Bank competition and industrial structure: Evidence from China[1]

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Abstract

We examine the impact of bank competition on the industrial structure using a city-industry level dataset during 2005-2009 in China. We find that bank competition increases the number of firms per capita and decreases average firm size in industries with higher external financial dependence. Bank competition affects industrial structure through increasing the proportion of SMEs. The impact of bank competition is more pronounced for private firms, and joint stock banks are the most efficient players in enhancing industrial structure. We instrument bank competition with average bank competition of other cities in the same province, and also employ the deregulation of bank branching in 2007 as a natural experiment, which confirm the robustness of our findings. Bank competition thus enhances the competition in the product market.

Key words: Bank competition, Industrial structure, External financial dependence, Deregulation

JEL classification: G21, G28, L11

1. Introduction

Bank competition has intensified substantially since the establishment of the China Banking Regulatory Commission (CBRC) in 2003. Large state-owned banks (SOBs) have been restructured into listed banks afterwards, which still dominate the banking market in the country till now. Joint stock banks (JSBs) and city commercial banks (CCBs) have continuously grown drastically, and the deregulation of cross – city / province branching for these banks has been brought into place in 2007 and 2009 by the CBRC. As a result, the number of branches for these banks has grown steadily afterwards.

The competition in the banking market can affect the real economy. A more competitive banking market can foster the credit supply, lower the borrowing cost, and channel more credit into the real economy, in particular for the small and medium sized enterprises (SMEs). Nevertheless, bank competition may hurt the formation of lending relationship, which can undermine the access to credit for SMEs and private firms. Thus, the impact of bank competition on the real economy is mixed in the literature.

Using a micro dataset at the city-industry level during 2005-2009 in China, we examine the impact of bank competition on the industrial structure in local markets. Chinese firms rely primarily on bank credit in the context of poorly developed equity and bond markets. Thus, the allocation of bank credit has substantial influence on the industrial structure. As banks compete mainly at the city level in China, we examine its impact on the industrial structure at the city level. The variation across cities within the same province facilitates the identification of this effect. Besides, we focus on the manufacturing sector, which relies substantially on local bank credit. Thus, bank competition at the city level can indeed capture the impact of banking market structure on the real economy in a local market.

We examine the impact of bank competition on the number of firms per capita and average firm size in each industry at the city level, which is identified through external financial dependence at the industry level. We use the bank branch data released by the CBRC to measure bank competition at the city level, and manufacturing firms' accounting data to calculate the industrial structure and external financial dependence for 30 industries in the manufacturing sector. We find that more

intense bank competition is associated with a larger number of firms per capita and a smaller average firm size in industries with higher external financial dependence, which is consistent with the findings in Cetorelli and Strahan (2006) for the US. Bank competition can enhance the financing environment for SMEs, which may end up in a more competitive industrial structure. We indeed find that bank competition enhances the proportion of SMEs in each industry. Besides, we find more intense bank competition is associated with a larger number of firms per capita of private firms than state-owned enterprises (SOEs) in each industry. Furthermore, we find that this enhancing effect is mainly driven by joint stock banks instead of state-owned or city commercial banks.

We use the bank competition of other cities in the same province as an instrumental variable for the bank competition in a specific city. In addition, we also employ the deregulation in bank branching in 2007 as a natural experiment, i.e. which generates an exogenous shock to bank competition in local markets, and estimate a triple difference model. These robustness checks all support our findings.

Our paper contributes to the literature in a few aspects. First, we examine the impact of bank competition on industrial structure in the context of the largest emerging economy, where bank credit is a dominant form of external financing for the real economy. Unlike US or other Western economies, stock and corporate bond market in China are underdeveloped and nascent in our sample period. Therefore, banking structure is even more relevant for the industrial structure in China than the US documented in Cetorelli and Strahan (2006). In addition, China is a nice laboratory where we observe tremendous heterogeneity in firms and banks in terms of ownership. In emerging and transition economies, private firms appear to benefit more proportionally more from bank competition versus SOEs, which have ample access to bank credit. Moreover, bank competition may stem from an expansion of different types of banks, which can have heterogeneous effect on industrial structure. In general, SOBs are less efficient (see Berger, Hasan and Zhou (2009) for bank ownership and efficiency in China). Bank competition driven by JSBs and CCBs could benefit the corporate sector than SOBs.

Second, our paper adds to the literature on finance-growth nexus by providing evidence at the intermediate level, while banking market is often claimed to be quite local (Berger, Demsetz and Strahan, 1999), i.e. industry - city level instead of macro

(national / province) or micro (firm) level. Our paper examines the impact of bank competition on the allocation of credit at the industry – city level, which can further affect the real economy. In addition, we measure bank competition at the city level in China as banks mainly compete with each other through branches in each city, i.e. while it's often measured at the country or province level in the literature. Moreover, we employ the city-industry level data to identify the channel through which bank competition affects the real economy, i.e. external financial dependence at the industry level, which alleviates the endogeneity concerns.

Finally, we employ the deregulation in bank branching in 2007 as a natural experiment to explore the exogenous shock to bank competition at the city level, and establish causality from bank competition to industrial structure. Unlike the bank deregulation in the US which often takes place across states after cumbersome bargaining and negotiations, the deregulation in China is centralized by the CBRC but varies across cities, i.e. depending on whether the treated banks (i.e., JSBs and CCBs) have presence in a city prior to the reform.

Our paper provides implications for the relationship between financial system and real economy. On the one hand, enhancing bank competition can improve the efficiency of credit allocation, and foster a better industrial structure. On the other hand, a more competitive banking market can facilitate the access to credit for SMEs, which is the driving force for the high economic growth in China.

Our paper proceeds as follows. Section 2 surveys the literature and develops hypothesis. Section 3 shows the methodology, data and variables. Section 4 presents the baseline results. Section 5 conducts a battery of robustness checks to address endogeneity issues. Section 6 concludes.

2. Literature and hypothesis

Finance-growth nexus has attracted widespread attention in the literature, e.g. theories as early as Bagehot (1873) and Schumpeter (1912), and empirics such as cross-country analysis (King and Levine, 1993; Levine and Zervos, 1998; Beck, Levine and Loayza, 2000), and firm and industry level analysis (Demirguc-Kunt and Maksimovic, 1998; Rajan and Zingales, 1998). Levine (1997) confirms the enhancing effect of finance on economic growth. Researchers have focused more on the structure

of financial system on economic growth, e.g. competition and market structure of the banking sector.

The impact of bank competition on real economy has been mixed in the literature. The information hypothesis proposes that more concentrated banking market can foster bank-firm relationship, while banks lack incentives to engage in relationship lending in a competitive banking market (Mayer, 1988; Petersen and Rajan, 1995; Hauswald and Marquez, 2006). In contrast, the structure-conduct-performance (SCP) hypothesis proposes that bank competition can enhance the access to credit by increasing credit supply and cutting interest rate (Chong, Lu and Ongena, 2013). In particular, the entry of small banks can enhance the access to credit for small firms.

Petersen and Rajan (1995) find that younger firms can obtain more credit in a concentrated market versus a competitive one for a sample of SMEs in the US, which is echoed by Fischer (2000) in Germany. However, a vast literature supports the SCP hypothesis. For example, bank competition can enhance the creation of new firms and the growth of SMEs in the US (Black and Strahan, 2002; Cetorelli and Strahan, 2006; Rice and Strahan, 2010). Beck, Demirguc-Kunt and Maksimovic (2004) also find that a more concentrated banking market is harmful for the access to credit with a cross-country dataset, while Love and Peria (2012) find qualitatively similar results. Besides, Bonaccorsi di Patti and Dell'Ariccia (2004) find non-linear relationship between bank competition and the real economic outcome. Finally, Chong, Lu and Ongena (2013) find that more competitive banking market can alleviate the credit constraints of SMEs in China.

In the context of bank deregulation, newly created firms have more access to credit; the number of firms increases; and the average firm size decreases (i.e. Cetorelli and Strahan (2006) with the US data, and Cetorelli (2004) with the EU data). We employ the identification strategy in Cetorelli and Strahan (2006) to examine the impact of bank competition on the industrial structure in the Chinese context, i.e. bank branching deregulation in 2007. Lin, Sun and Wu (2015) find that non-state owned banks (versus "big four" state-owned banks) can better support the growth of industries with a higher proportion of private firms, and small banks can better support the growth of labor (versus capital) intensive industries in China. Our paper focuses on one aspect of the financial structure, i.e. bank competition, and its impact on industrial structure, which complements Lin, Sun and Wu (2015) by providing

more micro level evidence. Our paper is also close to Gao, Ru, Townsend and Yang (2018) in the sense that both use bank branch data to measure bank competition and deregulation. This paper differs from Gao et al. (2018) in two key aspects. First, unlike Gao et al. (2018) use loan and firm level information to examine the impact of deregulation on loan terms and performance of firms, we use industry level information and focus on the link between banking structure and industrial structure. Second, departing from the 2009 bank entry deregulation in Gao et al. (2018), which mixed with other simultaneous policy shocks such as the four trillion RMB fiscal stimulus package, we choose the 2007 deregulation that enhances broader access for certain JSBs and CCBs.

Joint stock banks and city commercial banks expand rapidly during our sample period of 2005-2009. The entry and expansion of these banks can increase credit supply and lower cost of borrowing, which enhance the growth of firms with high reliance on bank credit, in particular SMEs (Hakenes, Hasan, Molyneux and Xie, 2015). Although more intense bank competition may harm the existing lending relationship, it may also foster new lending relationships for former credit rationed firms, which can end up in increased relationship lending in general (Degryse and Ongena, 2007). Cestone and White (2003) show that concentrated banking market can deter the entry of newly created firms, which can deteriorate the product market competition. Thus, we propose that more intense bank competition can spur credit supply and cut borrowing cost, which will also lead to more intense competition in the product market. Our first hypothesis is:

Hypothesis 1: More intense bank competition will lead to more competitive a product market, i.e. larger number of firms and smaller average firm size in each industry

The common trend of competition in banking and product market may be driven by a higher access to credit for SMEs, which are difficult to access the equity and bond market. Thus, SMEs rely more heavily on bank credit, which ends up in a more pronounced impact of bank competition on these firms. A more intense bank competition may enhance the entry of SMEs, which leads to a higher proportion of SMEs in an industry. We propose our second hypothesis:

Hypothesis 2: More intense banking market will lead to a higher proportion of SMEs in each industry

Private firms are often discriminated by banks in China, especially big state-owned banks (Allen, Qian and Qian, 2005). On the contrary, SOEs have better access to bank credit and are less credit constrained (Poncet, Steingress and Vandenbussche, 2010; Bailey, Huang and Yang, 2011). In the context of increased bank competition, the market share of joint stock banks and city commercial banks increases. Thus, private firms may benefit proportionally more from bank competition than SOEs. We propose our third hypothesis:

Hypothesis 3: The impact of bank competition on the number of firms and average firm size in each industry is more pronounced for private firms

The market share of state-owned banks has decreased substantially in the past few decades in China, with the emergence of joint stock banks and city commercial banks which are often more efficient than state-owned banks in serving SMEs and private firms. Thus, bank competition driven by joint stock and city commercial banks may have more pronounced impact on industrial structure. We propose our fourth hypothesis:

Hypothesis 4: Bank competition driven by joint stock banks and city commercial banks have more pronounced impact on industrial structure than state-owned banks

3. Methodology and data

3.1 Methodology

Identifying the impact of bank competition on industrial structure is not so straightforward in practice as it may suffer from endogeneity issues such as omitted variable bias and reverse causality. For example, observing few banks (high

concentration) and few firms in small and underdeveloped cities does not necessarily imply causality from banking market structure to industrial structure. In addition, local government often coordinates firms and banks for economic tournament, in particular city commercial banks. Our identification might be contaminated if unobserved local government factor is in play. Moreover, large banks often specialize in serving large, informationally transparent firms, while leaving small opaque firms to small banks (Berger, Miller, Petersen, Rajan and Stein, 2005; Berger and Black, 2011). A specific industrial structure in a city may elicit different types of banks to change their footprint in the local market. Thus, industrial structure may affect banking structure in a reverse way.

We employ the external financial dependence in Rajan and Zingales (1998) as an identification tool, i.e. industries have heterogeneous external financial dependence due to technological demand for external financing. For example, with ample cash flow but limited capital expenditure, tobacco industry has a lower external financial dependence than capital-intensive industry such as iron and steel. Thus, banks can have heterogeneous effects across industries with different external financial dependence. Bank competition is expected to have more pronounced impact on industries with higher external financial dependence.

Following Cetorelli and Gambera (2001) and Cetorelli and Strahan (2006), we estimate the following model:

$$Y_{jst} = \alpha \cdot \text{Employment Share}_{jst} + \delta \cdot \text{Market trend}_{st} + \gamma \cdot \text{Industry trend}_{jt} + \beta \cdot \text{EFD}_j \cdot \text{Bank competition}_{st} + \varepsilon_{jst} \quad (1)$$

where Y_{jst} stands for number of firms per capita and average firm size in industry j, city s and year t, i.e. local industrial structure. We include employment share for industry j in city s and year t to control the relative importance of an industry in the local market. Market trend_{st} is city-year fixed effects, capturing time-varying demand shocks in the local market. $\text{Industry trend}_{jt}$ is industry-year fixed effects, capturing time-varying and industry-specific shocks, such as technological innovation. EFD_j is the external financial dependence, which is calculated for 30

manufacturing industries in China (Rajan and Zingales, 1998). $\text{Bank competition}_{st}$ is bank competition in city s and year t. Following Petersen (2009), we cluster standard errors at the city-year and industry-year levels.

Market trend_{st} and $\text{Industry trend}_{jt}$ mitigate concerns on omitted variable bias and reverse causality by capturing city and industry specific unobserved factors. In addition, Market trend_{st} and $\text{Industry trend}_{jt}$ absorb the level effects of $\text{Bank competition}_{st}$ and EFD_j, which are thus not included separately in the model. We are interested in the coefficient of interaction term of $\text{Bank competition}_{st}$ and EFD_j, β. When the dependent variable is number of firms per capita, a negative β implies that bank competition increases number of firms per capita, i.e. more competitive an industrial structure. In addition, when the dependent variable is average firm size, a negative β implies that bank competition increases average firm size, which indicates a less competitive product market.

3.2 Data

We employ three datasets: Financial license database from the China Banking Regulatory Commission (CBRC); industrial enterprise database from National Bureau of Statistics of China (NBS), and population data at the city level from CSMAR.

We construct our bank competition measures from the financial license database provided by the CBRC. It is the population of all bank branches in China, which records detailed information on branch ID, branch address, and establishment date, etc., dating back to 1949, for over 190,000 bank branches in 2017. We extract information on the number and distribution of branches for commercial banks at the city level.[2] We aggregate the number of branches for each commercial bank at the city-year level. We thus eventually calculate bank competition measures for every city.

Following Degryse and Ongena (2007), we use Herfindahl-Hirschman Index (HHI) and concentration index of the top five banks (CR5) to measure bank competition in the local market, i.e. cities. Due to data limitation, deposit, asset, or

[2] We drop institutions other than commercial banks. In addition, we drop bank branches that do not extend loans. If not, we may overestimate the market share of Postal Savings Bank of China and rural commercial banks which have numerous and dispersed branches.

loan is not available at the branch level in China. Thus, we construct bank competition proxies based on the number of branches. We extract the distribution of branches for commercial banks at the city level from the financial license database.[3] We divide the number of branches of bank k by the total number of branches of all banks in the city as a measure for the market share in the local market. HHI is defined as the sum of squared market shares of all banks in a city. CR5 is defined as the sum of number of branches of top five largest banks ($q = 1, \dots, 5$) divided by the number of all bank branches in the city.

$$\mathrm{HHI}_{st} = \sum_{k=1}^{K} \left(\frac{\#\mathrm{branch}_{kst}}{\sum_{k=1}^{K} \#\mathrm{branch}_{kst}}\right)^2 \qquad (2)$$

$$\mathrm{CR5}_{st} = \frac{\sum_{q=1}^{5} \#\mathrm{branch}_{qst}}{\sum_{k=1}^{K} \#\mathrm{branch}_{kst}}, \quad q = 1, \dots, 5 \qquad (3)$$

where HHI_{st} and $\mathrm{CR5}_{st}$ are Herfindahl-Hirschman Index and concentration index in city s and year t. Figure 1 displays the dynamics of bank competition measured by negative HHI in China. Dark areas expanded substantially in 2009 versus 2005, which indicates more intensified bank competition in the country.[4]

(Insert Figure 1)

We employ industrial enterprise database to measure industrial structure in the local market. It is an annual survey data, covering all state-owned industrial firms and non-state-owned ones with sales more than five million RMB. Our sample includes 30 manufacturing industries with Chinese industry classification codes over 13-43 (i.e. excluding 38). Industrial firms covered in the database account for most of industrial value added and 22% of urban employment in China in 2005 (Cai and Liu, 2009). We set our sample period to 2005-2009 as the data quality deteriorates after 2009.

We use number of firms per capita and average firm size to proxy for the industrial structure. In particular, a higher number of firms per capita and smaller average firm size suggest a more competitive industrial structure. We define the

[3] Our bank sample covers 31 provinces / autonomous regions / municipalities in mainland China, with data missing in Hong Kong, Macau, and Taiwan regions.

[4] We sort all cities by HHI in 2005-2009 into quintiles: below 20 percentile, 20-40 percentile, 40-60 percentile, 60-80 percentile, and above 80 percentile.

number of firms per capita as the total number of firms in industry j, city s and year t, over the population of a city. The population data at the city level primarily comes from the CSMAR database.[5] Average firm size is defined as total employment divided by the total number of firms in industry j, city s and year t. We take the logarithm of average firm size as the dependent variable.

In addition, we follow Rajan and Zingales (1998) and calculate external financial dependence at the industry level using the industrial enterprise database. We calculate the external financial dependence of a firm as capital expenditures minus cash flow from operations, divided by the total capital expenditure.[6] We take the median of external financial dependence in industry j, city s and year t, and further generate the median of external financial dependence of all city-year pairs for each industry, which is used to measure the external financial dependence at industry level.

Besides, in order to control the relative importance of each industry in a city, we construct the industry share of employment, which is the fraction of total employment for industry j, city s and year t.

Table 1 presents some summary statistics. All variables except external financial dependence are winsorized at the 5^{th} and 95^{th} percentiles to deal with outliers. The mean of HHI is 0.171, while the CR5 has a mean of 0.824. Therefore, local banking markets in China are still quite concentrated. The sample mean of number of firms per capita is 0.073, close to the mean of establishments per capital in Cetorelli and Strahan (2006), while our sample mean of average firm size is approximately 212 employees, larger than average establishment size (69 employees) in the US. Variable definitions and data sources are listed in Appendix Table A1.

(Insert Table 1)

4. Empirical results

4.1 Bank competition and industrial structure

Table 2 reports baseline regressions for the impact of bank competition on local

[5] For some cities with missing population data in CSMAR, we supplement it by manually collecting the data from China Statistical Yearbook for Regional Economy.

[6] Formulas for cash flow and capital expenditure:

$$\text{Cash flow}_{ijst} = \text{Profit}_{ijst} + \text{Discount}_{ijst} - \Delta\text{Inventory}_{ijst} - \text{Receivable}_{ijst} + \text{Payable}_{ijst}.$$

$$\text{Capital expend}_{ijst} = \text{Fixed assets}_{ijst} - (1 - \text{Discount rate})\text{Fixed assets}_{ijs(t-1)}$$

industrial structure at the city level. The dependent variables are number of firms per capita in the first two columns and average firm size in the last two columns. We use HHI as the proxy for bank competition in the odd columns and CR5 in the even columns. In addition, we control for city-year and industry-year fixed effects, which absorb time-varying demand and industry specific shocks. Following Petersen (2009), we cluster the standard errors at the city-year and industry-year levels.

(Insert Table 2)

Table 2 shows that bank competition enhances product competition in these manufacturing industries. Columns (1) and (2) show that more intense bank competition increases the number of firms per capita. The interaction term of HHI and EFD is -0.38 and statistically significant at the 1% level. When HHI decreases (i.e. competition increases) by one standard deviation, the number of firms per capita goes up by 0.023 in an industry with an external financial dependence of 1 versus 0, i.e. 22.8% (i.e. 0.38×0.06/0.1) of the sample mean. The interaction term of CR5 and EFD is -0.138 and significant at the 1% level. When CR5 decreases (i.e. competition increases) by one standard deviation, the number of firms per capita goes up by 0.021 in an industry with an external financial dependence of 1 versus 0, i.e. 20.7% (i.e. 0.138×0.15/0.1) of the sample mean.

Columns (3) and (4) show that higher bank competition leads to smaller average firm size. The coefficient of interaction term of HHI and EFD is 2.338 and significant at the 1% level. When HHI decreases from the 75^{th} to 25^{th} percentile, average firm size decreases by 19.87% (i.e. 2.338×(0.125-0.21)) in an industry with an external financial dependence of 1 versus 0. Similarly, the coefficient of interaction term of CR5 and EFD is 0.696 and significant at the 5% level. When bank competition intensifies, say, CR5 decreases from the 75^{th} to 25^{th} percentile, average firm size decreases by 16.84% (i.e. 0.696×(0.714-0.956)) in an industry with external financial dependence of 1 versus 0.[7] In sum, we find that bank competition increases the number of firms per capita and decreases average firm size, and therefore reduces the concentration of an industry. By the way, the coefficients of employment share are

[7] The economic significance calculated might be biased upward. External financial dependence of 30 industries in our sample ranges over 0.19-1.13. In order to calculate economic significance, we compare two extreme industries with EFD=1 (fully dependent on external finance) versus EFD=0 (fully independent on external finance).

always positive and significant in all columns, i.e. number of firms per capita and average firm size are higher when the employment share is higher.

4.2 Heterogeneity across firm size

A more intense bank competition leads to a larger number of firms and smaller firm size in the above analysis, which may be driven by SMEs. While large firms can access diversified financing sources in the capital market, SMEs' financing is mainly restricted to local banks, which is more susceptible to bank competition in the local market. Thus, we may see that the share of SMEs in a specific industry increases in the local market with more intensified bank competition, while the share of large firms declines accordingly. We classify firms into quartiles according to number of employees: firms with fewer than 50, 50-149, 150-499, and with 500 or more employees. We use the share of firms with different sizes in each industry in the local market as the dependent variable, and examine the heterogeneous effect of bank competition across firm size.

Table 3 presents the heterogeneous effect of bank competition across firm size, where the dependent variables are the shares of firms in different size quartiles. We find that the coefficients of HHI in columns (1) and (3) are negative and significant at the 10% and 5% levels respectively, i.e. bank competition increases the share of SMEs (with fewer than 150 employees) of an industry in a city. By contrast, we find positive and significant coefficients of HHI and CR5 in columns (5) and (6), i.e. bank competition decreases the share of large firms (firms with 150-499 employees).[8] However, the coefficients in columns (7) and (8) are insignificant, i.e. bank competition is irrelevant for mega firms (with 500 or more employees), which usually have access to capital market and nation-wide credit market. These diversified financing sources undermine the impact of bank competition in the local market on the mega firms. In sum, we find evidence that bank competition mainly affects SMEs which are highly dependent on bank credit in the local market.

(Insert Table 3)

4.3 Heterogeneity across firm ownership

[8] We are cautious in interpreting economic significance as SMEs are just relatively small firms in industrial enterprise database. As the entry threshold of inclusion in industrial enterprise database is having sales greater than five million RMB for non-SOEs, the size of SMEs here is larger than the sample in Chong, Lu and Ongena (2013) who follow the criteria of SMEs by the NBS.

SOEs often enjoy advantages in credit market in emerging economies, especially in a concentrated and state dominated banking sector like China (Cull and Xu, 2003). Bank loans are usually allocated preferably to SOEs for non-economic purposes, leaving non-SOEs credit rationed to some extent. Thus, private firms are more likely to enjoy the benefit from intensified bank competition. In order to examine the heterogeneous impact of bank competition across firm ownership, we construct the following dependent variables: number of SOEs per capita, number of private firms per capita, average SOEs size, and average private firm size.

In the first four columns of Table 4, we find that bank competition increases number of firms per capita for both SOEs and private firms in industries with higher external financial dependence, while the impact on private firms is more pronounced than SOEs. Columns (5) and (7) show that bank competition decreases average size for both SOEs and private firms, while there is no statistically significant difference between SOEs and private firms.

(Insert Table 4)

4.4 Heterogeneity across bank types

The dynamics of bank competition may be driven by different types of banks, which can exert different impacts on industrial structure in the local market. For instance, SMEs might be better served in a local market by joint-stock banks. We focus on three types of banks in China: "big five" state-owned banks (SOBs), joint-stock banks (JSBs), and city commercial banks (CCBs). Following Chong, Lu and Ongena (2013), we define the contribution of each type of banks to HHI and CR5 as follows:

$$\text{Bank HHI}_{st} = \sum_{l=1}^{L} \left(\frac{\#\text{Bank branch}_{lst}}{\sum_{k=1}^{K} \#\text{branch}_{kst}}\right)^2 / \text{HHI}_{st}, \quad \text{Bank} = \text{SOB, JSB, CCB} \quad (10)$$

$$\text{Bank CR5}_{st} = \frac{\frac{\sum_{q=1}^{5} \#\text{branch}_{qst}}{\sum_{k=1}^{K} \#\text{branch}_{kst}}}{\text{CR5}_{st}}, \quad q = 1, \ldots, 5; \quad \text{Bank} = \text{SOB, JSB, CCB} \quad (11)$$

We put a triple interaction term among the contribution of each type of banks, bank competition and external financial dependence, which can cast light on the heterogeneity across bank types.[9] We report the estimation for SOBs, JSBs, and CCBs

[9] When calculating bank competition, we include foreign banks and rural commercial banks besides SOBs, JSBs and CCBs. However, these banks only serve a tiny fraction of our sample firms due to their limited market share in the local banking market, and hence are not the main focus of our analysis.

in Panels A, B, and C of Table 5 respectively. Panel A shows that the coefficient of triple interaction term is negative for number of firms per capita, but positive for average firm size. The impact of bank competition on industrial structure is more pronounced in cities with higher contribution of SOBs to bank competition, i.e. an expansion of SOBs leads to a more competitive industrial structure. Panel B also shows positive triple interaction term in columns (1)-(2), and negative in columns (3)-(4), i.e. the expansion of JSBs also enhances competition in the product market. More importantly, the coefficient of triple interaction term for JSBs in Panel B is significantly larger than that in Panel A for SOBs, i.e. JSBs is more efficient in fostering a competitive product market. The triple interaction term in Panel C for CCBs is qualitatively similar with Panel A for SOBs, though insignificant for average firm size.[10] In a word, the impact of bank competition on industrial structure is largely driven by the expansion of JSBs, while SOBs and CCBs are less efficient in doing so. This is consistent with Chong, Lu and Ongena (2013) who find evidence that JSBs can better alleviate credit constraint as than SOBs and CCBs.

(Insert Table 5)

5. Robustness

Our estimation of the impact of bank competition on industrial structure may suffer from endogeneity concerns. For example, banks may tap a new market when observing rising credit demand due to an expansion of a capital-intensive industry. Local government may coordinate banks and firms at the city level for economic tournament. Thus, the change in bank competition may be driven by some unobservable factors and reverse causality. To address these concerns, on the one hand, we employ the average value of bank competition indices in other cities in the same province as an instrumental variable (Chong, Lu and Ongena, 2013). On the other hand, we utilize a deregulation of bank branching in 2007 as a natural experiment for identification, which is similar with the settings in Bertrand, Schoar and Thesmar (2007) and Rice and Strahan (2010).

5.1 Instrumental variable regression

Following Chong, Lu and Ongena (2013), we use the average value of bank

[10] This is partly because our sample only covers a primary development period of CCBs in China. Therefore, it is not surprising that the effect of CCB is weak.

competition indices in other cities within the same province as an instrumental variable. On the one hand, banks often adopt competition strategies at the province level and coordinate among branches in different cities within a province. In addition, CBRC has regional bureaus at the province level for regulation and supervision. Therefore, bank competition in other cities in the same province is correlated with the bank competition in a specific city, which satisfies the relevance condition. On the other hand, cities are often segmented from each other as local credit markets, where firms mainly access credit from local bank branches. Thus, the financing of a firm is mainly independent of bank competition in other cities in the same province, which satisfies the exclusion condition.

Table 6 shows the estimation for the IV regression.[11] Column (1) in Panel A shows that the interaction term of HHI and EFD is negative and significant at the 5% level. The first stage regression in column (2) shows that the average HHI in other cities in the same province is positively related with the HHI in the local market. The F-statistic is greater than 10, and Cragg-Donald F-statistic is significant at the 1% level, i.e. average HHI is a strong instrument. We find qualitatively similar results in columns (3) and (4) when using average CR5 in other cities in the same province as an instrument. Panel B shows qualitatively but weaker results for average firm size when we adopt the same instrumentation strategy.

(Insert Table 6)

Table 7 employs both average HHI and average CR5 as instrumental variables and conducts over-identification tests. The results are similar to Table 6, which fail to reject the null hypothesis of over-identification (Hansen J test).

(Insert Table 7)

5.2 Deregulation of bank branching in 2007 as a natural experiment

Nevertheless, when multiple cities in the same province face a common demand shock, e.g., an infrastructure project that connects these cities, this spillover effect cannot be fully absorbed by the city-year fixed effects. If this common demand shock also affects bank competition in these cities, our IV strategy may not fully alleviate

[11] Since the four province-equivalent municipalities are highly integrated as a market, we can treat them as an integrated market, equivalent to a typical city in China. Therefore, we cannot find instrument for these four province-equivalent municipalities, which makes the sample of 2SLS smaller than the baseline model.

the endogeneity concerns. Thus, we further use the deregulation of bank branching in 2007 as an exogenous shock to bank competition to confirm the robustness of our results.

The CBRC has strict guidelines on the competition policy as the regulator of banking sector in China. Some internal documents reveal that the CBRC requires all affiliated bureaus to prevent "excessive" expansion of branches by JSBs and CCBs, for fear that their expansion may erode the market share of SOBs and pose a threat for financial stability. Although the big five SOBs were free to spread their businesses across the country, most JSBs and CCBs face strict geographical restrictions in branching (Berger, Hasan and Zhou, 2010).

This rule has somehow being changed in April 2007 when the CBRC issued the "No. 79 Regulation Letters", allowing JSBs and CCBs to set up branches in counties if they have already had branches in districts of cities.[12] Essentially, this deregulation of bank branching may end up in more intense bank competition in cities that already have branches of JSBs and CCBs before the reform, while leaving the cities intact with no presence of JSBs and CCBs *ex ante*.

We take the deregulation as an exogenous policy shock and adopt a difference-in-difference setting. We estimate the following model:

$$\mathrm{Y_{jst}} = \alpha \cdot \text{Employment Share}_{\mathrm{jst}} + \delta \cdot \text{Market trend}_{\mathrm{st}} + \gamma \cdot \text{Industry trend}_{\mathrm{jt}} + \mu \cdot \mathrm{Market_s} * \mathrm{Industry_j} + \beta \cdot \mathrm{Treated_s} \cdot \mathrm{Post_t} \cdot \mathrm{EFD_j} + \varepsilon_{\mathrm{jst}} \quad (12)$$

First, we take cities that have branches of JSBs or CCBs at the end of 2006 as the treatment group that partially removes the branching barriers and allows for fiercer competition, i.e. $\mathrm{Treated_s} = 1$. By contrast, cities with no presence of JSBs or CCBs at the end of 2006 belong to the control group that is immune to the policy shock, i.e. $\mathrm{Treated_s} = 0$. Second, we restrict the event window to 2006-2008.[13] For the year after the deregulation, i.e. 2008, $\mathrm{Post_t} = 1$; and for the year leading up to the deregulation, i.e. 2006, $\mathrm{Post_t} = 0$. Our variable of interest is the triple interaction term among *Treated*, *Post* and *EFD*, which captures the impact of the exogenous

[12] Counties (often far away from city centers) and districts (often close to city centers) are two lower hierarchical levels of prefecture-level cities.

[13] We exclude year 2009 as China introduced the "Four Trillion" fiscal stimulus package in 2009, and an rising shadow banking sector reshaped the landscape of financing in China since then (Chen, He and Liu, 2017).

shock to bank competition on industrial structure. In addition, we add a two-way interaction term, $\text{Market}_s \times \text{Industry}_j$, i.e. the city - industry fixed effects, to absorb the shocks to the same industry in the same city. All three two-way interaction terms capture the level effects of Treated, Post and EFD.

Table 8 reports the estimation for the deregulation of bank branching. The dependent variables are number of firms per capita and average firm size in each industry, city and year. We find that the triple interaction term is positive and significant at the 1% level in column (1), i.e. bank competition increases the number of firms per capita when the branch entry barriers are lifted. In addition, we find a negative coefficient of triple interaction term in column (2) and significant at the 5% level, i.e. average firm size declines as bank competition intensifies *ex post* the deregulation in 2007. In sum, our estimation for the natural experiment yields consistent results in line with our baseline regressions, which confirms that the product market becomes more competitive when bank competition is intensified *ex post* the deregulation of bank branching in 2007.

(Insert Table 8)

6. Conclusion

We employ external financial dependence to identify the impact of bank competition on industrial structure in cities of China. We find that more intense bank competition increases number of firms per capita and decreases average firm size in industries with higher external financial dependence. Bank competition increases the proportion of small firms, which end up in smaller average firm size in an industry. In addition, we find that bank competition has more pronounced impact on private firms, and joint stock banks are the major player in enhancing industrial structure. Our results are robust when using average bank competition in other cities in the same province as an instrumental variable. We also further confirm the robustness by employing the 2007 deregulation in bank branching as a natural experiment for the expansion of joint stock and city commercial banks.

Our paper has some implications for policy makers. The competition in the banking market can enhance the competition in the product market, which is insightful for the reform in China with a highly centralized structure in certain

industries. Deregulation in the banking sector can also enhance the development of SMEs and private firms proportionally more than large state-owned firms, which may provide vital engines for the economic growth in the country. Our findings can also be generalized to other economies with similar structure in the banking market and industrial sector. While it might be difficult to update industrial structure directly in certain countries by industrial policies, deregulating the banking sector could be a proper way to turn the industrial structure towards a more competitive one.

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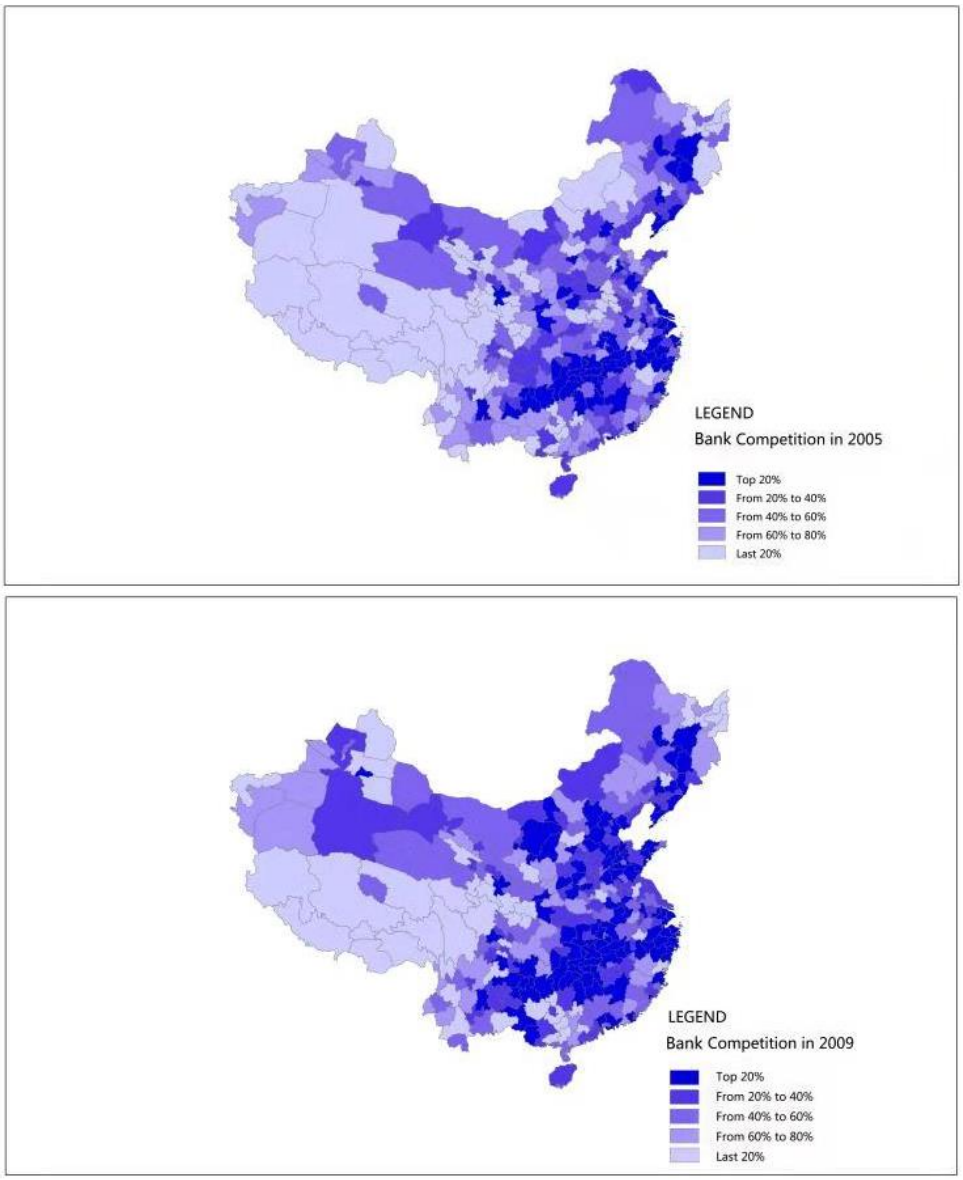

Figure 1: bank competition in 2005 and 2009 at the city level

Table 1: Summary statistics. See Appendix Table A1 for variable definitions. SD is the standard deviation. P5 and P95 are the 5th and 95th percentiles.

Variable name	N	Mean	SD	P5	Median	P95
HHI	38,809	0.171	0.059	0.087	0.164	0.292
CR5	38,809	0.824	0.145	0.538	0.842	1.000
EFD	38,808	0.745	0.164	0.193	0.774	1.127
Industry share of employment	38,808	0.038	0.044	0.001	0.019	0.164
Number of firms per capita	38,795	0.073	0.099	0.003	0.031	0.379
Number of SOEs per capita	38,795	0.003	0.004	0.000	0.000	0.015
Number of private firms per capita	38,795	0.053	0.072	0.000	0.022	0.272
Average firm size	38,808	211.814	165.142	45.000	158.813	698.571
Average SOE size	38,809	179.765	351.389	0.000	0.000	1314.000
Average private firm size	36,477	157.988	104.672	40.625	126.814	445.000
Share of firms with less than 50 employees	38,808	0.247	0.243	0.000	0.200	1.000
Share of firms with 50-149 employees	38,808	0.403	0.251	0.000	0.400	1.000
Share of firms with 150-499 employees	38,808	0.258	0.236	0.000	0.222	1.000
Share of firms with 500 or more employees	38,808	0.092	0.168	0.000	0.027	1.000

Table 2: The impact of bank competition on industrial structure. The dependent variables are number of firms per capita and logarithm of average firm size in columns (1) to (2) and columns (3) to (4) respectively. See Appendix Table A1 for variable definitions. Robust standard errors are clustered at city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)
	Number of firms per capita		Logarithm of average firm size	
Industry share of employment	0.979***	0.981***	8.387***	8.369***
	(0.046)	(0.046)	(0.325)	(0.325)
HHI× EFD	-0.380***		2.338***	
	(0.109)		(0.758)	
CR5× EFD		-0.138***		0.696**
		(0.041)		(0.306)
Fixed effects	Industry × Year			
	City × Year			
N	38,783	38,783	38,796	38,796
R^2	0.716	0.716	0.481	0.480

T**able 3: Heterogeneity across firm size.** The dependent variables are shares of firms in different size bins. See Appendix Table A1 for variable definitions. Robust standard errors are clustered at city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Firm share	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Fewer than 50 employees		50-149 employees		150-499 employees		500 or more employees	
Industry share of employment	-1.013***	-1.009***	-0.626**	-0.621**	0.502**	0.496*	1.137**	1.134**
	(0.063)	(0.063)	(0.063)	(0.062)	(0.056)	(0.056)	(0.072)	(0.072)
HHI×EFD	-0.430*		-0.488**		0.711**		0.206	
	(0.242)		(0.245)		(0.266)		(0.221)	
CR5×EFD		-0.126		-0.120		0.221**		0.025
		(0.093)		(0.092)		(0.102)		(0.087)
Fixed effects	Industry × Year							
	City × Year							
N	38,796	38,796	38,796	38,796	38,796	38,796	38,796	38,796
R^2	0.288	0.287	0.127	0.126	0.175	0.174	0.277	0.277

Table 4: Heterogeneity across ownership: SOEs versus private firms. The dependent variables are number of SOEs per capita, number of private firms per capita, logarithm of average SOE size, and logarithm of average private firm size. See Appendix Table A1 for variable definitions. Robust standard errors are clustered at city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Number of SOEs per capita		Number of private firms per capita		Logarithm of average size of SOEs		Logarithm of average size of private firms	
Industry share of employment	0.029***	0.029***	0.707***	0.709***	8.855***	8.828***	5.590***	5.580***
	(0.002)	(0.002)	(0.033)	(0.033)	(0.394)	(0.392)	(0.211)	(0.211)
HHI×EFD	-0.015**		-0.288**		3.402**		1.112*	
	(0.004)		(0.086)		(1.602)		(0.654)	
CR5×EFD		-0.005**		-0.104**		1.116		0.285
		(0.002)		(0.032)		(0.689)		(0.253)
Fixed effects	Industry × Year							
	City × Year							
N	38,783	38,783	38,783	38,783	15,985	15,985	36,460	36,460
R^2	0.500	0.500	0.683	0.683	0.425	0.425	0.396	0.396

Table 5: Heterogeneity across bank types. The dependent variables are number of firms per capita and logarithm of average firm size in the columns (1) to (2) and columns (3) to (4). Panels A, B, and C report regressions for SOBs, JSBs, and CCBs, respectively. See Appendix Table A1 for variable definitions. Robust standard errors are clustered at city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Panel A: State-owned banks	(1)	(2)	(3)	(4)
	Number of firms per capita		Logarithm of average firm size	
Industry share of employment	0.971***	0.971***	8.439***	8.427***
	(0.045)	(0.045)	(0.323)	(0.322)
HHI×EFD	0.336*		-1.621	
	(0.175)		(1.663)	
CR5×EFD		0.263***		-1.382**
		(0.072)		(0.670)
EFD×Share by state-owned banks	0.344***	0.778***	-2.087***	-4.262***
	(0.076)	(0.156)	(0.442)	(0.890)
HHI×EFD×Share by state-owned banks	-1.327***		7.683***	
	(0.325)		(2.175)	
CR5×EFD×Share by state-owned banks		-0.797***		4.273***
		(0.164)		(1.017)
Fixed effects	Industry × Year			
	City × Year			
N	38783	38783	38796	38796
R^2	0.719	0.719	0.483	0.482
Panel B: Joint stock banks	(1)	(2)	(3)	(4)
	Number of firms per capita		Logarithm of average firm size	
Industry share of employment	0.972***	0.972***	8.413***	8.401***
	(0.045)	(0.045)	(0.324)	(0.324)
HHI× EFD	-0.128		1.519*	
	(0.084)		(0.770)	
CR5× EFD		-0.048*		0.364
		(0.029)		(0.312)
EFD×Share by joint stock banks	12.620***	19.490***	-40.518***	-72.367***
	(2.772)	(4.956)	(13.224)	(26.868)
HHI×EFD×Share by joint stock banks	-49.867***		149.344*	
	(12.160)		(80.775)	
CR5×EFD×Share by joint stock banks		-18.348***		68.502**
		(5.361)		(33.780)
Fixed effects	Industry × Year			
	City × Year			
N	38783	38783	38796	38796
R^2	0.721	0.721	0.482	0.482
Panel C: City commercial banks	(1)	(2)	(3)	(4)
	Number of firms per capita		Logarithm of average firm size	
Industry share of employment	0.978***	0.980***	8.391***	8.377***
	(0.045)	(0.046)	(0.325)	(0.324)

HHI× EFD	-0.252**		2.381***	
	(0.098)		(0.831)	
CR5× EFD		-0.080**		0.624*
		(0.037)		(0.355)
EFD×Share by city commercial banks	0.511**	0.949**	0.400	-0.976
	(0.245)	(0.436)	(1.573)	(2.909)
HHI×EFD×Share by city commercial banks	-2.682**		-4.593	
	(1.212)		(8.542)	
CR5×EFD×Share by city commercial banks		-1.033**		0.516
		(0.480)		(3.385)
Fixed effects	Industry × Year			
	City × Year			
N	38783	38783	38796	38796
R^2	0.717	0.717	0.481	0.481

Table 6: Instrumental variable regressions: single IV. Instrumental variables are the average HHI or CR5 of other cities in the same province. Panel A and B report the regressions with number of firms per capita and logarithm of average firm size as dependent variables. See Appendix Table A1 for the variable definitions. Robust standard errors are clustered at city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Panel A	Number of firms per capita			
	(1)	(2)	(3)	(4)
	2nd stage	1st stage	2nd stage	1st stage
Industry share of employment	0.967***	-0.014***	0.969***	-0.023***
	(0.045)	(0.003)	(0.045)	(0.006)
mean HHI× EFD		0.471***		
		(0.052)		
mean CR5× EFD				0.742***
				(0.069)
HHI× EFD	-0.489**			
	(0.223)			
CR5× EFD			-0.181**	
			(0.080)	
Fixed effects	Industry × Year			
	City × Year			
N	38333	38333	38333	38333
R^2	0.714	0.977	0.714	0.987
First stage F-Statistic		230.82***		229.40***
Cragg-Donald F-Statistic		10170.08***		12877.87***
Panel B	Logarithm of average firm size			
	(1)	(2)	(3)	(4)
	2nd stage	1st stage	2nd stage	1st stage
Industry share of employment	8.423***	-0.014***	8.414***	-0.023***
	(0.331)	(0.003)	(0.328)	(0.006)
mean HHI× EFD		0.469***		
		(0.052)		
mean CR5× EFD				0.742***
				(0.069)
HHI× EFD	2.625			
	(1.631)			
CR5× EFD			1.086*	
			(0.589)	
Fixed effects	Industry × Year			
	City × Year			
N	38346	38346	38346	38346
R^2	0.481	0.977	0.480	0.987
First stage F-Statistic		333.53***		330.93***
Cragg-Donald F-Statistic		10190.08***		12898.96***

Table 7: Instrumental variable regressions: multiple IVs. Instrumental variables are average HHI and CR5 of other cities in the same province. Panel A and B report regressions with number of firms per capita and logarithm of average firm size as dependent variables. See Appendix Table A1 for variable definitions. Robust standard errors are clustered at city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Panel A	Number of firms per capita			
	(1)	(2)	(3)	(4)
	2nd stage	1st stage	2nd stage	1st stage
Industry share of employment	0.967***	-0.013***	0.969***	-0.023***
	(0.045)	(0.003)	(0.045)	(0.006)
mean HHI× EFD		0.201***		0.128
		(0.068)		(0.151)
mean CR5× EFD		0.187***		0.682***
		(0.042)		(0.112)
HHI× EFD	-0.483**			
	(0.210)			
CR5× EFD			-0.184**	
			(0.081)	
Fixed effects	Industry × Year			
	City × Year			
N	38333	38333	38333	38333
R^2	0.714	0.978	0.714	0.987
First stage F-Statistic		230.32***		229.47***
Cragg-Donald F-Statistic		6146.86***		6465.69***
Hansen J test		0.92		0.53
Panel B	Logarithm of average firm size			
	(1)	(2)	(3)	(4)
	2nd stage	1st stage	2nd stage	1st stage
Industry share of employment	8.426***	-0.013***	8.414***	-0.023***
	(0.329)	(0.003)	(0.328)	(0.006)
mean HHI× EFD		0.202***		0.128
		(0.067)		(0.148)
mean CR5× EFD		0.187***		0.682***
		(0.041)		(0.111)
HHI× EFD	2.779*			
	(1.509)			
CR5× EFD			1.088*	
			(0.589)	
Fixed effects	Industry × Year			
	City × Year			
N	38346	38346	38346	38346
R^2	0.481	0.978	0.480	0.987
First stage F-Statistic		332.03***		330.98***
Cragg-Donald F-Statistic		6172.51***		6477.03***
Hansen J test		0.79		0.94

Table 8: Deregulation in 2007 as a natural experiment. See Appendix Table A1 for variable definitions. Robust standard errors are clustered at the city-year and industry-year levels (Petersen, 2009) and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

	(1)	(2)
	Number of firms per capita	Logarithm of average firm size
Industry share of employment	0.478***	10.700***
	(0.041)	(0.634)
Treated ×Post × EFD	0.021***	-0.134**
	(0.005)	(0.062)
Fixed effects	Industry × Year	
	City × Year	
	Industry × City	
N	14546	14546
R^2	0.984	0.930

Appendix: Table A1: Variable definitions

Variables	Definitions	Source
HHI	Herfindahl-Hirschman Index=the sum of squared market shares of all banks in a city.	Financial license database from the CBRC
CR5	Concentration index=the sum of the number of branches of top five largest banks over the number of all bank branches in a city.	
EFD	External financial dependence = capital expenditures minus cash flow from operations over the capital expenditure, i.e. following Rajan and Zingales (1998).	Industrial enterprise database
Industry share of employment	Fraction of total employment of an industry.	
Number of firms per capita	Total number of firms in industry j, city s and year t over the population of a city.	
Number of SOEs per capita	Total number of private firms in industry j, city s and year t over the population of a city.	
Number of private firms per capita	Total number of SOEs in industry j, city s and year t over the population of a city.	
Average firm size	Total employment over the total number of firms in industry j, city s and year t.	Industrial enterprise database and CSMAR
Average SOE size	Total employment in private firms divided by the total number of firms in industry j, city s and year t.	
Average private firm size	Total SOE employment over the total number of firms in industry j, city s and year t.	
Share of firms with fewer than 50 employees	Share of firms with fewer than 50 employees in industry j, city s and year t.	Industrial enterprise database
Share of firms with 50-149 employees	Share of firms with 50-149 employees in industry j, city s and year t.	
Share of firms with 150-499 employees	Share of firms with 150-499 employees in industry j, city s and year t.	
Share of firms with 500 or more employees	Share of firms with 500 or more employees in industry j, city s and year t.	