Does Banking Competition Alleviate or Worsen Credit Constraints Faced by Small and Medium Enterprises? Evidence from China

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Abstract

Banking competition may enhance or hinder the financing of small and medium enterprises (SMEs). Using a survey on the financing of China's SMEs combined with detailed bank branch information, we investigate how concentration in the local banking market affects the availability of credit. It is found that lower market concentration alleviates financing constraints. The un-concentrated presence of joint stock banks has a larger effect on alleviating credit constraints, while the presence of state-owned banks has a smaller effect, than the presence of city commercial banks.

Key Words: Banking Competition, SMEs Financing, Credit Constraints

JEL: D41 D43 G21

I. Introduction

The impact of competition in the banking sector on the availability of credit for small and medium enterprises (SMEs) is a crucial policy and academic question that has again attracted widespread attention in light of global economic developments including the recent financial crisis. Formal (bank) financing is associated with economic growth (Beck, Demirgüç-Kunt and Levine 2005), but SMEs are often constrained in obtaining it (Beck, Demirgüç-Kunt, Maksimovic, 2008). Yet the determinants of this "financing gap" for SMEs have not yet been fully examined, in particular not in the context of a developing financial system. Competition in the banking sector, for example, may be an important driver (Petersen and Rajan, 1995; Carbo′-Valverde, Rodriguez-Fernandez and Udell 2009).

To investigate the impact of competition in the banking sector on the availability of credit for SMEs in a developing economy, we employ the almost 4,000 responses to a unique stratified survey that was sent in 2006 to Chinese private enterprises. China provides an almost ideal setting to investigate the banking competition – SME financing gap correspondence. China's economy is populated with a very large number of SMEs, which contribute substantially to its national economy.[1] At the same time SMEs in China are known to face major obstacles in obtaining access to financing, especially from the four state-owned banks, yet this access to formal financing also matters in China (Ayyagari, Demirgüç-Kunt and Maksimovic 2010; Cheng and Degryse 2010).

The Chinese government has long recognized the problem and has tried to help SMEs obtain bank financing for more than a decade, and even raising SME

[1] 4.3 million SMEs account for 99.3% of all firms at year-end 2004 and 74.7% of the industrial value added during 2004. The number of SMEs increased at an annual rate of 20.4% between 2001 and 2004 (Sources: *China Administration for Industry and Commerce* and *China Commission for Reform and Development*).

financing to the national development agenda which resulted in the "SMEs Promotion Law" in 2003.

However, SMEs financing difficulties persist according to a government report in 2005 which was based on a survey of 3,000 SMEs. Among the SMEs owners that responded, 79.5% of them rated financing environment as "not changed" or "deteriorating" compared with the years prior to 2005. Furthermore, this proportion was as high as 90.9% in the west part of the country, which is less developed than the eastern and central parts of the country. Hence SME financing difficulties may have never been fully solved by the implemented government policies. Therefore, to understand the determinants of SMEs financing is vitally important not only for academic but also for policy-makers.

In the 2006 survey we analyze netted 3,837 responses across all 31 regions (provinces, autonomous regions, or municipalities) from private enterprises that are mainly SMEs according to the existing official definition. The entrepreneurs or main investors provide information on the financing gap faced by the firm. Financing constraints are alleviated we find when banking markets are less concentrated, irrespective of whether concentration based on bank branch presence is measured with a Herfindahl–Hirschman Index (HHI) or a three-bank concentration ratio (CR3). A decomposition of the HHI according to the presence of state-owned banks, joint stock banks and city commercial banks, respectively, shows that the un-concentrated presence of joint stock banks alleviates credit constraints more than the presence of city commercial banks and much more than the presence of state-owned banks.

The paper aims to contribute to the literature by providing the first evidence on the effect of banking sector concentration (intended to measure the intensity of competition) on SME credit constraints in an emerging economy. For these

purposes the paper compiles a new dataset on the presence of bank branches across China and employs a quantitative measure of credit constraints that is likely to be more informative than the more traditional qualitative measures.

The rest of the paper is organized as follows. Section 2 introduces China's banking system. Section 3 presents the survey dataset and banking market data. Section 4 defines the measures of the financing gap, presents the tested hypotheses and describes the methodology. Section 5 discusses the summary statistics for the variables of interest. Section 6 presents and interprets the regression results for various model specifications. Section 7 concludes the paper.

II. China's Banking System and SMEs Financing

China's banking sector is dominated by four state-owned banks. As shown in Panel A of Figure 1, over half of total bank assets is owned by these four banks, which are also the largest four banks in the country.[2] State-owned banks usually prefer providing loans to state-owned firms, which are often very large firms, and show much less interest in SME financing. While there is a strand of literature showing that large banks prefer large firms, these stylized facts about state-owned banks in China are consistent with these findings.

[Figure 1 here]

[Figure 2 here]

[Figure 3 here]

Besides the four state-owned banks, there are twelve joint-stock banks in China, which in terms of size are in between state-owned banks and city commercial banks. The largest joint stock bank, Communication Bank, has a similar size with

[2] See Table 1 for the total assets of all fourteen listed banks. The four state-owned banks are the largest banks in total assets. For example, total assets of the Industrial and Commercial Bank of China (ICBC) totaled 1,772 billion USD at year-end 2009.

state-owned banks. In contrast, Hengfeng Bank, a new joint stock bank, is more similar in size than city commercial banks. Joint stock banks can open branches freely around the country, and their business orientation includes targeting SMEs, more so than their state-owned counterparts.

On the "small end" of the banking market, there are the city commercial banks (112 of them at the end of 2005), most of which were restructured from urban credit unions. Urban credit unions came into being in the 1980s as a main provider of credit to SMEs, which were categorized as non-bank financial institutions by the Chinese government.[3] However, the Chinese government restructured urban credit unions and set up city commercial banks in order to enhance the financial stability from the middle 1990s onwards. Due to financial regulation before 2006 city commercial banks could generally operate only within their headquarter cities. Consequently, city commercial banks focus exclusively on local banking markets with a strong business orientation towards SME financing, corresponding both their prior operation as urban credit cooperatives and their small sizes.

Table 1 shows the total assets of the listed banks in 2009. The joint stock banks are smaller than the four state-owned banks, but larger than the city commercial banks. Furthermore, Panel B in Figure 1 shows asset profiles for the twelve joint-stock banks, as well as for the 112 city commercial banks and urban credit unions,[4] which account for 14.1% and 6.6% of total bank assets in 2008

[3] According to Almanac of China's Finance and Banking (1995), there were 5,229 urban credit cooperatives at the end of 1994. In later years, around three thousands of them were restructured into 112 city commercial banks, while the rest two thousands were merged with rural credit unions. Besides the three types of banks discussed in the paper, there is a large population of rural credit unions which extend loans to agriculture, and three policy banks which are designed to provide loans to agriculture, infrastructure and foreign trade respectively. As these institutions do not provide loans to SMEs, we leave them out in the paper.

[4] There were around three hundreds urban credit unions still in operation at the end of 2005, with in branch numbers a market share of less than 0.6%. Around three thousand of urban credit unions were restructured

respectively. The most striking feature in Panel B of Figure 1 is that the market structure (in terms of total bank assets) has been increasing steadily for joint stock banks and city commercial banks in the 2003 to 2008 period.[5]

[Table 1 here]

In parallel, the competition in the banking market has intensified dramatically during the past decade. On the one hand, city commercial banks in China are still expanding, implying that competition in the credit market is getting fiercer.[6] Due to relatively their small size and local business orientation, most city commercial banks target local SMEs. The booming of city commercial banks therefore provides a unique opportunity for us to investigate the effect of competition on SME credit constraints. On the other hand, joint stock banks compete with state-owned banks for the large firms and with the city commercial banks for the SMEs. The competition in the banking market has increased substantially due to the joint stock banks and city commercial banks.

Different types of banks have different SME credit profiles. The Bank of Ningbo (NBCB), for example, a city commercial bank in east China, extended 66% of its loans to SMEs in 2005; in contrast, the Industrial and Commercial Bank of China (ICBC), the largest state-owned bank, extended only 38% of its loans to SMEs in the same year. Figure 2 compares the loan size distribution for NBCB and ICBC

into 112 city commercial banks, which means on average 26 (=3,000/112) urban credit unions were merged into a city commercial bank. Similarly, those urban credit unions still existed in 2005 were comparable with eleven (=300/26) city commercial banks. In other words urban credit unions have much smaller a role than city commercial banks in 2005. Hence, though we will include urban credit unions in our analysis as a source of credit for SMEs, their exclusion of branches is not likely to change our result substantially.

[5] Besides the three types of banks illustrated in the paper, there are also other financial institutions in China, namely three policy banks, there are still some existing urban credit cooperatives, rural credit cooperatives, trust and investment companies, and financial companies. While we only discuss commercial banks in the paper, the effect of non-bank financial institutions and policy banks on competition is a topic left for future research.

[6] As a Deutsche Bank report by Hu and Yue (2007) puts, "The city commercial bank is the fastest growing segment of China's banking sector in the years to come."

in 2006. Around 35% of total corporate loans of NBCB are less than 10 million RMB (about 120, 000 USD), while the proportion is less than 5% for ICBC. In addition, city commercial banks may be a vital source of formal financing for local SMEs. Figure 3 presents the market share of NBCB in Ningbo, its headquarter city. NBCB ranks fourth by total market share in the local credit market, which is surprisingly even larger than one of the four state-owned banks, i.e., the Bank of China. Consequently, city commercial banks may play a vital role in SME financing in local credit market. Similarly, joint stock banks orient more towards SMEs lending than state-owned banks, while also serve as important players in the local credit market, which is shown in Figures 2 and 3 accordingly.

In the following sections, we will introduce the SME survey dataset and banking competition measurements, and investigate whether the intensity of banking competition is associated with the severity of SME credit constraints.

III. Data

The data is composed of two parts: the SME survey dataset which was conducted in 2006, and hand-collected bank branch information.

3.1. SME Survey Dataset

A stratified survey dataset on Chinese private enterprises is available for the year 2006.[7] The survey comprises 3,837 observations, covering 31 regions (provinces, autonomous regions, or municipalities) in China.[8] Li, Meng and Zhang (2006) use the same survey to examine the political participation of entrepreneurs. We

[7] The data is obtained from University Service Center at The Chinese University of Hong Kong.

[8] The survey was initiated by four public institutes every two years since 1992: the China Administration for Industry and Commerce (government agency), the All-China Federation of Industry and Commerce (quasi-government agency), the China Private Economy Research Association (private research institute), and the United Front Work Department of CPC Central Committee (party agency).

use the dataset to investigate the determinants of firms' credit constraints.[9] 97.1% of the sample firms can be categorized as SMEs by total sales revenue, according to the standard SME definition followed by the Chinese government.[10] Consequently, the survey dataset can be used to investigate the SME financing.

The questionnaire mainly asks about the entrepreneurs' background and other firm characteristics. Most importantly, the questionnaire includes questions on credit and firm characteristics. Those questions are shown in Table 2. The survey not only probes for the credit demand of the firm, but also collects information on loans taken from banks, informal financing channels, individuals, and trade credit. Some accounting data is also being collected, such as equity, sales, and net profit.[11]

[Table 2 here]

The survey was conducted by the China Administration for Industry and Commerce and All-China Federation of Industry and Commerce. 4,300 SMEs, or 0.1% of the whole SMEs population, were chosen as sample firms. Each institution delivered half of the questionnaires (2,150 SMEs). The China Administration for Industry and Commerce selected the firms through its communication centers all over the country, while the All-China Federation of Industry and Commerce sampled proportionally from provinces, autonomous regions, and municipalities. All the questionnaires were filled out by trained surveyors in face-to-face interviews with the SMEs entrepreneurs or main

[9] Li, Meng and Zhang (2006) use the data from the 2004 survey, while we use the data from 2006 survey. The questionnaire for the 2006 survey has better information on bank credit than the 2004 survey. Both rounds of survey were conducted by the same institutions applying consistent criteria. However, there is no firm identity record rendering it impossible to combine 2004 and 2006 in a panel.

[10] According to the definition set by the China National Bureau of Statistics, SMEs have total sales revenues that is lower than 300 million RMB in industrial, construction, transportation and postal sectors, and lower than 150 million RMB in the wholesale, retail, accommodation, and catering sectors.

[11] The original questionnaire was sent out is in Chinese, but an English translation by the authors is available on request.

investors. Finally, 3,837 completed questionnaires were received, which resulted in a response rate of 89.23%.

The survey used standard stratification methods, which insures the randomness of the sampling process. Generally speaking, the sampling process was based on the number of private firms at each stratification level. Firstly, the whole country was stratified as provinces, municipalities, or autonomous region, and as cities, districts or counties. Secondly, the sample firms were stratified by urban or rural regions and industries. Thirdly, the number of sample firms was allocated proportionally at each stratification level. Finally, the firms were selected randomly within each stratification level with equal distance in the name list. If entrepreneurs or main investors of a sample firm refused to do the survey or could not be reached, the surveyees substituted the firm with a neighboring firm in the name list.

The sample distributions by industry and province are in Table 3. Panel A of Table 3 shows that 42.57% of sample firms are from the manufacturing industry, consistent with the population. In addition, Panel B of Table 3 shows that the percentage of sample firms in each province, autonomous region, or municipality are consistent with the population distribution of firms. Both industry and province distributions show that surveyed firms are representative of all other SMEs.

[Table 3 here]

3.2 Branch Information of State-Owned Banks, Joint Stock Banks and City Commercial Banks

State-owned banks, joint stock banks and city commercial banks have different organizational structures,[12] which lead to different bank branch distributions. State-owned banks have branches in almost every city.[13] Joint stock banks are allowed to open branches freely anywhere in the country, but they usually focus on a certain region of the country.[14] Before 2006 and due to financial regulations city commercial banks could only branch within their headquarter cities. Therefore, in terms of branch distribution, state-owned banks could be regarded as national banks, joint stock banks as regional banks, and city commercial banks as local banks. Table 4 presents the total number of branches that provide account services for firms in 2005.[15]

Not only the geographical footprint, but also the organization of the different banks is distinct. The four State-owned banks have five levels of branches, i.e., a *headquarter* (all in Beijing), a *provincial branch* (31 regions), a *city branch (*around 354 cities*),* a *county branch (*around 2,860 counties*),* and a *business office*. We hand-collect all branch information from their official websites.

The twelve joint stock banks have three levels of branches, i.e., a *headquarter*, a *province*, *municipality* or *city branch*, and a *business office*, and there is no limit on the number of new branches these banks are allowed to open. Joint stock banks

[12] Policy banks, foreign banks, and rural credit unions are not included in the branch statistics as these banks rarely extend loans to SMEs.

[13] For example according to its 2005 annual report the Agriculture Bank of China had over 28,000 branches located in many cities across China.

[14] For example, Shanghai Pudong Development Bank, a joint stock bank headquartered in Shanghai, mainly focuses on the east China market. In contrast, Guangdong Development Bank, another joint stock bank headquartered in Guangzhou, targets south China as its major market.

[15] Generally speaking, bank branches are categorized into two types: Corporate and Individual Service, and Individual Service Only. The former type can manage a corporate account, accept loan applications and make loan decisions, while the latter type can only provide services for an individual account. Depository and representative offices which provide solely the individual account service are excluded due to their irrelevance for SME financing.

are similar to state-owned banks in size and branch reach, while similar to city commercial banks in their business orientation toward SMEs.

Finally, the 112 city commercial banks have two levels of branches, i.e., a *headquarter* and a *local branch*. Most of the city commercial banks have their own websites, where branch names and addresses can be found. As city commercial banks could only operate in the local city market before 2006, we exclude those branches outside their headquarter cities in order to get close to the branch distribution in 2005.

Finally, the number of bank branches is merged with the survey data at the city level based on firms' headquarter postcodes. Hence we treat each city as a separate banking market, and measure competition using the number of branches for each bank in the city.

As the survey dataset was conducted in 2006, we need the branch distribution at the end of 2005 in order to investigate the association of banking competition and SMEs financing. While all the branch information is obtained from the banks' current websites, we try to get the branch distribution in 2005 by reading the banks' news announcements about the opening of new branches and relocation of existing ones. We check banks' websites in order to identify branches opened or relocated after 2005. Although we cannot identify bank branches closed after 2005, the problem seems to be mostly relevant for state-owned banks. State-owned banks have been shrinking in branch reach since 1997,[16] while joint stock banks and city commercial banks have witnessed an expansion during the same period. Omitting the state-owned branches closed after 2005 could lead to a

[16] Branch closures at the four state-owned banks have occurred for three reasons: 1) The Asian financial crisis in 1997 acted as a contractionary external shock; 2) The Government has since 1998 nudged all state-owned enterprises to reform; 3) Foreign banks have started to enter and compete since 2001 following the Chinese government's commitment to the WTO agreement for the financial industry.

downward measurement of concentration, which will inflate the coefficients estimations. Robustness checks would be done in order to deal with this possible measurement error.

Based on the number of branches for state-owned banks, joint stock banks and city commercial banks in each city, a Herfindahl-Hirschman Index (HHI) and a concentration ratio (CR3) can be calculated for the local credit market. Furthermore, HHI will be decomposed into three parts corresponding each bank type, to examine the heterogeneous effect across bank type on SME credit constraints.

IV. Measurement, Hypotheses and Methodology

4.1 Measurement for Credit Constraints: Financing Gap Dummy and Financing Gap Ratio

Credit constraints can be measured by the likelihood of loan applications and denials (Cavalluzzo, Cavalluzzo and Wolken 2002), access to bank finance and the use of trade credit (Petersen and Rajan 1995).[17] Generally speaking, credit constraints indicate a shortage of credit supply with respect to current credit demand, or a financing gap.[18] Instead of recording loan applications and denials, the questionnaire of the survey (we abridge in Table 2) asks directly about the demand for credit that is unfulfilled by the available credit supply, i.e., the

[17] According to a World Bank policy report, access to financial services requires that the services are available in sufficient quantity and at an affordable price when economic agents need it. Similarly, credit constraints then imply a lack of sufficient credit at an affordable interest rate when economic agents need credit.

[18] The OECD SMEs Financing Gap Book stresses: "There is no commonly agreed definition of this gap, but the term is basically used to mean that a sizeable share of economically significant SMEs can't obtain financing from banks, capital markets, or other suppliers of finance. Furthermore, it is often alleged that many entrepreneurs or SMEs that do not currently have access to funds would have the capability to use those funds productively if they are available; but due to structure characteristics, the formal financial system does not provide finance to such entities."

financing gap. Consequently, we can define a dummy variable (*DGAP*), which indicates whether a firm has financing gap, as:

Financing Gap = Credit Demand for Expansion + Credit Demand for Operation (1)

DGAP=1, if Financing Gap>0; DGAP =0, otherwise (2)

where *Credit Demand for Expansion* and *Credit Demand for Operation* are amounts from the questionnaire. Put it differently, the former is credit demand for investment, while the latter is credit demand for working capital. Both credit demand amounts are reported by the firm and in principle not included in the current outstanding credit balances that are surveyed in the next question.

To the authors' knowledge, there is no prior research exploring the magnitude of financing gap at the firm level. Easterly (1999) defines financing gap at the country level, which is the difference between the required investment and available resources. We apply a similar definition to firms in order to get a measure of financing gap instead of an indicator measurement. A firm's required investment could be decomposed into available resources which are credit balances in Table 2, and the financing gap defined above. In order to gain insight on how much proportion of the required investment faces credit constraints, we devise a quantitative measure, the *financing gap ratio* (*GAP*):

GAP = Financing Gap / [Financing Gap + Credit Balances] (3)

Where the *financing gap* is defined in equation (1) and the *Credit Balance* is the amount borrowed from all sources. In accordance with the questions reported in Table 2, the *Credit Balance* = Credit from State-Owned Banks + Joint Stock Banks + City Commercial Banks and Credit Unions + Informal Financing Channels + Individuals + Foreign Banks.

GAP could provide a more accurate measure than DGAP. While DGAP captures whether a firm is credit constrained or not, GAP characterizes the extent, or rather the tightness, of the credit constraint.

4.2 Measurement for Banking Competition: Herfindahl–Hirschman Index(HHI) and Concentration Ratio(CR3)

Competition in the banking sector can be measured by the banks' market share in the local credit market in deposits, loans, or number of branches (Petersen and Rajan 1995; Bikker and Haaf 2002; Degryse, Laeven and Ongena 2009). While deposit and loan market shares are not readily available in credit markets at the city level, number of branches in each city can be retrieved from the banks' websites. Following Degryse and Ongena (2007), for example, we measure the intensity of banking competition by the Herfindahl–Hirschman Index (HHI) and concentration ratio (CR3) using the banks' market shares in terms of bank branches.

Concentration measures are widely used to capture the intensity of competition in empirical banking research. The Structure-Conduct-Performance (SCP) approach is a popular paradigm which assumes that market concentration measures are good indicators of the intensity of competition (Scherer and Ross 1990). Petersen and Rajan (1995) for example use HHI by the market shares of deposits as a measure for competition. Market shares by bank branches are often highly correlated with the market shares by deposits or loans (Fischer 2000), hence when the latter are not available, the HHI by branches can be a robust measure of the market power of banks. Degryse and Ongena (2007) for example calculate Herfindahl–Hirschman Index (HHI) as the summed squares of market shares of bank branches in a firm's headquarter city.

Although concentration and competitiveness cover different concepts (Claessen and Laeven 2004), there is evidence that concentration impairs competitiveness (Bikker and Haaf 2002). However, Carbo′-Valverde, Rodriguez-Fernandez and Udell (2009) find that the Lerner Index is a better measure for banking market power, with which the HHI produces contradictory results on SMEs financing. In addition, Scott and Dunkelberg (2010) find that reports of increased competition by small firm owners is negatively related with the level and change in deposit concentration, while its effect on banking outcomes is independent of deposit concentration.

Generally speaking, the competitive environment of banks could be characterized by regulatory restrictions on competition, entry restrictions, and legal impediments to bank competition (Berger, Demirgüç-Kunt and Levine 2004). These characteristics could be captured by non-structural measures of competition, such as the Iwata model, the Bresnahan model and the Panzar and Ross approach (Bikker and Haaf 2002). These measures usually need credit demand and supply data, including interest rates, which are not available for our analysis. Hence, but aware of all *caveats*, we will use market concentration as our only measure for the intensity of competition.

When calculating the HHI and CR3, we assume implicitly that all bank branches are homogeneous in efficiency. However, joint stock banks and city commercial banks are usually more efficient than state owned banks due to their ownership and organizational structure. On the one hand, joint stock banks and city commercial banks have more discretion over loan interest rate,[19] which renders

[19] The People's Bank of China (the central bank) reformed the regulation on loan interest rate in 2004. For joint stock banks and city commercial banks, the lower bound of the loan interest rate is 90% of the baseline interest rate, while there is no upper bound for loans to SMEs. Generally speaking, there is no upper bound of loan interest rate for state-owned banks either, but their discretion over loan interest rate is much less than the other two types of banks. Anecdotal evidence suggests that loan interest rates charged

them more flexible in extending loans to firms, especially to local SMEs. On the other hand, joint stock banks have no policy burdens as state-owned banks have,[20] while they can still benefit from business diversification nationwide compared with city commercial banks. Consequently, joint stock banks could be more efficient than state-owned banks and city commercial banks.

In order to capture the heterogeneous effect of joint stock banks and city commercial banks on competition, we define two components of HHI:

$$HHIJS = HHI * HHI\_JSP \tag{4}$$

$$HHICC = HHI * HHI\_CCP \tag{5}$$

where HHI_JSP is the percentage of HHI contributed by joint stock banks, and HHI_CCP is the percentage of HHI contributed by city commercial banks. Put differently, HHI_JSP and HHI_CCP are the market shares of joint stock banks and city commercial banks. So HHIJS and HHICC are the interaction terms of HHI and market shares of joint stock banks and city commercial banks. Intuitively, joint stock banks and city commercial banks may change the marginal effect of HHI on the financing outcome, which could be captured by an interaction term of HHI and their respective market shares.

All the variable definitions are listed in Table 5. The first column is the variable category, which includes credit constraint measures, firm-specific variables and concentration measures, the second column lists the variable name and the third column lists the variable definitions.

[Table 5 here]

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by joint stock banks and city commercial banks are typically higher than those charged by state-owned banks while other loan conditions seem more equal.

[20] For example, state-owned banks are often required by the government to open branches in the western part of the country. Such expansion to serve political considerations may lower the banks' profitability.

4.3 Hypotheses

The effect of competition on credit constraints is ambiguous in the literature. Generally speaking, the literature revolves around two competing views: the *information hypothesis* which emphasizes relationship lending, and the *market power hypothesis* which follows from the Structure-Conduct-Performance approach. On the one hand, in the *information hypothesis* fiercer competition may make it more difficult for banks to internalize the benefit of assisting opaque firms which in turn lead to more credit constraints (Petersen and Rajan 1995).

Using a survey dataset of German manufacturing firms, Fischer (2000) for example finds that more concentration leads to more information acquisition which further results in more credit availability. In addition, Zarutskie (2003, 2006) finds that more competitive banking markets drive firms to use less outside debt and more inside debt and equity, and that — consistent with the model of Petersen and Rajan (1995) — more intense competition leads to more credit constraints for young firms.

On the other hand, under the benchmark *market power hypothesis* more competition in the banking market reduces the interest rate and hence increases the availability of credit to all firms irrespective of their opacity (Carbo′-Valverde, Rrodriguez-Fernandez and Udell 2009).

We will test the *market power hypothesis* against the *information hypothesis*. Under the market power hypothesis, a more competitive banking market will lead to less binding credit constraints, i.e., a lower HHI and CR3 ratio will lead to a lower probability of credit constraints and a lower financing gap ratio. Our first hypothesis can therefore be stated as follows:

Hypothesis 1: More competition leads to a less binding credit constraint.

whereby competition is measured by the HHI or CR3, and the credit constraints are measured by DGAP or GAP. Consequently, the predicted signs of HHI and CR3 are positive if the *market power hypothesis* holds, while negative otherwise.

Small banks may have a comparative advantage in lending to SMEs (Jayaratnea and Wolken 1999). In the Chinese banking market, small banks such as joint stock banks and city commercial banks may in addition have more business orientation toward SMEs. Our second hypothesis can therefore be stated as follows:

Hypothesis 2: Competition from joint stock banks and city commercial banks has a larger effect on credit constraints than competition from state-owned banks.

The competition from joint stock banks and city commercial banks are measured by HHIJS and HHICC defined in equations (2) and (3). As a result, the predicted signs for coefficients of HHIJS and HHICC should both be positive if they are more efficient in reducing credit constraints than state-owned banks. The coefficient of HHIJS should be larger than HHICC if joint stock banks are more efficient than city commercial banks in reducing credit constraints.

4.4. Econometric Model

In order to test the two aforementioned hypotheses, we model the effect of banking competition on SMEs credit constraints through a linear specification:

$$Credit\ Constraint\ Measures_i = \beta_0 + \beta_1 Concentration_i + \sum_l \gamma_{il} FC_{il} + \sum_j Industry_j + \varepsilon_i \quad (6)$$

Credit constraints measures are DGAP and GAP; concentration indices, i.e., *HHI* and CR3, measure banking competition; *FC* are firm specific control variables such as size, profitability and age; Industry stands for the set of industry dummies.

In order to gain insight on whether a firm is credit constrained, we employ OLS, Probit and Logit specifications to equation (6). For the financing gap ratio, OLS specification may not be appropriate because of censoring. The Panel A of Figure 4 shows a histogram of the financing gap ratio, which shows considerable mass on zero and one. We use a Tobit model to examine financing gap ratio, that accounts for left cencoring at zero and right censoring at one. When excluding both the zero and one values, we can get a clearer profile of the financing gap ratio in Panel B of Figure 4. Therefore, we do robustness checks using an OLS specification after excluding the observations with a financial gap ratio equals zero or one.

[Figure 4 here]

V. Summary Statistics

Table 6 presents summary statistics for the credit constraints measures, and the explanatory and control variables. The sample 75% percentile of firm sales is around $ 1 million, and the median is around $ 250,000, while the 25% percentile is around $ 65,000. Hence most of the firms are SMEs. Indeed, according to SMEs definition of Chinese government by sales, over 97.1% of the sample firms are SMEs. Consequently, we can say that most of sample firms are SMEs in a Chinese context. The sample firms have a mean sales growth rate of 52% and ROE of 30%, which indicates high growth opportunities and profitability for SMEs. Finally, firms have an average age of 7.06, which are much younger than

the firms in Scott and Dunkelberg (2010) for example who use a US SME sample and report an average age of 18.33.[21]

[Table 6 here]

The mean value of DGAP and GAP are 0.74 and 56% respectively. Put it differently, 74% of the firms fall in credit constraints while 56% of the credit required by the firm does not meet proper credit supply, which is consistent with the usual claim on SMEs financing dilemma. Besides, 30% of firms use trade credit, which also indicates a high proportion of credit constrained firms.

The mean of HHI is 0.22, while CR3 has a mean value of 0.68.[22] Hence the Chinese banking market is rather highly concentrated compared to other economies.[23] Furthermore, the proportion of HHI by joint stock banks is 4% and 8% for city commercial banks, which indicates that state-owned banks still dominate the banking market in terms of bank branch reach.

VI. Economic Importance of Banking Competition

Banking competition may enhance or deteriorate SMEs financing, depending on whether the *market power hypothesis* or the *information hypothesis* dominates. On the one hand, we examine SMEs probability of facing credit constraints through DGAP. On the other hand, we investigate the tightness of these credit constraints through the GAP. Hence, DGAP provides a qualitative measure, while GAP

[21] On the other hand, our sample SMEs are larger than the firms analyzed in Scott and Dunkelberg (2010). The mean (median) number of employees for example in our sample equals 177 (45), in their analysis it equals 13 (n/a).

[22] The national HHI is 0.18, and national CR3 is 0.66. National average of HHI across 354 cities is 0.31, and national average of CR3 is 0.80. Scott and Dunkelberg (2010) report a mean of 0.24 and standard deviation of 0.15 for the HHI based on deposit concentration, which is comparable with the value in our dataset.

[23] Bikker and Haaf (2002) report the national HHI (CR3) based on total banking assets in 1997 for 23 countries. The United States has the lowest HHI (CR3) that equals 0.02 (0.15), while Switzerland has the highest HHI (CR3) which equals 0.26 (0.72). For East Asian economies, South Korea's HHI (CR3) is 0.11 (0.45), while Japan's HHI (CR3) is 0.06(0.39).

provides a quantitative measure for credit constraints. Besides, both HHI and CR3 are used as concentration measures, while we decompose HHI by bank type in order to capture the heterogeneous effects. In order to tackle possible endogeneity concerns, we will employ an instrumental variable regression in robustness.

6.1 Financing Gap Dummy Variable

As shown in Table 5, DGAP, a dummy variable, indicates whether a firm faces credit constraints. We use OLS, Probit and Logit specifications to examine the effect of banking competition on the presence of credit constraints.

A. Banking Competition Measured by the HHI

Table 7 presents regressions of the financing gap dummy with OLS, Probit and Logit specifications. Model (1) presents full model OLS estimation for banking competition. A decrease in the HHI from its 75% to 25% percentile will result in a 6.5% reduction of the probability of having credit constraints. Similarly, the Probit model (3) yields an 8.4% reduction while the Logit model (5) an 8.5% decrease in this probability. All model specifications show that more banking competition is associated with a lower probability of having credit constraints for SMEs.

[Table 7 here]

Surprisingly, larger firms are more likely to face credit constraints. This is inconsistent with stylized facts that small firms are more likely to be credit constrained. However, alternative financing channels and governance mechanisms, such as reputation among and relationships with wealthy family members, friends or suppliers for example, are found to support China's private sector growth (Allen, Qian and Qian 2005). As the growth of the private sector is

mostly due to the growth of SMEs, a possible explanation for the above anomaly is that smaller firms can alleviate credit constraints through informal finance channels, while larger firms have to seek additional bank credit. The latter type of credit is often more difficult to obtain.

B. Banking Competition Measured by the CR3

CR3, which is the market share of the three largest banks based on the number of branches, can also be used to measure banking competition. Table 8 shows the regression results when we substitute the HHI with the CR3. Results are very similar. More intense banking competition, or a lower CR3, is associated with a lower probability SMEs face credit constraints. According to model (1) in Table 8, a decrease of CR3 from the 75% to the 25% percentile is associated with an 8.2% reduction in the probability of credit constraints are present, while the predicted reductions in the Probit model (3) is 8.2% and Logit model (5) is 8.0% respectively. The effect of banking competition on SMEs financing is not dependent on the choice of competition measure, which indicates the robustness of this correspondence.

[Table 8 here]

C. Instrumental Variable Regression

While more intense banking competition could help alleviate SMEs credit constraints, markets with more credit constrained firms may also attract more competing banks which could further increase the intensity of banking competition. This reverse effect could lead to an endogeneity concern in the model specification of equation (6).

We instrument the concentration indices with the average value of neighboring cities in the same province. With each city treated as a separate market, the

concentration indices of neighboring cities are not likely to affect local SMEs credit constraints due to transaction and information costs of cross-city lending.[24] On the one hand, four state-owned banks have branches almost in every city, which also have clear business segmentation among cities. Hence if firms are to apply for loans from state-owned banks, they should visit local branches in their headquarter cities, which insures business segmentation among cities. On the other hand, city commercial banks do not have branches outside their headquarter cities, so that they are constrained to local credit markets.

However, branches of joint stock banks can extend loans to firms outside the cities where they domicile, which may undermine the business segmentation among cities.[25] Petersen and Rajan (2002) document that the distance between banks and small firms is increasing in the US due to the improvement in lender productivity. However, banks in China are relatively inefficient in lending technology compared with the US, which may render small firms to rely exclusively on local banks. Furthermore, Degryse and Ongena (2007) find that more intense competition pushes banks to engage in relationship lending which involves acquisition of soft information of firms, while Agarwal and Hauswald (2010) find that borrower proximity facilitates the collection of soft information which is primarily local.

As China's banking industry has been facing intensifying competition since the 1997 Asian financial crisis, joint stock banks may also focus more local firms in order to access soft information for relationship lending. Consequently, the business segmentation among cities may still hold even if joint stock bank

[24] The distance between two cities in China is around 80 kilometers on average, with an average population of four million. As a result, SMEs are not likely to borrow from formal or informal financing channels in other cities, which make the concentration indices in other cities irrelevant to local SMEs financing.

[25] Generally speaking, if a joint stock bank has branches in a city, then firms should go to local branches for loan applications. For cities without branches, joint stock banks often allocate them to the nearest cities where they have branches. It is especially the latter case that may weaken the business segmentation among cities.

branches could lend across cities, which will lead to the irrelevance of concentration indices of neighboring cities for local SMEs financing.

In contrast, the concentration indices could be associated with the value of neighboring cities. Cities with intense competition could drive banks to turn for those with fewer competitors through opening new branches, which could affect the local concentration indices. As a result, average concentration indices of neighboring cities are correlated with local concentration indices, but uncorrelated with SMEs credit constraints, which makes these average concentration indices of neighboring cities good instruments.

Table 9 presents the instrument variable regressions for both the HHI and the CR3. Models (1) and (2) in Table 9 are OLS and Probit specifications with HHI instrumented by average HHI of neighboring cities. HHI is significant at the 1% level both in OLS and Probit models, and CR3 is significant at the 5% level in OLS model (3) and at the 10% level in Probit model (4). These IV regressions confirm that the relationship between banking competition and probability of credit constraints are not susceptible to the endogeneity problem.

[Table 9 here]

D. Decomposition of the HHI

Competition from joint stock banks and city commercial banks may be more efficient in alleviating SMEs credit constraints than state-owned banks. We investigate the heterogeneous effect of banking competition on reducing the probability of credit constraints by decomposing the HHI into three parts, as was illustrated in equations (4) and (5). Intuitively, the marginal effect of HHI could be heterogeneous across differently types of banks.

Models (2), (4) and (6) yield insignificant results for the heterogeneous effects when only including the concentration indices. However, we get significant

results when controlling for firm specific variables. OLS model (1) in Table 10 shows that the presence of joint stock banks are indeed more effective, and the presence of state-owned banks are less effective, than the presence of city commercial banks in reducing the probability of credit constraints. Probit model (3) and Logit model (5) yield qualitatively similar results with OLS model (1).

[Table 10 here]

To examine the economic significance of heterogeneous marginal effect of banking competition, note from the OLS model (1) that the marginal effect of HHI will increase by 21.2% if joint stock banks' market share increase from zero to its sample mean, and increase by 10.2% if city commercial banks' market share increase from zero to its sample mean. Furthermore, for a decrease of HHI from the 75% to the 25% percentile, the former results in a 9.9% decrease in probability of credit constraints, while the latter yields a 9.0% reduction. In contrast, for a market with only state-owned banks, the same change of HHI will only lead to 8.2% reduction in the probability of having credit constraints. In short, joint stock banks are more efficient, while state-owned banks are less efficient, than city commercial banks in reducing the probability SMEs face credit constraints.

6.2 Financing Gap Ratio

The GAP, or financing gap ratio, characterizes the extent that credit constraints are binding. While the existing literature typically focuses on whether firms are constrained, there is little empirical work on the size of the credit constraints that firms face. The unique dataset we employ allows us to examine the effect of banking competition on the size of the credit constraints.

A. Banking Competition Measured by the HHI

Table 11 presents the OLS and Tobit estimation results for models with GAP being the dependent variable. HHI is significant at the 1% level across all model specifications, which is consistent with the results for the financing gap dummy in Table 7. If HHI decreases from its 75% to 25% percentile, the financing gap ratio will decrease by 6.6% in OLS model (1).

[Table 11 here]

Figure 4 shows that substantial observations have financing gap ratios that are clustered at 0 and 100.[26] A Tobit model with left censoring at 0 and right censoring at 100 is employed to tackle with the problem, which is shown in model (3) in Table 11. If HHI decreases from the 75% to the 25% percentile, the financing gap ratio will decrease by 10.1%. As a robustness check, we exclude observations with 0 and 100 for the financing gap ratio in the OLS model (5), which yields qualitatively similar results with OLS model (1) and Tobit model (3), though the magnitude is much smaller.

Banking competition not only lowers the probability of credit constraints, but also reduces the extent of credit constraints and the financing gap ratio. These results are significant both in the statistical and economic sense.

B. Banking Competition Measured by the CR3

Alternatively, Table 12 presents regression results when CR3 is used as a measure for competition under various model specifications. CR3 is significant at the 1% level for all model specifications, whether firm specific variables are controlled for or not. Furthermore, a decrease of CR3 from the 75% to the 25% percentile will result in a 10.2% reduction of the financing gap ratio in the Tobit

[26] We rescale the coefficient estimates by multiplying the financing gap ratio by 100.

model (3). The choice of competition measurement does not change the effect of banking competition on the financing gap ratio.

[Table 12 here]

C. Instrumental Variable Regression

Faced with a similar endogeneity concern, we again conduct IV regressions for the financing gap ratio. Table 13 presents the IV estimations with the concentration indices instrumented with the average value for all neighboring cities. Model (1) is an IV specification and model (2) is an IV Tobit specification when HHI is employed as the competition measure. Both specifications yield positive significant coefficients for HHI at the 1% level, which confirms that more intense competition could reduce financing gap ratio. In addition, models (3) and (4) in Table 13 include the CR3. Coefficients are again significant at the 1% level. Hence IV regressions confirm the robustness of the claim that more intense banking competition could lead to a lower financing gap ratio.

[Table 13 here]

D. Decomposition of the HHI

Competition from different types of banks may result in heterogeneous effect on SMEs financing outcome. Generally speaking, state-owned banks are less aggressive than joint stock banks and city commercial banks, which could be captured by the interaction terms of HHI and their respective market share.

Table 14 presents OLS and Tobit estimations for the financing gap ratio. The coefficient on the HHI is positive and significant at the 1% level for all model specifications, which is consistent with the results that more intense banking competition can alleviate SMEs credit constraints by reduce financing gap ratio in Table 11.

[Table 14 here]

Model (1) in Table 14 yields positive significant coefficients for the interaction terms, HHIJS and HHICC, implying that joint stock banks and city commercial banks are more efficient than state-owned banks in reducing the financing gap ratio. Furthermore, joint stock banks are more efficient than city commercial banks as the coefficient on HHIJS is larger than the one on HHICC. In addition, Model (3) in Table 14 presents Tobit estimations with left censoring of 0 and right censoring of 100. Results are qualitatively similar with model (1). As a robustness check, we exclude the 0 and 100 values for the financing gap ratio in model (5) of Table 14, again confirming the result in model (1) and model (3). However, models (2) and (4) in Table 14 yield insignificant coefficients on the HHICC variable, when firm specific variables are not included. This insignificance may be the result of an omitted variable bias in model (2) and model (4), as coefficients become significant when firm specific variable are included in model (1) and model (3).

The heterogeneous effect of banking competition is also economically significant. If the market share of joint stock banks increase from zero to its sample mean 4%, the marginal effect of HHI will increase by 28.7%. If HHI decreases from its 75% percentile to 25% percentile, the financing gap ratio will decrease by 18.5% instead of 14.4%. Similarly, if the market share of city commercial banks increase from zero to its sample mean 8%, the marginal effect of HHI will increase by 8.7%. In particular, if HHI decreases from its 75% to 25% percentile, the financing gap ratio will decrease by 15.6% instead of 14.4%.

In sum, the marginal effect of the HHI on the financing gap ratio depends on the competition from different types of banks. Joint stock banks have a larger effect,

while state-owned banks have a smaller effect than the city commercial banks in alleviating the size of the SME credit constraints, or the financing gap ratio.

VII. Robustness Check

Firstly, we employ trade credit as an alternative measure for credit constraints (Petersen and Rajan 1995, 1997). Although the coefficient on the HHI turns insignificant in various model specifications, CR3 is still significantly positively related with the financing gap dummy variable and the financing gap ratio across all specifications.

Secondly, we add two regional dummies to the regression, "east", "central", in order to control for locations. We still get qualitatively similar results except for the instrumental regression. However, the instrumental regression still holds if we use the concentration indices of neighboring cities directly instead of its average value as instruments. A possible explanation is that regional dummies absorb too much variation, while including more information in the instrumental variables could capture more exogenous change of concentration indices.

Thirdly, we examine the heterogeneous effect of rural and urban firms. Generally speaking, rural firms may rely more on informal financing channels, while urban firms may rely more on formal finance or bank finance (Scott and Dunkelberg 2010). Consequently, bank competition may affect urban firms more than rural ones. We add interaction terms for HHI and CR3 with a rural dummy variable, but the estimated coefficients are insignificant across all model specifications. In a word, there is no evidence that banking competition has a different effect on SMEs in rural or urban areas.

Finally, Degryse and Ongena (2007) document that there is U-shaped effect of market concentration on relationship lending, and Presbitero and Zazzaro (2010)

provide an explanation based on organizational structure of local credit markets. We examine the non-linear effect of the concentration indices by adding squared terms. Although we find that the coefficient is significant for the squared terms at the 5% level, the result is misleading to some extent as only around five percent of the observations are beyond the turning point of concentration indices. In other words, in our dataset it may be the extreme values that dominate the non-linear effect, which may not be so informative about the underlying economic mechanism.

VIII. Conclusion

Banking competition can enhance SME financing by reducing the probability of the presence of credit constraints and the magnitude of the financing gap ratio. While there is plenty of literature on the probability of credit constraints, little evidence has been reported concerning the magnitude of these constraints. Using a survey dataset on Chinese SMEs, we investigate how banking competition contributes to alleviating credit constraints both in terms of the probability SMEs face credit constraints and the magnitude of the financing gap ratio. On the one hand, we find that more intense banking competition is associated with a lower probability SMEs face credit constraints, a finding that is robust to the choice of concentration measurement and in instrumental variable estimations. On the other hand, more intense banking competition is also associated with a lower level of financing gap ratio, a finding we think that has not been reported before in the empirical literature. Moreover, we find that the joint stock banks have a larger effect, while the state-owned banks have a smaller effect, than city commercial banks on reducing the probability SMEs face credit constraints and the magnitude of the financing gap ratio. Put differently, banking competition

from different types of banks can lead to heterogeneous effects on the credit constraints of SMEs.

While the information hypothesis predicts that creditors are more likely to finance credit constrained firms when credit markets are concentrated (Fischer 2000; Petersen and Rajan 2002; Bergstresser 2010), our evidence from China supports the market power hypothesis. Due to the difficulty in internalizing the benefit of relationship lending in a developing economy, transaction lending toward SMEs could be more popular among banks. Our evidence from China casts doubts on the relationship between banking market structure and credit constraints in emerging markets, where more intense banking competition seems to help in alleviating SME credit constraints. In order to support SMEs in emerging economics such as China, a potential policy implication is to promote regional banks, for example joint stock banks, which have both a business orientation toward SMEs and are regionally diversified.

While the paper examines credit constraints from the quantity perspective, it is rather interesting to investigate how banking competition affects loan price. The interest rate profile may capture the mechanism of how banking competition affects credit constraints, say through relationship lending. There is no price information in this dataset, hence we leave this question for future research.

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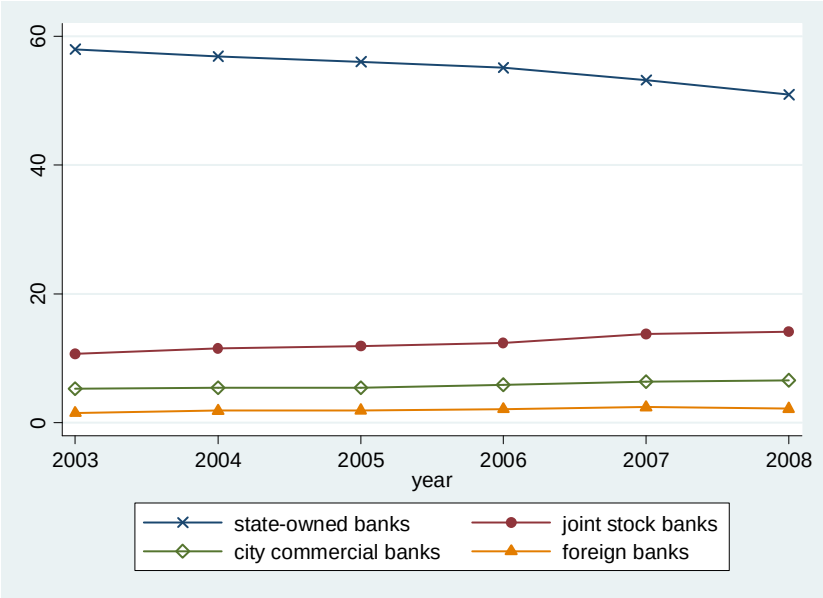
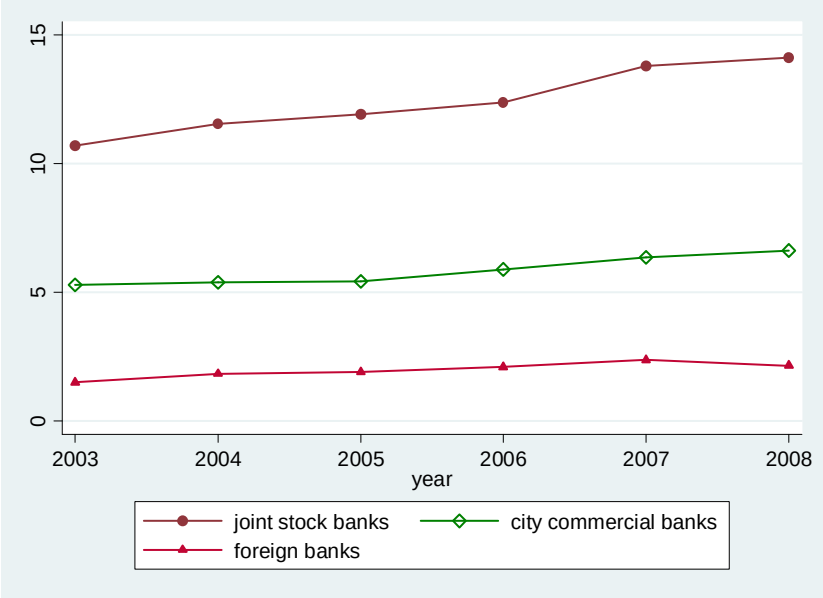


Panel A



Panel B

Figure 1: Market Share of Banks by Total Bank Assets. Data is from the OECD Economic Survey 2009. Panel A includes all four bank types, while Panel B excludes state-owned banks.

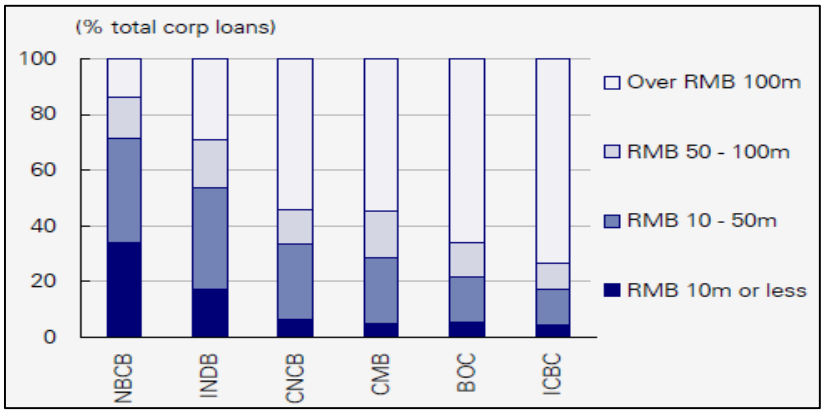


Figure 2: Corporate Loan Size Distribution. The figure is taken from the Deutsche Bank Report 2007. State-owned banks: ICBC and BOC (Bank of China). Joint stock banks: CNCB and CMB. City commercial banks: NBCB and INDB.

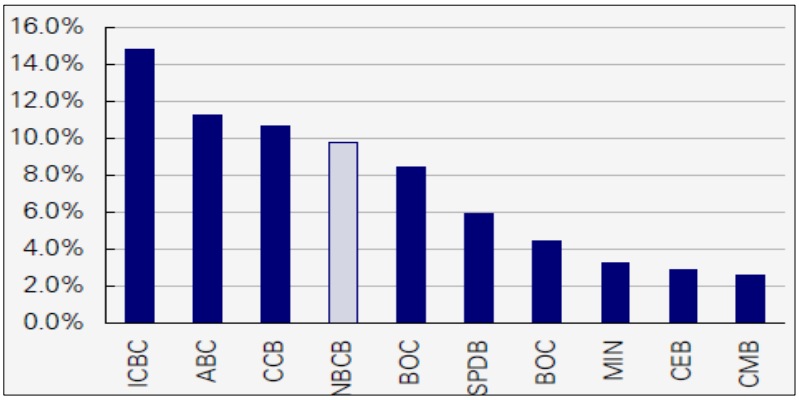
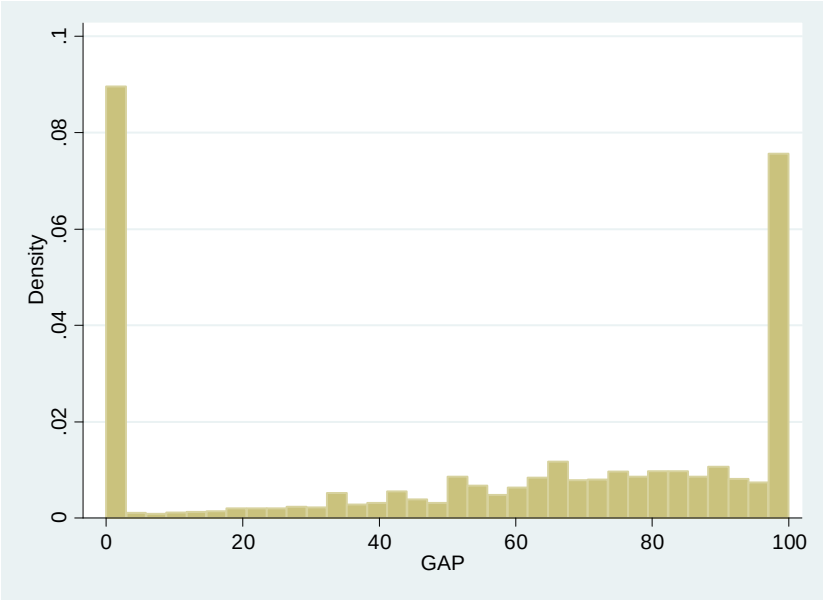
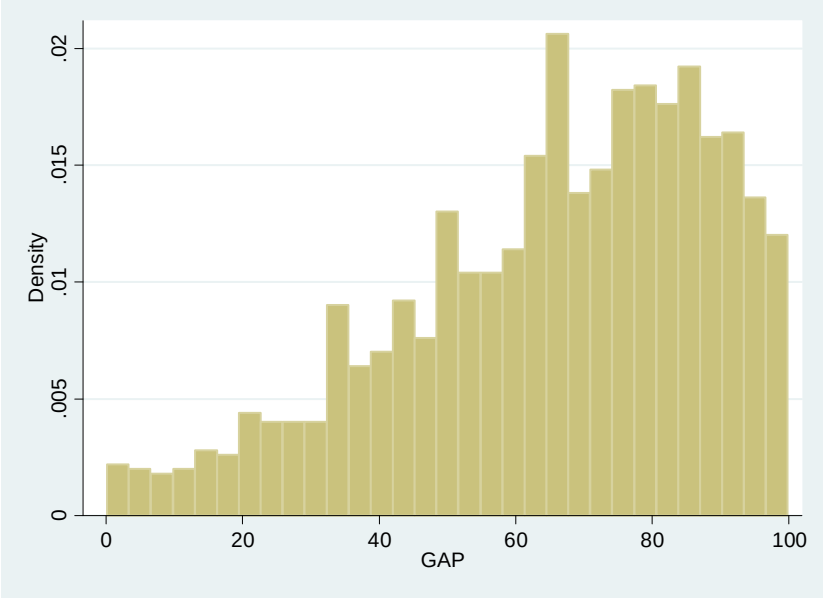


Figure 3: Market Share of Banks in NBCB's Headquarter City, Ningbo. The figure is taken from the Deutsche Bank Report 2007. State-owned banks: ICBC, ABC, CCB, and BOC (Bank of China). Joint stock banks: SPDB, BOC (Bank of Communication), MIN, CEB, and CMB. City commercial banks: NBCB.



Panel A



Panel B

Figure 4: Histogram for the Financing Gap Ratio (GAP). Data is in percentage points. Panel A is for the whole sample, the Panel B excludes 0 and 100 for GAP. In both panels, the horizontal (GAP) axis and the vertical (density) axis are identical.

Table 1: Total Assets of Listed Banks in 2009

Bank Type	Bank Name	Total Assets (USD billion)
State-owned Banks	Industrial and Commercial Bank of China	1,772.19
	China Construction Bank	1,447.12
	Bank of China	1,316.08
	Agriculture Bank of China*	1,293.23
Joint Stock Banks	Bank of Communication	497.61
	China Merchants Bank	310.97
	China Citic Bank	266.92
	Shanghai Pudong Development Bank	244.02
	China Minsheng Bank	214.50
	Industrial Bank	200.33
	Hua Xia Bank	127.14
	Shenzhen Development Bank	88.39
City Commercial Banks	Bank of Beijing	80.22
	Bank of Ningbo	24.56
	Bank of Nanjing	22.49

Notes: Data from CCER financial database. * Agriculture Bank of China was listed only in 2010 and its total assets are reported here for reference only. The total assets are converted into US dollar using the exchange rate at the last trading day of 2009, i.e., 6.65 RMB/USD.

Table 2: Survey Questionnaires

Panel A: Credit Demand and Credit Balance

(1). Credit demand for expansion___

(2). Credit demand for operation___

(3). In Dec 31st, 2003, the credit balance from:

a. four state-owned banks ___

b. joint stock banks___

c. city commercial banks and credit unions ___

d. informal financing channels ___

e. individuals ___

f. foreign banks ___

(4). Do other firms delay payment of trade credit or other loans to your firm: amount ___

(5). Does your firm delay payment of trade credit or other loans to other firms: amount___

Panel B: Firm-level Variables

Year	Sales	Tax	Fees	Net Profit after Tax
2000				
2004				
National Economic Survey 2004				
2005				

Table 3: Sample Distribution

Panel A: Sample Distribution by Industry

Industry Name	N	Percentage
Farming, Forestry, Animal Husbandry, and Fishery	245	6.60%
Mining, Energy and Utilities	123	3.31%
Manufacturing	1,581	42.57%
Construction	207	5.57%
Transportation	107	2.88%
Information and Technology	197	5.30%
Wholesale and Retail	831	22.37%
Consumer Discretionary	301	8.10%
Financials	122	3.28%
Total	**3,714**	**100.00%**

Panel B: Sample Distribution by Province

Province	Percentage Survey	Percentage Population	Province	Percentage Survey	Percentage Population
Beijing	5.88%	6.05%	Hubei	5.02%	3.00%
Tianjin	0.99%	1.80%	Hunan	3.24%	1.97%
Hebei	4.21%	2.95%	Guangdong	10.09%	10.44%
Shanxi	0.97%	1.66%	Guangxi	0.65%	1.21%
Neimenggu	0.78%	1.12%	Xizang	0.26%	0.75%
Liaoning	4.92%	3.84%	Chongqing	1.05%	1.76%
Jilin	0.78%	1.40%	Sichuan	2.98%	4.16%
Heilongjiang	3.61%	1.59%	Guizhou	0.58%	0.96%
Shanghai	11.19%	11.02%	Yunnan	0.92%	1.53%
Jiangsu	11.45%	11.80%	Hainan	0.44%	0.06%
Zhejiang	9.91%	8.35%	Shaanxi	1.28%	2.29%
Anhui	1.36%	2.46%	Gansu	2.85%	0.89%
Fujian	1.70%	2.96%	Qinghai	0.26%	0.25%
Jiangxi	4.11%	1.65%	Ningxia	0.37%	0.44%
Shandong	5.05%	7.33%	Xinjiang	1.23%	1.20%
Henan	1.80%	3.10%	**Total**	**100.00%**	**100.00%**

Table 4: Number of Branches with Public Service

Bank Type	Bank Name	Number of Branches
State-owned Banks	Agriculture Bank of China	23,178
	Industrial and Commercial Bank of China	12,648
	China Construction Bank	10,976
	Bank of China	9,773
Joint Stock Banks	Bank of Communication	2,736
	China Merchants Bank	742
	China Everbright Bank	546
	Shanghai Pudong Development Bank	536
	Guangdong Develoment Bank	530
	Industrial Bank	528
	China Citic Bank	420
	Hua Xia Bank	365
	China Minsheng Bank	361
	Shenzhen Development Bank	301
	Hengfeng Bank	91
	Zheshang Bank	19
City Commercial Banks	112 City Commercial Banks	6,643

Table 5

Variable Definitions

Variable Category	Variable Name	Definition
Credit Constraints Measures	DGAP	=1 if credit demand > 0, = 0 otherwise. Credit demand = credit demanded for expansion and credit demand for operation
	GAP	GAP = credit demand / (credit demand + credit balance). Credit balance = credit from State-owned Banks + Joint Stock Banks + City Commercial Banks and Urban Credit Unions + Informal Financing Channels + Individuals + Foreign Banks
	TRADE	= 1 if trade credit > 0, = 0 otherwise
Firm Specific Variables	SIZE	Firm size, calculated as log(equity), in 2005
	ROE	Return on equity = net income after tax over total equity, in 2005
	TANGIBLE	Property, plant, and equipment over total capital (equity), in 2005
	GROWTH	Sales growth rate, in 2005, calculated as the sales in 2005 divided by sales in 2004
	AGE	Log firm age = 2006 minus the year when a firm registered as a private firm
Concentration Measures	HHI	Herfindahl–Hirschman Index $=\sum_{k=1}^{K_i}\left(\#branch_k \Big/ \sum_{k=1}^{K_i}\#branch_k\right)^2$, K_i is the total number of banks in city i where the firm is domiciled
	HHI_JS	Market share of joint stock banks, $=\sum_{j=1}^{J}\left(\#branch_j \Big/ \sum_{k=1}^{K_i}\#branch_k\right)^2$ /HHI, , J is number of joint stock banks in local market, K_i is the total number of banks in city i where the firm domiciles
	HHI_CC	Market share of City Commercial Banks, $=\sum_{c=1}^{C}\left(\#branch_c \Big/ \sum_{k=1}^{K_j}\#branch_k\right)^2$ /HHI, , C is the number of city commercial banks in local market, K_i is the total number of banks in city i where the firm domiciles
	HHIA	Average HHI of neighboring cities in the same province. For Beijing, Shanghai, Tianjin, Chongqing, the neighboring cities in other provinces are used because these 4 cities are governed directly by the

		central government, so they do not have "neighboring cities in the same province". The same rule applies to CR3A
	CR3	Concentration Ratio for 3 Largest Banks = $\sum_{n=1}^{3}(\#branch_n) \Big/ \sum_{k=1}^{K_j} \#branch_k$, n=1, …, 3 are the 3 largest banks by number of bank branches
	CR3A	Average CR3 of neighboring cities in the same province; and for Beijing, Shanghai, Tianjin, Chongqing, the neighboring cities in other provinces are used

Table 6

Summary Statistics for Credit Constraints Measures and Explanatory Variables

	Variable	N	Mean	Median	Std. Dev.	p1	p10	p25	p75	p90	p99
Credit Constraints Measures	DGAP	2,907	0.74	1	0.44	0	0	0	1	1	1
	GAP	2,907	55.55	66.67	39.25	0	0	0	93.75	100	100
	TRADE	3,432	0.30	0	0.46	0	0	0	1	1	1
Explanatory Variables	SIZE	2,503	5.49	5.30	1.75	1.61	3.40	3.99	6.84	7.92	9.62
	ROE	2,187	0.30	0.12	0.58	-0.38	0.00	0.03	0.30	0.75	3.80
	TANGIBLE	3,398	0.41	0.40	0.30	0.00	0.00	0.10	0.70	0.80	0.97
	GROWTH	2,541	1.52	1.23	1.29	0.21	0.88	1.06	1.50	2.02	10.00
	AGE	3,678	7.06	6	4.46	1	2	4	10	13	20
	HHI	3,820	0.22	0.20	0.09	0.10	0.12	0.16	0.27	0.31	0.64
	HHI_JS	3,820	0.04	0.02	0.05	0.00	0.00	0.00	0.06	0.10	0.27
	HHI_CC	3,820	0.08	0.04	0.12	0.00	0.00	0.00	0.11	0.20	0.58
	HHIA	3,820	0.25	0.23	0.07	0.15	0.19	0.20	0.26	0.33	0.44
	CR3	3,822	0.68	0.68	0.13	0.40	0.48	0.59	0.78	0.85	1.00
	CR3A	3,820	0.74	0.73	0.09	0.57	0.66	0.68	0.79	0.86	0.93

Notes: All variables are defined in Table 5. DGAP equals one if the firm's credit demand is positive and equals zero otherwise; GAP is the financing gap ratio, in percentage points; TRADE equals one if firm trade credit is positive and equals zero otherwise; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment; HHI is the Herfindahl–Hirschman Index for all banks; HHI_JS is the market share of joint stock banks; HHI_CC is market share of city commercial banks; HHIA is average HHI of neighboring cities in the same province, and for Beijing, Shanghai, Tianjin, Chongqing in the neighboring cities in the other provinces; CR3 is the three-bank branch concentration ratio; CR3A is the average three-bank branch concentration ratio of neighboring cities in the same province, and for Beijing, Shanghai, Tianjin, Chongqing of neighboring cities in the other provinces. SIZE, ROE, and GROWTH are winsorized at the 1% and 99% percentiles.

Table 7: Effect of Banking Competition on Financing Gap Dummy (DGAP). The table provides OLS, Probit and Logit estimations for the model:

$$DGAP_i = \kappa_0 + \kappa_1 HHI_i + \sum_l \lambda_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

DGAP equals one if the firm's credit demand is positive and equals zero otherwise; HHI is the Herfindahl–Hirschman Index for all banks; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Pseudo R2 is reported for models (3) - (6) instead of R2. Marginal effects instead of coefficients are reported for models (3) - (6). Robust standard errors are in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	Probit	Probit	Logit	Logit
HHI	0.586***	0.577***	0.766***	0.665***	0.768***	0.702***
	[0.097]	[0.087]	[0.143]	[0.120]	[0.144]	[0.125]
SIZE	0.017**		0.017**		0.016**	
	[0.007]		[0.007]		[0.007]	
ROE	-0.035*		-0.030*		-0.028*	
	[0.021]		[0.017]		[0.016]	
TANGIBLE	0.020		0.018		0.020	
	[0.035]		[0.033]		[0.033]	
GROWTH	0.008		0.008		0.009	
	[0.008]		[0.010]		[0.011]	
AGE	0.001		0.002		0.001	
	[0.002]		[0.002]		[0.002]	
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,560	2,864	1,560	2,864	1,560	2,864
R2	0.038	0.040	0.042	0.037	0.042	0.037

Table 8: Effect of Banking Competition on Financing Gap Dummy (DGAP). The table provides OLS, Probit and Logit estimations for the model:

$$DGAP_i = \kappa_0 + \kappa_1 CR3_i + \sum_l \lambda_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

DGAP equals one if the firm's credit demand is positive and equals zero otherwise; CR3 is the three-bank branch concentration ratio; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Pseudo R2 is reported for model (3) - (6) instead of R2. Marginal effects are reported for model (3) - (6) instead of coefficients. Robust standard errors are in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1) OLS	(2) OLS	(3) Probit	(4) Probit	(5) Logit	(6) Logit
CR3	0.432***	0.475***	0.430***	0.475***	0.422***	0.471***
	[0.086]	[0.067]	[0.085]	[0.067]	[0.083]	[0.067]
SIZE	0.016**		0.016**		0.016**	
	[0.007]		[0.007]		[0.007]	
ROE	-0.034*		-0.030*		-0.028*	
	[0.021]		[0.017]		[0.016]	
TANGIBLE	0.026		0.025		0.026	
	[0.035]		[0.034]		[0.033]	
GROWTH	0.007		0.007		0.008	
	[0.009]		[0.010]		[0.011]	
AGE	0.001		0.001		0.001	
	[0.002]		[0.002]		[0.002]	
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,560	2,864	1,560	2,864	1,560	2,864
R2	0.038	0.045	0.038	0.040	0.039	0.040

Table 9: Instrumental Variable Regression on Financing Gap Dummy (DGAP).

The table provides OLS and Probit estimations with instrumental variables for the model:

HHI as concentration index

$$DGAP_i = \kappa_0 + \kappa_1 HHI_i + \sum_l \lambda_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

$$HHI_i = \alpha_0 + \alpha_1 HHIA_i + \sum_l \mu_{il} FC_{il} + \sum_j \theta_j Industry_j + \omega_i$$

CR3 as concentration index:

$$DGAP_i = \kappa_0 + \kappa_1 CR3_i + \sum_l \lambda_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

$$CR3_i = \theta_0 + \theta_1 CR3A_i + \sum_l \eta_{il} FC_{il} + \sum_j \theta_j Industry_j + \nu_i$$

DGAP equals one if the firm's credit demand is positive and equals zero otherwise; HHI is the Herfindahl–Hirschman Index for all banks; CR3 is the three-bank branch concentration ratio; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Coefficients are reported with robust standard errors in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1)	(2)	(3)	(4)
	IV	IV-Probit	IV	IV-Probit
HHI	0.663***	3.193***		
	[0.214]	[0.938]		
CR3			0.423**	1.646**
			[0.201]	[0.813]
SIZE	0.017**	0.065**	0.016**	0.061**
	[0.007]	[0.026]	[0.007]	[0.026]
ROE	-0.034*	-0.112*	-0.034*	-0.113*
	[0.021]	[0.064]	[0.021]	[0.065]
TANGIBLE	0.019	0.065	0.026	0.095
	[0.035]	[0.129]	[0.035]	[0.128]
GROWTH	0.008	0.029	0.007	0.026
	[0.009]	[0.038]	[0.008]	[0.037]
AGE	0.001	0.006	0.001	0.004
	[0.002]	[0.009]	[0.002]	[0.009]
Industry Dummy	Yes	Yes	Yes	Yes
Observations	1,560	1,560	1,560	1,560
R2	0.038	-	0.038	-

Table 10: Effect of Banking Competition on Financing Gap Dummy with Decomposition (DGAP). The table provides OLS, Probit and Logit estimations for the model:

$$DGAP_i = \kappa_0 + \kappa_1 HHI_i + \kappa_2 HHIJS_i + \kappa_3 HHICC_i + \sum_l \lambda_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

DGAP equals one if the firm's credit demand is positive and equals zero otherwise; HHI is the Herfindahl–Hirschman Index for all banks; HHIJS is the interaction term of HHI and market share of joint stock banks; HHICC is the interaction term of HHI and market share of city commercial banks ; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Pseudo R2 is reported for model (3) - (6) instead of R2. Marginal effects are reported for model (3) - (6) instead of coefficients. Robust standard errors are in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1) OLS	(2) OLS	(3) Probit	(4) Probit	(5) Logit	(6) Logit
HHI	0.744***	0.595***	1.187***	0.742***	1.227***	0.835***
	[0.120]	[0.106]	[0.220]	[0.176]	[0.218]	[0.189]
HHIJS	3.950*	0.555	7.872**	1.655	8.508***	2.474
	[2.150]	[1.754]	[3.107]	[2.099]	[2.964]	[2.145]
HHICC	0.945***	-0.130	1.102***	-0.180	1.068**	-0.189
	[0.286]	[0.282]	[0.426]	[0.275]	[0.443]	[0.271]
SIZE	0.018***		0.018***		0.018***	
	[0.007]		[0.007]		[0.007]	
ROE	-0.033		-0.028*		-0.026*	
	[0.021]		[0.016]		[0.015]	
TANGIBLE	0.019		0.016		0.017	
	[0.035]		[0.033]		[0.032]	
GROWTH	0.007		0.006		0.006	
	[0.008]		[0.010]		[0.011]	
AGE	0.001		0.001		0.001	
	[0.002]		[0.002]		[0.002]	
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,560	2,864	1,560	2,864	1,560	2,864
R2	0.044	0.041	0.053	0.037	0.053	0.038

Table 11: Effect of HHI on Financing Gap Ratio (GAP). The table provides OLS and Tobit estimates with lower limit 0 and upper limit 1 for the following model:

$$GAP_i = \beta_0 + \beta_1 HHI_i + \sum_l \gamma_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

GAP is the financing gap ratio, which is rescaled by multiplying by 100; HHI is the Herfindahl–Hirschman Index for all banks; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Pseudo R2 is reported for model (3) - (4) instead of R2. Robust standard errors are in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1) OLS	(2) OLS	(3) Tobit	(4) Tobit	(5) OLS Reduced Sample	(6) OLS Reduced Sample
HHI	59.628***	47.104***	91.749***	75.635***	32.190***	21.477***
	[9.576]	[8.236]	[17.466]	[15.244]	[9.367]	[7.593]
SIZE	-0.956		-1.959**		-1.136**	
	[0.621]		[0.986]		[0.495]	
ROE	-0.904		-2.463		3.060**	
	[1.816]		[2.968]		[1.193]	
TANGIBLE	3.113		4.630		2.026	
	[3.203]		[5.150]		[2.596]	
GROWTH	1.166		1.417		1.099**	
	[0.777]		[1.219]		[0.508]	
AGE	0.225		0.223		0.326*	
	[0.222]		[0.346]		[0.168]	
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,560	2,864	1,560	2,864	953	1,541
R2	0.031	0.020	0.004	0.002	0.056	0.015

Table 12: Effect of CR3 on Financing Gap Ratio (GAP). The table provides OLS, Tobit, and OLS with reduced sample estimates for the following model:

$$GAP_i = \delta_0 + \delta_1 CR3_i + \sum_l \phi_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

GAP is the financing gap ratio, which is rescaled by multiplying by 100; CR3 is the three-bank branch concentration ratio; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Pseudo R2 is reported for model (3) - (4) instead of R2. Robust standard errors are in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	Tobit	Tobit	OLS Reduced Sample	OLS Reduced Sample
CR3	39.001***	35.798***	53.795***	56.185***	21.534***	18.485***
	[8.196]	[6.043]	[13.392]	[11.379]	[6.302]	[4.949]
SIZE	-1.031*		-2.068**		-1.142**	
	[0.623]		[0.990]		[0.495]	
ROE	-0.930		-2.529		3.122***	
	[1.828]		[2.988]		[1.196]	
TANGIBLE	3.747		5.598		2.256	
	[3.204]		[5.161]		[2.593]	
GROWTH	1.070		1.296		1.073**	
	[0.778]		[1.220]		[0.506]	
AGE	0.189		0.166		0.315*	
	[0.223]		[0.348]		[0.169]	
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,560	2,864	1,560	2,864	953	1,541
R2	0.027	0.022	0.003	0.003	0.054	0.017

Table 13: Instrumental Variable Regressions for Financing Gap Ratio (GAP).
The table provides instrumental variable (IV) estimates for both full and reduced sample, and Tobit with IV estimates. The regressions are as follows for HHI:

$$GAP_i = \beta_0 + \beta_1 \hat{HHI}_i + \sum_l \gamma_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

$$HHI_i = \alpha_0 + \alpha_1 HHIA_i + \sum_l \mu_{il} FC_{il} + \sum_j \theta_j Industry_j + \omega_i$$

The regressions for CR3 are as follows:

$$GAP_i = \delta_0 + \delta_1 CR3_i + \sum_l \phi_{il} FC_{il} + \sum_j \theta_j Industry_j + \xi_i$$

$$CR3_i = \theta_0 + \theta_1 CR3A_i + \sum_l \eta_{il} FC_{il} + \sum_j \theta_j Industry_j + \nu_i$$

GAP is the financing gap ratio, which is rescaled by multiplying by 100; HHI is Herfindahl–Hirschman Index for all banks; CR3 is the three-bank branch concentration ratio; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Coefficients are reported, with robust standard errors in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1)	(2)	(4)	(5)
	IV	IV Tobit	IV	IV Tobit
HHI	84.080***	103.062***		
	[21.084]	[25.869]		
CR3			65.391***	60.693***
			[19.362]	[23.167]
SIZE	-0.889	1.268*	-0.970	1.195
	[0.624]	[0.756]	[0.629]	[0.756]
ROE	-0.698	-1.661	-0.608	-1.639
	[1.809]	[2.280]	[1.830]	[2.316]
TANGIBLE	2.668	3.093	3.442	4.031
	[3.233]	[3.906]	[3.223]	[3.876]
GROWTH	1.181	1.664*	1.030	1.553
	[0.782]	[0.979]	[0.789]	[0.976]
AGE	0.257	0.423	0.217	0.364
	[0.224]	[0.269]	[0.225]	[0.270]
Industry Dummy	Yes	Yes	Yes	Yes
Obs.	1,560	1,560	1,560	1,560
R2	0.028	-	0.021	-

Table 14: Effect of Concentration on Financing Gap Ratio (GAP) with Decomposition The table provides OLS, Tobit, and OLS with reduced sample estimates for the following model:

$$GAP_i = \beta_0 + \beta_1 HHI_i + \beta_2 HHIJS_i + \beta_3 HHICC_i + \sum_l \gamma_{il} FC_{il} + \sum_j \theta_j Industry_j + \varepsilon_i$$

GAP is the financing gap ratio, which is rescaled by multiplying by 100; HHI is Herfindahl–Hirschman Index for all banks; HHIJS is the interaction term of HHI and market share of joint stock banks; HHICC is the interaction term of HHI and market share of city commercial banks; SIZE is log(equity); ROE is net income after tax over total equity; TANGIBLE is property, plant, and equipment over total assets; GROWTH is the sales growth rate; AGE is the number of years since the firm's establishment. Variable definitions are provided in Table 5. Pseudo R2 is reported for model (3) - (4) instead of R2. Robust standard errors are in parentheses, significance * at 10%, ** at 5%, *** at 1%.

	(1) OLS	(2) OLS	(3) Tobit	(4) Tobit	(5) OLS Reduced Sample	(6) OLS Reduced Sample
HHI	83.992***	61.927***	130.608***	100.133***	54.261***	35.485***
	[12.246]	[10.585]	[22.570]	[19.287]	[13.043]	[10.114]
HHIJS	631.216***	375.050**	937.697***	613.905**	515.215***	350.819***
	[202.301]	[163.455]	[324.990]	[301.325]	[154.928]	[126.254]
HHICC	105.735***	34.048	141.436***	58.464	61.330**	56.258***
	[30.080]	[25.978]	[49.934]	[49.193]	[24.321]	[20.100]
SIZE	-0.810		-1.736*		-0.983**	
	[0.620]		[0.984]		[0.494]	
ROE	-0.653		-2.097		3.257***	
	[1.820]		[2.959]		[1.174]	
TANGIBLE	2.862		4.111		1.523	
	[3.195]		[5.123]		[2.585]	
GROWTH	0.999		1.195		1.009**	
	[0.752]		[1.185]		[0.507]	
AGE	0.172		0.153		0.296*	
	[0.219]		[0.341]		[0.166]	
Industry Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,560	2,864	1,560	2,864	953	1,541
R2	0.043	0.023	0.005	0.003	0.073	0.025