The Profitability of Chinese banks: impacts of risk, competition and efficiency

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Abstract

Purpose- This study aims to test the impacts of risk-taking behaviour, competition and cost efficiency on bank profitability in China.

Design/methodology/approach- We use a two-step Generalized Method of Moments (GMM) system estimator to examine the impacts of risk, competition and cost efficiency on profitability of a sample of Chinese commercial banks over the period 2003-2013.

Findings- We find that credit risk, liquidity risk, capital risk, security risk and insolvency risk significantly influence the profitability of Chinese commercial banks. To be more specific, credit risk is significantly and negatively related to bank profitability; liquidity risk is significantly and positively related to Return on Assets (ROA) and Net Interest Margin (NIM) but negatively related to Return on Equity (ROE); capital risk has a significant and negative impact on ROA and Net Interest Margin (NIM) but positive impact on ROE; there is a significant and negative impact of security risk on bank profitability (ROA and NIM). It is found that Chinese commercial banks with higher levels of insolvency risk have higher profitability (ROA and ROE). Finally, higher competition leads to lower profitability in the Chinese banking industry and Chinese commercial banks with higher levels of cost efficiency have lower ROA. In other words, Structure-Conduct-Performance paradigm rather than Efficient-structure paradigm holds in the Chinese banking industry.

Originality/value- This is the first paper to investigate the impact of different types of risk, including credit risk, liquidity risk, capital risk, security risk and insolvency risk, on bank profitability. This is the first study which uses more accurate measurements of efficiency and competition compared to previous Chinese banking profitability literature and which tests their impact on bank profitability. Our findings not only provide a general picture on the risk, efficiency and competition conditions in the Chinese banking industry, but also give valuable information to the Chinese government and to the banking regulatory authorities to make relevant policies.

Keywords Risk-taking behaviour, Lerner index, Profitability, Chinese banking

Paper Type: Research paper

1 Introduction

According to the World Bank, the Chinese economy has undergone significant growth during the period 2003-2013, with an annual GDP growth rate of more than 7%, while developed countries such as the United States and the United Kingdom have GDP growth rates of less than 5%. The banking sector in China plays an important role in the development of the country's economy. The World Bank statistics report that the domestic credit provided by the financial sector in China over the period 2003-2013 accounted for more than 120% of GDP, with the figure reaching a peak in 2013, when it accounted for more than 150% of GDP.

The efficient functioning of the banking sector in China is attributed to various rounds of banking reforms. In particular, competition has increased significantly since China joined the World Trade Organization (WTO) in 2001. Thus, domestic Chinese commercial banks were required to compete more vigorously with others within the ownership type. They were also exposed to competition from other countries for the first time. The traditional structure-conduct-performance (SCP) hypothesis uses concentration as an indicator of bank competition and argues that in a low competition environment (with higher concentration), banks tend to collude with each other to obtain high profits.

There are a number of studies which use concentration to measure competition and test its impact on bank profitability in China (see Tan and Floros, 2012a; Tan and Floros, 2012b; Garcia-Herrero et al., 2009, among others). They report mixed findings with regard to the effect of concentration on bank profitability. Most recently, using a sample of Chinese commercial banks over the period 2003-2013, Tan (2016) uses the Lerner index as a competition indicator and tests its impact on bank profitability. The findings show that there is no robust impact of competition on bank profitability in China.

By contrast with the traditional SCP hypothesis, the efficient-structure hypothesis argues that it is superior efficiency, rather than collusive behaviour, which actually leads to an improvement in bank profitability. However, the empirical literature has different findings with regard to the impact of efficiency on bank profitability (Berger, 1995a; Garcia-Herrero et al., 2009; Gelos, 2006; among others). Our study extends the work by Garcia-Herrero et al. (2009) in the Chinese banking industry by using the Lerner index and a three-bank concentration ratio to test further the impact of competition on bank profitability. Rather than using the accounting ratio to measure cost efficiency (Tan, 2016), the current study uses the stochastic frontier approach (SFA) to evaluate bank efficiency in China, and further examines its impact on bank profitability.

A significant amount of research has focused on analysing the impact of risk, rather than competition and efficiency, on bank profitability. In particular, there is a growing volume of literature examining the effect of risk on profitability in the Chinese banking industry (see Tan and Floros, 2012a, 2012b, 2012c; Tan and Floros, 2014; Tan, 2015;

Sufian, 2009; Sufian and Habibullah, 2009, among other). All of them focus on one or two types of risk such as credit risk, liquidity risk or insolvency risk. However, commercial banks are exposed to other types of risk as well, such as capital risk and security risk. In particular, there is no empirical study investigating the impact of security risk on commercial bank profitability in China. The investigation of the impact of various types of risk on bank profitability will provide more policy implications to the Chinese government as well as to the banking regulatory authorities.

Our paper contributes to the empirical literature on the investigation of bank profitability in China in the following ways: 1) the comprehensive examination of types of risk, especially the impacts of security risk and capital risk, on bank profitability in China, provides new and important policy recommendations to the Chinese government and the banking regulatory authorities; 2) using SFA to measure cost efficiency, the Lerner index and 3-bank concentration ratio to measure competition, we obtain more robust results with regard to the impact of efficiency and competition on bank profitability. Thereby we extend the studies of Garcia-Herrero et al. (2009) and Tan (2016).

The empirical results suggest that the profitability of Chinese commercial banks is significantly affected by credit risk, liquidity risk, and insolvency risk; in particular, we find that security risk has a significant and negative impact on bank profitability (ROA and NIM); the impact of capital risk on ROA and NIM is significant and negative, while significant and positive on ROE. Moreover, we find that as competition increases, the profitability of Chinese commercial banks decreases. The efficiency of Chinese commercial banks is found to be significantly and negatively related to the Return on Assets (ROA) of Chinese commercial banks. In other words, Chinese commercial banks with higher levels of cost efficiency have lower ROA.

The remainder of the paper will be organized as follows: section 2 reviews the literature on the investigation of profitability in the banking sector; section 3 describes the data and methodology; section 4 presents the empirical results; while section 5 concludes the paper.

2 Literature review

There is a large amount of literature investigating the profitability in the US banking sector as well as the European banking sector. The findings show that bank profitability is significantly affected by bank size, bank liquidity, bank capitalization, bank credit risk, bank efficiency, bank diversification, concentration, inflation as well as GDP. Table 1 provides a summary of the empirical studies focusing on US and Europe.

<<Table 1---about here>>

Literature review on profitability of Chinese banking sector

Using a sample of Chinese commercial banks over the period 2000-2005, Sufian and Habibullah (2009) investigate the impact of credit risk on bank profitability. Their results suggest that credit risk has a significant and positive impact on the profitability of Chinese state-owned commercial banks and joint-stock commercial banks. In addition, Sufian (2009) uses 4 state-owned commercial banks and 12 joint-stock commercial banks to examine the determinants of bank profitability during 2000-2007 in China with a focus on the credit risk and liquidity risk under a fixed effect model. The results show that Chinese commercial banks with greater levels of credit risk and liquidity risk have higher profitability.

More recently, Tan and Floros (2012a, 2012b, 2012c) use a sample of Chinese commercial banks over the period 2003-2009 to examine the determinants of bank profitability with a focus on the impacts of credit risk and competition on bank profitability under a Generalized Method of Moments (GMM) estimator. Competition is measured by 3-bank and 5-bank concentration ratios. To be more specific, Tan and Floros (2012a) use both a 3-bank concentration ratio and a 5-bank concentration ratio to investigate the joint effects of risk and competition on bank profitability in China. They do not find any significant impact. The findings from Tan and Floros (2012b) show that the profitability of Chinese commercial banks is significantly affected by credit risk. Finally, the results from Tan and Floros (2012c) report that Chinese joint-stock commercial banks with higher levels of credit risk have higher profitability.

Using a sample of Chinese commercial banks over the period 2003-2009, Tan and Floros (2014) investigate the inter-relationship between risk, profitability and competition in the Chinese banking industry. Two types of risk are considered - credit risk and insolvency risk - while competitive conditions are measured by the Lerner index. They also use Seemingly Unrelated Regression to analyse the inter-relationships. The results show that there is a negative impact of competition on bank profitability in China, while there is no robust impact of different types of risk on bank profitability in China.

Using a sample of Chinese commercial banks over the period 1997-2004, Garcia-Herrero et al. (2009) explain the low profitability in the Chinese banking industry with a focus on the investigation of the impacts of competition and efficiency in the Chinese banking industry. The authors use a GMM estimator as the econometric technique. Efficiency is measured by the parametric stochastic frontier approach, while competition is measured by the Herfindahl-Hirshman index. The results show that Chinese commercial banks with higher efficiency have higher levels of profitability and that there is no clear impact of competition on bank profitability in China.

Tan (2016) uses a sample of Chinese commercial banks over the period 2003-2011 to examine the impacts of risk and competition on bank profitability in China via a GMM

estimation. Two types of risk are evaluated - credit risk and insolvency risk - and competition is measured by a Lerner index. The results show that there is no robust impact of risk and competition on bank profitability in China.

Existing literature shows that there is no study investigating the impact of comprehensive types of risk on bank profitability in China. To be more specific, capital risk and security risk are missing in the empirical studies. However, their impacts on bank profitability will be very important for the Chinese government and banking regulatory authorities in their policy making. To be more specific, the investigation of capital risk and in particular its impact on bank profitability is supposed to give policy implications to the Chinese government in terms of the capital level held by the commercial banks. This will be significantly related to banks' operations and performance. Besides the loan business, the security business is the second largest earning assets in the Chinese banking industry. However, it suffers from risk, especially for bonds issued by non-government supported companies. Its impact on bank profitability will also give valuable information to the Chinese commercial banks in terms of whether or not they should increase or decrease the amount of securities held. Secondly, there is no robust investigation with regard to the joint-impacts of efficiency and competition on bank profitability in China. The current study uses more accurate measurements of efficiency (SFA) and competition (Lerner index and 3-bank concentration ratio) compared to previous Chinese banking profitability literature and tests their impact on bank profitability thereby providing more reliable results.

3 Description of methodology and data

3.1 Estimation of competition in the Chinese banking sector-Lerner index

The Lerner index is defined as the difference between a bank's price and its 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 its marginal cost.

The price is computed by estimating the average price of bank production as the ratio of total revenue to total assets following Fernandez de Guevara et al. (2005) and Carbo et al. (2009a,b). 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:

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

LN denotes natural logarithm, COST denotes total cost, i and t indicate specific bank operating at a specific year; ASSETS represents total assets, INPUT represents three input prices used in the current study and different input prices are represented by the subscripts j and k. Further, INPUT1 is price of funds (ratio of interest expenses to total funding), INPUT2 indicates price of capital (ratio of other non-interest expenses to fixed assets), and INPUT3 stands for price of labour (ratio of personnel expenses to total assets). α_0 and ξ stand for constant and error terms, respectively. The estimated coefficients of the cost function are then used to compute the marginal cost (MC).

$$MC_{it} = \frac{\text{COST}_{it}}{ASSETS_{it}}(\hat{a}_1 + \hat{a}_2 LNY + \sum_{j=1}^{3} \hat{\gamma}_{itj} LNINPUT_{itj}) \quad (2)$$

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. The formula used to estimate the Lerner index can be expressed as follows:

$$Lernerindex_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (3)$$

P represents the price which is calculated as the total revenue divided by total assets. We use the same three input prices to calculate the marginal cost, which are the price of funds, the price of capital and the price of labour. $\hat{a}_1, \hat{a}_2\, \hat{\gamma}_{itj}$ are the coefficients estimated from equation (1).

3.2 Estimation of cost efficiency in the Chinese banking industry: SFA approach

Cost efficiency measures how well a bank is predicted to perform relative to a "best-practice bank" producing the same outputs under the same environmental conditions (Berger et al., 2009). To be more specific, the cost efficiency measures the distance of a specific bank to the benchmark bank with regard to the difference in the ability to minimize cost in producing the same volume of output. The efficiency level can be estimated by specifying the commonly-used translog functional form for the cost function[1] which is expressed as below:

$$\begin{aligned} LNCOST_{it} = {} & \alpha_0 + \alpha_1 LNASSETS_{it} + \frac{1}{2}\alpha_2 (LNASSETS_{it})^2 \\ & + \sum_{j=1}^{3} \beta_{itj} LNINPUT_{itj} \\ & + \sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{itjk} LNINPUT_{itj} LNINPUT_{itk} \\ & + \sum_{j=1}^{3} \gamma_{itj} LNASSETS_{it} LNINPUT_{itj} + v_{it} + \mu_{it} \end{aligned} \quad (4)$$

[1] Stochastic Frontier approach (SFA) rather than Data Envelopment Analysis (DEA) is used to measure cost efficiency because Fries and Taci (2005) argue that the SFA is more appropriate over the DEA in efficiency studies in developing countries where problems of measurement errors and an uncertain economic environment are more likely to prevail.

Where i and t represent a specific bank operating at a specific year, cost stands for total cost, one output is considered in the current study which is total assets, while INPUT represents three input prices which are price of funds (ratio of interest expenses to total funding), price of capital (the ratio of non-interest expenses to fixed assets), and price of labour (the ratio of personnel expenses to total assets). v_{it} is a two sided normal disturbance term with zero mean and variance σ_v^2, which represents the effect of statistical noise, and u_{it} is a non-negative random disturbance term capturing the effects of inefficiency. The definition of the variables used to estimate the Lerner index and cost efficiency and descriptive statistics of the variables are reported in Table 2.

<<Table 2---about here>>

3.3 Estimation of insolvency risk in the Chinese banking industry- Z-score

Z-score is used in the current study to estimate insolvency risk in the Chinese banking industry. Z-score reflects the extent to which banks have the ability to absorb the losses. Thus, a higher value of Z-score indicates lower risk and greater stability. The Z-score has been used widely to measure the stability of financial institutions in empirical studies (see Iannotta *et al*. 2007; Liu and Wilson 2013, Liu et al., 2013). The calculation of Z-score can be expressed as follows:

$$Z = \frac{ROA + E/A}{\sigma(ROA)} \qquad (5)$$

Where ROA is banks' Return on Assets, E/A is the ratio of equity over total assets, $\sigma(ROA)$ is the standard deviation of Return on Assets[2].

3.4 Estimation on the determinants of bank profitability

When estimating bank profitability, either measured by the ROA or NIM, a number of challenges are presented. First, it is endogeneity: more profitable banks may be able to increase their equity more easily by retaining profits. The relaxation of the perfect capital markets assumption allows an increase in capital to raise expected earnings. Another important problem is unobserved heterogeneity across banks, which may be very large in the Chinese case given differences in corporate governance. Finally, the profitability could be very persistent for Chinese banks because of political interference.

We tackle these three problems together by following the method of Athanasglou et al (2008) by using a two-step Generalized Method of Moments (GMM) system estimator

[2] Thanks very much to the referee's comment on this. Rather than using the ordinary Z-score, we use the standardized Z-score to obtain more robust results. The standardization of Z-score can be expressed as: $Z^{'} = (Z - Z_{mean}) / sd$ where $Z^{'}$ represents the standardization of Z, Z_{mean} represents the mean of Z and sd represents the standard deviation of Z.

to estimate profitability in the Chinese banking industry. To be more specific, this study follows and expands the specification proposed by Athanasglou et al. (2008) which can be expressed as follows:

$$\pi_{it} = C + \delta\pi_{i,t-1} + \sum_{j=1}^{j} \beta_j X_{it}^{j} + \sum_{l=1}^{l} \beta_l X_{it}^{l} + \sum_{m=1}^{m} \beta_m X_{it}^{m} + \gamma JSCBs_{it} + \vartheta CCBs_{it} + \nu_{it} + \mu_{it} \quad (6)$$

Where i refers to year and t refers to an individual bank, π_{it} represents the profitability indicator for the specific bank at a specific year, C is constant term and $\pi_{i,t-1}$ 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} [3]. The unobserved bank-specific effect and the idiosyncratic error are represented by ν_{it} and μ_{it}, respectively. β_j, β_l, and β_m are coefficients to be estimated, while δ represents the speed of adjustment to equilibrium. Its value ranges from 0 to 1, with a higher figure representing slower adjustment and a less competitive structure, while a lower figure indicates that there is a stronger competitive condition and higher speed of adjustment[4]. 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;this helps us to compare their profitability to that of the state-owned commercial banks (SOCBs)[5].

3.5. Data

Our sample consists of data from five SOCBs, twelve JSCBs and eighty three CCBs. The sample covers the period 2003-2013 and the bank-specific data is collected from the Bankscope database produced by Bureau Van Dijk (www.bvdinfo.com). The industry-specific and macroeconomic variables are retrieved from the website of the China Banking Regulatory Commission (www.cbrc.gov.cn) and the World Bank

[3] Thanks very much to the referee's comment with regard to potential collinearity issue by including efficiency and Lerner index in the same model. Therefore, two different models will be estimated by including cost efficiency without Lerner index in one and including Lerner index without cost efficiency in another.

[4] We are grateful to the referee's comments with regard to use lagged values of all variables in the specification. Only dependent variable is lagged, while the current level of all the other variables is used because we follow the studies of Athanasoglou et al. (2008); Garcia-Herrero et al. (2009); Dietrich and Wanzenried (2011) and Tan (2016).

[5] We appreciate the invaluable comment provided by the referee in terms of including ownership dummies in the specification. Although quite a few empirical studies investigated the relationship between ownership and bank profitability with different findings (Short, 1979; Bourke, 1989; Molyneux and Thornton (1992); Athanasoglou et al., 2008; among others), while this issue is still unveiled in the Chinese banking industry. The investigation of this issue will be helpful to the Chinese government and the banking regulatory authorities to make relevant policies.

database (data.worldbank.org). Due to the fact that not all the banks have available information for all the years, we opt for an unbalanced panel dataset in order not to lose degrees of freedom. We use three different profit measures, which are ROA (Athanasoglou et al., 2008; Garcia-Herrero-et al., 2009), ROE (Dietrich and Wanzenried, 2011), and NIM (Dietrich and Wanzenried, 2011; Athanasoglou et al., 2008; Tan and Floros 2012a, 2012b, 2012c).

The bank-specific determinants of profitability include credit risk, liquidity risk, security risk, capital risk, insolvency risk, bank size, bank diversification and cost efficiency. The industry-specific variables include competition, banking sector development and stock market development. With regards to the macroeconomic determinants, we include both annual inflation rate and annual GDP growth rate. Table 3 provides a summary of the variables used and their expected effects on bank profitability.

<<Table 3---about here>>

4 Empirical results

4.1 Cost efficiency in the Chinese banking industry

Table 4 reports the results with regard to the efficiency of three different ownership types of Chinese commercial banks over the period examined. It is noticed from the figure that city commercial banks have the highest cost efficiency, followed by the joint-stock commercial banks, while the state-owned commercial banks have the lowest cost efficiency.The results show that the cost efficiency for state-owned commercial banks, joint-stock commercial banks and city commercial banks are 0.752, 0.754 and 0.759 on average over the examined period. This indicates that by generating the same volume of outputs under the same inputs prices, the state-owned commercial banks, joint-stock commercial banks and city commercial banks waste about 24.8%, 24.6% and 24.1% of their costs relative to the best price banks. This result is in line with the findings of Du and Girma (2011) in terms of cost efficiency in the Chinese banking industry.

<<Table 4---about here>>

4.2 Competitive conditions in the Chinese banking industry

Figure 1a shows the mean Lerner indices for each category of banks and for each year. The Lerner index suggests that, over the period 2003-2013, SOCBs have the highest market power. With regard to the JSCBs, the findings show that the market power of this ownership is relative more stable during 2003-2007 compared to the rest of the examined period. Finally, the results show that the market power of CCBs kept increasing over most of the years of the examined period. Our finding is in line with the results obtained by Tan and Floros (2014) and this finding is partly in accordance with

the results reported by Tan (2016), while the current study extends and updates the data of the previous papers[6] and is supposed to provide more accurate results with regard to the market power of Chinse commercial banks.

Figure 1b shows the 3-bank concentration ratio in the Chinese banking sector over the period 2003-2013. In general, we report that the total assets of the 3 largest banks in China in terms of total assets kept declining to the lowest point in 2012, while there was a slight increase in 2013 compared to 2012.

<<Figure 1a—about here>>

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

4.3 The impacts of risk, efficiency and competition on bank profitability

Table 5 presents the determinants of bank profitability with a focus on the impacts of risk and cost efficiency, Table 6 shows that results with emphasis on the impacts of risk and competition (Lerner index) on bank profitability, finally, Table 7 uses cost efficiency as well as concentration ratio to test the impacts of risk, efficiency and competition on bank profitability. The Wald tests of different profitability indicators are significant at the1% level; this indicates that the explanatory power of the model is high. The Hansen tests show that there is no evidence of over-identifying restrictions. A negative first-order autocorrelation is present, while all the second-order autocorrelations are insignificant which indicates that our estimates are consistent.

The results from Tables 5 and 6 show that credit risk is significantly and negatively related to bank profitability in China. Our results are in contrast with the findings of Sufian and Habibullah (2009) and Sufian (2009). The main reason for this difference lies in the fact that different econometric techniques are used[7]. We further explain the negative impact of credit risk on bank profitability to the fact that a large volume of non-performing loans increases the banking cost and further precedes a decline in bank profitability.

We find also from these two tables that liquidity risk is significant and positive when two profitability indicators - ROA and NIM - are used. This result is in line with Molyneux and Thornton (1992). The finding can be explained by the fact that higher volumes of loans made by banks increase income and further improve bank profitability. However, the results show further that higher liquidity risk leads to a decline in ROE. The negative impact of liquidity risk on bank ROE is in line with Falzon (2013).

[6] Tan and Floros (2014) examine the period of 2003-2009, Tan (2016) uses the data from 2003-2011 while the current paper covers the period of 2003-2013.

[7] Fixed effect estimation is used by Sufian (2009), Sufian and Habibullah (2009) while we use GMM system estimator which is supposed provide more accurate and robust results.

With regard to Table 5 and Table 6, Capital risk is shown to be significantly and negatively related to bank profitability with regards to the ROA and NIM of Chinese commercial banks. The negative impact can be explained by the fact that: 1) the funding cost can be reduced for the banks with higher levels of capital; 2) banks with higher levels of capital are more likely to engage in prudent lending, which results in higher profitability; 3) banks with higher levels of capital need to borrow less; the reduction in the volume of borrowing increases the bank profitability. We find that the impact of capital risk on ROE is significant and positive, indicating that lower levels of capital risk (higher levels of capital) lead to a lower ROE. This finding can be explained by the fact that higher levels of capital reduce the risk on equity and lower the equilibrium expected return on equity required by investors (Berger, 1995b).

The results from Table 5 and Table 6 show that there is a significant and negative impact of security risk on bank profitability (ROA and NIM). This finding reflects the fact that the returns on the security business engaged in by Chinese commercial banks, especially the bonds issued by non-government supported companies, is still less than the costs incurred, which leads to a decline in bank profitability because of the higher risks associated with this type of bond.

Table 5 and Table 6 show that insolvency risk is significantly and positively related to bank profitability (ROA and ROE). This result is in contrast with the finding of Tan (2016) which reports that there is no robust impact of insolvency risk on bank profitability. The different finding is attributed to the fact that different insolvency risk indicators are being used[8].

With regard to other bank-specific determinants of profitability, both Table 5 and Table 6 report that bank size is significantly and positively related to ROA and ROE. The positive impact of size on bank profitability can be explained by the fact that larger banks can reduce costs via economies of scale. The reduction in cost leads to an improvement in bank profitability. It is further shown that bank size is significantly and negatively related to NIM. This can be explained by the fact that large banks have higher ability to focus on non-interest generating businesses, the reduction in the volumes of interest-generating activities reduces NIM.

Bank diversification is found to be significantly and positively related to ROA and negatively related to ROE and NIM as reflected from Table 5 and Table 6. The results can be explained by the fact that bank diversification reduces banks' costs via economies of scope. The reduction in banks' costs leads to an improvement in bank profitability. However, the negative impact of diversification on NIM is due to the fact that more funds are invested by banks in engaging in other non-traditional activities.

[8] Tan (2016) uses stability inefficiency as the insolvency risk indicator while the current study uses the standardized Z-score.

The reduction in the volume of funds available for traditional loan-deposit services reduces bank income and further decreases bank profitability.

Cost efficiency is shown to have a significant and negative impact on bank profitability (ROA), but positive impact on ROE and NIM. However, Lerner index in Table 6 shows that Chinese commercial banks with higher levels of market power (lower level of competition) have lower profitability. The investigation on the impacts of efficiency and competition on bank profitability aims to test whether efficient-structure or structure-conduct-performance (SCP) paradigm holds. The current findings suggest that Chinese banking industry is in line with the SCP hypothesis.

Both Table 5 and Table 6 show that banking sector development have a significant and positive impact on bank profitability. This finding is in contrast with the results of Demirguc-Kunt and Huizinga (1999). However, our finding is in line with Tan and Floros (2012a) for the Chinese banking industry. A larger proportion of banking assets in GDP reflects the fact that there is a larger demand for banking services. An increase in the volume of business engaged in by banks reduces costs via economies of scale and further improve bank profitability. Finally, Table 5 and Table 6 show that stock market development has a significant and positive impact on ROA and ROE of Chinese commercial banks. This finding indicates that the volume of non-interest generating businesses increases significantly in a more highly developed stock market and that the income from these non-interest generating businesses contributes more than interest income to the overall income of Chinese commercial banks.

It is found that Chinese commercial banks have higher profitability in a more inflationary environment. This result is in line with Garcia-Herrero et al. (2009) for the Chinese banking industry. This finding reflects the fact that inflation is well anticipated; the adjustment in interest rate increases the revenue and further improves bank profitability. Chinese commercial banks also have higher profitability (NIM) during periods of economic boom. This can be explained by the fact that the credit condition of firms is better during periods of economic boom. The resulting reduction in the volume of non-performing loans increases bank profitability. However, the results show that during periods of economic boom, Chinese commercial banks have lower ROA. Bearing in mind the positive impact of GDP growth on NIM, which focuses on traditional interest-generating activities, this finding indicates that non-interest generating business contributes more to the overall profitability of Chinese commercial banks. In other words, during periods of economic boom, Chinese commercial banks make more effort and devote more resources to engaging in traditional interest generating activities. The reduction in the volume of non-interest generating businesses reduces banks' ROA.

Table 7 reports the impact of the determinants of bank profitability using a 3-bank concentration ratio as the measure of bank competition. The results confirm a number of

findings as reported in Tables 5 and 6: 1) Credit risk has a negative impact on bank profitability; 2) liquidity risk is positively related to ROA and NIM and negatively related to ROE; 3) there is a negative impact of capital risk on ROA and NIM, while the effect is positive for ROE; 4) the effect of security risk on ROA and NIM is significant and negative; 5) insolvency risk is significantly and positively related to ROA and ROE; 6) bank size is significantly and positively related to ROA and ROE, but negatively related to NIM; 7) there is a significant and negative impact of diversification on ROE and NIM, while the impact is positive for ROA; 8) a more highly developed stock market leads to an increase in ROA and ROE; 9) Chinese commercial banks have higher ROE and NIM in a higher inflationary environment; 10) Chinese commercial banks have lower ROA and higher NIM during periods of economic boom.

When competition is measured by the Lerner index and the concentration ratio, the impact on bank profitability is different. The concentration ratio is significant and negative indicating lower competition leads to higher bank profitability which is different from the results reported from Lerner index. That is because, the Lerner index provides more robust results (Casu and Girardone, 2006). In other words, our result is in line with the SCP hypothesis. Compared to state-owned commercial banks, city commercial banks in China have higher ROA.

<<Table 5---about here>>

<<Table 6---about here>>

<<Table 7---about here>>

5 Summary

This paper investigates the determinants of bank profitability in China with a focus on the impacts of efficiency, risk and competition on bank profitability. The study uses a sample of Chinese commercial banks over the period 2003-2013 (5 state-owned commercial banks, 12 joint-stock commercial banks and 83 city commercial banks). Our study contributes to the empirical literature in the following ways: 1) it examines in depth different types of risk; and 2) uses more accurate measures of efficiency (SFA) and competition (Lerner index and 3-bank concentration ratio). It therefore provides more robust results with regard to the impacts of competition and efficiency on bank profitability compared to Garcia-Herrero et al. (2009) and Tan (2016).

Our results show that Chinese commercial banks have higher profitability in a lower competitive environment and different types of risk such as credit risk, liquidity risk, capital risk, security risk and insolvency risk are related significantly to bank profitability in China. Finally, we find that SCP hypothesis rather than efficient-structure hypothesis holds in the Chinese banking industry.

The current study provides several policy implications to the Chinese government as well as the banking regulatory authorities: 1) Chinese commercial banks should further enhance the process of monitoring and managing the loan business, the resulted reduction in the level of credit risk leads to higher profitability 2) Chinese commercial banks should reduce the volumes of security business engaged in, especially the bond issued by non-government support companies; 3) Chinese commercial banks can make full use of available funds to engage in different types of businesses; although there is an issue of insolvency, strong government support will give protection to Chinese commercial banks.

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Figure 1 Competitive conditions of three different ownership types of Chinese banks over the period 2003-2013

Figure 1a competitive condition measured by Lerner index

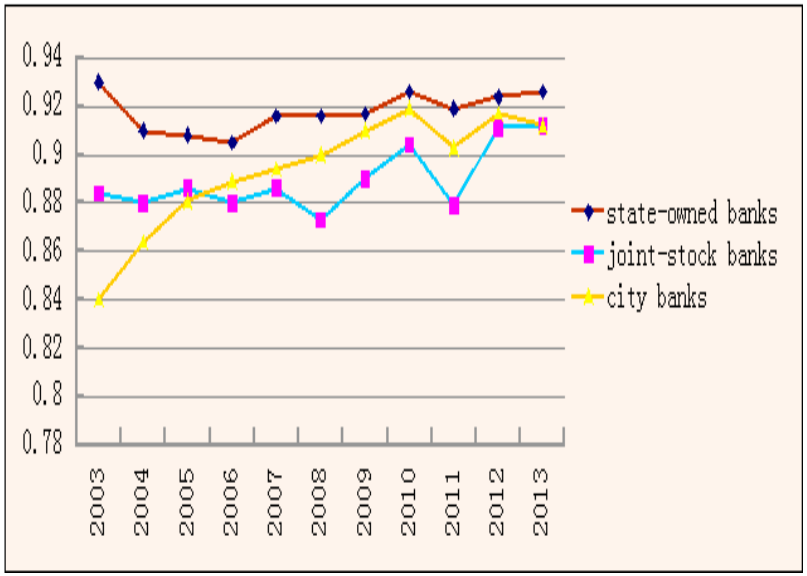

Figure 1b competitive condition measure by 3-bank concentration

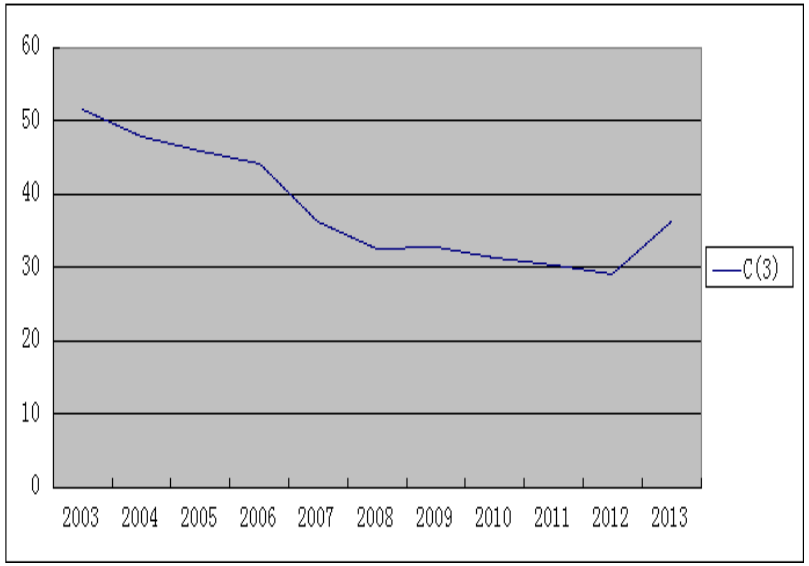

Table 1 Literature review on profitability in European and US banking sectors

References	Banking sector investigated	Data period	Methodology	Empirical findings
Molyneux and Thornton (1992)	European banking industry	1986-1989	Ordinary least square estimator	Liquidity is significantly and negative related to bank profitability
Goddard et al. (2004a)	European banking industry	1992-1998	GMM	There is a positive impact of diversification on bank profitability
Goddard et al. (2004b)	European banking industry	1992-1998	OLS and GMM	Capital-asset ratio has a significant and positive impact on bank profitability
Kosmidou (2008)	Greek banking industry	1990-2002	Fixed effect estimator	Higher capitalization and lower cost ratio leads to higher profitability. GDP has positive impact and inflation has negative impact on bank profitability
Athanasoglou et al. (2008)	Greek banking industry	1985-2001	GMM	There is no evidence in support of structure-conduct-performance paradigm in Greek banking industry

Staikouras and Wood (2004)	European banking industry	1994-1998	Fixed effect estimator	There is a negative impact of credit risk on bank profitability.
Dietrich and Wanzenried (2011)	Switzerland banking industry	1999-2009	GMM	Banks with more diversified activities have higher profitability
Rhoades (1985)	US banking industry	1969-1978	Ordinary least square estimator	There is a significant and negative impact of credit risk on bank profitability
Smirlock (1985)	US banking industry	1973-1978	Ordinary least square estimator	Size is significantly and negatively related to bank profitability
Berger (1995a)	US banking industry	Ten years of 1980s	Ordinary least square estimator	Banks with larger market share and differentiate product have higher profitability
Goddard et al. (2001)	European banking industry	1989-1996	Ordinary least square estimator	Scale economies and productive efficiency are positively related to profitability, while bank size has negative impact on profitability
Tregenna (2009)	US banking industry	1994-2005	OLS and GMM	Bank concentration increases bank profitability

Table 2 The definition of variables used to estimate the Lerner index

Variable	Notation	Measurement	observation	Mean	S.D	Min	Max
Total cost	COST	Interest expenses plus non-interest expenses	777	3.35	0.97	-0.79	6.86
Total assets	ASSETS		811	4.89	0.97	0.71	8.32
Input prices	INPUT	Input price 1: price of fund- ratio of interest expenses over total funding	777	1.27	0.18	0.74	1.96
		Input price 2: price of capital- ratio of other non-interest expenses over fixed assets	776	1.92	0.26	0.68	2.83
		Input price 3: price of labour- ratio of personnel expenses over total assets	432	1.7	0.87	-2.93	4.77
Marginal cost	MC	Estimated using equation 1 and equation 2					

Table 3 Summary of the variables used in the current study and their expected effects on bank profitability

Variables	Measurement	Expected effect	Source
Profitability indicators			
ROA	Net income/total assets		**Bankscope**
ROE	Net income/shareholder's equity		**Bankscope**
NIM	Net interest income/earning assets		**Bankscope**
Bank-specific variables			
Credit risk	Impaired loans/gross loans	**-**	**Bankscope**
Liquidity risk	Liquid assets/total assets	**?**	**Bankscope**
Security risk	Total securities/total assets	**+**	**Bankscope**
Capital risk	Total regulatory capital ratio	**?**	**Bankscope**
Insolvency risk	Z-score	**+**	**Bankscope**
Bank size	Natural logarithm of total assets	**+**	**Bankscope**
Bank diversification	Non-interest income/gross revenue	**+**	**Bankscope**
Cost efficiency	Derived from SFA	**?**	**Banksocpe**
Industry-specific variables			
Bank competition (Lerner index)	Estimated from cost frontier	**+**	
Bank competition (3-bank concentration ratio)	Total assets of largest three banks/total assets of the whole banking industry	**+**	**China Banking Regulatory Commission**
Banking sector development	Banking sector assets/GDP	**+**	**China Banking Regulatory Commission**
Stock market development	Market capitalization of listed companies/GDP	**+**	**World Bank**
Macroeconomic variables			
Inflation	Annual inflation rate	**?**	**World Bank**
GDP growth	Annual GDP growth rate	**-**	**World Bank**

Notes: "+" means positive effect, "-" means negative effect, "?" means no indication.

Table 4 Cost efficiency in the Chinese banking industry (2003-2013)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average
SOCBs	0.775	0.732	0.686	0.734	0.786	0.848	0.762	0.895	0.636	0.691	0.727	0.752
JSCBs	0.745	0.713	0.72	0.747	0.769	0.823	0.842	0.75	0.719	0.671	0.791	0.754
CCBs	0.741	0.706	0.72	0.736	0.78	0.766	0.844	0.721	0.735	0.814	0.791	0.759

Table 5 Empirical results: The impacts of risk-taking behaviour and competition on bank profitability (cost efficiency only)

	ROA		ROE		NIM	
	coefficient	standard errors	coefficient	standard errors	coefficient	standard errors
Lag of dependent variable	0.06***	0.008	0.21***	0.013	0.45***	0.015
Bank characteristics						
Credit risk	-0.0002***	0.00002	-0.002***	0.0001	-0.023***	0.005
Liquidity risk	-0.008***	0.0005	0.16***	0.0066	-0.99***	0.09
Capital risk	0.0002***	0.00001	-0.005***	0.0002	0.034***	0.003
Security risk	-0.007***	0.0004	-0.001	0.0097	-1.64***	0.12
Z-score	-0.007***	0.0008	-0.006***	0.0007	0.0001	0.0001
Bank size	0.0008***	0.0002	0.007***	0.0016	-0.22***	0.037
Bank diversification	0.00005***	3.51e-06	-0.0003***	0.00005	-0.02***	0.0007
Cost efficiency	-0.02***	0.0009	0.091***	0.022	1.29***	0.39
Industry characteristics						
Banking sector development	0.006***	0.0004	0.03*	0.006	0.73***	0.12
Stock market development	0.00003***	7.88e-07	0.0003**	0.00003	0.11***	0.015
Macroeconomics						
Inflation	0.0004***	0.00001	0.005***	0.0002	0.09***	0.004
GDP growth rate	-0.0007***	0.00003	-0.0001	0.0008	0.11***	0.01
Joint-stock commercial banks	-0.005	0.0005	-0.02	0.01	-0.13	0.15
City commercial banks	0.003***	0.0007	-0.03	0.008	-0.22	0.15
Constant	0.006***	0.001	-0.017	0.045	-0.27	0.68
Wald test	3495.76***		28182.00***		22991.50***	
Hansen(p value)	0.374		0.371		0.488	
AR(1)	Z=-6.16	P=0.000	Z=-2.8	P=0.013	Z=-2.64	P=0.008
AR(2)	Z=0.08	P=0.918	Z=-0.05	P=0.922	Z=-1.39	P=0.181
No. of observations	411		415		391	

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

Table 6 Empirical results: The impacts of risk-taking behaviour and competition on bank profitability (Lerner index only)

	ROA		ROE		NIM	
	coefficient	standard errors	coefficient	standard errors	coefficient	standard errors
Lag of dependent variable	0.044***	0.008	0.18***	0.014	0.59***	0.02
Bank characteristics						
Credit risk	-0.0001***	0.00003	-0.003***	0.0001	-0.01***	0.002
Liquidity risk	-0.006***	0.0004	0.13***	0.012	-0.95***	0.11
Capital risk	0.0001***	0.00002	-0.005***	0.0003	0.03***	0.004
Security risk	-0.007***	0.0003	0.033***	0.007	-1.71***	0.08
Z-score	-0.0005***	0.0002	-0.0006***	0.0007	-0.0004***	0.0009
Bank size	0.0008***	0.0001	0.004***	0.001	-0.21***	0.02
Bank diversification	0.00008***	4.55e-06	-0.0001***	0.00004	-0.02***	0.0009
Industry characteristics						
Lerner index	0.03***	0.001	0.41***	0.02	1.66***	0.17
Banking sector development	0.008***	0.0003	0.03***	0.004	0.57***	0.06
Stock market development	0.00001***	6.07e-07	0.0002**	4.79e-06	-0.003***	0.00009
Macroeconomics						
Inflation	0.0003***	8.18e-06	0.006***	0.0002	0.1***	0.002
GDP growth rate	-0.0002***	0.00001	-0.002***	0.0002	0.08***	0.004
Joint-stock commercial banks	0.001	0.001	-0.005	0.007	-0.4**	0.16
City commercial banks	0.005***	0.0007	0.002	0.008	-0.23*	0.12
Constant	-0.05***	0.002	-0.3***	0.03	0.53	0.32
Wald test	3495.76***		28182.00***		22991.50***	
Hansen(p value)	0.374		0.371		0.488	
AR(1)	Z=-5.18	P=0.000	Z=-2.18	P=0.013	Z=-2.38	P=0.019
AR(2)	Z=0.08	P=0.285	Z=-0.05	P=0.619	Z=-1.39	P=0.435
No. of observations	411		415		391	

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

Table 7 Empirical results: The impacts of risk-taking behaviour and competition on bank profitability (3-bank concentration ratio as competition indicator)

	ROA		ROE		NIM	
	coefficient	standard errors	coefficient	standard errors	coefficient	standard errors
Lag of dependent variable	0.03***	0.009	0.18***	0.019	0.45***	0.02
Bank characteristics						
Credit risk	-0.0002***	0.00002	-0.003***	0.0001	-0.01**	0.005
Liquidity risk	-0.009***	0.0005	0.12***	0.007	-1.05***	0.1
Capital risk	0.0001***	0.00001	-0.006***	0.0002	0.02***	0.003
Security risk	-0.006***	0.0006	0.01	0.008	-1.53***	0.11
Z-score	-0.0005***	0.0003	-0.0007***	0.0001	0.0002***	0.0001
Bank size	0.007***	0.0002	0.008***	0.002	-0.21**	0.05
Bank diversification	0.00004***	5.59e-06	-0.0004***	0.00005	-0.024***	0.0007
Cost efficiency	-0.03***	0.001	-0.001	0.018	-1.25***	0.39
Industry characteristics						
Concentration	-0.0004***	0.00001	-0.003***	0.0002	-0.04***	0.003
Banking sector development	-0.003***	0.0004	-0.03***	0.005	-0.32***	0.096
Stock market development	0.00001***	1.36e-06	0.0001***	0.00002	-0.004***	0.0004
Macroeconomics						
Inflation	0.0001	0.00001	0.003***	0.0002	0.05***	0.003
GDP growth rate	-0.0007***	0.00004	0.0004	0.0006	0.08***	0.014
Joint-stock commercial banks	-0.001*	0.0006	-0.02***	0.009	-0.37***	0.1
City commercial banks	0.002***	0.001	-0.002	0.008	-0.14	0.16
Constant	0.053***	0.002	0.29***	0.04	6.19***	0.73
Wald test	600.63***		5243.45***		6152.60***	
Hansen(p value)	0.233		0.748		0.454	
AR(1)	Z=-2.88	P=0.013	Z=-2.91	P=0.016	Z=-2.79	P=0.037
AR(2)	Z=-1.28	P=0.233	Z=-0.35	P=0.531	Z=-1.07	P=0.645
No. of observations	411		441		417	

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

Revision on Paper in Review of Accounting and Finance- Manuscript Number: RAF-05-2015-0072.R2

Dear Professor Janis Zaima
Editor of Review of Accounting and Finance

Thank you very much for your email and in particular, we appreciate very much for your invaluable and constructive comments and we are much honored to be offered the opportunity to respond to the comments. All the comments have been addressed very carefully and the new version of the paper benefits significantly from the comments. Besides carefully address the comments provided by the referee, the revised version of the manuscript has removed a number of redundant words without compromising on the degree of clarity. Now, the manuscript is within the 8000 word limit.

1. There are still some methodological issues.
a. One of the main comments on the earlier version of the paper was: …"authors use DEA for efficiency estimation then they use SFA for Lerner index, with confusing input-output specifications. Why not use SFA for both efficiency estimates and Lerner index?" Now that this has been sorted out, one is left wondering what specification author(s) use exactly for their SFA estimates. The formula 1 is blurry and text provides no answers. For example, do they use time variant model or not, or maybe something else. Is the same model used also for estimating Lerner index? Author(s) need to clarify this point.

Response: Thank you very much for this comments. The specification used to measure cost efficiency has been clearly clarified and expressed in the paper. Please see the last paragraph on Page 6 for detail:

Cost efficiency measures how well a bank is predicted to perform relative to a "best-practice bank" producing the same outputs under the same environmental conditions (Berger et al., 2009). To be more specific, the cost efficiency measures the distance of a specific bank to the benchmark bank with regard to the difference in the ability to minimize cost in producing the same volume of output. The efficiency level can be estimated by specifying the commonly-used translog functional form for the cost function[1] which is expressed as below:

$$LNCOST_{it} = \alpha_0 + \alpha_1 LNASSETS_{it} + \frac{1}{2}\alpha_2 (LNASSETS_{it})^2 + \sum_{j=1}^{3} \beta_{itj} LNINPUT_{itj} + \sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{itjk} LNINPUT_{itj} LNINPUT_{itk} + \sum_{j=1}^{3} \gamma_{itj} LNASSETS_{it} LNINPUT_{itj} + v_{it} + \mu_{it} \quad (4)$$

Where i and t represent a specific bank operating at a specific year, cost stands for total cost, one output is considered in the current study which is total assets, while INPUT represents three

[1] Stochastic Frontier approach (SFA) rather than Data Envelopment Analysis (DEA) is used to measure cost efficiency because Fries and Taci (2005) argue that the SFA is more appropriate over the DEA in efficiency studies in developing countries where problems of measurement errors and an uncertain economic environment are more likely to prevail.

input prices which are price of funds (ratio of interest expenses to total funding), price of capital (the ratio of non-interest expenses to fixed assets), and price of labour (the ratio of personnel expenses to total assets). v_{it} is a two sided normal disturbance term with zero mean and variance σ_v^2, which represents the effect of statistical noise, and u_{it} is a non-negative random disturbance term capturing the effects of inefficiency. The definition of the variables used to estimate the Lerner index and cost efficiency and descriptive statistics of the variables are reported in Table 2.

b. On the page 10, in the formula (6) the author(s) use one period lagged profitability measure but no other variables are lagged. Why not lag all, for example. Authors need to explain this choice.

Response: Thank you very much for the comments. The reason for only using lagged profitability measure but not lagged other variables has been clearly explained in footnote 4 on page 8.

We are grateful to the referee's comments with regard to use lagged values of all variables in the specification. Only dependent variable is lagged, while the current level of all the other variables is used because we follow the studies of Athanasoglou et al. (2008); Garcia-Herrero et al. (2009); Dietrich and Wanzenried (2011) and Tan (2016).

c. Further, regarding the same model, some variables inclusion needs to be properly motivated. Why do author(s) use both efficiency and Lerner in the main model? As they come from the same cost function, one would assume that they are highly correlated and so one or other should only be included (authors might have more models then currently presented). Your results in the table 3 support my reservation (sings and significance is changing in the same model specification) and this should be re-estimated.

Response: Thank you very much for the comments. Due to the fact that the Lerner index and cost efficiency are from the same cost function, we have addressed this issue by estimating two different models with one only considering the impact of cost efficiency on bank profitability and the other concentrating on the impact of Lerner index on bank profitability. Please see footnote 3 on page 8 for detail. While the results with regard to the separate models are reported in Table 5 and Table 6, respectively.

Thanks very much to the referee's comment with regard to potential collinearity issue by including efficiency and Lerner index in the same model. Therefore, two different models will be estimated by including cost efficiency without Lerner index in one and including Lerner index without cost efficiency in another.

d. Lastly, what is the added value of using dummy variables for bank types? Authors need to motivate this.

Response: Thank you very much for the comments. The added value of using dummy variables for bank types has been clearly explained in footnote 5 on page 8.

We appreciate the invaluable comment provided by the referee in terms of including ownership dummies in the specification. Although quite a few empirical studies investigated the relationship between ownership and bank profitability with different findings (Short, 1979; Bourke, 1989; Molyneux and Thornton (1992); Athanasoglou et al., 2008; among others), while this issue is still unveiled in the Chinese banking industry. The investigation of this issue will be helpful to the Chinese government and the banking regulatory authorities to make relevant policies.

2. The discussion of main results is still confusing and with inconsistencies that are also reflected in the section devoted to conclusions. The author(s) should pay attention to several points:
a. In Section 4.1. author(s) provide two figures practically showing the same thing. They should use tabulated form to present their findings, so that they can incorporate all that they want. More importantly, discussion regarding the results in figures 1 and 2 is rather confusing. On the page 11 author(s) state: "…this result is not in accordance with the finding by Du and Girma (2011) which show that joint-stock commercial banks have higher cost efficiency compared to estate-owned commercial banks. The different findings reported are mainly attributed to the fact that the current study examines the period 2003-2013, while Du and Girma (2011) evaluate the period 1995-2011." I think that the author(s) should provide a more convincing explanation of these results, some of which are counterintuitive.

Response: Thank you very much for the comments. The two figures in section 4.1 have been expressed using a tabulated form. Please see Table 4 for detail. With regard to the discussion about Figure 1 and Figure 2, it has been revised to get rid of the confusion. Please see section 4.1 on page 9 for detail.

Table 4 reports the results with regard to the efficiency of three different ownership types of Chinese commercial banks over the period examined. It is noticed from the figure that city commercial banks have the highest cost efficiency, followed by the joint-stock commercial banks, while the state-owned commercial banks have the lowest cost efficiency.The results show that the cost efficiency for state-owned commercial banks, joint-stock commercial banks and city commercial banks are 0.752, 0.754 and 0.759 on average over the examined period. This indicates that by generating the same volume of outputs under the same inputs prices, the state-owned commercial banks, joint-stock commercial banks and city commercial banks waste about 24.8%, 24.6% and 24.1% of their costs relative to the best price banks. This result is in line with the findings of Du and Girma (2011) in terms of cost efficiency in the Chinese banking industry.

b. The author(s) should be careful about claims they make. For example, on the page.12 author(s) state: "The Lerner index suggests that, over the period 2003-2013, SOCBs have the highest market power. In other words, the competition among SOCBs in China is the lower than for JSCBs and CCBs. Further, after 2005, CCBs have greater market power than JSCBs". Now, the author(s) do not show results for marginal cost rather only for Lerner index. They should either add the marginal cost results or amend the discussion.

Response: Thank you very much for the comments. The discussion has been amended. Please see the last paragraph on page 9 for detail:

Figure 1a shows the mean Lerner indices for each category of banks and for each year. The Lerner index suggests that, over the period 2003-2013, SOCBs have the highest market power. With regard to the JSCBs, the findings show that the market power of this ownership is relative more stable during 2003-2007 compared to the rest of the examined period. Finally, the results show that the market power of CCBs kept increasing over most of the years of the examined period. Our finding is in line with the results obtained by Tan and Floros (2014) and this finding is partly in accordance with the results reported by Tan (2016), while the current study extends and updates the data of the previous papers[2] and is supposed to provide more accurate results with regard to the market power of Chinse commercial banks.

c. The comment regarding credit risk is unclear. The author(s) affirm(s) that (p.12): "The results from Table 3 show that the credit risk is significantly and negatively related to bank profitability in China when profitability is measured by ROA and ROE. Our results are in contrast with the findings of Sufian and Habibullah (2009) and Sufian (2009). The main reason for this difference lies in the fact that different econometric techniques are used and a different time period is examined." Frankly, I am not sure what to make out of this.

Response: Thank you very much for the comments. A footnote has been added in the paper to further clarify the different econometric techniques used by Sufian (2009), Sufian and Habibullah (2009) and the current paper. Please see footnote 7 on page 10 for detail.

Fixed effect estimation is used by Sufian (2009), Sufian and Habibullah (2009) while we use GMM system estimator which is supposed provide more accurate and robust results.

d. The comment regarding insolvency risk is unclear. The author(s) affirm(s) that (p.13): "The results show that insolvency risk is significantly and positively related to bank profitability. This result is in contrast with the finding of Tan (2016) which reports that there is no robust impact of insolvency risk on bank profitability. The different finding is attributed to the fact that different insolvency risk indicators are being used…Our results imply that Chinese commercial banks can fully use their funds in engaging in different activities since the profitability of Chinese commercial banks is strongly protected by the government". Firstly, the coefficients are quite large so author(s) should look into their insolvency risk measure and standardize it. Secondly, what are those different indicators exactly? Lastly, how the author(s) reach last conclusion is beyond me.

Response: Thank you very much for the comments. The standardization of Z-score is used in the revised version of the paper. Please see footnote 2 on page 7 for detail. With regard to the different indicators used between Tan (2016) and current paper, this issue has been clearly addressed in footnote 8 on page 11. Finally, the last conclusion has been removed to get rid of confusion.

[2] Tan and Floros (2014) examine the period of 2003-2009, Tan (2016) uses the data from 2003-2011 while the current paper covers the period of 2003-2013.

Thanks very much to the referee's comment on this. Rather than using the ordinary Z-score, we use the standardized Z-score to obtain more robust results. The standardization of Z-score can be expressed as: $Z^{'} = (Z - Z_{mean}) / sd$ where $Z^{'}$ represents the standardization of Z, Z_{mean} represents the mean of Z and sd represents the standard deviation of Z.
Tan (2016) uses stability inefficiency as the insolvency risk indicator while the current study uses the standardized Z-score.

e. The comment regarding cost efficiency is completely wrong. The author(s) affirm(s) that (p.14): "Cost efficiency is shown to have a significant and negative impact on bank profitability (ROA).Our finding can be explained by the fact that banks with higher levels of efficiency focus on the volumes of loans made, while ignorance about the quality of the loans increases the volumes of non-performing loans and further leads to a reduction in bank profitability". Cost efficiency is not about maximising outputs (i.e. loans) so how can one reach such a conclusion is a puzzle.

Response: Thank you very much for the comments. The discussion with regard to the impact of cost efficiency on bank profitability has been re-written. Please see the second paragraph on page 12 for detail.

Cost efficiency is shown to have a significant and negative impact on bank profitability (ROA), but positive impact on ROE and NIM. However, Lerner index in Table 6 shows that Chinese commercial banks with higher levels of market power (lower level of competition) have lower profitability. The investigation on the impacts of efficiency and competition on bank profitability aims to test whether efficient-structure or structure-conduct-performance (SCP) paradigm holds. The current findings suggest that Chinese banking industry is in line with the SCP hypothesis.

f. Also, when presenting the main tables with results (like table 3 and 4) the author(s) should use standard errors instead of t-stat values.

Response: Thank you very much for the comments. The tables have been revised to report standard errors instead of t-stat values. Please see tables 5, 6, and 7 for detail.

g. Further, pending the re-estimation of the main tables, the results and conclusion section should be completely redrafted removing inconsistencies.

Response: Thank you very much for the comments. The models have been re-estimated according to the comments (separate estimations on Lerner index and cost efficiency as well as use the standardization of Z-score). Relevant revisions have been made to get rid of inconsistencies.