.190)	5.352*** (0.188)	5.355*** (0.188)
Industry-HHI	-0.420 (1.534)	0.469 (0.314)	0.306 (0.308)	0.307 (0.308)
CR4	0.948 (0.884)	-0.458** (0.200)	-0.363* (0.201)	-0.429** (0.203)
Gov1			1.563*** (0.184)	
CR4 × Gov1			1.411** (0.627)	
Gov2				1.360*** (0.161)
CR4 × Gov2				1.156** (0.556)
Region fixed effects	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES
Obs.	68437	1096262	1164699	1164699
Adj. R ²	0.768	0.575	0.581	0.581

Notes: Gov1 is a continuous variable. Gov2 is a dummy variable. In column 3, CR4 and Gov1 are mean centered when we construct CR4 × Gov1 interaction term. In column 4, CR4 is mean centered when we construct CR4 × Gov2 interaction term. The statistical inferences are based on robust standard errors (reported in brackets) clustered at the prefecture-level city and industry. ***, **, * denote significance at the 1%, 5%, and 10% level, respectively.

5. Conclusions

In this paper we check how prefecture-level bank concentration impacts firms' debt maturity, highlighting the heterogeneous effects of bank concentration on debt maturity with

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differences of firm size and firm government ownership. For the transition economy of China, this study provides evidence that the concentration of the Big Four state-owned banks is negatively related to long-term debt maturity structure. The result for firm-level variables is not homogenous across firm size and firm ownership. Specifically, bank concentration has a greater negative effect on debt maturity for SMEs and non-SOEs, whereas in the case of large-sized firms and SOEs, bank concentration has little influence on debt maturity. The negative effect of bank concentration on debt maturity weakens with firm size and firm government ownership. These findings support the intuitive view that bank concentration results in a shorter debt maturity consistent with the general economic theory.

These results show that the different role of bank concentration depending on firm size and firm government ownership. The increase of bank concentration provides for intensifying information asymmetry in SMEs and non-SOEs, which explains the negative relationship with long-term debt maturity structure. Information asymmetries are obvious in SMEs and non-SOEs, and these firms will be more detrimented by bank concentration than large-sized firms and SOEs. Michael and Smith (1995) argue the similar findings; they argue that firms with higher information asymmetries tend to have less long-term debt. As large-sized firms and SOEs have better access to financing, these firms are less likely to rely on bank loans and thus are less influenced by the variation of bank concentration.

This paper reveals that bank concentration and firm characteristics result in differences in debt maturity. An effective mechanism to alleviate financing constraints is reducing the prefecture-level bank concentration for SMEs and non-SOEs. However, those results reveal caution when reducing bank concentration since, the decrease of bank concentration leads to an increase in debt maturity, while large-sized firms and SOEs benefit least from bank concentration decline compared to SMEs and non-SOEs. The study makes a case for banking reforms to promote small and medium-sized bank institutions and decrease the concentration of the banking sector, which may be effective in reducing debt risks and credit discrimination. State ownership may result in poor efficiencies due to implicit debt guarantee, ineffective supervision, and moral hazard, which implies that privatizing SOEs and reducing government's interventions would be effective ways to improve capital allocation efficiency. These suggestions may be helpful for the reforms of SOEs and the marketization of the economy in China.

However, the study does not control for potential survival bias. When the development of the banking market and long-term debt leads to higher survival chances, the negative relationship between bank concentration and firms' debt maturity may be influenced by surviving firms. For instance, the relationship may be different for firms which have withdrawn from the market. As another limitation, because our study samples from China, the results might not be generalized to other countries' settings. These works are beyond the scope of the study, and we leave it for future research.

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