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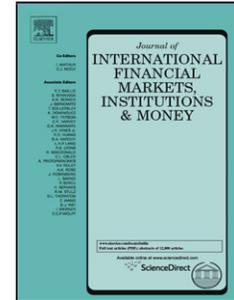
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## HIGHLIGHTS

- We investigate the impacts of risk and competition on profitability in Chinese banking industry
- We do not find any robust results with regards to the impacts of risk and competition on bank profitability.
- The results show that Chinese bank profitability is significantly affected by taxation, overhead cost, labour productivity and inflation.

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**The impacts of risk and competition on bank profitability in China**

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## The impacts of risk and competition on bank profitability in China

### Abstract

Several rounds of banking reforms in China have aimed to increase the competitive condition and further enhance stability in the Chinese banking sector, while the joint effects of competition and risk-taking behaviour on the profitability in the banking sector have not been studied well enough so far in the literature. The current study contributes to the empirical literature by testing the impacts of risk and competition on profitability in the Chinese banking industry (state-owned, joint-stock and city commercial banks) over the period 2003-2011 under a one-step Generalized Method of Moments (GMM) system estimator. The results do not show any robust finding with regards to the impacts of competition and risk on bank profitability, while it is found that Chinese bank profitability is affected by taxation, overhead cost, labour productivity and inflation. The study provides policy implications to the Chinese banking industry and different ownership types of Chinese commercial banks.

**JEL classification:** G21, C23,

**Key words:** bank profitability, bank competition, risk, GMM, China

## 1 Introduction

As an important part of the financial system, the banking sector plays a more and more important role in the development of China's economy. Several rounds of banking reforms in China have aimed to create a more competitive environment and improve the bank performance. However, stronger competition does not necessarily contribute to improvement in profitability. The Structure-Conduct-Performance (SCP) hypothesis argues that in a highly concentrated banking market where competition is lower, the banks tend to collude with each other to obtain supernormal profit. Concentration in the Chinese banking sector is quite high compared to other countries. According to the statistics of the annual report from China Banking Regulatory Commission (CBRC), at the end of 2011, the assets of five large commercial banks account for 47.3% of the total assets in the banking industry, a decrease of 2% compared to the previous year. Comparing with other countries, such as Luxembourg, Germany, and Austria at the same year, the five-bank concentration ratios of which are much lower, with Luxembourg (31.2%), Germany (33.5%) and Austria (0.4%) (European Central Bank structural financial indicators 2011).

The financial crisis that happened from 2007 makes the government, banking regulatory authority and bank managers more concerned by the risk-taking behaviour of Chinese banks. Due to the special characteristics of the Chinese banking industry, the operation of Chinese banks, and especially the state-owned commercial banks (SOCBs), is largely influenced by the central government, which leads to the accumulation of non-performing loans. The large volumes of non-performing loans hinder the profitability improvement of Chinese banks. The credit quality of Chinese banks has improved significantly during recent years. The non-performing loan ratio of all banking institutions is 1.77% in 2011, which is 0.66% lower than the previous year (CBRC annual report 2011). Although the figure in China is much lower than some of banking sectors in European countries, such as Ireland and Lithuania, the non-

performing loan ratios of which are 16.1% and 16.3%, respectively, it is still higher than Luxembourg, Finland and Sweden, all of which have non-performing loan ratios below 1% (European Banking Sector Facts and Figures 2012).

In this paper, we focus on the analysis of bank profitability in China due to the fact that it reflects the bank management and, especially nowadays in the Chinese banking industry, as all the banks are encouraged to be listed in the stock exchange to obtain external monitoring and funds, a higher profitability can increase the competitiveness of the bank.

Using a sample of state-owned, joint-stock and city commercial banks, this study tests whether the Chinese banking industry is in line with the SCP hypothesis and further examines whether the improvement of risk management increases bank profitability in China. We also control for comprehensive determinants of bank profitability in order to give policy implications to bank managers, the regulatory authority and government. The contributions of this paper are as follows: 1) It is the first paper among empirical banking studies to use stability inefficiency as the main risk indicator to test its impact on bank profitability while the risk is cross checked by Z-score and ratio of loan loss provision over total loans; 2) we provide robust results regarding the impact of competition on bank profitability by using both Lerner index and Herfindahl-Hirschman index as competition indicators. The use of the Lerner index as the competition indicator provides the competitive conditions of different ownership types of Chinese banks, which fills a gap in empirical literature on Chinese bank competition.

The results do not show any robust findings with regards to the impacts of competition and risk on Chinese bank profitability. However, they show that Chinese bank profitability is significantly affected by taxation, overhead cost, labour productivity and inflation. The findings further show that, compared to the state-owned commercial banks (SOCBs), the

joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) in China have lower profitability in terms of Return on Assets (ROA), Net Interest Margin (NIM) and Profit Margin (PBT). We also do separate estimations on different types of bank ownership and relevant findings as well as policy implications are provided.

The paper is organized in the following manner. Section 2 reviews the development of the Chinese banking sector; Section 3 discusses the existing literature on bank profitability and bank competition as well as the impact of competition on bank profitability. Section 4 presents the determinants of bank profitability, variable selection as well as the empirical model, followed by section 5, which describes the data and methodology. Section 6 presents the empirical results. Section 7 provides further discussion on the empirical results. Section 8 concludes the paper.

## **2 Development of the Chinese banking sector**

Before 1978, the Chinese banking system followed a mono-bank model. The central bank- Peoples' Bank of China (PBC) took the function of a central bank as well as engaging in commercial bank operations. A series of economic reforms was initiated by the Chinese government in 1979 to transfer the planned economy to a market-based economy. The banking sector in China was also rebuilt and redesigned through a number of reforms. The two-tier banking system was created during the period 1979-1993, with PBC free to serve as the central bank and four state-owned commercial banks (SOCBs)<sup>1</sup> to engage in commercial bank lending. Not only the state-owned commercial banks (SOCBs), but also a number of joint-stock commercial banks (JSCBs)<sup>2</sup>, rural and urban credit cooperatives were gradually

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<sup>1</sup> They are Bank of China (BOC), Agricultural Bank of China (ABC), China Construction Bank (CCB) and Industrial and Commercial Bank of China (ICBC).

<sup>2</sup> These banks include Citic Bank, China Merchant Bank, Shenzhen Development Bank, China Everbright Bank, Industrial Bank, Guangdong Development Bank, HuaXia Bank and Shanghai Pudong Development Bank.

established during this period. Over this period, the state-owned commercial banks (SOCBs) made loans to state-owned enterprises under government direction with no consideration of credit check and risk monitoring which leads to the accumulation of non-performing loans. During this period, the competition among Chinese banks is limited.

In order to alleviate the problem of large volumes of non-performing loans in state-owned commercial banks (SOCBs), three policy banks were established by Chinese government in 1994. Their main functions were: 1) take over the responsibilities undertaken by state-owned commercial banks (SOCBs) previously and 2) make loans under the government policies. Thus, state-owned commercial banks (SOCBs) were gradually transferred to true commercial banks; they had more freedom in terms of credit and lending decisions.

In order to reduce the volumes of non-performing loans in state-owned commercial banks (SOCBs), four assets management companies (AMCs) (Cinda AMC, Huarong AMC, Great Wall AMC and Oriental AMC) were established by government in 1999, with each oriented to a specific state-owned commercial bank. The AMCs purchase and manage the non-performing loans and they were under the supervision of PBC. Up to the present, there have been three instances of non-performing loan write-off by AMCs, which happened in 1999, 2004 and 2005, respectively. In 1999, four AMCs purchased RMB 1.4 trillion non-performing loans from four state-owned commercial banks (SOCBs) and China Development Bank; in 2004, the non-performing loans worth of RMB 278.7 billion from Bank of China and China Construction Bank were purchased by Cinda AMC and, finally, in 2005, the non-performing loans worth of RMB 142.4 billion from Bank of China, RMB 56.9 billion from China Construction Bank and RMB 64 billion from Bank of Communication were purchased by Oriental and Cinda AMCs. These purchases reduced the volumes of non-performing loans of Chinese state-owned commercial banks (SOCBs) and increased their competitiveness in the world.

Not only does it deal with the issue of non-performing loans, the Chinese government also takes measurements to increase competition in the banking sector, such as ease the licensing and entry requirement of new small and medium domestic banks. A number of new joint-stock commercial banks (JSCBs) were established in 1996, 2003, 2004 and 2005<sup>3</sup>. Furthermore, in order for the banks to obtain external funds and additional monitoring and increase the competition among banks, all Chinese banks are encouraged to be listed on the stock exchange. By the end of 2011, all the state-owned commercial banks (SOCBs) have successfully offered their initial public offerings (IPOs) with ICBC raising US\$21.9 billion in Shanghai and Hong Kong stock exchanges in 2006, becoming the largest IPO at that time. Among the twelve joint-stock commercial banks (JSCBs), eight of them have been listed on the stock exchange<sup>4</sup>.

Established by the State Council in 2003, the CBRC is the primary government agency and point of control for commercial banks. The CBRC is not only responsible for supervising commercial banking operations, but also for formulating rules and regulations, authorizing the establishment, changes, termination and business scope of the banking institutions and conducting an onsite examination and offsite surveillance of their operations. The objective is to protect the interest of depositors and maintain market confidence through prudential and effective supervision.

At the end of 2011, the Chinese banking sector consisted of 3 policy banks, 5 large-scale (state-owned) commercial banks (SOCBs)<sup>5</sup>, 12 joint-stock commercial banks (JSCBs), 144

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<sup>3</sup> They are: China Minsheng Bank, China Evergrowing Bank, China Zheshang Bank and China Bohai Bank.

<sup>4</sup> They are: China Merchant Bank, China Citic Bank, Hua Xia Bank, China Everbright Bank, Shanghai Pudong Development Bank, China Minsheng Bank, Industrial Bank and Ping An bank (Shenzhen Development bank).

<sup>5</sup> They are: Bank of China (BOC), China Construction Bank (CCB), Industrial and Commercial Bank of China (ICBC), Agricultural Bank of China (ABC) and Bank of Communication (BOCOM).

city commercial banks (CCBs) and a large number of other financial institutions, such as credit cooperatives, foreign banks, trust companies, finance companies of enterprise groups, etc. The proportion of assets of large-scale state-owned commercial banks (SOCBs) in the total banking sector assets keeps decreasing from 2003 to the lowest point in 2011, which is 47.3%, while on the other hand, the proportion of assets of joint-stock and city commercial banks in the total banking sector assets keeps increasing from 2003 to the highest points of 16.22% and 8.81% in 2011, respectively.

In summary, several rounds of banking reforms in China have aimed to increase the competitive condition and lower risk-taking behaviour, which is supposed to have influence on bank profitability. Our study examines the impacts of competition and risk on the profitability of Chinese banks.

### **3 Literature review**

#### **3.1 Empirical literature on bank profitability**

The empirical literature investigating bank profitability can be divided into two streams: one of which focuses on the analysis of bank profitability in multiple country studies, while the second group of literature places emphasis on the examination of bank profitability in single country studies. Table 1 gives a summary of the studies mentioned above.

<<Table 1—about here>>

There are a number of studies investigating profitability in the Chinese banking sector. The studies can be divided into three groups according to the methods used, which are principal analysis, fixed effect estimator and Generalized Method of Moments (GMM) estimator. Shih et al. (2007) investigate the performance of the big four, joint-stock and city commercial banks in China under the principal analysis. The results indicate that joint-stock commercial

banks (JSCBs) have better performance than state-owned and city commercial banks. They argue that the impact of size on bank performance is insignificant.

The second stream of studies uses the fixed effect estimator to investigate the determinants of bank profitability in China. Sufian (2009) uses this method to evaluate the determinants of profitability for four state-owned and twelve joint-stock commercial banks in China over the period 2000-2007. The findings show that Chinese commercial banks with higher levels of credit risk, higher levels of capitalization and larger size in terms of total assets have higher profitability, while Chinese commercial banks with higher levels of liquidity and higher levels of overhead costs have lower profitability. The findings finally show that both economic growth and inflation precede an improvement in bank profitability in China. The same method has been used by Sufian and Habibullah (2009) to assess the determinants of Chinese bank profitability over the period 2000-2005. Their findings suggest that higher levels of risk, higher levels of capitalization and higher levels of liquidity lead to higher profitability for state-owned commercial banks (SOCBs), whereas higher levels of risk and lower levels of cost lead to higher profitability for joint-stock commercial banks (JSCBs). Finally, they find that larger bank size, in terms of total assets and higher levels of costs, lead to lower profitability for city commercial banks (CCBs), while city commercial banks (CCBs) with higher levels of capitalization and more diversified business have higher profitability.

Most of the research papers on Chinese banking profitability use the Generalized Method of Moments (GMM) estimator. Garcia-Herrero et al. (2009) use the two-step GMM system estimator to explain the low profitability of Chinese commercial banks over the period 1997-2004. Their results show that higher profitability can be achieved by the banks with higher levels of capitalization, higher X-efficiency and larger shares of deposits. The findings also report that Chinese commercial banks have higher profitability in a less concentrated banking market. Finally, the results indicate that joint-stock commercial banks (JSCBs) have higher

profitability than state-owned commercial banks (SOCBs) over the examined period. The two-step GMM system estimator is also used by Tan and Floros (2012a) to test the impact of inflation on bank profitability in China over the period 2003-2009. Their results show that Chinese banks with lower levels of diversification, lower levels of overhead cost and lower levels of taxation have higher profitability; while they find that higher developed banking market and higher developed stock market lead to profitability improvement in Chinese commercial banks. Finally, the results show that Chinese commercial banks have higher profitability in a higher inflationary environment. Rather than using the two-step GMM system estimator, Tan and Floros (2012b) use the one-step GMM system estimator to examine the impact of GDP growth on bank profitability in China over the period 2003-2009. Their findings suggest that Chinese commercial banks have lower profitability during the periods of economic boom (higher GDP growth rate).

Instead of using two-step GMM system estimators, Tan and Floros (2012c) use both the one-step difference estimator and one-step system estimator to investigate the impact of stock market volatility on bank performance in China over the period 2003-2009. Four performance indicators are used, namely the return on equity (ROE), excess return on equity (EROE), Net Interest Margin (NIM) and Economic Value Added (EVA). Their results show that state-owned and joint-stock commercial banks with higher levels of taxation have lower ROE and EROE, while joint-stock commercial banks (JSCBs) with higher levels of capitalization have lower ROE and EROE. In addition, they report that state-owned and joint-stock commercial banks with lower levels of overhead cost and higher levels of labour productivity have higher EVA and NIM. They also find that state-owned commercial banks (SOCBs) with higher levels of diversified business have lower EVA and NIM. Finally, the findings report that lower levels of risk, lower levels of taxation and a higher developed banking sector lead to higher EVA and NIM for joint-stock commercial banks (JSCBs).

Both the two-step GMM estimator and fixed effect estimator are used by Heffernan and Fu (2010) to test the determinants of performance for state-owned, joint-stock, city and rural commercial banks over the period 1999-2006. Their findings show that banks with higher efficiency have better performance and bank listing contributes to the performance improvement. They further find that Chinese bank profitability is significantly affected by real GDP growth rate and unemployment, while the impacts of bank size and off-balance-sheet activities on bank profitability are insignificant. Finally, compared to state-owned, joint-stock and city commercial bank, the rural commercial banks in China have better performance.

### **3.2 Empirical literature on bank competition and its measurement**

The empirical literature uses a number of methods to estimate competition in the banking sector through analysing market power and efficiency. Bresnahan (1982) and Lau (1982) develop a method to estimate bank competition through measuring market power. This method has been recently used by Bikker (2003), Uchida and Tstsui (2005) and Qin and Shaffer (2014). The aggregate level of bank behaviour is analysed and average conjectural variation of banks is estimated through this method. This model is based on two structural equations, namely inverse demand equation and a supply equation, both of which are derived from the first order condition of profit maximization. This model estimates the mark-up of price over marginal cost as a measure of market power. Thus, this method is also called mark-up test. If the output price equals marginal cost, as reflected by a zero value of conjectural variation, there is perfect competition in the market, while the value equals to one, which indicates that there is a monopoly in the market.

The second approach that measured the bank competition is developed by Panzar and Rosse (1987). The model measures the extent to which a change in a vector of input prices is

reflected in gross revenue. Thus, this method is also called the revenue test. The H-statistic is used in the method to estimate bank competition. The H-statistic is defined as the sum of the elasticities of the reduced-form revenues with respect to the input prices. A value equal to or smaller than zero indicates that the market is operated under monopoly, while a value of H-statistic between zero and one suggests that the market is in a condition of monopolistic competition, and if the value of H-statistic equals 1, it shows that the market is perfectly competitive. This approach has been widely used in the empirical literature to measure banking sector competition (see Bikker and Haaf, 2002; Matthews et al., 2007; Goddard and Wilson, 2009; Moch, 2013; Barbosa et al., 2015, among others).

The third type of indicator to measure bank competition is through the analysis of market power. There are two indicators, which are Hirschman-Herfindahl index (HHI) and concentration ratio, both of which measure the degree of market concentration. These two indicators are used based on the structure-conduct-performance (SCP) hypothesis, which makes the assumption that the banks' behaviour is affected by market power, while the market structure plays a decisive role in bank performance. The idea of this hypothesis is based on the fact that in a more concentrated market where significant shares are occupied by a few banks, the competitive condition is lower, while higher concentration leads to greater market power, and the resultant increase in the collusive behaviour leads to higher profits. These indicators were recently used by Al-Muharrami et al. (2006) and Fu et al. (2014) to measure competition in the banking industry.

Market power can be also reflected from profitability due to the fact that higher profits achieved by the bank may indicate that there is a lower level of competition. The price-cost margin is an indicator used to measure profitability. The profit-cost margin can be estimated by the difference between output price and marginal cost, then divided by the output price. The so-called Lerner index is widely used in the empirical literature to measure the

competition. The Lerner index ranges from zero to one. The Lerner index equals zero under the condition of perfect competition; the degree of competition decreases as the increase in the value of Lerner index. The market is operated under monopoly if the value of the Lerner index equals one. Empirical literature using the Lerner index to measure competition includes Cipollini and Fiordelisi (2012); Fungacova et al., (2014); among others.

The SCP hypothesis, as discussed above, suggests that market structure affects competitive behaviour which further influences bank performance. In other words, this hypothesis argues that bank profitability is derived from market structure. However, Demsetz (1973) develops the efficient-structure hypothesis, which argues that different profitability achieved by the bank is derived from efficiency. Thus, this hypothesis suggests that banks with higher efficiency have higher ability to increase their market shares and bank size, which further leads to excess profit. A new indicator was developed by Boone (2008) to measure bank competition. The so-called Boone indicator considers the impact of efficiency on performance with regards to profitability and market share. It also considers that competition improves the performance of efficient firms and weakens the performance of inefficient ones. The Boone indicator can be positive as well as negative. A more negative Boone indicator indicates that there is a higher level of competition, while a larger positive value indicates the competition is lower. Considerable literature recently has used this measurement of competition in the banking sector, including Delis (2012), Tabak et al., (2012), among others.

### **3.3 The impact of competition on bank profitability**

There are some hypotheses in the empirical literature investigating the influence of competition on firm's profitability. Using concentration ratio and Herfindal index as the indicators of market structure, the Structure-Conduct-Performance (SCP) hypothesis argues that through offering lower deposit rates and charging higher loan rates, firms have the ability to extract monopolistic rents in a concentrated market. In other words, this hypothesis

suggests that lower competition resulting from higher concentration in the market leads to market power, which enables firms to earn monopolistic or abnormal profit. There are a number of pieces of research providing support to the SCP hypothesis, and the research is undertaken by Rose and Fraser (1976); Heggstad and Mingo (1977); Berger and Hannan (1989); Lloyd-Williams et al., (1994); and Samad (2005), among others. Moreover, Giber (1984) conducted a survey and provided a summary of 44 studies with regards to the relationship between market concentration and bank performance. The findings show that among the 44 studies, 32 of them reported that there is a significant and positive impact of concentration on bank performance.

Alternatively, it is argued that the significant impact of competition (concentration) on firm profitability does not arise from market power but from higher efficiency of firms with larger market share. This Efficient Structure Hypothesis (ESH), as indicated by Demsetz (1973), suggests that the firms with higher efficiency have higher ability to increase their market shares and firms' sizes, while this higher efficiency allowed the firms to concentrate and the resulting lower competition leads to higher profit (Lloyd-Williams et al., 1994). Lloyd-Williams et al. (1994) further argue that the profit can be maximized by the banks with higher efficiency mainly through two ways: 1) maintaining the current market size and pricing policies; 2) accommodating size expansion and price reduction strategies, while Berger (1995) suggest that the profit as well as the market share can be increased by a more efficient bank with superior management or production technology. The above two statements (Williams et al., 1994; Berger, 1995) can also be explained from the perspectives of two different efficiencies, namely X-efficiency and scale efficiency. The X-efficiency is related to superior management of production and technologies, the banks with higher X-efficiency have higher ability to lower the operation cost and increase the profit. On the other hand, the scale efficiency assumes that the banks have the same management level and technology; however,

they have different operation scales, and some banks produce in a more efficient scale than their counterparts, the higher efficient scales lead to a reduction of unit cost and an increase in unit profit. The efficiency-structure hypothesis is supported by studies of Brozen (1987) and Seelanatha (2010). Both of these two hypotheses hold the viewpoint that higher efficiency or larger market power increases concentration, which leads to a reduction in competition.

However, the contestable market theory (CMT), as developed by Baumol (1982), argues that if there was no barrier for new entrants to enter the market, a concentrated industry can behave competitively. In other words, in a higher concentrated banking market which is dominated by few large banks, there is still a higher level of competition. This positive relationship between concentration and competition can be further explained by the fact that in a contestable market, some firms are driven out of the market because of more competition, while a higher concentration is the result of more competition.

Through reviewing the empirical literature on profitability in the banking sector, most of the studies find that banks with higher risk have lower profitability, while the impact of competition on bank profitability is ambiguous. Furthermore, the empirical researches report that there are comprehensive factors influencing bank profitability, such as bank size, capitalization, liquidity, overhead cost, inflation and GDP growth rate.

Although there are studies investigating the impacts of risk and competition on bank profitability, they use traditional accounting ratio to measure the bank risk and concentration ratio as the measurement of competition. This study provides the robust analysis regarding the impacts of risk and competition by firstly attempting to use stability inefficiency as a risk indicator, which is cross checked by ratio of loan loss provision over total loans and Z-score. More importantly, we use the Lerner index which firstly evaluates the competitive conditions

of different ownership types of banks in Chinese banking literature and the Lerner index is also cross-checked by Herfindal-Hirschman index.

#### **4 Determinants of bank profitability, variable selection and empirical model**

##### **4.1 Determinants of bank profitability**

###### **4.1.1 Bank-specific determinants:**

Bank size: we use the natural logarithm of total assets to measure this variable. This measurement is widely used in the empirical literature (see Goddard et al., 2004; Athanasoglou et al., 2008; Dietrich and Wanzenried, 2011 among others). On the one hand, banks with larger size are able to reduce costs from economies of scale and scope (Akhavain et al., 1997; Bourke, 1989; Molyneux and Thornton, 1992; Bikker and Hu, 2002; Goddard et al., 2004; Iannotta et al., 2007; Mercieca et al., 2007; Elsas et al., 2010). On the other hand, Barros et al. (2007) argue that the asymmetric information problems associated with leading can be reduced by smaller and specialized banks, preceding a negative impact of size on bank profitability. Furthermore, Berger and Humphrey (1994) argue that small banks can obtain economies of scale by increasing their size to a certain point where further increase in size will result in diseconomies of scale. This is supported by Athanasoglou et al. (2008), who argue that profitability initially increases with size and then declines for bureaucratic and other reasons. So there is not a prior expectation on the impact of this variable on bank profitability.

Liquidity: we use the ratio of total loans over total assets to measure this variable. We follow Goddard et al. (2013) for the choice of this measurement. It reflects the possible inability of banks to accommodate decreases in liabilities or fund increases on the assets' side of the balance sheet (Tan and Floros, 2012a). The larger figure of this ratio indicates that there is a

lower liquidity level. However, a large volume of loans implies that there is more interest revenue generated. Hence, a negative impact of liquidity on bank profitability is expected, which is consistent with the findings of Molyneux and Thornton (1992). However, it is in direct contrast with the findings of Bourke (1989) in relation to the European banking industry who argues that banks with higher liquidity levels have higher profitability. Higher volume of loans will lead to a decline in bank profitability if the bank does not have a good risk management system. So there is no a prior expectation for this variable.

Risk: we use the ratio of loan loss provision over total loans (LLPTL) to measure this variable. A higher ratio suggests that the bank has higher risk. Empirical studies indicate that an increase in risk exposure leads to a decrease in bank profitability (see Miller and Noulas, 1997). Therefore, we expect that there will be a negative impact of LLPTL on bank profitability in China. Due to the fact that in Chinese banking industry, all the banks are required to hold more than enough loan loss provision to enhance the risk management, this volume will be set at the beginning of the year, thus this variable should be treated as a predetermined variable. We complement this measurement and check the robustness of the result by employing another two alternative risk indicators, which are Z-score and stability inefficiency derived from frontier estimation<sup>6</sup>. The Z-score is used by a number of empirical studies as the risk/stability indicator in the banking sector (see Iannotta et al. 2007; Liu et al. 2013; Liu and Wilson, 2013) and it is calculated by using the sum of a bank's return on assets and equity to total assets ratio over the standard deviation of the bank's return on assets. A higher Z-score indicates that there is a higher stability and lower risk. However, Fang et al. (2011) argue that the potential stability that each bank can achieve is not reflected by Z-score, and the deviation from the bank's current stability and the maximum stability given the

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<sup>6</sup> See Appendix for more detail about the estimation.

economic and regulatory conditions must be considered. Therefore, the so-called “stability inefficiency” is invented. So negative impact of risk on profitability is expected.

Capitalization: we use the ratio of shareholders’ equity over total assets to proxy this variable (see Athanasoglou et al., 2008; Garcia-Herrero et al., 2009; Dietrich and Wanzenried, 2011). This variable is important in explaining the performance of financial institutions. A positive impact of capitalization on bank profitability is expected for the following reasons: first, the funding cost can be reduced for the banks with higher capital levels due to the fact that a higher capital ratio indicates that the banks have higher creditworthiness. Second, the banks with higher capital levels are more likely to engage in prudent lending, which leads to an increase in bank profitability. Thirdly, capital plays an important role in absorbing the risk arising from higher risk assets, such as loans; the interest revenue generated from loans fosters bank profitability. Finally, the banks with higher capital levels need to borrow less, which reduces cost and further increases profitability. However, Berger (1995) argues that capitalization can have a negative impact on bank profitability because the higher the level of capitalization, the lower the relative risk position of the bank. According to the risk-return trade-off, lower risk leads to lower return. This is supported by Modigliani and Miller (1963) and more recently by Dietrich and Wanzenried (2011). So we do not have a prior expectation on the impact of this variable on bank profitability. While the opposite causation is produced according to the relaxation of one-period assumption, which argues that the increase in earnings is allowed to increase the capital ratio. Thus, capital is modelled as the endogenous variable<sup>7</sup>.

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<sup>7</sup> Clear process has been followed to find the endogenous variables. The same model has been tested twice, with the first time the capital treated as exogenous variable and second time as endogenous variable. The results of Sargan test for over-identifying restrictions indicate that the capital should be treated as endogenous variable. Furthermore, the same test has been conducted on other variables as well and the results show that the ratio of loan loss provisions over total loans should be treated as predetermined variable.

Cost management: we use the ratio of overhead cost over total assets to measure this variable. This measurement has been used extensively in the empirical literature (Dietrich and Wanzenried, 2011; Liu and Wilson, 2010; Garcia-Herero et al., 2009; Kosmidou, 2008). Athanasoglou et al. (2008) argue that well-managed banks have the ability to reduce operating costs, which led to an increase in bank profitability in Greece. This opinion is supported by Bourke (1989); and Jiang et al. (2003), among others. However, there is a positive impact of operating expenses on profitability in the European banking industry (Molyneux and Thornton, 1992). This finding can be explained by the fact that large volume of operating expenses is derived from paying salaries and wages to staff, while higher levels of salaries and wages paid to staff significantly improve the staff productivity, while the resulting improvement in the bank profitability is much larger than the salaries and wages paid out by the bank. This explanation is also in line with the efficiency wage theory. The positive impact of operating expenses on profitability is also supported by Ben Naceur (2003) and Guru et al. (2003) in terms of the Tunisian and Malaysian banking industries, respectively. So there is no a prior expectation for this variable.

Diversification: we measure this variable by using the ratio of non-interest income over gross revenue. As argued by Tan and Floros (2012a), more income can be generated when banks are engaged in a number of different businesses. In addition, the banks with more diversified activities have the ability to reduce their costs from economies of scope. Thus, a positive impact of diversification on bank profitability is expected. This is in line with the findings of Jiang et al. (2003) in terms of the Hong Kong banking industry. However, Gischer and Jutter (2001) and Demircug-kunt and Huizinga (1999) argue that there is a negative relationship between diversification and bank profitability due to the fact that, compared to the traditional interest income activity, there is stronger competition in the area of fee-income generating

business, which precedes a decrease in bank profitability. So there is no a prior expectation for this variable.

Labour productivity: we use the ratio of gross revenue over total number of employees to measure this variable. This variable has been widely used in the empirical literature to examine its impact on bank profitability (see Athanasoglou et al., 2008; Tan and Floros 2012a, 2012b, 2012c). Higher labour productivity not only reflects efficient bank management, but also increases the bank's efficiency and further fosters the bank's profitability. So we expect that this variable has a positive impact on bank profitability.

Taxation: the ratio of tax over operating profit before tax is used to measure this variable. This measurement has been used by Tan and Floros (2012a, 2012b, 2012c) in the Chinese banking industry. The findings of Tan and Floros (2012a, 2012b, 2012c) show that there is a significant and negative impact of taxation on bank profitability in China. This can be explained by the fact that higher level of taxes incurred by the banks increase the bank cost and further leads to a reduction in bank profitability, thus, we expect that this variable has a negative impact on bank profitability.

#### **4.1.2 Industry-specific determinants**

Competition: we use Lerner index/Herfindahl-Hirschman index to measure this variable. The SCP hypothesis argues that firms in a financial system with less competition (higher Herfindahl-Hirschman index and higher Lerner index) tend to have larger scales of operation, which leads to a higher degree of profit. This is supported by Claessens and Laeven (2004). However, on the other hand, the competition-efficiency hypothesis argues that in a higher competitive environment, banks managers have more incentive to improve efficiency; the cost reduction derived from efficiency improvement further precedes an increase in profitability. So we do not have any a prior expectation on the sign of this variable.

Banking sector development: we use the ratio of banking sector assets over GDP to measure this variable. This is a country-specific rather than a region-specific variable and it is widely used by empirical studies (see Tan and Floros, 2012a, 2012b, 2012c). Tan and Floros (2012a) suggest that there is a significant and positive impact of banking sector development on bank profitability in China. They argue that in a higher developed banking sector, the demand for banking services increases, which will attract more potential competitors to enter the market. However, although the Chinese banking sector has been gradually opened up through several rounds of banking reforms, it is still difficult for new banks to enter the market. The reduction in supply of banking services relative to the increased demand increases the prices of banking services and further increases the profitability of existing banks. So we expect that this variable has a positive impact on bank profitability.

Stock market development: we use the ratio of market capitalization of listed companies over GDP to measure this variable. According to Demirguc-Kunt and Huizinga (1999) and Bashir (2000), banks in countries with well-developed stock markets normally have higher profitability. The reasons can be explained as follows: 1) higher developed stock market increases the number of firms to obtain funds from stock market rather than banks, this not only reduces the volume of loan service provided by banks, but decreases the risk of loan default, the risk reduction leads to an increase in bank profitability. Furthermore, the risk reduction also increases the borrowing capacity of banks, which fosters bank profitability. Finally, the stock market provides more information on the public traded firms, which makes it easier for banks to evaluate and monitor the risk. Thus, it precedes a reduction of bank cost and an increase in bank profitability (Tan and Floros, 2012a). So we expect that this variable has a positive impact on bank profitability. In other words, it can be concluded that banks and the stock market complement each other and therefore they grow together when they develop. This correlation between banking sector development and stock market development is

confirmed by the research undertaken by Demircuc-Kunt and Levine, 1996; Garcia and Liu, 1999; Li, 2007; among others).

#### **4.1.3 Macroeconomic determinants:**

Inflation: we use the annual inflation rate to measure this variable. Inflation is an important determinant of bank performance. The impact of inflation on bank profitability is firstly examined by Revell (1979) and further investigated by Perry (1992). Both of them argue that the effect depends on whether inflation is anticipated or unanticipated. If inflation rate is fully anticipated, banks can adjust the interest rates or manage the operating expenses accordingly to make the revenues increase faster than costs, which leads to higher profitability, while if inflation is not fully anticipated, the loan losses will be accumulated, which leads to a decrease in bank profitability, thus, there is no a prior expectation for the impact of inflation on bank profitability.

GDP growth rate: some of the researchers argue that it has a positive impact on bank profitability due to the fact that the demand for lending increases during cyclical upswings (see Dermircuc-Kunt and Huizinga, 1999; Bikker and Hu, 2002; Athanasogolou et al., 2008). However, Tan and Floros (2012b) find that GDP growth rate has a negative impact on bank profitability in China. They suggest that higher economic growth improves the business environment and lowers the bank entry barriers. The consequently increased competition dampens bank's profitability. So we do not have any a prior expectation for this variable.

#### **4.2 Variable selection**

The main goal of this paper is to test the impacts of risk and competition on bank profitability in China while controlling for comprehensive bank-specific, industry-specific and macroeconomic variables. There are four profitability indicators considered in the study:

Return on Assets (ROA), Return on Equity (ROE), Net Interest Margin (NIM) and Profit Margin (PBT) (see Table 2). ROA, ROE and NIM are used to compare the results with the findings reported in the literature, while the inclusion of PBT as one of the profitability indicators follows the study of Demircuc-Kunt and Huizinga (1999).

ROA shows the profits earned per unit of assets and reflects the management ability to utilize banks' financial and real investment resources to generate profits (Hassan and Bashir, 2003). ROA has emerged as the key ratio for the evaluation of bank profitability and has become the most common measure of bank profitability in the literature (Athanasoglou et al., 2008; Garcia-Herrero-et al., 2009; Golin, 2011). Figure1a shows the profitability of state-owned commercial banks (SOCBs), joint-stock commercial banks (JSCBs) and city commercial banks (CCBs)<sup>8</sup> over the examined period. In general, JSCBs have the lowest profitability and the difference of profitability between city and state-owned commercial banks is small.

<< Figure1a- about here>>

ROE measures the return to shareholders on their equity and it reflects how much profit a bank generates with the money which shareholders have invested. Although ROE is commonly used in the financial literature, it is not the best profitability indicator for the following reasons. First, banks with higher levels of equity (lower leverage) normally have a higher ROA but a lower ROE. Second, ROE disregards the higher risk that is associated with higher leverage and the effect of regulation on leverage (Dietrich and Wanzenried, 2011). Figure 1b shows the profitability (ROE) of three different groups of Chinese banks. The results suggest that state-owned and city commercial banks have nearly the same profitability, while there is a strong volatility of profitability for joint-stock commercial banks.

<sup>8</sup> The current study includes state-owned commercial banks, joint-stock commercial banks and city commercial banks only due to the fact that these three types of ownership represent the largest three banking groups according to the assets. Furthermore, most of these banks, especially state-owned commercial banks and joint-stock commercial banks, operate nationwide, which better reflects the true picture of competitive condition in the Chinese banking industry.

<<Figure 1b---about here>>

Further, Net Interest Margin (NIM) is the third profitability indicator and it has been widely used in research on bank performance (Dietrich and Wanzenried, 2011; Athanasoglou et al., 2008; Tan and Floros 2012a, 2012b, 2012c). It reflects how successful a bank's investment decisions are relative to its interest expenses. The difference between ROA and NIM is that the former emphasizes the profit earned per unit of assets while the latter focuses on the profit earned on the interest generating activities. Figure 1c shows that the NIM of city commercial banks (CCBs) was highest over the period 2004-2011, while the NIM of state-owned commercial banks (SOCBs) is slightly higher than joint-stock commercial banks (JSCBs) in general.

<<Figure 1c---about here>>

Finally, the profit margin is used as one of the profitability indicators. The difference between ROA and profit margin lies in the fact that the latter considers the tax expenses in bank profitability. We include this indicator to see whether tax has an influence on Chinese bank profitability. When measured by the profit margin, we find from Figure 1d that the profitability of state-owned commercial banks (SOCBs) is higher than city commercial banks (CCBs) in general, while the joint-stock commercial banks (JSCBs) have the lowest profitability. This result indicates that joint-stock commercial banks (JSCBs) pay higher taxes.

<<Figure 1d---about here>>

In summary, we use comprehensive profitability indicators to examine the Chinese bank profitability. They reflect different aspects of banking operations. To be more specific, ROA represent bank's ability to generate profits from assets, while ROE is related to banks' financing and leverage decisions, NIM more specifically focuses on lending activities, while

profit margin consider the tax effect on bank profitability. The different profitability indicators reflect the Chinese banking profitability from different perspectives, which gives the widest overview of Chinese bank profitability to government and it is helpful for the government to make accurate policies.

### 4.3 Empirical model

This study follows and expands the specification proposed by Athanasoglou et al. (2008), which can be expressed as follows:

$$II_{it} = C + \delta II_{i,t-1} + \sum_{j=1}^j \beta_j X_{it}^j + \sum_{l=1}^l \beta_l X_{it}^l + \sum_{m=1}^m \beta_m X_{it}^m + \gamma JSCBs_{it} + \theta CCBs_{it} + v_{it} + \mu_{it} \quad (1)$$

Where  $i$  refers to year and  $t$  refers to an individual bank,  $II_{it}$  represents the profitability indicator for the specific bank at a specific year,  $C$  is constant term,  $II_{i,t-1}$  is one period lagged profitability.  $X_{it}$  are determinants of bank profitability. They are grouped into bank-specific determinants  $X_{it}^j$ ; industry-specific determinants  $X_{it}^l$  and macroeconomic determinants  $X_{it}^m$ . The unobserved bank-specific effect and the idiosyncratic error are represented by  $v_{it}$  and  $\mu_{it}$ , respectively.  $\beta_j$ ,  $\beta_l$ , and  $\beta_m$  are coefficients to be estimated, while  $\delta$  represents the speed of adjustment to equilibrium. Its value ranges from 0 to 1 with a higher figure representing slower adjustment and less competitive structure while a lower figure indicates that there is a stronger competitive condition and higher speed of adjustment. In the model, two dummy variables are added, which are joint-stock commercial banks (JSCBs) and city commercial banks (CCBs), represented by JSCBs and CCBs, respectively, to compare their profitability to the state-owned commercial banks (SOCBs).

## 5 Data and Methodology

### 5.1 Data

The banking data includes 41 Chinese commercial banks (5 state-owned commercial banks, 11 joint-stock commercial banks and 25 city commercial banks) over the period 2003-2011. Due to the fact that not all selected banks have available information for all years, an unbalanced panel dataset is opted not to lose degrees of freedom<sup>9</sup>. With regards to the data sources, the bank-specific variables are from bankscope database which is maintained by Fitch/IBCA/Bureau Van Dijk. It is considered to be the most comprehensive database for research in banking. While the industry-specific variables are from China Banking Regulatory Commission (CBRC) annual reports, the macroeconomic data (inflation and annual GDP growth rate) is from the World Bank database. Table 2 gives a summary of the variables used in the study and their expected impacts on bank profitability.

<<Table 2---about here>>

Figure 2 shows the competitive conditions of the Chinese banking industry over the examined period. As measured by the Lerner index, which is reflected by Figure 2a, it is found that the city commercial banks (CCBs) have lower competition over the period 2005-2009. This finding can be explained by the fact that, unlike the state-owned and joint-stock commercial banks, all the city commercial banks (CCBs) are not listed on the stock exchange, and their funds are mainly from the city government and local enterprises and they have no incentive to compete in order to get funds from public. Furthermore, we report that the joint-stock commercial banks (JSCBs) have the highest competition over most years of the examined period. This finding is due to the fact that, unlike state-owned commercial banks

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<sup>9</sup> Each bank in the sample has a minimum number of consecutive observations of 3 years.

(SOCBs), which are fully supported by the government, the joint-stock commercial banks' operation is largely attributed to the contribution from shareholders. The incentive to attract more shareholders leads to highest competition. When looking at the competitive condition of Chinese banking sector on a year by year basis, which is measured by the Herfindahl-Hirschman index as reflected by Figure 2b, it is notable that the index keeps declining over the examined period except for the year 2008, which shows a slight increase compared to 2007. This indicates that the competitive condition in Chinese banking industry has been increasing in general, while the slight decrease in the competitive condition in 2008 compared to 2007 can be explained by the fact that the Olympic Games in Beijing gave larger banks (especially state-owned commercial banks) advantages to make loans to large infrastructure construction projects. The substantially increase in the market share of state-owned commercial banks (SOCBs) further increases the Herfindahl index and leads to a relatively less competitive condition.

<<Figure 2a---about here>>

<<Figure 2b---about here>>

Figure 3a, 3b and 3c report the risk conditions of Chinese banks over the period 2003-2011 as measured by the ratio of loan loss provision over total loans (LLPTL), Z-score and stability inefficiency, respectively. Figure 3a shows that the volume of loan loss provision is the highest in city commercial banks after 2004. We explain this finding by mainly two reasons: 1) compared to the state-owned and joint-stock commercial banks, the city commercial banks (CCBs) have a short history and they lack the ability of risk management; 2) the city commercial banks (CCBs) normally make loans to local enterprises within the city, and the small enterprises have higher probability of default on loans. We further report that, the joint-stock commercial banks (JSCBs) have higher risk than state-owned commercial banks

(SOCBs) over the period 2004-2008 due to the fact that stronger competition among joint-stock commercial banks (JSCBs) induces bank managers to undertake higher risk in order to obtain higher return.

<<Figure 3a---about here>>

Z-score, another risk indicator, as represented by Figure 3b, shows that in most of the years joint-stock commercial banks (JSCBs) have the highest risk and city commercial banks (CCBs) have the lowest risk. Comparing this to the LLPTL which focuses on lending risk, the Z-score is an indicator of insolvency risk. In other words, it emphasizes banks' volatility of return. The lowest volatility of return of city commercial banks (CCBs) can be explained by the fact that they mainly operate within the city where they were established and the number of business engaged by them is very limited, which leads to a relative stable return.

<<Figure 3b---about here>>

Finally, we look at the risk condition of the Chinese banking industry on a year by year basis, which is reflected by the stability inefficiency as shown by Figure 3c. The figure shows that there is a strong volatility regarding the risk condition in the Chinese banking sector over the period 2003-2006, while during 2007-2011, the risk condition in the Chinese banking sector is relatively more stable. The stronger volatility over the period 2003-2006 can be explained by the capital injection initiated by the Chinese government to state-owned commercial banks (SOCBs) which hinders the competition and leads to higher risk taken by banks (especially state-owned commercial banks), while during 2007-2011, a number of regulations and supervisions took effect, such as RMB business being fully opened to foreign-funded banks, entry requirements being relaxed for new type rural financial institutions, which precedes an increase in competition and more stable environment in the banking sector. This is in line with the competition-stability hypothesis.

<<Figure 3c---about here>>

Table 3 shows the profitability conditions of Chinese banks over the examined period. Furthermore, the profitability of three different groups of Chinese banks is also presented. From the table we can see that over the whole examined period, the state-owned commercial banks (SOCBs) and city commercial banks (CCBs) have a higher profitability in terms of ROA and ROE than joint-stock commercial banks (JSCBs), while the NIM of city commercial banks (CCBs) is higher than joint-stock and state-owned commercial banks. With regards to PBT, the state-owned commercial banks (SOCBs) have the highest profitability, while the profitability of joint-stock commercial banks (JSCBs) is the lowest. The higher profitability in term of ROA and ROE in state-owned commercial banks (SOCBs) can be largely attributed to the fact that the overall income generated by the state-owned commercial banks (SOCBs) is higher, which indicates that state-owned commercial banks (SOCBs) have advantages of engaging in more diversified activities, while the higher NIM for city commercial banks (CCBs) suggests that city commercial banks' business focuses on the traditional deposit-loan service.

<<Table 3---about here>>

Panel A of Table 4 presents the summary statistics for the explanatory variables of all Chinese banks, while panel B, C, and D report the summary statistics of the explanatory variables for state-owned, joint-stock and city commercial banks, respectively. The table shows that Chinese state-owned commercial banks (SOCBs) have the largest size in terms of total assets, while state-owned commercial banks (SOCBs) are the most liquid banking group compared to joint-stock commercial banks (JSCBs) and city commercial banks (CCBs). Furthermore, city commercial banks (CCBs) have the highest capital levels, followed by state-owned commercial banks (SOCBs), while the capitalization of joint-stock commercial

banks (JSCBs) is the lowest. The level of diversified business engaged by state-owned commercial banks (SOCBs) is higher than joint-stock and city commercial banks, while the joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) have higher labour productivity. The lower labour productivity for state-owned commercial banks (SOCBs) is attributed to the fact that state-owned commercial banks (SOCBs) are very big and difficult to manage. In terms of the overhead cost among the three different groups of Chinese banks, state-owned commercial banks (SOCBs) is higher than joint-stock commercial banks (JSCBs) and city commercial banks (CCBs). This is attributed to the larger bank size of state-owned commercial banks (SOCBs).

With regards to the industry and macroeconomic environment in China, the table suggests that banking sector development, inflation and GDP growth in China are more stable than stock market development over the examined period. The higher volatility of the Chinese stock market can be mainly attributed to the share segregation reform initiated by the Chinese government in 2005, which leads to a substantial amount of companies being listed on the stock exchange. By the end of 2007, there were 1550 listed companies in the Shanghai and Hong Kong stock exchange, the value of which reached RBM 32.71 billion, and accounting for 132.6% of GDP at the same year. On the other hand, the stock market development was in its early stage before 2005.

<<Table 4---about here>>

## **5.2 Methodology**

During recent years, a number of research articles use different methods to investigate the competitive condition in the banking industry (see Al-Muharrami et al., 2006; Matthew et al., 2007; Jeon et al., 2011; Olivero et al., 2011; Tabak et al., 2012; Cipollini and Fiordelisi, 2012; Fungacova et al., 2014; Fu et al., 2014; among others). To be more specific, the competition

in GCC banking system over the period 1993-2002 is estimated by Al-Muharrami et al., 2006, using three different indicators, namely K-bank concentration ratio, Herfindahl-Hirschman index as well as the Panzar Rosse H statistic; while the Panzar-Rosse H statistic is used by Matthew et al., 2006 to investigate the competitive condition of British banks over the period 1980 to 2004. The Panzar-Rosse H statistic is used by Jeon et al., 2011 to evaluate the competitive condition of the Asia and Latin America banking sector over the period 1997-2008. Olivero et al, 2011 assess the competitive condition of the Asian and Latin American banking sector over the period 1996-2006 under the Panzar-Rosse H statistic; the Boone indicator is used by Tabak et al., 2011 to investigate the competition of Latin American banking industry during 2003 and 2008; Cipollini and Fiordelisi (2012) use Lerner index as well as Herfindahl-Hirschman index to examine to competitive condition of a sample of European banks over the period 1996-2009; Fungocova et al., 2014 use Lerner index to examine the competitive condition for a sample of banks from 12 Euro area countries over the period 2002-2010, while both the three-bank concentration ratio as well as Lerner index are used by Fu et al., (2014) to evaluate the competition in the Asian Pacific banking industry over the period 2003-2010.

Although there are a number of researchers using the Panar-Rosse H statistic to investigate the competition in the banking sector, it mainly suffers from two drawbacks. First, as argued by Leuvensteijn et al., (2011), the H statistic was developed on the basis of a static model, and there are no predictions on the H-statistic which is one of the weaknesses of this test. In other words, the estimate is surrounded by a degree of uncertainty. Furthermore, as argued by Claessens and Laeven (2004), the overall market equilibrium required by the test cannot be fulfilled because of market entry and exit, which leads to further limits on the interpretation of such analysis.

Furthermore, the Boone indicator also suffers from two disadvantages. First, as argued by Tabak et al. (2012) it makes the assumption that part of the efficiency gains achieved by the banks will be passed onto consumers. In addition, this indicator also suffers from idiosyncratic variation, i.e. uncertainty.

The Lerner index is used in this study mainly because of the following reasons: 1) it can be easily estimated by each bank at each year; and also it matches with its determinants, which are bank-level variables at each year; 2) we can estimate the competitive conditions (market power) for three different ownership types of Chinese banks. Moreover, compared between the K-bank concentration ratio and Herfindahl-Hirschman index, the latter is preferred and used in the current study due to the fact that it takes into account the relative size of the firms in an industry.

### **5.2.1 Estimation of bank competition**

#### **5.2.1a Lerner index**

The Lerner index is defined as the difference between a bank's price and the marginal cost, divided by the price. The index value ranges from a maximum of 1 to a minimum of zero, with higher numbers indicating greater market power and hence less competition. The Lerner index represents the extent to which a particular bank has market power to set its price above the marginal cost.

The price is computed by estimating the average price of bank production (proxied by total assets) as the ratio of total revenue over total assets following Fernandez de Guevara *et al.*, (2005), Carbo *et al.*, (2009a,b) and others. The marginal cost is estimated on the basis of a translog cost function with one output (total assets) and three input prices (price of labour, price of capital and price of funds). Symmetry and linear homogeneity restrictions in input prices are imposed. The cost function is specified as:

$$LNCOST_{it} = \alpha_0 + \alpha_1 LNASSETS_{it} + \frac{1}{2} \alpha_2 (LNASSETS_{it})^2 + \sum_{j=1}^3 \beta_{itj} LNINPUT_{itj} + \sum_{j=1}^3 \sum_{k=1}^3 \beta_{itjk} LNINPUT_{itj} LNINPUT_{itk} + \sum_{j=1}^3 \gamma_{itj} LNASSETS_{it} LNINPUT_{itj} + \varepsilon_{it} \quad (2)$$

LN denotes the natural logarithm, COST denotes total cost, i and t indicate the specific bank operating at the specific year; ASSETS represents the total assets, INPUT represents the three input prices used in the current study and different input prices are represented by the subscripts j and k: INPUT1 is the price of funds (ratio of interest expenses to total funding), INPUT2 indicates the price of capital (ratio of other non-interest expenses to fixed assets), INPUT3 stands for the price of labour (ratio of personnel expenses to total assets).  $\alpha_0$  and  $\varepsilon$  stand for the constant and error terms, respectively. The estimated coefficients of the cost function are then used to compute the marginal cost (MC).

$$MC_{it} = \frac{COST_{it}}{ASSETS_{it}} (\hat{\alpha}_1 + \hat{\alpha}_2 LNY + \sum_{j=1}^3 \hat{\gamma}_{itj} LNINPUT_{itj}) \quad (3)$$

Once the marginal cost is estimated and the price of output computed, we calculate the Lerner index for each bank and obtain a direct measure of bank competition. We use the same three input prices to calculate the marginal cost, which are the price of funds, price of capital and price of labour. The  $\hat{\alpha}_1, \hat{\alpha}_2, \hat{\gamma}_{itj}$  are the coefficients estimated from equation (2). The definition of the variables used to estimate the Lerner index is summarized in Table 5.

<<Table 5---about here>>

### 5.21b Herfindahl-Hirschman index (HHI)

The HHI sums the squared market shares of firms in the relevant market. The relative size and distribution of the firms in a market are taken into consideration by the HHI. The value of HHI approaches zero when there is a large number of firms with relatively similar size in the market. As the number of firms in the market decreases, as well as the increase in the

difference in size among these firms, it leads to an increase in the value of HHI. The calculation of HHI can be expressed as follows:

$$HHI = \sum_{i=1}^n (MS_i)^2 \quad (4)$$

where MS is the market share of the firm and n is the number of firms in the market. Al-Muharrami et al. (2006) indicate that this indicator assigns a greater weight to larger banks than smaller banks. In other words, it attaches importance to the larger banks. Furthermore, each bank is incorporated individually to avoid the arbitrary cut-offs and insensitivity to the share distribution.

### 5.2.2 Measurement of stability inefficiency

Fang et al. (2011) argue that the potential stability of banks cannot be necessarily reflected by the Z-score. The deviation from the bank's current stability and the maximum must be considered. We provide a measure of the bank's stability inefficiency by estimating a stochastic frontier (Aigner et al., 1977; Meeusen and Van den Broeck, 1977) with the Z-score as the dependent variable of the translog specification. The equation we use to estimate the frontier can be expressed as follows:

$$\begin{aligned} \ln\left(\frac{Z-score}{W_2}\right)_{it} = & \delta_0 + \sum_j \delta_j \ln Y_{jit} + \frac{1}{2} \sum_j \sum_k \delta_{jk} \ln Y_{jit} \ln Y_{kit} + \beta_1 \ln\left(\frac{W_1}{W_2}\right)_{it} + \frac{1}{2} \beta_2 \ln\left(\frac{W_1}{W_2}\right)_{it} \\ & + \sum_j \theta_j \ln Y_{jit} \ln\left(\frac{W_1}{W_2}\right)_{it} + v_{it} - u_{it} \end{aligned} \quad (5)$$

where W represents the input price; we consider two input prices which are the price of funds (interest expenses to total deposits) and the price of capital (non-interest expenses to total assets). Y represents four outputs, which are total loans, total deposits, other earning assets and non-interest income. The sub-index i and t represent bank i operates at time t, while j and k represent different output. The error term  $\varepsilon_{it}$  equals  $v_{it} - u_{it}$ . The first term  $v_{it}$  captures the

random disturbance, which is assumed to be normally distributed and represents the measurement errors and other uncontrolled factors, i.e.  $v_{it} \sim N(0, \sigma_v^2)$ . The second term  $u_{it}$  captures the technical and allocative inefficiency, both under managerial control, and we assume it to be half-normally distributed, i. e.  $u_{it} \sim N^+(\mu_{it}, \sigma_u^2)$ . Higher stability inefficiency indicates that the bank risk is higher, while lower stability inefficiency means that the bank is more stable.

### 5.2.3 Method to investigate the determinants of bank profitability in China

Empirical literature uses a variety of methods to investigate the determinants of bank profitability. Fixed effects is used by Sufian (2009) to investigate the determinants of bank profitability in China. More recent research undertaken by Tan and Floros (2012a, 2012b, 2012c) use Generalized Method of Moments (GMM) difference and system estimators (one-step and two-step) to investigate the determinants of Chinese bank profitability.

GMM estimator is used in the current study due to the fact that a number of problems in estimating the determinants of bank profitability including endogeneity, unobserved heterogeneity, autocorrelation and profit persistence cannot be solved by fixed effects. To be more specific, comparing between difference and system GMM estimators, we prefer the latter because the system GMM estimator addresses the issue of unit root property and produces more precise results (Bond, 2002), while compared to two-step GMM estimator, the one-step estimator is chosen due to the fact that it produces a smaller bias and a smaller standard deviation of the estimation (Judson and Owen, 1999). Besides using the one period lag of profitability indicators, through the Sargan over-identifying test, we confirm that the capital will be treated as endogenous variable, while one of the risk indicators (the ratio of loan loss provisions over total loans) will be treated as predetermined variable, other variables do not suffer any endogenous issue. In order to make sure there is no second order

autocorrelation in the estimation, the predetermined variable is instrumented using levels lagged by one year period, while the endogenous variable is instrumented using levels lagged by two years periods.

## 6 Empirical results

Table 6 reports the empirical results of the impacts of risk and competition on bank profitability in China using stability inefficiency as risk indicator and Lerner index as competition indicator. The F-statistic shows the joint significance of the variables, while the Sargan test shows no evidence of over-identifying restrictions. Even though the equations indicate that first-order autocorrelation is present, this does not imply that the estimates are inconsistent. Inconsistency would be implied if second-order autocorrelation was present (Arellano and Bond, 1991), but this case is rejected by the test of AR(2) errors.

The significant coefficients of the lagged dependent variables (ROA, NIM and PBT) confirm the dynamic character of model specification.  $\delta$  takes values of 0.08, 0.4 and 0.34 when profitability is measured by ROA, NIM and PBT, respectively, which shows that the profitability of Chinese banks does not persist, it implies that departure from a perfectly competitive market structure in the Chinese banking sector is not very large. In other words, the Chinese banking sector has a relatively competitive structure.

Turning to other explanatory variables, the coefficient of bank size is significant and negative, suggesting that there is a negative impact of bank size on ROA, NIM and PBT. This finding can be explained by the fact that the smaller banks, such as city commercial banks (CCBs), are easier to be managed and bank managers can concentrate on a smaller number of business engaged, which leads to a higher profitability. Liquidity is found to be significantly and negatively related to ROA, NIM and PBT; this result indicates that higher degree of loan exposure (lower liquidity) leads to an increase in bank profitability. It reflects the fact that

Chinese banks have the ability to monitor and manage the loans very well, and the subsequent cost reduction leads to an increase in bank profitability.

We find that taxation has a significant and negative impact on ROA, ROE and PBT of Chinese commercial banks. The result indicates that large volume of taxes reduces Chinese bank profitability. This finding is in line with Tan and Floros (2012a, 2012b, 2012c) in the Chinese banking industry. We further notice that overhead cost is highly significant and positively related to bank profitability with regards to ROE, NIM and PBT; this is in line with Tan and Floros (2012a) for the Chinese banking sector. The significant and negative impact of diversification on bank profitability (NIM) suggests that higher level of diversified business precedes a decline in bank profitability. This result can be explained by the fact that a larger variety of business engaged by banks reduces the volume of funds available for traditional loan business, which precedes a decline in NIM. Concerning the impact of labour productivity, it is positively and significantly related to profitability of Chinese banks, indicating a positive relationship between bank profitability and labour productivity. Labour productivity is measured by the total revenue generated by a member of staff; a higher figure indicates higher revenue generated and higher profitability. This is in line with Athanasoglou *et al.* (2008) for Greek banks.

The Lerner index has significant and positive signs for ROA, NIM and PBT of Chinese commercial banks, indicating that there is a negative impact of competition on bank profitability. This is in line with the Structure-Conduct-Performance (SCP) hypothesis.

The banking sector development is found to be significantly and positively related to ROA, NIM and PBT of Chinese commercial banks. This is in line with our expectation. The sign of stock market development is positive and this variable is significant, indicating that there is a

positive relationship between stock market development and bank profitability (ROA). This finding confirms the empirical results of Ben Naceur (2003) for Tunisian banks.

Turning to the macroeconomic variables, inflation is found to be significantly and positively related to bank profitability (ROA, NIM and PBT). This result indicates that during the examined period, the inflation is fully anticipated by Chinese banks, so the bank regulatory authorities and bank managers adjust the interest rates accordingly. Furthermore, it also reflects that Chinese bank managers manage the expenses very well during this period, which leads to an increase in bank profitability. Pasiouras and Kosmidou (2007) have the same finding for the EU banking industry as well as Sufian (2009), Garcia-Herrero et al. (2009) for the Chinese banking industry. The findings further suggest that GDP has a significant and positive impact on NIM and PBT of Chinese commercial banks; this result can be explained by the fact that the demand for lending increases during the periods of economic boom, which leads to an improvement in bank profitability.

With regards to the ownership dummy variable, the findings suggest that, compared to the state-owned commercial banks (SOCBs), the joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) have lower profitability. This finding is in direct contrast with the results reported by Garcia-Herrero et al. (2009) who argue that joint-stock commercial banks (JSCBs) have higher profitability, and state-owned commercial banks (SOCBs) are the main drag of bank profitability in China. Our finding can be explained by the fact that, following the successful listing of Agricultural Commercial Bank of China in 2011, all the state-owned commercial banks (SOCBs) have been listed on Chinese stock exchanges. This increase in the external monitoring induces the bank managers of state-owned commercial banks (SOCBs) to improve and enhance the bank management; the resulting decline in cost precedes an improvement in bank profitability. Furthermore, compared to joint-stock and city commercial banks in China, Chinese state-owned commercial banks (SOCBs) engage in

larger volumes of loan business, which leads to economies of scale and further reduces the cost and increase the bank profitability. In addition, a larger variety of business is engaged by Chinese state-owned commercial banks (SOCBs), and the cost benefit derived from economies of scope further promotes the profitability of state-owned commercial banks (SOCBs).

<<Table 6---about here>>

Table 7 reports the empirical results regarding the joint impacts of risk and competition on bank profitability using stability inefficiency as risk indicator and Herfindahl index as competition indicator. Most of the results are in accordance with the findings reported in Table 6. To be more specific, we find that size is significantly and negatively related to NIM and PBT of Chinese banks; Chinese banks with higher liquidity have lower profitability in terms of NIM and PBT; Chinese commercial banks with higher taxes have lower profitability in terms of ROA, ROE and PBT; there is a significant and positive relationship between overhead cost and bank profitability in terms of ROE, NIM and PBT; Chinese banks with higher levels of diversified activities have lower NIM and bank profitability in China can be increased if labor productivity is improved. With regards to the industry-specific variables, we find that higher developed banking market leads to higher profitability of Chinese commercial banks in terms of ROA and PBT and higher stock market development precedes an improvement in ROA of Chinese commercial banks. With regards to the macroeconomic variables, the results show that in a higher inflationary environment, Chinese banks have higher ROA, NIM and PBT, while higher economic growth in China leads to higher NIM and PBT of Chinese banks. We finally find that compared to state-owned commercial banks (SOCBs), joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) have lower profitability with regards to ROA, NIM and PBT. However, this table shows that

competition, as measured by Herfindahl index, has a significant and positive impact on PBT of Chinese commercial banks, which is in contrast with our finding in Table 6.

<<Table 7---about here>>

Table 8 reports the empirical results regarding the impacts of risk and competition on bank profitability using *Z*-score as risk indicator and Lerner index as competition indicator. Compared to the results reported from Table 6 and Table 7, we confirm the following findings: 1) Chinese banks with bigger size in terms of total assets have lower NIM and PBT; 2) Chinese banks with higher liquidity have lower profitability in terms of NIM and PBT; 3) there is a significant and negative impact of taxation on Chinese bank profitability in terms of ROA, ROE and PBT; 4) There is a significant and positive impact of overhead cost on Chinese bank profitability in terms of ROE, NIM and PBT; 5) There is a significant and negative relationship between diversification and NIM of Chinese banks; 6) Chinese banks with higher labour productivity have higher profitability; 7) The banking sector development has a positive and significant impact on ROA and PBT of Chinese banks; 8) Higher stock market development leads to higher ROA of Chinese commercial banks; 8) Inflation has a significant and positive impact on ROA, NIM and PBT of Chinese commercial banks; 9) higher economic growth leads to higher NIM and PBT of Chinese commercial banks. Finally, the results confirm that joint-stock commercial banks and city commercial banks have lower profitability compared to state-owned commercial banks.

<<Table 8---about here>>

Table 9 reports the empirical results regarding the impacts of risk and competition on bank profitability using LLPTL as risk indicator and Lerner index as competition indicator. The following findings are in accordance with the results reported from Table 6, Table 7 and Table 8: 1) Bigger Chinese banks in terms of total assets have lower profitability in terms of

NIM and PBT; 2) More liquid Chinese banks have lower NIM and PBT; 3) higher volumes of tax reduce Chinese bank profitability in terms of ROA, ROE and PBT; 4) Chinese banks with higher volumes of overhead costs have higher ROE, NIM and PBT; 5) Chinese banks with higher levels of diversified activities have lower NIM; 6) There is significant and positive impact of labour productivity on bank profitability; 7) Higher developed banking sector contributes to the profitability improvement of Chinese banks with regards to ROA and PBT; 8) Chinese bank profitability (ROA, NIM and PBT) is higher when there is a higher inflation, 9) higher economic growth leads to higher PBT of Chinese commercial banks. Finally, the findings of this table confirm that, compared to the state-owned commercial banks, joint-stock commercial banks and city commercial banks have lower profitability in terms of ROA, NIM and PBT.

<<Table 9---about here>>

Using stability inefficiency as the risk indicator and Lerner index as the competition indicator, Table 10, 11 and 12 show the impacts of competition and risk on bank profitability for different ownership types of Chinese commercial banks, starting from the state-owned commercial banks (SOCBs). Table 10 shows that stability inefficiency has a significant and positive impact on NIM, which suggests that higher insolvency risk leads to higher NIM of state-owned commercial banks (SOCBs). Insolvency risk in banking measures the degree or the probability that a bank can no longer meet its financial obligation with its depositors. State-owned commercial banks (SOCBs) can excessively use the depositors fund to make loans due to the fact that government provides full support when necessary, thus, large volume of loans made by the banks increase the insolvency risk; however, it leads to an increase in the NIM of state-owned commercial banks (SOCBs). Furthermore, the table shows that large state-owned commercial banks (SOCBs) have higher NIM, as reflected by significant and positive sign of this variable, higher NIM of larger state-owned commercial

banks (SOCBs) can be explained from the economies of scale as well as economies of scope. In addition, the table shows that higher liquidity leads to higher PBT of state-owned commercial banks (SOCBs). This can be explained by the fact that a large number of loans in assets (lower liquidity) increases the proportion of non-performing loans, because of the support from government, the state-owned commercial banks (SOCBs) have less incentive and effort to monitor the loans and this leads to a decline in PBT of state-owned commercial banks (SOCBs). Compared to table 6-9, table 10 also confirms a number of findings: 1) taxation has significant and negative impact on ROA and ROE; 2) overhead cost has significant and positive impact on ROE and NIM; 3) diversification has a significant and negative impact on NIM; 4) labour productivity has significant and positive impact on ROE, NIM and PBT. Finally, the table shows that a higher developed stock market leads to higher NIM of state-owned commercial banks (SOCBs). This can be explained by the fact that a well-developed stock market provides valuable information to the banks about companies' credit situation, and this information substantially reduces the cost of monitoring risk and further leads to an increase in NIM.

<<Table 10---about here>>

Table 11 shows the results with regards to the joint impacts of competition and risk on profitability of Chinese joint-stock commercial banks (JSCBs). The findings show that large joint-stock commercial banks (JSCBs) have higher profitability with regards to ROE and PBT. This finding can also be explained by the fact that larger joint-stock commercial banks (JSCBs) benefit from economies of scale as well economies of scope. The table further reports that higher liquidity leads to lower ROA of joint-stock commercial banks (JSCBs). This can be explained by the fact that non-interest income generating activities engaged by joint-stock commercial banks (JSCBs) contribute more than the traditional loan services to the overall income of joint-stock commercial banks (JSCBs), large volume of loan business

reduces the volumes of funds for joint-stock commercial banks (JSCBs) to engage in other activities, which leads to a decline in ROA. This table provides support to the results as found by table 6-10 as follows: 1) taxation has significant and negative impacts on ROA and ROE; 2) overhead cost and labour productivity have significant and positive impact on NIM.

<<Table 11---about here>>

The impacts of competition and risk on profitability of city commercial banks (CCBs) are reported in Table 12. The table shows that stability inefficiency has a significant and negative impact on ROE, which indicates that higher insolvency risk reduces the profitability of city commercial banks (CCBs). Furthermore, we notice that bank size is significantly and negatively related to profitability of Chinese city commercial banks (CCBs). This can be explained by the fact that smaller city commercial banks (CCBs) normally operate within the city where they were found; however, larger city commercial banks (CCBs) have branches in other cities as well. The local city government provides support and give beneficial policies (i.e. tax reductions) to their own city commercial banks (CCBs), while city commercial banks (CCBs) from other cities do not have this cost advantage, and the resulting increase in cost leads to a decline in bank profitability. Liquidity is found to be significantly and negatively related to NIM of city commercial banks (CCBs), indicating a large volume of loans leads to improvement in NIM of city commercial banks (CCBs). This finding can be explained by the fact that city commercial banks (CCBs) have higher ability of loan monitoring and credit checking. This table also has similar findings compared to the previous tables which are: 1) taxation has significant and negative impacts on ROA and ROE; 2) overhead cost and labour productivity have significant and positive impact on NIM. We noticed that diversification has a significant and negative impact on NIM of city commercial banks (CCBs). This can be explained by the fact that loan business is still the focus for city commercial banks (CCBs),

and more diversified activities reduces the volumes of funds available for making loans, which further precedes a decline in banks' NIM.

<<Table 12---about here>>

## **7 Discussion on the empirical results for Chinese banking industry**

Table 13 provides a summary for the empirical results using different risk and competition indicators across various profitability measurements. Starting from single profitability measurement, we find that one period lagged ROA is significantly and positively related to the current ROA (except for the case when Herfindahl index is used as the competitor indicator). The results indicate that the profitability of Chinese banks tends to be persistent to some extent and it confirms our correct choice of dynamic model in the empirical analysis. We further report that the taxation is significantly and negatively related to ROA of Chinese banks. This can be explained by the fact that higher taxes paid by banks increase the non-interest expenses, which further precedes a decline in bank profitability. Labour productivity, which is another significant variable in terms of ROA, is found to be positively related to bank profitability. This finding indicates that Chinese banks should provide more training and professional opportunities to the staffs in order to increase their productivity and further improve profitability. In addition, Chinese banks should also recruit more staffs with higher productivity. In terms of the industry-specific variables, it is found that banking sector development is significantly and positively related to ROA of Chinese banks.

When using ROE as the profitability indicator, the results confirm the findings that higher taxes paid by banks leads to lower profitability, while banks with higher labour productivity have higher profitability. In addition, the results show that banks with higher overhead cost leads to higher bank profitability. This finding can be explained by the fact that the Chinese banks have the ability to transfer operational cost to the depositors; the resulting reduction in

cost and increase in income promote the improvement in bank profitability. This finding also indicates that higher salaries paid to staff, especially experienced staff, significantly improve the productivity, while the resulting increase in the profitability is larger than the salary cost.

With regards to NIM, one period lag of NIM is significant for all the cases which indicates that the NIM of Chinese commercial banks at the current year is significantly affected by the situation at the previous year. Furthermore, the values of one period lagged NIM are less than 0.4, which indicates that Chinese bank profitability does not persist to a large extent. In other words, it is relatively competitive in the Chinese banking industry. Compared to ROE, we also find that banks with high overhead cost and labour productivity have higher profitability, while the results report that large banks have lower profitability. This can be explained by the fact that larger volumes of funds are used by larger banks to engage in diversified activities, while the reduction in the volumes of funds for traditional services further precedes a decline in bank profitability (NIM). In addition, the liquidity variable is significant and positive for all the cases indicating lower liquidity (higher volumes of loans) leads to higher profitability. This finding shows that in general, Chinese banks have improved their ability and skills in credit checking, monitoring and managing loans, which leads to an improvement in bank profitability. The diversification is found to be significant and negative for all the cases, indicating the larger variety of business engaged by banks reduces the NIM. This can be explained by the fact more diversified business engaged by the banks reduces the volumes of funds available for traditional loan services, which further precedes a decline in bank profitability. The positive and significant impact of inflation on Chinese bank profitability reflects the fact that Chinese banks have the ability to forecast inflation, and the interests rates are adjusted accordingly, the revenues increase faster than costs, which leads to higher profitability.

Finally, the table confirms a number of findings when using PBT as the profitability indicator, which can be summarized as follows: 1) the profitability of Chinese commercial banks tends to be persistent to some extent as reflected by the significant one period lagged dependent variable; 2) larger bank have lower profitability; 3) larger volume of loans (lower liquidity) leads to higher profitability; 4) Chinese commercial banks with higher taxes have lower profitability; 5) Chinese commercial banks with larger volumes of overhead cost and labour productivity have higher profitability; 6) higher inflationary environment leads to improvement in Chinese bank profitability. In addition, the results indicate that higher developed banking sector improves Chinese bank profitability, which is in line with our expectation, while higher GDP growth also has a significant and positive impact on Chinese bank profitability. This can be explained by the fact that during the period of economic boom, the volumes of leading increase, and the resulting increase in interest income further leads to an improvement in bank profitability. Table 13 shows that, compared to state-owned commercial banks, both joint-stock commercial banks and city commercial banks have lower profitability (ROA, NIM and PBT) as reflected by the significant and negative coefficients.

<<Table 13---about here>>

## 8 Conclusion

The aim of this paper is to test the impacts of competition and risk on bank profitability in China over the period 2003-2011. We check the robustness of the results by using different risk and competition indicators. To be more specific, we use two different measurements of bank competition, which are Lerner index and Herfindahl-Hirschman index. There are three alternative measurements in terms of bank risk: stability inefficiency, Z-score and ratio of loan loss provision over total loans. Besides the analysis on the effects of risk and competition on bank profitability, we also control for comprehensive bank-specific, industry-

specific and macroeconomic determinants of bank profitability. With regards to the econometric estimation, the one-step GMM system estimator is applied.

The results suggest that Chinese bank profitability persists to a small extent, while we do not find any robust impact of risk and competition in the Chinese banking industry, the unclear impact of risk on bank profitability can be attributed to the fact that the Chinese government still have strong influence or provide strong support to Chinese banks (especially state-owned commercial banks) through four assets management companies and capital injections. This study does not support the traditional SCP hypothesis; this may be explained by the fact that in the Chinese banking industry, the efficient-structure hypothesis may be prevailing, thus, future research can be conducted, including efficiency as one of the determinants to test this hypothesis. The findings further show that taxation has a significant and negative impact on Chinese banking profitability with regards to ROA, NIM and PBT, while Chinese banks with higher labour productivity have higher profitability. In addition, the results report that Chinese banks with higher overhead cost have higher profitability (ROE, NIM and PBT) and more diversified Chinese banks have lower profitability with regards to NIM. In terms of the macroeconomic environment, the findings suggest that Chinese banks have higher profitability (ROA, NIM and PBT) in a higher inflationary environment. Finally, we find that compared to state-owned commercial banks (SOCBs), joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) have lower ROA, NIM and PBT.

The results with regards to the separate estimations on different ownership types of Chinese commercial banks show that government still has strong influence and give strong support to state-owned commercial banks (SOCBs), which to some extent reduces their profitability, while with regards to the joint-stock commercial banks (JSCBs), it is argued that non-interest income generating business earns higher income compared to the traditional loan services.

Finally, it is found that large city commercial banks (CCBs) have lower profitability and city commercial banks (CCBs) with higher business diversification have lower NIM.

The findings have several policy implications to Chinese government, regulatory authority and bank managers in order to improve bank profitability: 1) Chinese government should reduce the tax rate for commercial banks; 2) recruit more productive and experienced staffs and provide more training opportunities to existing staffs. With regards to different ownership types of Chinese commercial banks, the following policies should be considered: 1) reduce the degree of influence and support by the government to the state-owned commercial banks (SOCBs); 2) encourage the joint-stock commercial banks (JSCBs) to engage in more diversified activities; 3) relevant agreement should be made between cities to give beneficial policies or support to the city commercial banks' trans-city operation; 4) city commercial banks (CCBs) should focus on providing traditional loan services. Finally, for the whole Chinese banking industry, relevant monetary and fiscal policies should be used to control inflation to a certain extent.

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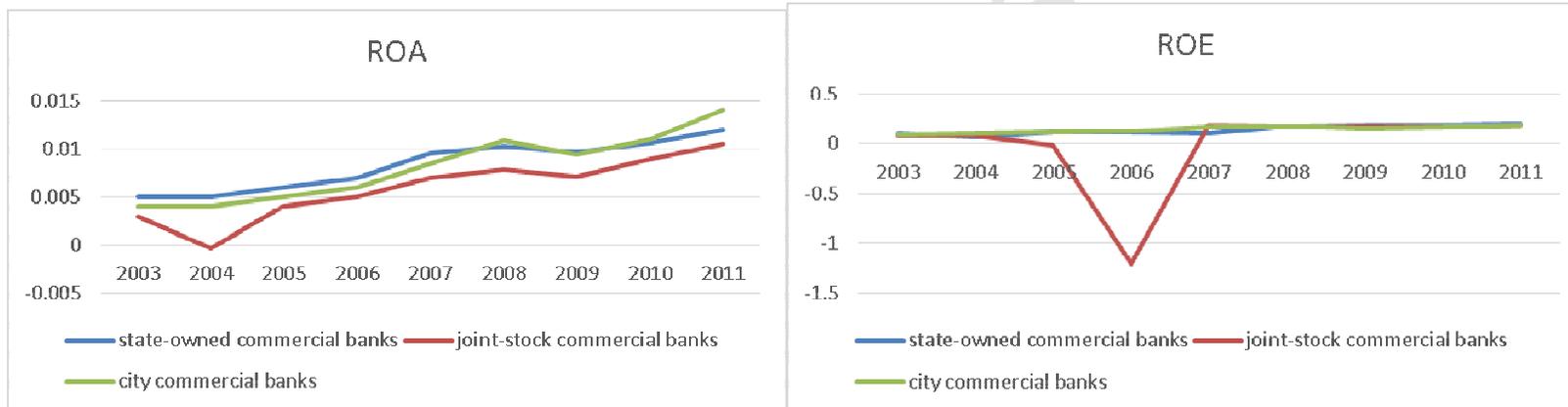
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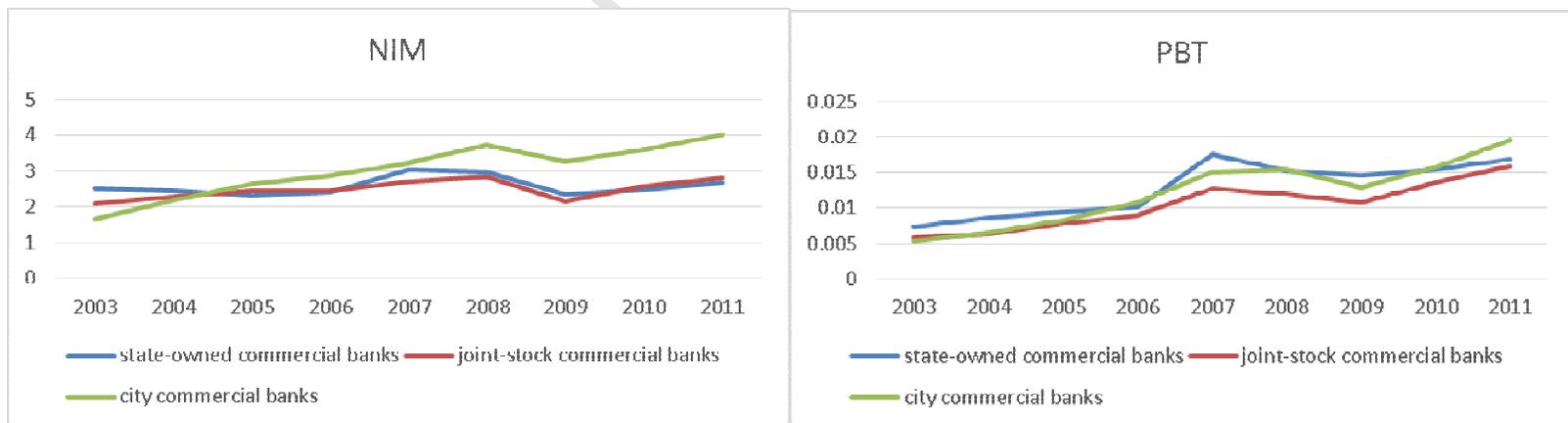
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**Figure 1 Profitability of Chinese banks over the period 2003-2011**



1a. ROA  
· the y-axis represents the values of ROA, while x-axis represents years

1b. ROE  
· the y-axis represents the values of ROE, while x-axis represents years



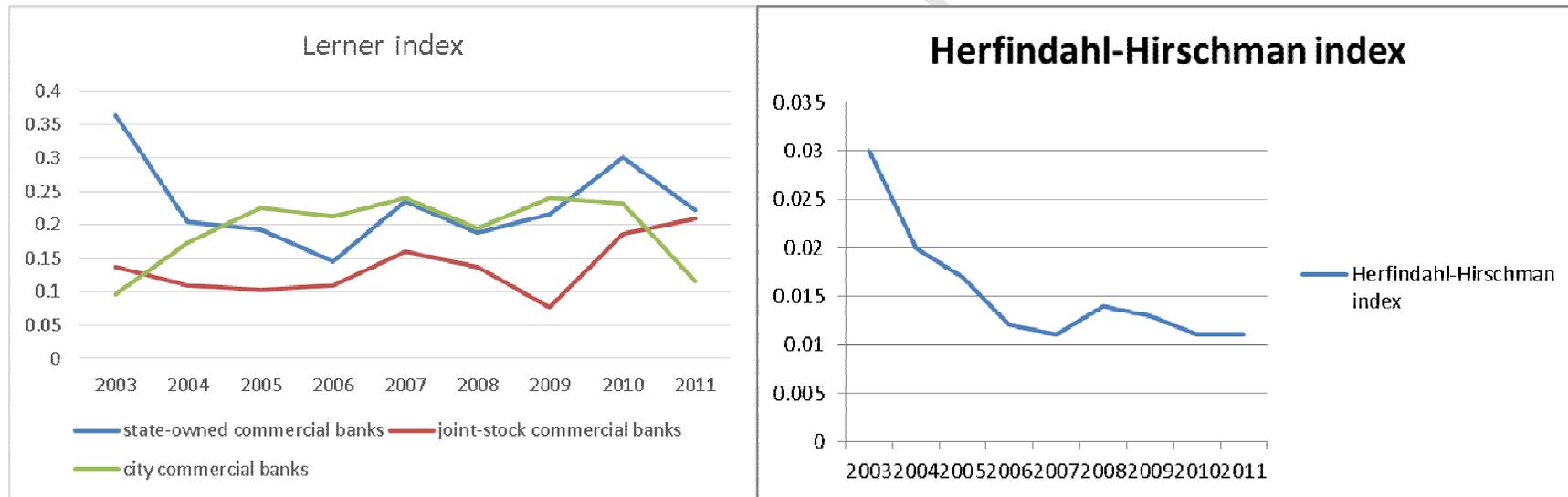
1c. NIM  
· the y-axis represents the values of ROA, while x-axis represents years

1d. PBT  
· the y-axis represents the values of ROA, while x-axis represents years

**Figure 2 The competitive conditions in Chinese banking industry: 2003-2011 (Lerner index & 3-bank concentration ratio)**

2a. competitive conditions measured by Lerner index

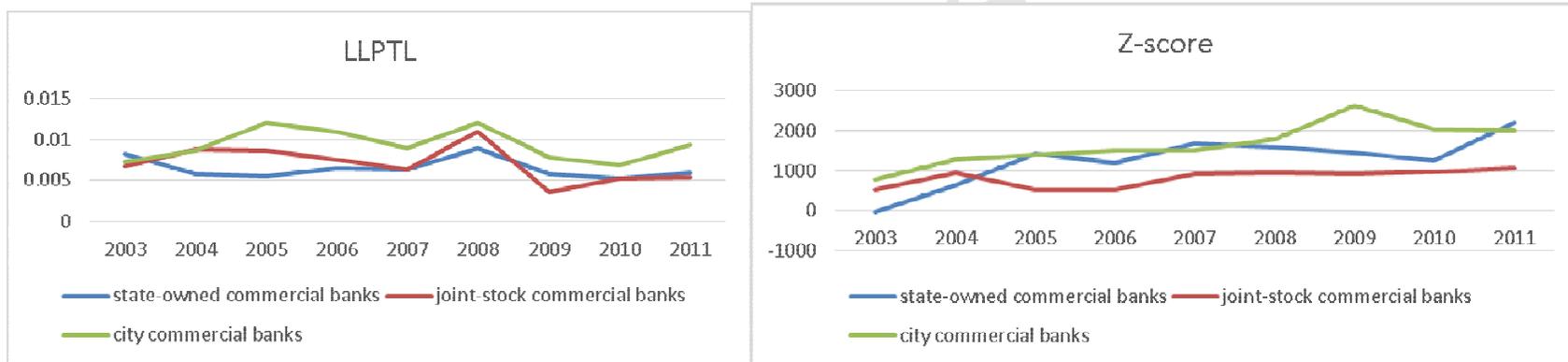
2b. competitive condition measured by Herfindahl- Hirschman index



· The y-axis represents the values of Lerner index, while x-axis represents years

· The y-axis represents the value of Herfindahl index, while x-axis represents years

Figure 3 The risk conditions in Chinese banking industry 2003-2011



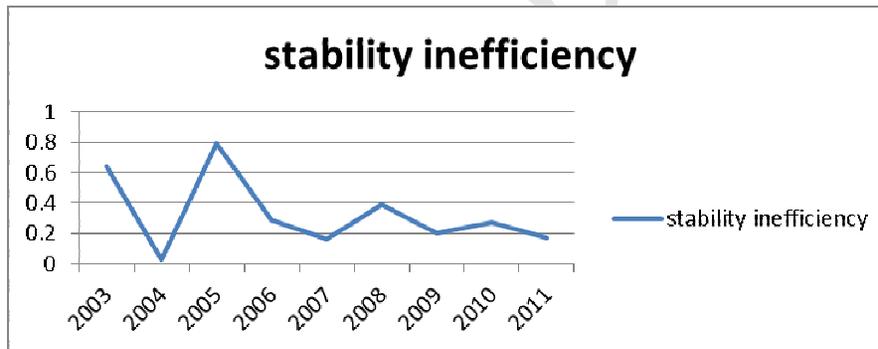
• The y-axis represents the values of LLPTL, while x-axis represents year

3a. risk is measured by LLPTL

• the y-axis represents the values of Z-score, while x-axis represents years

3b. risk is measured by Z-score

3c. risk is measured by stability inefficiency



• The y-axis represents the values of stability inefficiency, while x-axis represents years

**Table 1 Summary of recent studies on investigation of profitability in European, US and Emerging market banking sectors**

<b>Author(s)</b>	<b>Year of publication</b>	<b>Banking sector investigated</b>	<b>Data period</b>	<b>Methodology</b>	<b>Empirical results</b>
Staikouras and Wood	2004	European banking sector	1994-1998	Fixed effect estimator	There is a negative impact of risk on bank profitability
Goddard et al.	2004a	European banking sector	1992-1998	GMM two-step system estimator	There is a positive impact of diversification on bank profitability in UK
Goddard et al.	2004b	European banking sector	1992-1998	OLS and GMM two-step system estimator	The impact of size on bank profitability is weak, while the influence of off-balance-sheet items on bank profitability is different across the countries and capital-assets ratio has a significant and positive impact on bank profitability.
Pasiouras and Kosmidou	2007	European banking sector	1995-2001	GMM one-step system estimator	The profitability is significantly affected by banking sector concentration
Maudos and Fernandez de Guevara	2004	European banking sector	1993-2000	McShane and Sharpe (1985) and Angbazo (1997) single-stage approach	Increase in market power and concentration leads to fall of margins.
Goddard et al	2013	European banking sector	1992-2007	GMM two-step system estimator	Profitability is higher for banks that are efficient and diversified, while lower for those which are higher capitalized
Athanasoglou et al.	2008	Greek banking sector	1985-2001	GMM one-step system estimator	Capitalization, credit risk, productivity growth and operating expenses management are significantly related to bank profitability in Greece
Dietrich and Wanzenried	2011	Switzerland banking sector	1999-2009	GMM two-step system estimator	Banks with diversified activities have higher profitability
Hoffmann	2011	US banking sector	1995-2007	GMM two-step system estimator	There is a significant impact of capital ratio on bank profitability
Chronopoulos et al.	2013	US banking sector	1984-2010	System GMM with	Competition process reduces

				Windmeijer-corrected standard errors	positions of abnormal profitability, while the financial crisis appears to have resulted in an increase in the persistence of bank profitability.
Sufian	2011	Korean banking sector	1986-1995	Fixed effect estimator	Risk is negative related to bank profitability while concentration has positive effect
Liu and Wilson	2010	Japanese banking sector	2000-2007	GMM two-step system estimator and fixed effect estimator	Well capitalized and efficient banks with lower credit risks tend to have higher profitability than less capitalized and less efficient banks with higher credit risks, while industry concentration, stock market development and GDP growth significantly influence bank profitability.
Sufian and Chong	2008	Philippine banking sector	1990-2005	Fixed effect estimator	Risk is negatively related to bank profitability.

**Table 2 Summary of the variables used in the current study and their expected effects on bank profitability**

<b>Variables</b>	<b>Measurement</b>	<b>Expected effect</b>	<b>Source</b>
<b>Profitability indicators</b>			
ROA	Net income/total assets		Bank-scope
ROE	Net income/shareholder's equity		Bank-scope
NIM	Net interest income/earning assets		Bank-scope
PBT	Profit before tax/ total assets		Bank-scope
<b>Bank-specific variables</b>			
Bank size	Natural logarithm of total assets	?	Bank-scope
Bank risk (LLPTL)	Loan loss provision/total loans	-	Bank-scope
Bank risk (Z-score)	Ratio between a bank's return on assets plus equity capital/total assets and the standard deviation of the return on assets		Bank-scope
Bank risk (stability inefficiency)	Estimated from stochastic frontier (see appendix)		Bank-scope
Liquidity	Loans/assets	?	Bank-scope
Capitalization	Shareholder's equity/total assets	?	Bank-scope
Overhead cost	Overhead/total assets	?	Bank-scope
Diversification	Non-interest income/gross revenue	?	Bank-scope
Labour productivity	Gross revenue/total number of employees	+	Bank-scope
Taxation	Tax/operating profit before tax	-	Bank-scope
<b>Industry-specific variables</b>			
Competition (Lerner index)	Estimated from the cost function (see appendix)	?	Bank-scope
Competition (three-bank concentration ratio)	Total assets of largest three banks/total assets of the whole banking industry	?	CBRC
Banking sector development	Banking sector assets/GDP	+	CBRC
Stock market development	Market capitalization of listed companies/GDP	+	World bank
<b>Macroeconomic variables</b>			
Inflation	Annual inflation rate	?	World bank
GDP growth rate	Annual GDP growth rate	?	World bank

• “+” means positive effect, “-” means negative effect, “?” means no indication

**Table 3 Descriptive statistics for profitability measures (ROA, ROE, NIM and PBT) by ownership type**

	Panel A: All banks					Panel B: SOCBs					Panel C: JSCBs					Panel D: CCBs				
	Obs	Mean	Min	Max	SD	Obs	Mean	Min	Max	SD	Obs	Mean	Min	Max	SD	Obs	Mean	Min	Max	SD
ROA	331	0.008	-0.04	0.24	0.005	45	0.008	0.002	0.014	0.003	98	0.006	-0.04	0.013	0.006	188	0.008	-0.001	0.024	0.005
ROE	339	0.095	-14.52	0.4	0.8	46	0.14	-0.06	0.251	0.076	98	-0.02	-14.52	0.3	1.49	195	0.14	-0.017	0.4	0.074
NIM	341	2.81	0.54	8.05	1	46	2.57	1.05	3.29	0.45	102	2.48	0.68	3.42	0.47	193	3.04	0.54	8.05	1.22
PBT	347	0.012	-0.003	0.035	0.006	46	0.013	0.002	0.02	0.005	106	0.01	-0.003	0.019	0.004	195	0.012	0.002	0.035	0.007

Table 4 Summary statistics: explanatory variables

	Panel A: All banks					Panel B: SOCBs					Panel C: JSCBs					Panel D: CCBs				
	Obs	Mean	Min	Max	SD	Obs	Mean	Min	Max	SD	Obs	Mean	Min	Max	SD	Obs	Mean	Min	Max	SD
Banks size	349	5.15	3.43	7.19	0.94	46	6.73	5.97	7.19	0.28	106	5.7	4.01	7.19	0.5	197	4.49	3.43	5.98	0.5
LLPTL	332	0.008	-0.0004	0.03	0.005	46	0.006	0.002	0.01	0.003	101	0.007	0.0004	0.03	0.004	185	0.009	-0.0004	0.03	0.01
Z-score	421	1245.6	-2956	1108.6	1369	49	1253	-2956	7111	1583.4	118	722.3	-58.6	4653	606	254	1487	0	1108.0	1511
Stability inefficiency	369	0.33	0.025	0.789	0.23	45	0.33	0.025	0.789	0.23	99	0.33	0.03	0.79	0.23	225	0.33	0.03	0.79	0.23
liquidity	349	53.45	18.56	77.58	8.72	46	51.77	43	64	5.56	106	56.09	32.5	68.4	6.65	197	52.41	18.6	77.6	9.9
Capitalization	349	4.96	-14	14.63	2.63	46	4.27	-14	7.75	4.63	106	4.06	-1	14	1.95	197	5.6	1.71	14.6	2.09
Taxation	345	0.4	-0.39	2.84	0.23	46	0.39	0.149	0.93	0.18	104	0.46	-0.39	2.84	0.34	195	0.37	0.11	1.51	0.16
Diversification	345	13.02	-12.94	74.3	13.08	46	16.44	5.4	43.3	8.1	104	10.03	-12.94	34	6.81	195	13.8	-2.62	74.3	16
Overhead	330	0.01	0.005	0.03	0.003	46	0.11	0.009	0.014	0.001	104	0.01	0.005	0.02	0.002	180	0.01	0.006	0.03	0.003
Labour productivity	258	0.01	0.001	0.03	0.005	45	0.007	0.001	0.014	0.003	89	0.01	0.003	0.03	0.004	124	0.01	0.002	0.03	0.005
Lerner index	228	0.18	0.003	0.92	0.15	40	0.23	0.05	0.92	0.13	59	0.1	0.003	0.33	0.16	129	0.2	0.014	0.49	0.14
Herfindahl index	369	0.015	0.011	0.03	0.006															
Banking sector development	369	2.13	1.98	2.4	0.17															
Stock market development	392	70.62	24.31	184.1	46.46															
Inflation	393	2.8	-0.77	5.86	2.16															
GDP growth	369	10.74	9.1	14.2	1.61															

Table 5 The definition of variables used to estimate the Lerner index

Variable	Notation	Measurement
Total cost	COST	Interest expenses plus non-interest expenses
Total assets	ASSETS	
Input prices	INPUT	<p>Input price 1: price of fund- ratio of interest expenses over total funding</p> <p>Input price 2: price of capital- ratio of other non-interest expenses over fixed assets</p> <p>Input price 3: price of labour- ratio of personnel expenses over total assets</p>
Marginal cost	MC	Estimated using equation 2 and equation 3

**Table 6 Empirical results (stability inefficiency as risk indicator and Lerner index as competition indicator)**

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
one period lag of dependent variable	0.08**	2.24	-0.004	-1.34	0.4***	9.31	0.34***	5.29
<b>Bank characteristics</b>								
Stability inefficiency	0.0005	0.56	-0.009	-0.45	0.155	1.28	-0.002	1.6
Bank size	-0.001***	-2.79	0.006	0.77	-0.43***	-6.49	-0.003***	-6.10
Liquidity	0.0001*	1.92	0.0001	0.13	0.012***	2.82	0.0001**	2.26
Taxation	-0.01***	-8.37	-0.21***	-6.82	-0.05	-0.31	-0.008***	-4.20
Capitalization <sup>a</sup>	0.00001	0.16	0.002	1.4	-0.015*	-1.69	-0.0001	-0.81
Overhead cost	0.16	1.31	5.55**	2.50	109.6***	6.17	0.44***	2.90
Diversification	-9.34e-06	-0.49	0.001	1.55	-0.023***	-8.07	3.56e-06	0.13
Labour productivity	0.4***	6.31	4.68***	4.52	44.64***	5.20	0.52***	6.80
<b>Industry characteristics</b>								
Lerner index	0.004**	2.01	0.015	0.50	1.47***	6.13	0.005**	2.32
Banking sector development	0.005***	3.02	0.006	0.26	0.84***	3.63	0.005***	3.71
Stock market development	0.00001**	2.13	0.0001	0.53	0.0003	0.38	5.36e-06	0.83
<b>Macroeconomics</b>								
Inflation	0.0004***	4.14	0.002	1.04	0.105***	7.96	0.0005***	4.25
GDP growth rate	-0.0001	-0.35	0.004	1.41	0.04*	1.68	0.0006***	3.21
Joint-stock commercial banks	-0.005***	-6.16	0.009	0.61	-0.74***	-6.4	-0.007***	-6.84
City commercial banks	-0.004***	-3.66	0.012	0.63	-0.75***	-4.89	-0.008***	-6.32
F-test	199.26***		164.29***		1466.24***		288.87***	
Sargan <sup>1</sup>	126.66		89.84		167.62		176.85	
AR(1) <sup>2</sup>	Z=-3.55	P=0.000	Z=-1.80	P=0.073	Z=-2.33	P=0.02	Z=-3.79	P=0.000
AR(2) <sup>3</sup>	Z=-0.05	P=0.963	Z=-0.88	P=0.381	Z=-1.58	P=0.115	Z=0.62	P=0.533
No. of observations	121		171		121		174	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup> the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

**Table 7 Empirical results (stability inefficiency as risk indicator and Herfindahl index as competition indicator)**

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
One period lag of dependent variable	0.07	1.52	-0.002	-0.71	0.37***	5.90	0.21***	2.88
<b>Bank characteristics</b>								
Stability inefficiency	0.001	0.89	0.01	0.47	-0.04	-0.22	-0.001	-0.74
Bank size	-0.0004	-0.75	-0.003	-0.38	-0.29***	-3.43	-0.002***	-4.44
Liquidity	0.00002	0.73	-0.001	-1.01	0.012*	1.97	0.0001**	2.49
Taxation	-0.005***	-7.44	-0.13***	-7.33	-0.22*	-1.81	-0.006***	-5.85
Capitalization <sup>a</sup>	0.00001	0.04	-0.008	-1.63	0.08	1.26	-0.0001	-0.25
Overhead cost	0.2	1.20	7.00***	2.87	89.67***	2.87	0.4***	3.18
Diversification	-0.00002	-1.20	0.0004	1.15	-0.02***	-6.67	1.65e-06	0.08
Labour productivity	0.33***	3.94	5.57***	5.01	40.94**	2.58	0.57***	8.87
<b>Industry characteristics</b>								
Herfindahl index	-0.08	-1.59	-0.76	-0.47	-0.34	-0.04	-0.12*	-1.82
Banking sector development	0.004**	2.16	0.06**	2.02	0.41	1.39	0.005***	3.12
Stock market development	0.00001**	2.08	0.0001	1.52	-0.001	-0.53	5.02E-06	0.93
<b>Macroeconomics</b>								
Inflation	0.0003***	3.58	0.002	1.21	0.09***	5.10	0.0003***	3.92
GDP growth rate	-0.0002	-1.39	0.002	0.93	0.07***	2.85	0.0005***	3.64
Joint-stock commercial banks	-0.004***	-4.39	-0.008	-0.49	-0.7***	-4.07	-0.007***	-8.27
City commercial banks	-0.002*	-1.69	0.0004	0.02	-0.56***	-2.96	-0.006***	-5.43
F-test	198.62***		172.20***		900.43***		427.6***	
Sargan <sup>1</sup>	5.24		26.74		8.22		22.94	
AR(1) <sup>2</sup>	Z=-2.86	P=0.004	Z=-3.35	P=0.001	Z=-2.51	P=0.012	Z=-5.00	P=0.000
AR(2) <sup>3</sup>	Z=-1.06	P=0.289	Z=-0.98	P=0.328	Z=-1.18	P=0.239	Z=1.01	P=0.313
No. of observations	163		226		164		321	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup> the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

Table 8 Empirical results (z-score as risk indicator and Lerner index as competition indicator)

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
One period lag of dependent variable	0.07**	2.00	-0.004	-1.50	0.4***	8.73	0.36***	5.57
<b>Bank characteristics</b>								
Z-score	-1.71e-07	-0.77	-0.00001***	-3.43	-0.00001	-0.36	2.88e-07	1.29
Bank size	-0.001***	-2.75	0.003	0.43	-0.43***	-6.49	-0.003***	-6.64
Liquidity	0.0001*	1.97	0.0003	0.57	0.012***	2.65	0.0001**	2.03
Taxation	-0.01***	-8.33	-0.21***	-7.06	-0.06	-0.38	-0.008***	-4.27
Capitalization <sup>a</sup>	0.00005	0.61	0.004**	2.33	-0.01	-0.98	-0.0002	-1.65
Overhead cost	0.17	1.31	4.72**	2.16	108.01***	5.94	0.44***	2.99
Diversification	-4.45E-06	-0.22	0.001*	1.83	-0.02***	-7.78	-4.66E-06	-0.18
Labour productivity	0.4***	6.35	4.32***	4.23	45.32***	5.16	0.54***	7.16
<b>Industry characteristics</b>								
Lerner index	0.004**	2.06	0.02	0.56	1.48***	5.99	0.004**	2.26
Banking sector development	0.005***	3.03	0.02	0.85	0.88***	3.69	0.006***	4.05
Stock market development	0.00001**	2.28	0.0001	0.90	-0.0002	-0.32	8.44E-06	1.41
<b>Macroeconomics</b>								
Inflation	0.0004***	4.08	0.002	1.30	0.105***	7.76	0.0005***	3.19
GDP growth rate	-0.00005	-0.34	0.003	1.15	0.05**	2.24	0.0006***	3.19
Joint-stock commercial banks	-0.005***	-6.20	0.0001	0.00	-0.76***	-6.21	-0.007***	-6.96
City commercial banks	-0.004***	-3.61	0.01	0.58	-0.77***	-4.90	-0.008***	-6.91
F-test	195.71***		169.03***		1396.74***		296.4***	
Sargan <sup>1</sup>	123.98		88.66		161.36		182.17	
AR(1) <sup>2</sup>	Z=-3.36	P=0.001	Z=-1.78	P=0.074	Z=-2.23	P=0.02	Z=-3.92	P=0.000
AR(2) <sup>3</sup>	Z=-0.38	P=0.702	Z=-1.00	P=0.319	Z=-1.41	P=0.159	Z=0.92	P=0.359
No. of observations	121		171		121		174	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup> the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

Table 9 Empirical results (LLPTL as risk indicator and the Lerner index as competition indicator)

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
One period lag of dependent variable	0.096***	3.12	-0.004	-1.40	0.37***	8.99	0.36***	5.79
<b>Bank characteristics</b>								
LLPTL <sup>a</sup>	0.16***	-5.32	-0.72	-1.01	24.94***	5.85	-0.14***	-3.05
Bank size	-0.002***	-4.65	0.004	0.61	-0.35***	-5.58	-0.003***	-7.14
Liquidity	0.00003	1.16	0.0001	0.21	0.015***	3.69	0.0001**	2.22
Taxation	-0.009***	-8.46	-0.2***	-6.66	-0.24	-1.51	-0.008***	-3.92
Capitalization <sup>o</sup>	-4.76e-06	-0.08	0.002	1.41	-0.01	-1.23	-0.0001	-1.16
Overhead cost	0.23**	2.10	5.48**	2.36	98.61***	5.94	0.55***	3.68
Diversification	-5.09e-06	-0.30	0.001*	1.70	-0.02***	-9.20	7.82e-06	0.31
Labour productivity	0.43***	7.82	4.75***	4.61	41.68***	5.18	0.55***	7.45
<b>Industry characteristics</b>								
Lerner index	0.005***	3.31	0.02	0.57	1.21***	5.27	0.004**	2.34
Banking sector development	0.008***	4.69	0.007	0.33	0.69***	3.13	0.006***	4.14
Stock market development	3.68e-06	0.76	0.00005	0.54	0.001	1.21	6.03e-06	1.02
<b>Macroeconomics</b>								
Inflation	0.0006***	5.92	0.002	1.19	0.087***	6.81	0.0005***	4.70
GDP growth rate	0.0001	0.88	0.004	1.47	0.03	1.56	0.0006***	3.38
Joint-stock commercial banks	-0.006***	-7.57	0.007	0.52	-0.72***	-6.58	-0.007***	-7.61
City commercial banks	-0.005***	-5.11	0.011	0.62	-0.67***	-4.63	-0.008***	-6.95
F-test	261.06***		163.7***		1656.19***		313.95***	
Sargan <sup>1</sup>	134.21		91.84		154.06		188.37	
AR(1) <sup>2</sup>	Z=-3.00	P=0.003	Z=-1.68	P=0.093	Z=-2.48	P=0.013	Z=-3.49	P=0.000
AR(2) <sup>3</sup>	Z=-1.16	P=0.244	Z=-0.91	P=0.363	Z=-0.90	P=0.366	Z=0.64	P=0.525
No. of observations	121		170		121		173	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup> the predetermined variable is instrumented using levels lagged by one period

<sup>o</sup> the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

**Table 10 Empirical results for state-owned commercial banks (stability inefficiency as risk indicator and Lerner index as competition indicator)**

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
One period lag of dependent variable	-0.09	-0.56	-0.02	-0.25	0.055	0.43	0.15	0.89
<b>Bank characteristics</b>								
Stability inefficiency	-0.001	-0.52	-0.002	-0.09	0.34**	2.38	0.0001	0.06
Bank size	0.03	1.62	0.03	1.56	0.56**	2.63	0.003	1.69
Liquidity		0.16	-0.0002	-0.19	0.003	0.32	-0.0002**	-2.33
Taxation	-0.01***	-3.90	-0.22***	-4.40	-0.21	-0.89	0.003	1.05
Capitalization <sup>a</sup>	0.00002	0.17	0.008***	5.14	-0.02*	-1.93	-0.0004***	-3.82
Overhead cost	-0.08	-0.18	7.43*	1.77	165.67***	3.98	0.11	0.39
Diversification	-0.0001	-0.92	-0.003**	-2.46	-0.05***	-4.56	0.00003	0.36
Labour productivity	0.71	1.63	7.7*	1.91	110.11**	2.70	1.2***	3.30
<b>Industry characteristics</b>								
Lerner index	0.01**	2.39	0.12	1.50	1.09**	2.13	0.02***	3.46
Banking sector development	-0.007	-0.87	-0.006	-0.10	-1.33	-1.68	-0.008	-1.66
Stock market development	3.98E-07	0.03	0.0001	0.77	0.004**	2.49	0.00001	1.16
<b>Macroeconomics</b>								
Inflation	-0.0001	-0.31	-0.002	-0.83	-0.01	-0.28	-0.0003	-1.38
GDP growth rate	-0.00003	-0.08	-0.009*	-1.93	-0.07	-1.75	0.0003	0.72
F-test	90.65***		92.69***		958.83***		180.63***	
Sargan <sup>1</sup>	36.61		30.66		28.92		35.31	
AR(1) <sup>2</sup>	Z=-0.01	P=0.996	Z=-0.84	P=0.399	Z=-1.65	P=0.099	Z=-0.94	P=0.347
AR(2) <sup>3</sup>	Z=-1.61	P=0.108	Z=-0.09	P=0.929	Z=1.45	P=0.146	Z=-1.60	P=0.110
No. of observations	29		36		29		36	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup>the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

Table 11 Empirical results for joint-stock commercial banks (stability inefficiency as risk indicator and Lerner index as competition indicator)

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
One period lag of dependent variable	-0.04	-1.05	-0.001	-0.46	0.25*	1.85	0.006	0.05
<b>Bank characteristics</b>								
Stability inefficiency	-0.0002	-0.26	-0.009	-0.36	0.02	0.13	-0.001	-0.95
Bank size	0.001	1.02	0.024*	1.87	-0.18	-1.11	0.002**	2.14
Liquidity	-0.0001*	-1.93	0.002	1.64	0.012	1.02	-0.0001	-0.99
Taxation	-0.014***	-6.13	-0.41***	-5.62	-0.41	-0.96	-0.012***	-3.10
Capitalization <sup>a</sup>	0.0001	0.39	-0.02***	-5.09	0.005	0.19	0.0006***	2.81
Overhead cost	0.24	1.34	-4.18	-0.96	78.64**	2.31	-0.02	-0.09
Diversification	0.0001	0.92	0.001	0.56	-0.005	-0.47	0.0001*	1.89
Labour productivity	0.23***	2.87	1.23	0.76	33.83**	2.34	0.11	1.36
<b>Industry characteristics</b>								
Lerner index	0.004*	2.02	-0.014	-0.35	0.93**	2.31	0.004*	2.00
Banking sector development	0.001	0.45	0.03	0.83	0.2	0.54	-0.001	-0.82
Stock market development	-8.71e-06	-0.86	-0.0001	-0.46	-0.001	-0.49	-8.97e-06	-1.36
<b>Macroeconomics</b>								
Inflation	-0.00001	-0.09	0.003	1.2	0.09***	4.44	0.0001	0.60
GDP growth rate	0.0004	1.4	0.01**	2.03	0.05	0.89	0.0007***	2.97
F-test	157.88***		117.73***		664.16***		263.6***	
Sargan <sup>1</sup>	60.92		64.02		48.1		63.88	
AR(1) <sup>2</sup>	Z=-0.96	P=0.335	Z=-0.68	P=0.497	Z=-0.91	P=0.361	Z=-0.83	P=0.405
AR(2) <sup>3</sup>	Z=-0.81	P=0.416	Z=-0.40	P=0.688	Z=-0.59	P=0.558	Z=-0.77	P=0.440
No. of observations	35		50		35		53	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup> the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

**Table 12 Empirical results for city commercial banks (stability inefficiency as risk indicator and Lerner index as competition indicator)**

	ROA		ROE		NIM		PBT	
	coefficient	t-statistic	coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
One period lag of dependent variable	0.21	1.43	0.19**	2.41	0.4***	4.56	0.06	0.5
<b>Bank characteristics</b>								
Stability inefficiency	-0.001	-0.23	-0.06*	-1.92	-0.03	-0.08	-0.004	-1.10
Bank size	-0.002*	-1.76	-0.04***	-3.96	-0.65***	-4.10	-0.004***	-4.56
Liquidity	0.0001	0.90	0.001	0.72	0.02**	2.34	0.0001	1.11
Taxation	-0.009***	-3.40	-0.17***	-5.26	0.006	0.02	-0.009***	-3.03
Capitalization <sup>a</sup>	0.00004	0.09	-0.02***	-5.56	-0.03	-0.48	0.001***	2.94
Overhead cost	0.16	0.62	4.64*	1.94	97.86***	3.02	0.56**	2.35
Diversification	0.00001	0.29	0.0003	0.64	-0.02***	-3.75	0.00004	0.82
Labour productivity	0.45**	2.61	5.54***	4.32	62.77***	3.49	0.87***	6.30
<b>Industry characteristics</b>								
Lerner index	0.0002	0.05	0.04	0.98	1.5***	3.05	0.004	0.96
Banking sector development	0.005	1.24	0.13***	4.52	0.92**	2.03	0.002	0.68
Stock market development	0.00002	0.88	0.0002	1.2	-0.001	-0.63	8.77e-06	0.67
<b>Macroeconomics</b>								
Inflation	0.0005**	2.04	0.007***	3.69	0.11***	4.24	0.0005**	2.48
GDP growth rate	-0.0001	-0.32	0.004	1.26	0.02	0.49	0.0006	1.65
F-test	38.94***		121.51***		411.89***		109.37***	
Sargan <sup>1</sup>	35.47		51.17		87.63		44.45	
AR(1) <sup>2</sup>	Z=-2.34	P=0.019	Z=3.12	P=0.002	Z=-1.76	P=0.079	Z=-2.92	P=0.003
AR(2) <sup>3</sup>	Z=0.81	P=0.417	Z=1.5	P=0.134	Z=-1.31	P=0.191	Z=0.50	P=0.614
No. of observations	57		85		57		85	

\*, \*\* and \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

<sup>a</sup> the endogenous variable is instrumented using levels lagged by two periods

<sup>1</sup> the test for over-identifying restrictions in GMM dynamic model estimation

<sup>2</sup> Arellano-Bond test that average autocovariance in residuals of order 1 is 0 (H0: no autocorrelation)

<sup>3</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0 (H0: no autocorrelation)

**Table 13 Summary of empirical results for different profitability, risk and competition indicators**

	ROA				ROE				NIM				PBT			
	+	-	insignificant	inconsistent												
lag																
<b>BSV</b>																
Size																
Risk																
Liquid																
Tax																
Cap																
Cost																
DIV																
LP																
<b>ISV</b>																
Comp																
BSD																
SMD																
<b>Mac</b>																
INF																
GDP																
JSCBs																
CCBs																

•lag represent the lag of dependent variable; BSV stands for bank-specific variables which include Size (bank size); Risk (bank risk); Liquid (bank liquidity); Tax (bank taxation); Cap (capitalization); Cost (overhead cost); DIV (diversification); LP(labour productivity); ISV is the industry-specific variables which include Comp (competition); BSD (banking sector development); SMD (stock market development); Mac is the macroeconomic variables considered in the study which include INF (inflation) and GDP (annual GDP growth rate).

• “+” represents that the variable is significantly and positively affect the bank profitability; “-” indicates that the variable is significantly and negatively affect the bank profitability; “insignificant” means that the variable is not significantly related to bank profitability; “inconsistent” underlines that different results are obtained for different indicators being used.