Regional economic development, strategic investors

and efficiency in Chinese city commercial banks

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Abstract

We investigate the impact of strategic investors on bank efficiency in the context of regional economic development. The data on Chinese city commercial banks operating regionally are well-suited for the study. Findings suggest that strategic investors significantly increase efficiency in Chinese city commercial banks; the impact of strategic investors on the efficiency of Chinese city commercial banks is negatively correlated to the level of regional economic development. The negative correlation of the impact of strategic investors on Chinese city commercial banks' efficiency with regional economic development may be explained by the mix of the local official promotion system and the city commercial banks' governance structure.

1. Introduction

Attracting strategic investors has been one of the strategies to reform banking in China since WTO entry in 2001. Existing literature (Megginson, 2005; Berger et al. 2008) also shows that strategic investors have a significantly positive impact on bank's efficiency in transition economies including China. Not only is China, as the second largest economy, vast in territory but also there are significant regional disparities in economic development (Qian and Litwack, 1998; Sun and Yamori, 2009). Different development level of regional economy creates different demands for types of financial arrangements (Levine, 1997) and governs divergent entrepreneurship (Wennekers et al. 2005), which may result in different efficiency in Chinese banking. The Chinese case is well-suited to investigate the impact of strategic investors on bank efficiency in the context of regional economic development.

To examine the impact of strategic investors on efficiency in the context of regional economic development, we need to find suitable data. In China, large banks often operate in geographically wide regions. [1] It is very hard to identify regional efficiency of these banks. In this regard, "city commercial banks" are well-suited for a study on our topic in China. [2] For a typical large commercial bank, we have only access to aggregate financial data of branches distributed throughout the country. The aggregate data does not reflect regional efficiency of the bank. [3] On the contrary, city commercial banks were created originally following the rule

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[1] These large banks usually refer to five state-owned commercial banks (i.e., Big-Five banks) and twelve joint-stock commercial banks.

[2] On summary of Chinese city commercial banks, see section 3 for details.

[3] Even if the financial data of provincial-level branches (the highest level branch) of these banks are available,

of one-city-one-bank, were located in central cities of every province (province-level or prefecture-level cities) and operated within each province. Under the permit of CBRC (China Banking Regulatory Commission), several city commercial banks have made a rapid extension outside their own provinces since 2007. In other words, a vast majority of city commercial banks operate regionally. Therefore, it is feasible to investigate empirically the impact of strategic investors on banks' efficiency in the context of regional economic development when employing the data on Chinese city commercial bank which operated regionally.

We explore the impact of strategic investors on efficiency in the context of regional economy in Chinese city commercial banks. We find that strategic investors significantly increase efficiency in Chinese city commercial banks; the impact of strategic investors on Chinese city commercial bank's efficiency is negatively correlated to the level of regional economic development. The negative correlation of the impact of strategic investors on Chinese city commercial banks' efficiency with regional economic development may be explained by the mix of the local official promotion system and the city commercial banks' governance structure. The above conclusions are robust and show that further reforms of commercial banks are necessary to bring more efficient banking in China.

The remainder of the paper is structured as follows. In the next section, we provide a brief review of the related literature. Section 3 gives background information on Chinese city commercial banks. The data on the Chinese city commercial banks are showed and our

the data also does not reflect truly the local branch profits efficiency performance because the existence of an internal funds market within a bank usually allows the reallocation of deposits and/or loans across branches and provinces at internal price.

empirical methodology is outlined in section 4. In section 5, we represent empirical results. Section 6 concludes.

2. Literature on banking efficiency

A wealth of literature on the financial institution efficiency focuses on the relationship between the institution efficiency, market structure, deregulation, M&A, and foreign bank entry mainly in the US and European countries. Berger and Humphrey (1997) and Berger and Mester (1997) provide an extensive and valuable survey of literature. In contrast to those for developed countries, efficiency studies for developing countries have been mainly focus on ownership, privatization and their impacts on governance and efficiency. Quite exhaustive surveys of the literature on bank efficiency for developing countries already exit (Megginson and Netter, 2002; Clarke et al. 2005; Megginson, 2005; Boubakri et al. 2005). Hence, we review here the results on bank efficiency in China because the results may give deeply insight into Chinese banking sector and the industrial environment of city commercial banks.

There have been only a handful of recent studies on bank performance for China. Chen et al. (2005) shows that large state-owned banks and smaller banks are more efficient than medium sized Chinese bank, technical efficiency dominates the allocative efficiency, and financial deregulation of 1995 improves cost efficiency. Fu and Heffernan (2007) finds ownership types and banking reform stage each affect the Chinese banking X-efficiency. Specifically, the cost efficiency of joint-stock commercial banks is higher than those in state-owned commercial banks, and cost efficiency is also higher in the first phase of reforms

than in the second phase. Yao et al. (2007) examines the effects of ownership structure and hard budget constraint on bank efficiency before WTO entry in China. Their empirical results suggest that non-state banks are more efficient than state banks; banks facing a harder budget tend to outperform those heavily capitalized by the state or regional governments. Berger et al. (2008) explores the impact of bank ownership on efficiency in China. They find that the consistent conclusions with previous research in terms of the correlation between the ownership and efficiency. Although selection effects are not ruled out entirely, minority ownership is associated with efficiency improvement above and beyond any selection effects. Lin and Zhang (2009) assesses the effects of Chinese bank ownership on performance using a joint analysis of the static, selection, and dynamic effects and finds consistent conclusions regarding the correlate between ownership and performance. They argue that the banks undergoing a foreign acquisition or public listing have better pre-event performance. Jiang et al. (2009) investigates the effects of governance changes on bank efficiency in China. They conclude that bank efficiency has improved, strong selection effects are found for both foreign acquisition and going public reform strategies, and privatization via IPOs has only some short term effects. From what has been reviewed above, these studies have something in common as follows. Ownership structure does matter in Chinese banking sector; Governance changes caused by gradualist reforms and privatization raise bank performance in China; Selection effects can not be ruled out for Chinese banking sector.

3. Background on city commercial banks in China

The precursor of the city commercial bank is primarily urban credit cooperatives which came about in the end of the 1970s. Due to bad management, a lot of NPLs formed in urban credit cooperatives. In 1995, the central bank, the People's Bank of China, decided to salvage urban credit cooperatives from the NPLs-endangered situation. All urban credit cooperatives plus some rural credit cooperative and local financial institutions located in towns were ordered to merge and consolidate into the newly formed joint-stock companies, i.e. city commercial banks. These city commercial banks inherited all NPLs from urban credit cooperatives, but local public funds were injected into these city commercial banks as capital. For the typical city commercial bank, shareholders included local government, urban collective-owned firms, urban private-owned firms, and citizens, but citizens were not allowed to become new shareholders. City commercial banks were created following the rule of one city one commercial bank. All the city commercial banks were located in central cities: province-level or prefecture-level cities. They were required to operate only within their own administrative regions until 2006, when CBRC permitted the city commercial banks to set up branches in other provinces. Several city commercial banks have made a rapid extension outside their own provinces since 2007. Attracting strategic investors was an important strategy for a better governance and performance. For example, the International Financial Corporation purchased a 2.4% stake in Xi'an Commercial Bank in 2001. Apart aside attracting strategic investors, going public was another important strategy. For example, Beijing Bank was listed successfully on the ShangHai Stock Exchange in 2007. At the end of 2009, a total of 143 city commercial banks were distributed unevenly throughout the country. City commercial banks rank third in terms of business development among all the categories

of Chinese financial institutions, [1] preceded by Big-Five state owned commercial banks (SOCBs) and 12 joint-stock commercial banks. As shown in Table 1, Chinese city commercial banks make up only around 7~8% of total assets, total liabilities, equity, profits after tax, and non-performance loans of all the Chinese banking. In contrast to Big-Five state-owned commercial banks which dominate Chinese banking, the size of city commercial banks are small.

Insert table 1 here.

4. Methodology

4.1. The specification of city commercial banks' efficiency equation

Two distinct economic efficiency concepts, namely, cost and profit efficiencies, are usually employed to measure financial institutions' efficiency. Profit efficiency is based on the more accepted economic goal of profit maximization and explains errors on the output side as well as those on the input side. Therefore, the profit efficiency concept is superior to the cost efficiency for evaluating the overall performance of the bank (Berger and Mester, 1997). We here use profit efficiency to predict the efficiency scores of the banks.

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[1] As of the end 2009, Chinese banking sector comprises 3 policy banks, 5 large state-owned commercial banks (i.e., Big-Five banks), 12 joint-stock commercial banks, 143 city commercial banks, 43 rural commercial banks, 196 rural cooperative banks, 11 urban credit cooperatives, 3,056 rural credit cooperatives, one postal savings banks, 4 banking assets management companies, 37 local incorporated foreign banking institutions, 58 trust companies, 91 finance companies of enterprise groups, 12 financial leasing companies, 3 money brokerage firm, 10 auto financing companies, 148 village and township banks, 8 lending companies and 16 rural mutual cooperatives.

Profit efficiency measures how well a bank is predicted to perform relative to a "best-practice" bank producing the same outputs under the same conditions. In other words, profits efficiency measures how close to maximum profit a bank is, where the maximum is determined by the best performer in the sample. Our preferred model for estimating efficiency specifies the commonly-used translog functional form for the profit functions. The profit equation is shown as follows.

$$\ln\left(\pi/w_2 z + \theta\right)_{it} = \delta_0 + \sum_j \delta_j \ln\left(y_j/z\right)_{it}$$

$$+\frac{1}{2}\sum_j\sum_k \delta_{jk} \ln\left(y_j/z\right)_{it} \ln\left(y_k/z\right)_{it}$$

$$+\beta_1 \ln\left(w_1/w_2\right)_{it} + \frac{1}{2}\beta_{11} \ln\left(w_1/w_2\right)_{it} \ln\left(w_1/w_2\right)_{it}$$

$$+\sum_j \phi_j \ln\left(y_j/z\right)_{it} \ln\left(w_1/w_2\right)_{it} + v_{it} - u_{it} \qquad (1)$$

where i, t index the bank and year, respectively, j or $k = 1,..,4$ index the four output variables, and $\delta_{jk} \equiv \delta_{kj}$. π represents the bank's profits. A constant θ is added before taking the logarithm to avoid taking a logarithm of negative number. There are four outputs, total loans y_1, total deposits y_2, total investments y_3, and non-interest income y_4.[1] The input prices are the price of funds w_1, and the price of capital w_2.[2] The v_{it} term represents a random error that incorporates measurement error and other uncontrollable factors while the term u_{it} represents technical and allocative inefficiency aspects that can be influenced by

[1] Following Fu and Heffernan (2007), we introduce non-interest income into the standard outputs as a proxy of off-balance sheet activities (OBS). Some literature (e.g. Stiroh, 2000; vennet, 2002) argues that outputs should be augmented by including OBS.

[2] Total expenses on employees are unavailable. Hence, following the previous studies (Hasan and Marton, 2003; Bonin et al, 2005; Berger et al, 2008), we use a broad measure for the price of all inputs, namely, the ratio of non-interest expenses to the total fixed assets.

management. The profit function is estimated using the $(v_{it} - u_{it})$ as a composite error term. The normalization by the input price w_2 ensures price homogeneity. The normalization by city commercial bank's total assets z reduces heteroskedasticity and allows banks of any size to have comparable residual terms from which the efficiencies are calculated. As another robustness check, we replace total assets with equity e to scale.

Furthermore, the v_{it} terms are assumed to be independent and identically distributed as normal variates with mean zero and variance equal to σ_v^2. The v_{it} terms are independent of the u_{it} terms, which are non-negative random variables distributed normally but truncated below zero. We assume that the u_{it} terms are distributed independently but not identically. That is, the u_{it} terms are assumed to follow a half normal distribution, i.e., $N\left(\mu_{it}, \sigma_{\mu it}^2\right)$, in which both mean and variance may vary. Time effects are included in the estimation of the frontier because structural conditions in Chinese banking and general macroeconomic conditions may generate differences in profit efficiency of city commercial banks from time to time. Specifically, we estimate frontiers that allow for a mean shift or for a heteroscedastic variance. In each case, the mean or the heteroscedastic variance shift is specified by $\varphi'x$, where x is a vector of dummy variables for year effects.

4.2. The regression of efficiency scores on strategic investors and regional economic development

In order to explore the impact of strategic investors on bank efficiency in the context of regional economic development, we specify the regression equation as follows:

$$EFFI_{i,t} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 PCGDP_{it} + \alpha_3 DUM_{it} + \alpha_4 DUM_{it} \cdot PCGDP_{it} + \varepsilon_{it}, \quad (2)$$

where i, t index the bank and year, respectively. *EFFI* is the estimated score of profit efficiency. *SIZE* represents the size of the city commercial bank, which is the logarithm of the total assets of the city commercial bank. *PCGDP* is the logarithm of per capital GDP of the province in which the city commercial bank is located. [1] The dummy variable *DUM*, which takes value 1 for the city commercial bank with strategic investors and 0 otherwise, enters equation (2). In order to capture the correlation of the impact of strategic investors on efficiency with regional economic development, we add the interaction term *DUM·PCGDP* to equation (2).

4.3. Data and sample description

Financial and operating data of city commercial banks, which is hand-gathered, is drawn from the annual reports released by the official websites of city commercial banks and the Chinese leading financial newspaper *Finance Time*. The growth rate of provincial GDP and per capita GDP are extracted from China Statistical yearbooks from years 2002 to 2010. The city commercial banks which have branches in other provinces are eliminated. After that, 72 Chinese city commercial banks and 174 bank-year observations during the period of 2002-2009 are left. [2] 14 city commercial banks out of the 72 banks and 34 bank-year

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[1] It is reasonable to use provinces as regional division for investigating regional economic development herein because first, city commercial banks were created originally following the rule of one-city-one-bank; second, all the city commercial banks in the sample are located in the central cities of every province (province-level or prefecture-level cities) and operate within their own provinces.

[2] Only a small minority of Chinese city commercial banks disclosed publicly their financial statements every year. Moreover, these banks did so off and on. Hence, of 143 city commercial banks, only a small portion of banks are available in our research every year.

observations of the 174 observations have attracted strategic investors. [1] The number of

banks and the number of bank-year observations are shown in Table 2. The 72 Chinese city

commercial banks are distributed unevenly across 26 provinces. Zhejiang Province dominates

our sample with 10 city commercial banks (making up 13.89% of banks number) and 38

bank-year observations (making up 21.84% of the number of bank-year observations). The

number of City commercial banks and the number of bank-year observations are the second

highest in Shangdong province with 8 banks (11.11%) and 21 observations (12.67%),

respectively. Henan Province is ranked the third highest with 7 banks (9.72%) and 13

observations (7.47%). The observations of city commercial bank number are spread relatively

evenly across the other 23 provinces. The observations are distributed relatively evenly over

years 2005-2009 in the sample, but years 2002-2004 have fewer observations.

Insert Table 2 here.

A summary of the statistics for the key variables used in the empirical specification is

presented in Table 3. All variables, excluding the price of funds and the price of capital, are

inflation-adjusted to base year 2002.

The average of Chinese city commercial bank assets is 261.7548 million Yuan with a

coefficient of variation of 1.29, which shows that the size of city commercial banks is on

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[1] The 14 city commercial banks with strategic investors include Nanjin, Hangzhou, Yantai, Chongqin, Dalian,

Tianjin, Nancong, Laishang, Ninbo, Yingkou, Rizhao, Xi'an, Qilu, Fudian. Strategic investors are divided into

two categories: strategic foreign investor and strategic domestic investor. Out of these banks, Yantai, Laishang,

Rizhao, and Fudian are with domestic strategic investors. The reason why we don't separate strategic foreign

investors from the strategic domestic investors in our study is as follows. The strategic domestic investors of the

four city commercial banks are from the large banks in which strategic foreign investors contribute not only

capital but also independent foreign directors to bank governance.

average small. The 0.77% proportion of non-interest income to total assets indicates that city commercial banks seldom offer other financial services except accepting deposits and extending loans in China. Taking other balance sheet characteristics as percentages of assets, total loans are 51.67%, total deposits are 77.53%, total costs are 24.97%, equity is 59.16%, and investment expenditure is 20.26%. The input prices are on average 0.0218 for funds and 1.0370 for capital. Provincial per capita GDP in China ranges hugely from the minimum of 6073.04 Yuan to the maximum of 52265.57 Yuan.

Insert Table 3 here.

5. Empirical results

5.1. Efficiency scores of city commercial banks in China

Summary statistics for estimates of stochastic profit frontier with total assets and equity normalizations are reported in Table 4.

Insert Table 4 here.

Each panel comprises two specifications: mean shift and heteroscedaasticity shift. A mean shift, which is determined by year effects, is imposed on the inefficiency term, μ_{it}, in the first column of each panel. The second column of each panel captures the heteroscedasticity shift in the variance of inefficiency, σ_{uit}^2, which is determined by year effects.

The values of the log likelihood function are showed in the first row. The estimate of variance in disturbance, namely, $\sigma^2 = \sigma_u^2 + \sigma_v^2$, and the ratio of the variance in disturbance

that is due to inefficiency, namely, $\gamma = \sigma_u^2 / \sigma^2$, are reported in the next two rows.

Specifications (1) to (4) have the log likelihood values 245.9476, 240.8647, 8.8362, and

6.6815, respectively. Estimates of the ratio are 0.9975 for specification (1) and 0.9915 for (3).

It shows that inefficiency dominates the composite error term and is more important than

stochastic variation in the frontier itself. The mean profit efficiency for each specification is

reported in the sixth row. Profit efficiency of individual bank here is measured relative to best

practice, and its estimate is always positive value between zero and unity. The mean profit

efficiency scores for specifications (1) to (4) are 0.9460, 0.9233, 0.8733, and 0.8302,

respectively. It shows that only 5.40%, 7.67%, 12.67% and 16.98% of potential profits that

could be earned by a best-practice bank are lost on average to inefficiency, respectively. As is

evident from the Table 5, the Pearson's correlation coefficients among the efficiency scores

from the four specifications (1) to (4) are highly correlated and significant at the 1% level,

which indicates that the scores' rank order obtained from the specifications (1) to (4) are

almost identical and the scores' rank order of the city commercial banks are highly robust.

5.2. The impact of strategic investors on city commercial banks' efficiency in the context of

regional economic development

As mentioned above, we obtain efficiency scores from pooled observations

incorporating year dummies. Generally speaking, causality runs both from economic

development to bank efficiency and from bank efficiency to economic development. As

shown in Table 1, city commercial banks account for a very small share of the market in

Chinese banking. Ferri (2009) argues that Chinese city commercial banks should not be the

driving force for local economic development, although the causality from city commercial

banks performance to local economic development can not be ruled out entirely. We accept

Ferri's argument (2009) and neglect the issue of endogeneity in estimation, which may arise

due to the causality from city commercial banks efficiency to economic development. The

empirical results from equation (2) are reported in Table 6.

Insert table 6 here.

The results of four regressions (5) to (8) are reported in Table 6. Four types of efficiency

scores corresponding to previous efficiency specifications in Table 4 are employed as the

dependent variables. The results with normalization by total assets are presented in the first

and second columns. The results scaled by equity are reported in the last two columns. The

explanatory variables are city commercial bank's size variable *SIZE*, regional economic

development variable *PCGDP*, a dummy variable *DUM* reflecting strategic investors, and the

interaction term $DUM \cdot PCGDP$. We use Huber-White heteroscedasticity correction so that

the standard errors will be consistent estimates. In addition, z-statistic from the bootstrapped

standard errors with 500 replications is presented below each t-statistic.

Taking the regressions (5) and (6) in Table 6 first, not only is the absolute value of the

coefficients on *SIZE* very small but also the estimates of the coefficients are not statistically

significant. The magnitude of the two coefficients α_2 on *PCGDP* is small and insignificant,

too. It indicates that there is not significant impact of regional economic development itself

on the city commercial bank efficiency. The two coefficients α_3 on the strategic investor

dummy variable *DUM*, which are termed intercept shifters, are 0.4050 and 0.5379,

respectively. Their values are very large relative to other partial regression coefficients.

Moreover, seen from both t-stat and z-stat, the coefficients on dummy variable *DUM* both are statistically significant at 5% level. The estimates of α_3 show that strategic investors significantly increase Chinese city commercial banks' efficiency, which is consistent with existing literature on the role of strategic investors in bank's efficiency. Based on equation (2), for the city commercial banks with strategic investors, the impact of regional economic development on efficiency may be captured by $\partial EFFI / \partial PCGDP = \alpha_2 + \alpha_4$. Taking into account that the estimate of α_2 is very small and insignificant, we focus on the coefficient α_4. The coefficients α_4 in regressions (5) and (6), which are termed slope shifters, are -0.0406 and -0.0538, respectively. The estimates both are statistically at the 5% significant level. It shows that although strategic investors significantly increase the city commercial banks' efficiency level, which is indicated by the estimate of α_3, the impact of strategic investors on efficiency is negatively correlated to the development level of regional economy in Chinese city commercial banks. That is, the efficiency level to city commercial banks with strategic investors will, on average, decline as regional economy develops. The R^2 values both are very small. It is not surprising because the existing literature (e.g., Berger and Mester. 1997) shows that many factors such as market structure, organizational forms, and the bank's characteristics and so on may exert influence on bank efficiency. [1] Both regressions (7) and (8) display almost the same empirical results as the regressions (5) and (6) except that first, the coefficients on *DUM* and $DUM \cdot PCGDP$ are significant at the 10% level; second, coefficients on $DUM \cdot PCGDP$ in terms of bootstrapped standard error in (7) is marginally significant at the 10% level (z-statistic is -1.61). The results from regressions (7) and (8)

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[1] These factors are not included in our study only because of the lack of reliable data.

indicate further that the empirical results are robust after using different specifications and estimates.

Before concluding, we briefly investigate the mechanisms of the impact of strategic investors on city commercial banks' efficiency in the context of regional economic development. Taking into account the fact that the mechanism behind the positive impact of strategic investors on financial institutions performance have been discussed in details in existing literature (e.g. Bonin et al. 2005; Berger et al. 2008), we will focus on the reasons why the impact of strategic investors on city commercial banks' efficiency is negatively correlated to the regional economic development in China. For a typical city commercial bank in China, local government was usually a majority shareholder and the chief executive officer himself was an official and was nominated by local government. The internal government structure of city commercial banks determined usually these banks' business operations. In the situation that local government was not allowed to issue bonds in China, city commercial banks were usually taken as one of financial platforms by local officials. The city commercial banks were mandated to continuously extend loans to city infrastructure investment, regional firms, regional infrastructures, and regional real estate to successfully spur regional economic growth and development without strictly assessing credit risk. Local officials' obsession with regional economic performance resulted in management distortion which further created technical and allocative inefficiency in Chinese city commercial banks.[1] The management distortion may partially offset the positive role of strategic investors

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[1] We may find answer to the reason why local officials are obsessed by their own regional economic development from Chinese political system. In Chinese political system, the higher-level officials usually determined the local official's career mobility such as promotion, demotion, retirement and so on. Local

in improving Chinese city commercial banks' efficiency. To some extent, the level of regional economic development usually reflected the ability to mobilize credits and extent of distorting management. The faster the level of economic development is in one region, the more the positive impact of strategic investors on efficiency decreases in the region. Hence, findings indicate the empirical regularity that the impact of strategic investors on city commercial banks' efficiency is negatively correlated to regional economic development in China.

6. Conclusions

Attracting strategic investors is an important strategy for more efficiency in Chinese city commercial banks. Existing literature suggests that strategic investors should result in more efficient banks in transition countries. Different from previous empirical work, we investigate the issue in the context of regional economic development using well-suited data on Chinese city commercial banks. We estimate first the profit efficiency with four specifications using hand-gathered data which covers 74 banks and 174 year-bank observations over 2002 to 2009. Second, we explore the impact of strategic investors on city commercial banks' efficiency in

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economic performance became an important indicator for the higher-level officials assessing local officials. Local officials have also been empowered with the authority in allocating local political and economic resources to improve local economic performance. The M-form structure of Chinese economy made local officials' economic performance individually distinguishable and comparable to peers (Maskin et al. 2000). Hence, local officials' concerns about their prospect of career mobility have become a very important incentive mechanism to motivate the local officials to build up the local economic development (Blanchard and shleifer, 2001; Li and Zhou, 2005).

the context of regional economic development. The empirical results show that strategic

investors significantly increase Chinese city commercial banks' efficiency level. It is

consistent with existing literature on the role of strategic investors in financial institutions'

efficiency. Moreover, we find that the impact of strategic investors on Chinese city

commercial banks' efficiency is negatively correlated to the level of regional economic

development. We present a credible explanation for the negative correlation of the impact of

strategic investors on city commercial banks' efficiency with the regional economic

development using the mix of local official promotion system and the city commercial banks'

governance structure. It is worth noting that due to the lack of enough continuous year

observations for each bank, we do not test further for selection effects of strategic investors in

Chinese city commercial banks.

Our findings have the following policy implications. Our results show that central

government was in a dilemma in China. On one hand, strategic investors were attracted for

obtaining more efficient city commercial banks; on the other hand, local government was

tempted to retain the effective control of city commercial banks. Our results show that under

Chinese current mechanism of official promotion, it is necessary that local governments cede

control entirely to strategic investors to bring better city commercial banks to China. In

addition, dominating Big-Five state-owned commercial banks also took the same strategy of

attracting strategic foreign investors while central government entirely retained control of the

five banks. If our findings are generalized to Big-Five state-owned commercial banks, doubts

are cast on the possibility that the foreign strategic investors will bring more efficient banking

to China at last as Chinese economy develops, although existing literature (for example,

Berger et al. 2008) shows that strategic foreign investors may increase the efficiency in Chinese banking.

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Table 1 The overview of market structure of Chinese city commercial banks at the end of 2009

	Total Assets	Share %	Total liabilities	Share %	Total owner's equity	Share %	Profits after tax	Share %	Non performance loans	Share %
CCBs	56800.1	7.2	53213.0	7.1	3587.1	8.1	496.5	7.8	376.9	7.6
SOCBs	400890.2	50.9	379025.6	51.0	21864.6	49.3	4001.2	59.9	3627.3	72.9
Others	330000.2	41.9	311110.0	41.9	18890.2	42.6	2186.5	32.7	969.1	19.5
Total	787690.5	100.0	743348.6	100.0	44341.9	100.0	6684.2	100.0	4973.3	100.0

Notes: All financial variables are measured in 100 million of constant 2009 RMB. SOCBs include five state-owned commercial banks. CCBs include 143 city commercial banks. Others include policy banks, joint-stock commercial banks, rural commercial banks, foreign banks, banking asset management companies, non-bank financial institutions, small and medium sized rural financial institutions, rural cooperative institutions, new-type financial institutions, etc. Share shows the proportion of one type of bank to all the banking sectors.

Table 2 Frequency distribution of year-bank observations by provinces

Province	Number of banks	Observations by year							
		2002	03	04	05	06	07	08	09
Tianjin	1	1							1
Zhejiang	10	38	1	2	2	5	9	10	6	3
Jiangsu	2	8	1	1	1	1			2	2
Shandong	8	21			1	2	5	6	6	1
Fujian	2	7			1	1	2	2	1	
Liaoning	3	7				1		2	3	1
Hebei	5	9				1		2	3	3
Guangdong	1	2					1	1		
Anhui	1	4					1	1	1	1
Heilongjiang	2	3					1	1	1	
Henan	7	13				2	2	4	3	2
Shanxi	1	2					1	1		
Sichuan	6	10				1	3	5		1
Guangxi	3	7				1	1	2	2	1
Hunan	1	2					1	1		
Gansu	1	2					1	1		
Jiangxi	4	7					3	4		
Ningxia	1	4					2	1	1	
Neimeng	1	4					2	1	1	
Hubei	3	6					2	3	1	
Xinjiang	1	2					1	1		
Guizhou	1	1						1		
Shanxi	3	5						1	2	2
Qinghai	1	1						1		
Yunnan	1	2							1	1
Chongqing	2	6					1	1	2	2
Total	72	174	2	3	5	15	39	53	36	21

Notes: Depending on the availability of data, 72 city commercial banks are included as follows. Wenzhou, Hangzhou, Yantai, Haixia, Chongqing, Tianjin, Dalian, Huishang, Haerbing, Zhenzhou, Qingdao, Datong, Jiaxin, Jiaozhuo, Changzhou, Nancong, Panzhihua, Luoyang, Liuzhou, Laishang, Tangshan, Tailong, Taizhou, Hengyang, Nanzhou, Quanzhou, Nanchang, Ningxia, Mintai, Chouzhou, Qiqihaer, Jingzhou, Nanjing, Baoshang, Zhanjiang, Yingkou, Mianyang, Xiaogan, Kelamayi, Rizhao, Ji'ning, Huzhou, Ningbo, Ganzhou, Huangshi, Xinxiang, Jiujiang, Jinhua, Weihai, Beibuwan, Xuchang, Hankou, Hebei, Guiyang, Shangrao, Deyang, Xi'an, Pingdingshan, Zigong, Xi'ning, Qilu, Dezhou, Jiangsu, Anyang, Guiling, Fudian, Sanxia, Xingtai, Jingshang, JinCheng, Handan, and Yibing.

Table 3 Variables used to investigate city commercial banks' efficiency in China

	Observations	Mean	Std. Dev.	Min	Max
Profits	174	3.1453	4.3964	0.0029	29.4578
Total loans	174	135.2359	183.8848	3.9026	1580.8180
Total deposits	174	202.9462	276.9064	12.5882	2328.2080
Total costs	174	6.5359	9.0174	0.4035	67.2046
Total assets	174	261.7548	339.2804	16.1403	2761.8230
Equity	174	15.4855	21.2319	0.1051	125.6038
Total investments	174	53.0365	80.2538	0.1355	729.3821
Non-interest income	174	2.0178	2.8185	0.0361	24.4697
The price of funds	174	0.0218	0.0517	0.0047	0.6920
The price of capital	174	1.0370	0.4839	0.0073	2.6329
Per capita GDP	174	20365.1900	8521.5650	6073.0400	52265.5700

Notes: All financial variables excluding input prices are inflation-adjusted to base year 2002. They are measured in million Yuan. The definitions of total costs, total loans, total deposits, total investments, non-interest income, and total assets are in accordance with Fu and Heffernan (2007). The price of funds is defined as the ratio of interest expenses to total deposits, and the price of capital is measured by non-interest expenses as the percentage of total fixed assets.

Table 4 Summary statistics for Stochastic profit frontier estimates

	Panel A: Normalized by total assets		Panel B: Normalized by equity	
	Mean shift μ_{it}	Heteroscedasticity shift $\sigma^2_{\mu it}$ with	Mean shift μ_{it}	Heteroscedasticity shift $\sigma^2_{\mu it}$ with
	with year effects	year effects	with year effects	year effects
	(1)	(2)	(3)	(4)
Log likelihood	245.9476	240.8647	8.8362	6.6815
σ^2	0.4416		3.7601	
	0.3543		6.0908	
γ	0.9975		0.9915	
	0.0021		0.0137	
Mean score	0.9460	0.9233	0.8733	0.8302
Score Std. Dev.	0.0557	0.0619	0.1041	0.1029

Notes: Standard errors are represented in parentheses for the estimated parameters. Specifications (1) and (3) did not converge; the reported estimates are the results after 100 iterations. Specifications (2) and (4) achieved convergence at iteration 8 and 11, respectively.

Table 5 Pearson's correlation coefficients of efficiency scores

		Normalized by total assets		Normalized by equity	
		Mean shift with year effects	Heteroscedasticity shift with year effects	Mean shift with year effects	Heteroscedasticity shift with year effects
Normalized by total assets	Mean shift with year effects	1.0000			
	Heteroscedasticity with year effects	0.9727[***] (0.0000)	1.0000		
Normalized by equity	Mean shift with year effects	0.7720[***] (0.0000)	0.7533[***] (0.0000)	1.0000	
	Heteroscedasticity with year effects	0.7831[***] (0.0000)	0.7871[***] (0.0000)	0.9852[***] (0.0000)	1.0000

Notes: P-values are shown in parentheses for the Pearson's correlation coefficients. Asterisks [***] denote the 1% significant level.

Table 6 The results on regression of Chinese city commercial banks' efficiency

	Normalized by total assets		Normalized by equity	
	Score From Mean Shift	Score from heteroscedasticity shift	Score from mean shift	Score from heteroscedasticity shift
	(5)	(6)	(7)	(8)
CONSTANT	0.9184	0.8673	0.6501	0.6093
t-stat	11.27***	8.45***	3.14***	2.98***
z-stat	11.12***	8.23***	3.18***	2.99***
SIZE	-0.0002	0.0001	-0.0007	-0.0025
t-stat	-0.06	0.01	-0.10	-0.33
z-stat	-0.06	0.01	-0.10	-0.33
PCGDP	0.0029	0.0056	0.0227	0.0234
t-stat	0.36	0.55	1.16	1.19
z-stat	0.36	0.54	1.17	1.19
DUM	0.4050	0.5379	0.5112	0.5735
t-stat	2.11**	2.47**	1.77*	1.83*
z-stat	2.16**	2.41**	1.68*	1.79*
DUM·PCGDP	-0.0406	-0.0538	-0.0494	-0.0557
t-stat	-2.06**	-2.41**	-1.69*	-1.75*
z-stat	-2.10**	-2.35**	-1.61	-1.72*
Number of Obs.	174	174	174	174
$F_{(4, 169)}$	1.63	2.03	1.59	1.50
Wald(4)	6.53	7.70	5.90	5.49
R^2	0.0183	0.0245	0.0158	0.0172

Notes: Four regression equations are estimated corresponding to four types of scores from city commercial banks' efficiency estimation specification as the dependent variables. The explanatory variable includes *SIZE* (the logarithm of total assets), *PCGDP* (the logarithm of provincial per capita GDP), *DUM* (a dummy variable taking value 1 for bank with strategic investors and 0 otherwise), and *DUM·PCGDP* (an interaction term between strategic investor dummy variable *DUM* and the logarithm of provincial per capita GDP variable *PCGDP*). t-statistics which are obtained via OLS and Huber-White heteroscedastic consistent estimates are reported. In addition, z-statistics from the bootstrapped standard errors with 500 replications are presented. F and Wald values are reported for Huber-White heteroscedasitic consistent estimate and bootstrapped stand error, respectively. Asterisks ***, **, and * represent the 1%, 5%, and 10% significant level, respectively.

Appendix A The parameter estimates of profit frontier for normalization by total assets

Explanatory variable	Description of explanatory variable	Mean shift with year effects	Heteroscedasticity shift with year effect
Constant		-0.40(0.26)	-0.20(0.25)
$Ln(y_1/z)$	Loans Scaled by total assets	1.40(0.56)**	1.50(0.51)***
$Ln(y_2/z)$	Deposits Scaled by total assets	0.69(0.79)	1.24(0.99)
$Ln(y_3/z)$	Investment scaled by total assets	-0.23(0.16)	-0.35(.014)**
$Ln(y_4/z)$	Non interest income scaled by total assets	0.14(0.12)	0.20(0.11)*
$Ln(y_1/z)ln(y_1/z)/2$	Scaled loans times scaled loans	0.33(0.34)	0.43(0.36)
$Ln(y_1/z)ln(y_2/z)/2$	Scaled loans times scaled deposits	-0.64(0.33)*	-0.79(0.36)**
$Ln(y_1/z)ln(y_3/z)/2$	Scaled loans times scaled investment	-0.62(0.20)***	-0.68(0.19)***
$Ln(y_1/z)ln(y_4/z)/2$	Scaled loans times scaled non interest income	1.20(0.13)***	1.25(0.12)***
$Ln(y_2/z)ln(y_2/z)/2$	Scaled deposits times scaled deposits	0.41(0.41)	0.47(0.45)
$Ln(y_2/z)ln(y_3/z)/2$	Scaled deposits times scaled investment	-0.08(0.27)	-0.10(0.30)
$Ln(y_2/z)ln(y_4/z)/2$	Scaled deposits times scaled non interest income	-0.19(0.20)	-0.19(0.21)
$Ln(y_3/z)ln(y_3/z)/2$	Scaled investment times scaled investment	-0.11(0.03)***	-0.12(0.04)***
$Ln(y_3/z)ln(y_4/z)/2$	Scaled investment times scaled non interest income	0.10(0.04)**	0.10(0.05)**
$Ln(y_4/z)ln(y_4/z)/2$	Squared scaled non interest income	0.01(0.01)	0.01(0.01)
$Ln(w_1/w_2)$	Funds price normalized by capital price	0.16(0.02)***	0.17(0.02)***
$Ln(w_1/w_2)ln(w_1/w_2)/2$	Squared funds price normalized by capital price	-0.32(0.28)	-0.32(0.24)

Explanatory variable	Description of explanatory variable	Mean shift with year effects	Heteroscedasticity shift with year effect
$\mathrm{Ln}(y_1/z)\ \mathrm{Ln}(w_1/w_2)$	Scaled loans times normalized funds price	$0.66(0.36)^{*}$	$1.00(0.45)^{**}$
$\mathrm{Ln}(y_2/z)\ \mathrm{Ln}(w_1/w_2)$	Scaled deposits times normalized funds price	$-0.01(0.07)$	$-0.04(0.06)$
$\mathrm{Ln}(y_3/z)\ \mathrm{Ln}(w_1/w_2)$	Scaled investment times normalized funds price	$-0.13(0.03)^{***}$	$-0.10(0.03)^{***}$
$\mathrm{Ln}(y_4/z)\ \mathrm{Ln}(w_1/w_2)$	Scaled non interest times normalized funds price	$0.46(0.17)^{***}$	$0.58(0.17)^{***}$
Variance parameters for compound error			
σ^2		$0.44(0.35)$	
γ		$0.99(0.002)$	
Log likelihood		245.94	240.86
Iteration completed		Not achieved	8

Notes: In profit efficiency estimation, we let constant θ equal 0.05 to avoid taking a logarithm of negative number. Inefficiency errors are non-negative random variables distributed normally but truncated below zero. They are distributed independently but not identically. Standard errors are reported in parentheses. Asterisks ***, **, and * denote the 1%, 5%, and 10% significant levels, respectively.

Appendix B The parameter estimates of profit frontier for normalization by equity

Explanatory variable	Description of explanatory variable	Mean shift with year effects	Heteroscedasticity shift with year effect
Constant		0.69(0.98)	0.57(1.03)
$Ln(y_1/e)$	Loans Scaled by equity	0.95(0.78)	0.85(0.81)
$Ln(y_2/e)$	Deposits Scaled by equity	-1.46(1.05)	-1.24(1.11)
$Ln(y_3/e)$	Investment scaled by equity	0.14(0.23)	0.12(0.24)
$Ln(y_4/e)$	Non interest income scaled by equity	-0.01(0.17)	0.01(0.18)
$Ln(y_1/e)ln(y_1/e)/2$	Scaled loans times scaled loans	0.05(0.17)	0.13(0.18)
$Ln(y_1/e)ln(y_2/e)/2$	Scaled loans times scaled deposits	-0.14(0.24)	-0.21(0.25)
$Ln(y_1/e)ln(y_3/e)/2$	Scaled loans times scaled investment	-0.23(0.10)[**]	-0.23(0.11)[**]
$Ln(y_1/e)ln(y_4/e)/2$	Scaled loans times scaled non interest income	0.28(0.08)[***]	0.29(0.08)[***]
$Ln(y_2/e)ln(y_2/e)/2$	Scaled deposits times scaled deposits	0.27(0.16)[*]	0.26(0.17)
$Ln(y_2/e)ln(y_3/e)/2$	Scaled deposits times scaled investment	0.20(0.13)	0.19(0.13)
$Ln(y_2/e)ln(y_4/e)/2$	Scaled deposits times scaled non interest income	-0.32(0.08)[***]	-0.34(0.08)[***]
$Ln(y_3/e)ln(y_3/e)/2$	Scaled investment times scaled investment	-0.02(0.01)	-0.02(0.02)
$Ln(y_3/e)ln(y_4/e)/2$	Scaled investment times scaled non interest income	0.03(0.02)	0.03(0.02)
$Ln(y_4/e)ln(y_4/e)/2$	Squared scaled non interest income	-0.01(0.01)	-0.01(0.01)
$Ln(w_1/w_2)$	Funds price normalized by capital price	0.13(0.07)[*]	0.13(0.08)
$Ln(w_1/w_2)ln(w_1/w_2)/2$	Squared funds price normalized by capital price	-0.03(0.32)	-0.03(0.34)

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Explanatory variable	Description of explanatory variable	Mean shift with year effects	Heteroscedasticity shift with year effect
$Ln(y_1/e)$ $Ln(w_1/w_2)$	Scaled loans times normalized funds price	0.17(0.37)	0.20(0.39)
$Ln(y_2/e)$ $Ln(w_1/w_2)$	Scaled deposits times normalized funds price	0.01(0.08)	0.01(0.08)
$Ln(y_3/e)$ $Ln(w_1/w_2)$	Scaled investment times normalized funds price	-0.05(0.06)	-0.05(0.06)
$Ln(y_4/e)$ $Ln(w_1/w_2)$	Scaled non interest times normalized funds price	0.46(0.41)	0.41(0.42)
Variance parameters for compound error			
σ^2		3.76(6.09)	
γ		0.99(0.01)	
Log likelihood		8.83	6.68
Iteration completed		Not achieved	11

Notes: In profit efficiency estimation, we let constant θ equal 0.05 to avoid taking a logarithm of negative number. Inefficiency errors are non-negative random variables distributed normally but truncated below zero. They are distributed independently but not identically. Standard errors are reported in parentheses. Asterisks ***, **, and * denote the 1%, 5%, and 10% significant levels, respectively.