



## Competitions in different banking markets and shadow banking: evidence from China

Journal:	<i>International Journal of Emerging Markets</i>
Manuscript ID	IJOEM-04-2020-0401.R1
Manuscript Type:	Research Article
Keywords:	bank competition, shadow banking, China, Boone indicator

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## Competitions in different banking markets and shadow banking: evidence from China

### Abstract

**Purpose-** This study investigates the inter-relationships between competitions in different banking markets and shadow banking for the Chinese banking industry over the period 2003-2017. The current study also examines the determinants of competition in different banking markets and the factors influencing the size of shadow banking.

**Design/methodology/approach-** Bank competition is measured by Boone indicator, while the relationship between bank competition and shadow banking is examined through three-stage least Square estimator.

**Findings-** The findings suggest that a larger volume of shadow banking leads to a decline in the level of competition in the deposit market, loan market and non-interest income market, while an increase in the level of competition in the loan market, deposit market and non-interest income market leads to an expansion of shadow banking. We find that higher bank risk and higher developed of stock market reduce the competitive condition in the loan market, the competition in the deposit market will be enhanced by higher levels of banking sector development and higher levels of inflation, but bank diversification will reduce the level of competition in the deposit market. We further find that higher bank profitability and higher stock market development reduce bank competition in the non-interest income market. Finally, the results show that larger bank size and higher development of stock market reduce the size of shadow banking in China, but higher economic growth increases the size of shadow banking.

**Originality-** This is the first piece of research investigating the relationship between bank competition and shadow banking. This will also be the first piece of research examining the determinants of competition in different banking markets and also the factors influencing the size of shadowing banking in China.

Keywords: bank competition, shadow banking, China, Boone indicator

JEL classification: G21, C33

## 1. Introduction

The Chinese government has initiated several rounds of banking reforms since 1978. The main purpose of these banking reforms has been to increase competitive conditions, enhance stability and improve the performance of the Chinese banking sector (Tan, 2016a). With regards to the competitive condition in the Chinese banking industry, it is noticed that the state-owned commercial banks (SOCBs)<sup>1</sup> still dominate the industry. However, according to statistics from the China Banking Regulatory Commission (CBRC), the share of SOCB assets in total banking sector assets decreased between 2003 and 2017 to a low point of 36.77%. On the other hand, the joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) have kept increasing in size in a general trend and in 2017 they held 17.81% and 12.57% of total banking sector assets. Therefore, this statistic shows that the competitive condition is still quite low given that the five largest banks hold nearly 40% of total banking sector assets. Table 1 summarises the assets of SOCBs, JSCBs, CCBs and total banking institutions in China over the period 2003-2017.

<<Table 1---about here>>

The lower level of competition in the Chinese banking industry is not only represented by the concentration ratio in terms of total assets as illustrated before, this can also be reflected from different types of businesses engaged in by the Chinese commercial banks. In order to improve the competitive conditions in the deposit market and the loan market, the Central Bank of China (the Peoples' Bank of China) had made efforts to liberalise the interest rate since 1996. From 20<sup>th</sup> July 2013 and 23<sup>rd</sup> October 2015, the loan interest rate, as well as the deposit interest rate in China, had been liberalized. The effectiveness of interest rate liberalisation, in other words, the impact of interest rate liberalisation on the competitive conditions in the deposit market, the loan market, as well as the non-interest income market in China, has been a concern for the Chinese government and banking regulatory authorities in China. Recently, the issue has been investigated by Tan (2017). The results of the research show that over the period 2003-2013, the non-interest income market has a higher level of competition compared to the deposit market and loan market in the Chinese banking industry.

Although the financial reform in China, as characterised by the interest rate liberalisation, is supposed to increase the competitive conditions in different banking markets in China, because of the specific and special characteristics of the Chinese banking industry, the banking sector still allocates the

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<sup>1</sup> There are five state-owned commercial banks in China now, including Bank of China, Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China and Bank of Communication.

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3 credits (providing loan services) focusing on large or state-owned enterprises and the medium and  
4 small size enterprises find obtaining loans difficult, and thus, it is very difficult for them to be  
5 competitive and survive in the market (Elliott et al. (2015). This biased treatment to the micro, small  
6 and medium-sized enterprises has a significant and negative impact on Chinese economic growth.  
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8 Most of the funds for small and medium-sized enterprises are from shadow banking<sup>2</sup>. Table 2 shows  
9 the size and composition of China's shadow banking over the period 2003-2017 (Elliot et al., 2015,  
10 CNBC and Bloomberg). The table shows that the shadow banking is becoming more and more  
11 important in China.  
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17 <<Table 2---about here>>  
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19 Although there are few pieces of research studies investigating the relationship between shadow  
20 banking and interest rate liberalization in China (Wang et al., 2016; Hu, 2014), there is no study  
21 examining the inter-relationship between shadow banking and competition in different banking  
22 markets (loan market, deposit market and non-interest income market) in China. Investigating this  
23 issue is very important from two different perspectives. First, the examination on the impact of  
24 competition in three different markets on shadow banking will provide more policy implications to  
25 the Chinese government and financial authorities in related to how to further solve the issue of  
26 difficulty for the small and medium sized enterprises to get funding, i.e. through further regulation  
27 on the environment for traditional banking businesses and non-traditional activities engaged in by the  
28 banks, the resulted influence on the growth of shadow banking can further increase the funding  
29 channels for the small and medium sized enterprises. Second, the investigation on the influence of  
30 shadow banking on competition in different banking markets can provide additional channel to adjust  
31 the level of competition in the banking market through better and proper regulation on the non-  
32 banking financial market. On the one hand, the increase in the size of shadow banking takes away  
33 large amounts of loan businesses engaged in by the Chinese commercial banks, as the main source of  
34 bank income, this will increase the competition among Chinese commercial banks in the loan business.  
35 In addition, stronger competition in the loan market indicates that it is more difficult for the banks to  
36 grant credits to businesses. In order words, the volume of loan businesses engaged in by the Chinese  
37 commercial banks will be decreased, this further leads to a decline in the level of competition in the  
38 deposit market. Finally, a large amount of shadow banking not only takes away the loan business  
39 from commercial banks, but takes away the non-interest income generating business as well, this will  
40 lead to an increase in the level of competition among Chinese commercial banks in the non-interest  
41 income market.  
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60 <sup>2</sup> The Financial Stability Board (2013) defines shadow banking as credit intermediation involving entities and activities  
outside the regular banking system.

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5 On the other hand, lower level of competition in the loan market in the Chinese banking industry  
6 indicates that a large number of firms need the loans, this gives a big opportunity for the development  
7 of shadow banking in China. In other words, lower level of competition in the loan market leads to  
8 an increase in the size of shadow banking in China. In addition, increase in the level of competition  
9 in the deposit market in the Chinese banking industry reflects the fact that the Chinese commercial  
10 banks are short of funds to make loans, this will further lead to an expansion of shadow banking in  
11 China. Finally, lower level of competition in the non-interest income market in the Chinese banking  
12 industry indicates that Chinese commercial banks still focus on providing loan services to different  
13 enterprises, this is supposed to restrain the development of shadow banking in China.  
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22 In summary, the current study fills the gaps in the empirical literature in the following three ways: 1)  
23 as the literature review section indicates, we will contribute to the existing studies by investigating  
24 the inter-relationships between competition in different banking markets and bank competition, this  
25 will be useful for the Chinese government and financial regulatory authority to regulate the shadow  
26 banking system through making relevant policies in the banking industry and also regulate the  
27 competition in different banking markets through making relevant policies to control the size of  
28 shadow banking; 2) as far as we are concerned, there has been no published empirical study  
29 examining the determinants of competition in different banking markets (loan market, deposit market  
30 and non-interest income market); we will investigate this issue in the current study; 3) besides the  
31 examination on the impact of competition on shadow banking as reflected from the first contribution,  
32 we will also investigate the factors that influence the size of shadow banking system in China. The  
33 latter two contributions are very useful for the government and financial regulatory authority to make  
34 specific policies to regulate either bank competition or/and shadow banking in China.  
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46 The findings show that an increase in the volume of shadow banking leads to a decline in the  
47 competitive condition in the loan market, deposit market and non-interest income market, while the  
48 increase in the level of competition in the loan market, deposit market and non-interest income market  
49 leads to an increase in the volume of shadow banking in China. We find that higher bank risk and  
50 higher developed of stock market reduce the competitive condition in the loan market, the competition  
51 in the deposit market will be enhanced by higher levels of banking sector development and higher  
52 levels of inflation, but bank diversification will reduce the level of competition in the deposit market.  
53 We further find that higher bank profitability and higher stock market development reduce bank  
54 competition in the non-interest income market. Finally, the results show that larger bank size and  
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3 higher development of stock market reduce the size of shadow banking in China, but higher economic  
4 growth increases the size of shadow banking.  
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8 This paper will be structured as follows: section 2 will review the empirical literature on bank  
9 competition, shadow banking and its relationships, which is followed by section 3, describing the  
10 data and methods. Section 4 reports the results, followed by discussing the robustness check in section  
11 5. Finally, section 6 provides a summary and conclusion of the whole paper.  
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## 17 2. Literature review on bank competition

### 18 2.1 Empirical literature on bank competition in China

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21 There are a number of studies investigating the competitive conditions in the Chinese banking  
22 industry using different methods including Lerner index (Tan and Floros, 2013; Tan and Floros, 2014;  
23 Tan, 2016a; Tan et al., 2017; Tan and Anchor, 2017b; Tan and Floros, 2018a; Fungacova et al., 2013);  
24 Panzar-Rosse H statistic (Tan, 2014; Tan, 2016b); Efficiency-adjusted Lerner index (Tan and Anchor,  
25 2017a; Tan and Floros, 2018b), concentration ratio and Hirfindahl-Hirschmann index (Tan and Floros,  
26 2012b, Tan and Floros, 2012c; Tan, 2016, Tan, 2014)  
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33 Although the above-mentioned studies use different methods to estimate the level of competition in  
34 the Chinese banking industry, none of the above-mentioned methods evaluates the competitive  
35 conditions in different banking markets in China.  
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40 Tan (2017a) innovatively uses the Boone indicator to investigate the competitive conditions of  
41 different banking markets (deposit market, loan market and non-interest income market) in China  
42 over the period 2003-2009 and further tests the effects of competition and shadow banking on bank  
43 profitability in China. The results indicate that non-interest income market in the Chinese banking  
44 industry has a higher level of competition compared to deposit market and loan market, and a lower  
45 level of competition in the deposit market leads to an increase in the profitability of Chinese banks.  
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52 Using the Boone indicator as the competition measurement, Tan (2017b) investigate the competitive  
53 condition in the loan market, deposit market and non-interest income market in the Chinese banking  
54 industry over the period 2003-2013 and further tests its inter-relationships with different types of risk  
55 (credit risk, liquidity risk, capital risk and insolvency) and different types of efficiency (cost  
56 efficiency, revenue efficiency and profit efficiency) of Chinese commercial banks under a three-stage  
57 least square estimation. The results indicate that higher level of competition leads to higher credit  
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3 risk, higher liquidity risk and higher capital risk, while a higher level of competition leads to lower  
4 level of efficiency of Chinese commercial banks.  
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## 8 2.2 Literature review on shadow banking in China 9

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11 Although data on shadow banking in China is available, the research in this topic has not received  
12 enough attention from academia and there are very limited research studies examining this important  
13 issue. Allen et al. (2019) collected the data from all public nonfinancial firms' annual reports over the  
14 period 2004-2013 and had a close look at the largest component of shadow banking in China, which  
15 is entrusted loans. The performance of transaction level analysis shows that the level of interest rate  
16 charged by nonaffiliated loans is twice as high as the one offered by the official bank loan rate, while  
17 the level of interest rate charged by the affiliated loans is roughly the same as the one of the official  
18 bank loan rate. The findings further show that there is a level of difference between the nonaffiliated  
19 loans and the affiliated loans with nearly half of the former flow into real estate and construction and  
20 the latter are within-industry loans. Finally, the results report that although borrowers' fundamental  
21 and information risks are the determinants of pricing of both these two types of loans, the risk is  
22 incorporated in the rate of nonaffiliated loans in a more efficient way.  
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34 Rather than looking at the specific component of Chinese shadow banking, Chen et al. (2018)  
35 examine the influence of monetary policy on Chinese shadow banking activities over the period 2009-  
36 2015. The study contributes to the empirical literature by developing and estimating the endogenously  
37 switching monetary policy rule and the findings suggest that the shadow banking loans rise rapidly  
38 under the contractionary monetary policy, this increased in the volumes of shadow banking loans  
39 does not only offset the expected decline of the traditional banking loans, but reduce the level of  
40 effectiveness of monetary policy on banking credit allocation.  
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48 Different from the above two studies investigate the specific component of shadow banking and the  
49 relationship between monetary policy and shadow banking, Chen et al. (2020) investigate the impact  
50 of China's stimulus package in 2009 on the growth of shadow banking. Therefore, this study  
51 differentiates itself from the previous two studies by analyzing the influence on the shadow banking  
52 activities from the local government perspectives. The findings suggest that the provinces with higher  
53 degrees of loan growth in 2009 not only experience an increase in the volumes of municipal bond  
54 issuance over the period 2012-2015, but also experience a boom in the level of shadow banking  
55 activities including trust loans and wealth management products.  
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### 2.3. the investigation on the relationship between shadow banking and bank competition

There are few pieces of research examining the relationship between shadow banking and bank competition. The studies focused on the issue both within the Chinese financial system as well as the one outside of China. Using the US data, Ann and Breton (2014) examine the impact of loan securitization on competition in the loan market. This study suffers from the limitation that the shadow banking is represented by the securitization and the results cannot be generalized to the whole shadow banking markets, another limitation of the study lies to the fact that there is no explicit consideration on the level of competition in different banking markets.

There are also few studies evaluating the relationship between shadow banking and bank competition in China. On top of Tan (2017) examining the shadow banking as well as its impact on bank profitability, Guo and Zhao (2017) used 16 Chinese commercial banks during 2008-2015 to assess the relationship between deposit competition and shadow banking. The study failed to identify the level of competition in another two important areas in banking operation which are competition in the loan market as well as competition in the non-interest income market, therefore, the study also missed the investigation on the inter-relationship between the competition in these different banking markets and bank competition.

Instead of investigating the relationship between shadowing banking and deposit competition with a additional analysis of the intermediate role played by shadow banking in the influence of bank competition on risk-taking behavior, Zhou (2019) examined the relationship between bank competition and shadow banking using a sample of listed Chinese commercial banks over the period 2007-2017. The study further evaluates the effect of shadow banking on the effectiveness of monetary policy. This study suffers the same limitation as the one of Guo and Zhao (2017).

In summary, through the review of empirical literature on investigating the competitive condition in the banking sector in China as well as the empirical research studies on the investigation of shadow banking in China, it is noticed that there is no empirical research examining the relationship between bank competition and shadow banking. The current research fills in the gap of the empirical literature from this perspective. In addition, this will be the first piece of research examining the determinants of competition in different banking markets and also the factors influencing the size of shadowing banking in China.



### 3. Data and Methodology

#### 3.1. Measurement of competitive condition in different banking markets in China—Boone indicator

As reviewed in the literature review section, Lerner index and Panzar-Rosse H statistics are widely used in the empirical literature to estimate the level of competition in the banking industry. However, Leuvensteijn et al. (2007) argue that due to the fact that the Panzar-Rosse H statistics are developed based on the static model, there would be no prediction on the value and this indicator suffers from the limitation that it can not fulfil the overall market equilibrium requirement (Claessens and Laeven, 2004). The Lerner index is suffered from the limitation in terms of the difficulty to derive the marginal cost, because of different methods can be adopted to measure the marginal cost, therefore, the accuracy and robustness in related to the level of competition are affected (Fukuyama and Tan, 2020). Kwoka (1977) argue that the main limitation suffered by the Hirfindahl-Hirschman index is related to the fact that this indicator embodies both size inequality and firm numbers with weight, which are assumed a priori instead of being derived. Finally, Maksimović & Kostić (2012) argue that the concentration ratio suffers from the limitation of its inability to acknowledge market structure stability, level of product differentiation, entry barriers as well as operating cost.

The current study uses the method proposed by Boone (2008) to measure the competition. The Boone indicator holds the idea that the performance of efficient firms is improved and the performance of inefficient firms is weakened by competition. The basic logic of Boone indicator is in line with the argument of efficiency structure hypothesis, as developed by Demsetz (1973), which links the influence of efficiency on performance. The performance can be measured by profit or market share. A stronger effect will lead to a more negative Boone indicator. Although this indicator suffers from the same disadvantage as the Lerner index in terms of the estimation of marginal cost, this indicator is superior to other indicators for its ability to estimate competition in different banking markets and competition for different bank ownership types (Tan, 2018). The Boone indicator for bank  $i$  can be defined by the simplest equation as follows:

$$LN(MS_{ki}) = \alpha + \beta LN(MC_{ki}) \quad (1)$$

Where  $i$  represents the specific bank,  $k$  stands for a specific bank output,  $MS$  is the market share, while  $MC$  measures the marginal cost.  $\beta$  denotes the Boone indicator. In this paper, we focus on the analysis of competition in different markets, reflecting interest income activities as well as non-interest generating businesses. Thus,  $K$ =loans, deposits, non-interest income.

The marginal cost is estimated on the basis of a translog cost function with four outputs (total loans, total deposits, securities and non-interest income) and two input prices (price of labour, price of capital). The specification of the translog cost function is shown below (Tabak et al., 2012):

$$LN\left(\frac{C}{W_2}\right)_{it} = \delta_0 + \sum_j \delta_j LNY_{jit} + \frac{1}{2} \sum_j \sum_k \delta_{jk} LNY_{jit} LNY_{kit} + \beta_1 LN\left(\frac{W_1}{W_2}\right)_{it} + \frac{1}{2} \beta_{11} LN\left(\frac{W_1}{W_2}\right)_{it} LN\left(\frac{W_1}{W_2}\right)_{it} + \sum_j \theta_j LNY_{jit} LN\left(\frac{W_1}{W_2}\right)_{it} + \varepsilon_{it} \quad (2)$$

where C represents total cost of the bank, Y represents four outputs, including total deposits, total loans, non-interest income and securities, W stands for two input prices with W1 representing the price of funds, which is measured by the ratio of interest expenses to total deposits, W2 represents the price of capital, which is measured by the ratio of non-interest expenses to fixed assets. Two input prices are considered due to the fact that non-interest expenses include the labour cost as well (Hasan and Morton, 2003). In other words, the price of capital considers the factors relating to the price of physical capital as well as the price of human capital. The linear homogeneity is ensured by normalising the dependent variable and W1 by another input price, W2. The summary statistics of the variables are reported in Table 3. The statistics provided in Table 3 show that as compared to the price of funds, the Chinese commercial banks have a larger difference in the price of capital. This finding indicates that the Chinese commercial banks should place more emphasis on controlling the non-interest expenses. In addition, with regard to the banking outputs, the table suggests that Chinese commercial banks have the largest difference in generating the non-interest income, while they have the smallest difference in generating deposits.

<<Table 3---about here>>

The marginal cost of loans can be obtained by taking the first derivative of the dependent variable in the above equation in relation to the output loans as follows:

$$MC_{ilt} = \left(\frac{C_{it}}{Y_{ilt}}\right) \left(\delta_{j=l} + 2\delta_{ll} LNY_{ilt} + \sum_{k=1, \dots, k, k \neq l} \delta_{lk} LNY_{ikt} + \theta_l LN\left(\frac{W_1}{W_2}\right)\right) \quad (3)$$

The marginal cost of deposit and non-interest income can be obtained similarly by taking the first derivative of the dependent variable in the above equation in relation to the outputs deposits and non-interest income as below:

$$MC_{idt} = \left(\frac{C_{it}/W_2}{Y_{idt}}\right)(\delta_{j=d} + 2\delta_{dd}LNY_{idt} + \sum_{k=1\dots k, k \neq d} \delta_{dk}LNY_{ikt} + \theta_1 LN(\frac{W_1}{W_2})) \quad (4)$$

$$MC_{int} = \left(\frac{C_{it}/W_2}{Y_{int}}\right)(\delta_{j=n} + 2\delta_{nn}LNY_{int} + \sum_{k=1\dots k, k \neq n} \delta_{nk}LNY_{ikt} + \theta_1 LN(\frac{W_1}{W_2})) \quad (5)$$

### 3.2. Estimation on the inter-relationships between bank competition and shadow banking

We rely on the three-stage least square estimation to investigate the inter-relationships between bank competition and shadow banking as it takes account the endogeneity between bank competition and shadow banking in China

In order to disentangle the inter-relationships between bank competition and shadow banking, the following equations are estimated:

$$BooneLoan_t = \beta_0 + \beta_1 shadow_t + \beta_2 BSD_t + \beta_3 SMD_t + \beta_3 Risk_{it} \quad (6)$$

$$BooneDeposit_t = \alpha_0 + \alpha_1 shadow_t + \alpha_2 BSD_t + \alpha_3 Diverse_{it} + \alpha_4 INF_t \quad (7)$$

$$BooneNII_t = \delta_0 + \delta_1 shadow_t + \delta_2 SMD_t + \delta_3 Profit_{it} \quad (8)$$

$$shadow_t = \gamma_0 + \gamma_1 Boone_{it} + \gamma_2 SMD_{it} + \gamma_3 GDPG_t + \gamma_4 Size_{it} \quad (9)$$

Where  $t$  denotes the time dimension. BooneLoan represent the competitive condition in the loan market, BooneDeposit stands for the competitive condition in the deposit market, while BooneNII is the competitive condition in the non-interest income market, shadow represents the size of shadow banking in China. We control for different bank-specific, industry-specific and macroeconomic variables which are supposed to have an influence on bank competition and shadow banking in China. The bank specific variables include bank profitability, measured by the net interest margin (ratio of net interest income to earning assets); bank risk, measured by the ratio of non-performing loans to total loans, bank diversification, measured by the ratio of non-interest income to gross revenue and bank size, measured by the natural logarithm of total assets. The industry-specific variables are BSD and SMD, representing banking sector development and stock market development, respectively, while there are two macroeconomic variables considered in the current study which are INF (annual inflation rate) and GDPG (annual GDP growth rate).

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3 In order to use the three-stage least square estimator in the analysis, a set of unique variables are  
4 needed for a specific equation but not the other three. These instruments are supposed to be  
5 exogenous and do not correlate with the error term. We expect that the following variables only  
6 affect specific dependent variables, therefore, they only appear in one specific equation but not the  
7 other three.  
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12 Equation 6 only

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15 Bank risk is used in this equation, it is measured by the ratio of non-performing loans to total loans.  
16 We expect that higher levels of credit risk will induce the banks to be more cautious in making the  
17 credit allocation decisions, they will be more selective and raising the requirement on the loan  
18 applications made by different businesses, comparing to the scenario when there is a very low level  
19 of credit risk during which the banks would compete very strongly in the loan market, the higher  
20 levels of risk will reduce the level of competition in the loan market.  
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26 Equation 7 only

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29 Bank diversification is used in this equation, it is measured by the ratio of non-interest income to  
30 gross revenue. We argue that higher levels of diversification will reduce the reliance on the  
31 traditional deposit and loan businesses engaged in by the banks, more resources and efforts will be  
32 diverted to other businesses, this is supposed to reduce the level of competition in the deposit  
33 market.  
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38 Equation 8 only

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41 Bank profitability is used in this equation. It is measured by the net interest margin (the ratio of net  
42 interest income to earning assets). The whole banking business can be generally divided into two  
43 parts, the traditional interest generating businesses as well as the non-traditional non-interest  
44 generating activities. Bank profitability, as measured by the net interest margin, reflect the level of  
45 profitability in the traditional interest generating businesses, a higher level of profitability indicates  
46 that banks would be able to get more profits from engaging in this specific activity, more resources  
47 will be allocated to this business area and this is supposed to lead to a decrease in the level of  
48 competition in the non-traditional non-interest generating businesses.  
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55 Equation 9 only

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58 Bank size is used in this equation. It is measured by the natural logarithm of total assets. Large  
59 banks would be able to reduce the costs from economies of scale and economies of scope, the  
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3 reduction would be helpful to reduce the level of loan price. In other words, lower levels of cost  
4 derived from economies of scale and scope would expand the credits available from the traditional  
5 banking, this will also constraint the amount of credits from the shadow banking sector.  
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9 We conduct the over-identification test and the test statistics show that the instruments used are  
10 valid.  
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13 The competitive condition in different banking markets including deposit market, loan market and  
14 non-interest income market will be assessed through the Boone indicator as illustrated in the previous  
15 section, and the variables used to measure the Boone indicator is collected from Bankscope and  
16 fithconnect databases. The size of shadow banking will be measured by the volume of shadow  
17 banking. It is from Elliott et al. (2015), CNBC and Bloomberg. With regard to the measurement of  
18 industry-specific variables, the banking sector development is measured by the ratio of total assets of  
19 the whole banking industry to GDP and stock market development is measured by the ratio of market  
20 capitalization of listed firms to GDP, the data is retrieved from China Banking Regulatory Authority  
21 and World Bank database, with regard to the data of macroeconomic variables, both annual inflation  
22 rate and GDP growth rate are obtained from the world bank database. The selection of the variables  
23 that have potential influence on the level of competition in different banking markets is in line with  
24 Tan (2017b). with regard to the selection of the controlled variables that have potential influence on  
25 shadow banking, we mainly have the following considerations: higher levels of stock market  
26 development will provide an additional channel for the small and medium sized enterprises to raise  
27 funding besides the traditional banking loans, this will also crowd out the role of shadow banking in  
28 the process of credit allocation and further reduce the size of shadow banking. In terms of inflation,  
29 we argue that higher levels of inflation result in a contraction of credits, this will include the traditional  
30 banking credits as well as the one provided in the shadow banking sector. Totally, we collect a  
31 balanced dataset of 30 Chinese commercial banks over the period 2003-2017 including 5 state-owned  
32 commercial banks, 12 joint-stock commercial banks and 13 city commercial banks. Table 4 provides  
33 the information with regard to the measurement of the variables, the source of data as well as the  
34 expected impact on shadow banking and competition in different banking markets. Table 5 present  
35 the descriptive statistics of the variables in the current study. It is noticed that the competition in  
36 different banking markets in China (deposit market, loan market and non-interest income market)  
37 over the examined period does not have too much difference, in comparison, it is found that the  
38 shadow banking and stock market development have a relatively large dispersion over the examined  
39 period.  
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<<Table 4---about here>>

<<Table 5---about here>>

## 4. Empirical results

### 4.1. Findings on the competitive conditions of different banking markets in China

Comparing the competitive conditions among the above three different banking markets, it was noticed that over the period 2006-2013, the competitive condition in these three different markets was the same. The main difference was noticed during the period 2003-2005 and 2014-2017. Figure 1 shows that the competitive condition in the non-interest income market was the highest, in general, between 2003 and 2005, and between 2014 and 2017 compared to the other two markets, while the competitive condition in the loan market and the deposit market were the same over the same period.

This finding is partly in line with Tan (2017).

<<Figure 1---about here>>

### 4.2. Findings on the inter-relationships between bank competition and shadow banking in China

Before proceeding to the econometric estimation on the inter-relationships between bank competition and shadow banking in China, the correlation between the variables has been tested to make sure that there is no multicollinearity issue. The results show that the correlation among variables is below 0.5, which indicates that the analysis does not suffer from any multicollinearity problem<sup>3</sup>. In order to test the inter-relationships between competition in different banking markets and shadow banking in an accurate way, we control for the individual bank effect as well as the time trend in the models. Most importantly, the results reported are adjusted by standard errors. Table 6 shows the empirical results with regard to the inter-relationship between bank competition and size of shadow banking in China (when we focus on the impact of bank competition in the deposit market on shadow banking). The findings show that the size of shadow banking is significantly and negatively related to the competitive condition in the deposit market, loan market and non-interest income market in the Chinese banking industry, indicating that larger volume of shadow banking in China reduces the competitive condition among Chinese commercial banks. The significant and negative impact of shadow banking on the competitive condition in the deposit market is in line with our expectation as outline in the Introduction, while the impacts on competition in the loan market and the non-interest income market are in contrast with our expectation. The negative impact of

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<sup>3</sup> The results with regard to the correlation is not provided in the text, however, it is available upon request from the corresponding author.

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3 shadow banking on the level of competition in the loan market can be explained by the fact that  
4 medium and small size enterprises have a higher probability and larger opportunities to get funding  
5 from better development in the shadow banking, and the traditional banking industry mainly focuses  
6 on granting credits to relatively larger size enterprises, all the Chinese commercial banks have  
7 established stable relationship with relevant enterprises, in other words, each bank has its own  
8 customers in terms of credit allocation, this leads to a less competitive condition in the loan market.  
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10 The same as the loan market, larger volume of shadow banking in China takes away larger amount  
11 of non-traditional banking businesses from the traditional banking sector, while Chinese commercial  
12 banks mainly engage in the non-interest income generating activities with its established customers,  
13 under this circumstance, the competitive condition is quite low in the non-interest income market.  
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15 The findings further indicate that higher level of competition in the deposit market leads to an  
16 increase in the volume of shadow banking, this is in accordance with our expectation as discussed  
17 in the Introduction.  
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28 The results from the table further report that higher developed banking sector leads to a higher level  
29 of competition in the deposit market. This is due to the fact that higher developed banking sector  
30 indicates that there is a larger demand for banking services and in order to provide different types  
31 of services, the Chinese commercial banks need large a volume of funds, this fund is mainly from  
32 the deposit. In other words, the higher developed banking sector induce Chinese commercial banks  
33 to compete more in the deposit market in order to get more funds. The results show that higher  
34 developed stock market leads to a reduction in the level of competition in the loan market and non-  
35 interest income market in the Chinese banking industry, as reflected by the significant and positive  
36 signs of the variable. This finding can be explained by the fact that higher developed stock market  
37 provides an additional source of funding for different companies, the resulted reduction in the  
38 demand for loans from commercial banks decreases the price of loans, which further precede a  
39 decline in bank competition in this market. A higher developed stock market attracts more funds  
40 from the public and significantly reduces the volume of non-traditional business engaged in by the  
41 commercial banks, the resulted increase in the cost of engaging in the non-interest income activities  
42 reduces the incentive of commercial banks to engage in this activity and further leads to a decline in  
43 the competition in the non-interest income market. It is found that higher level of inflation leads to  
44 an increase in the level of bank competition in the deposit market. This can be explained by the fact  
45 that higher inflation reflects the fact that there is an excessive circulation with regard to the amount  
46 of currency in the market, rather than saving the money in the banks, people will normally prefer to  
47 spend the money in the money, this will lead to a situation that Chinese commercial banks are short  
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of funds to make loans. This will further lead to an increase in the level of competition in the deposit market. We also have the following results which are in line with our expectation: 1) higher levels of stock market development reduce the size of shadow banking; 2) higher bank risk reduces the level of competition in the loan market and higher profitability reduces the level of competition in the non-interest income market; 3) large bank size reduces the size of shadow banking; 4) GDP growth increases the size of shadow banking.

Table 7 and Table 8 test the impact of competition in the loan market on the size of shadow banking and the effect of competition in the non-interest income market on the size of shadow banking, respectively. The findings suggest that higher level of competition in the loan market leads to an expansion of shadow banking in China and also the size of shadowing banking will increase if the competitive condition in the non-interest income market in the Chinese banking industry improves. The impact of the level of competition in the non-interest income market on shadow banking is in accordance with our expectation in the introduction, however, the impact of competition in the loan market on shadow banking is different from our expectation. The significant and positive impact of competition in the loan market on shadow banking can be explained by the fact that higher level of competition in the loan market indicates that there are not too many companies seeking loans and probably that the country is slowing down the economic growth, under this period, the commercial banks will be very selective on the companies to which they grant credit due to the consideration that there would an increase in the non-performing loans in this period. This will make the medium and small size enterprises more difficult to obtain loans from commercial banks, therefore, this will lead to an expansion of shadow banking in China. Table 9 provides a summary of the significant variables in the analysis.

<<Table 6---about here>>

<<Table 7---about here>>

<<Table 8---about here>>

<<Table 9---about here>>

## 5. Robustness check

In order to check the robustness of the results, the current study mainly focuses on the use of the following two ways: 1) instead of using the Boone indicator to measure the competitive condition



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3 in the deposit market, loan market and non-interest income market in China, the current study uses  
4 the Herfindahl-Hirschman index to measure the competition in these three different markets; 2) in  
5 terms of the econometric techniques, the current study cross check the robustness of the results by  
6 using the Seemingly Unrelated Regression rather than the three-stage Least square estimator.  
7 Through the use of the above two ways, the results show that the findings of our original estimation  
8 are robust due to the fact that the findings of these three different estimations are quantitatively  
9 similar<sup>4</sup>.

## 15 6. Summary and conclusion

16 Although the development of the banking industry plays an important part to the economic growth of  
17 a country and it is a traditional source of funding for different types of enterprises, it is still quite  
18 difficult for the medium and small size enterprises to get funding from the banking sector. This  
19 induces the small and medium-size enterprises to seek funding from the non-banking sector and  
20 further promote the development of the shadow banking industry in China. As the official statistics  
21 show that the shadow banking in China has undergone significant growth during recent years. What  
22 will be the impact of the development of shadow banking on the traditional banking sector and at the  
23 same time, what will be the influence of the traditional banking industry on the shadow banking  
24 industry? The answers to these questions will not only contribute to the empirical literature, but  
25 provide more policy implications to the Chinese government and regulatory authorities to further  
26 develop the traditional banking industry and the shadow banking industry. The current study  
27 contributes to the empirical banking literature by being the first piece of research investigating the  
28 inter-relationships between bank competition and shadow banking using a sample of Chinese  
29 commercial banks over the period 2003-2017 under a three-stage least square estimator. In addition,  
30 the current study fills in the gap of the empirical literature by investigating the determinants of  
31 competition in different banking markets (loan market, deposit market and non-interest income  
32 market) and also the factors influencing the size of shadow banking in China.

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The findings suggest that larger volume of shadow banking leads to a decline in competition in the  
loan market, deposit market and non-interest income market. The results further show that higher  
level of competition in the loan market, deposit market and non-interest income market results in an  
increase in the volume of shadow banking in China. We find that higher bank risk and higher  
developed of stock market reduce the competitive condition in the loan market, while the competition  
in the deposit market will be enhanced by higher levels of banking sector development and higher

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<sup>4</sup> The estimation results of the robustness check are not reported in the paper; however, they are available from request from the corresponding author.

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levels of inflation, but bank diversification will reduce the level of competition in the deposit market. We further find that higher bank profitability and higher stock market development reduce bank competition in the non-interest income market. Finally, the results show that larger bank size and higher development of stock market reduce the size of shadow banking in China, but higher economic growth increases the size of shadow banking.

The findings provide important policy implications to the Chinese government and regulatory authorities as follows: 1) the Chinese banks should further enhance the risk management practice, the reduction in the risk level will increase the competition in the loan market and further increase the size of shadow banking, this will provide more fundings to the small and medium sized enterprises; 2) the government and financial regulatory authorities should consider to control the stock market development, because a lower level of stock market development will increase the competitive condition in the banking market and further increase the size of shadow banking, the expansion of shadow banking can further increase the funding channels for the small and medium sized enterprises; 3) the government and financial regulatory authority should further consider to improve the banking sector development by encouraging more innovation in financial products, this will be also helpful for the shadow banking expansion.

Future research can focus on the investigation of the inter-relationships between risk, performance, competition and shadow banking and also the data can be expanded to include a number of different countries in a region (Asia, North America, or Europe) to test whether the similar or different results will be obtained.

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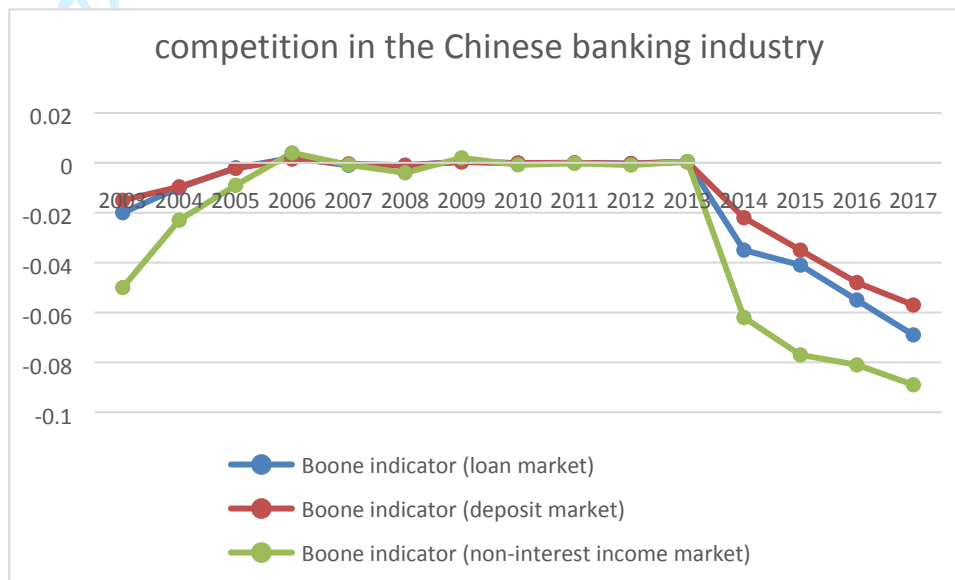
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**Table 1 Summary of the assets of SOCBs, JSCBs, CCBs and total banking institutions in China over the period 2003-2017**

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
SOCBs	160512 (58.03%)	179817 (56.9%)	210050 (56.1%)	242364 (55.2%)	285000 (53.7%)	325751 (51.59%)	407998 (51.31%)	468943 (49.2%)	536336 (47.34%)	600401 (52.84%)	656005 (43.34%)	710141 (41.21%)	781630 (39.21%)	865982 (37.29%)	928145 (36.77%)
JSCBs	29599 (10.7%)	36476 (11.5%)	44655 (11.92%)	54446 (12.4%)	72742 (13.69%)	88337 (13.99%)	118181 (14.86%)	149037 (15.64%)	183794 (16.22%)	235271 (20.71%)	269361 (17.8%)	313801 (18.21%)	369880 (18.55%)	434732 (18.72%)	449620 (17.81%)
CCBs	14622 (5.3%)	17056 (5.4%)	20367 (5.44%)	25938 (5.9%)	33405 (6.29%)	41320 (6.54%)	56800 (7.14%)	78526 (8.24%)	99845 (8.81%)	123469 (10.87%)	151778 (10.03%)	180842 (10.49%)	226802 (11.38%)	282378 (12.16)	317217 (12.57%)
Banking institutions	276584	315990	374697	439500	531160	631515	795146	953053	1132873	1136224	1513547	1723355	1993454	2322532	2524040

• The data above is collected from CBRC (China Banking Regulatory Commission) annual reports, and the figures are in RMB 100 million.

**Figure 1 Competitive condition in different banking markets in China over 2003-2017**



• The graph is made of data from Bankscope and fitchconnect databases as well as own estimation.

**Table 2 Size and composition of China's shadow banking during 2003-2017 (RMB 1 billion)**

	Total	%GDP	Domestic credit to private sector by banks over GDP (%)
2003	784	6	125.52
2004	1067	7	118.55
2005	1266	7	111.81
2006	2212	11	109.13
2007	3503	13	105.71
2008	4530	14	101.9
2009	5995	17	124.2
2010	11111	27	126.29
2011	14180	29	122.75
2012	19207	36	128.49
2013	24952	42	133.8
2014	29000	45	140.74
2015	32000	46	153.23
2016	44000	59	157.57
2017	48000	58	157.02

• The data is collected from Elliott et al. (2015), CNBC and Bloomberg



**Table 3 Summary statistics**

<b>Variables</b>	<b>Observations</b>	<b>Mean</b>	<b>S.D</b>	<b>Min</b>	<b>Max</b>
Total cost (interest expenses and non-interest expenses)	450	3.35	0.97	-0.79	6.86
Price of funds (the ratio of interest expenses to total deposits)	450	1.27	0.18	0.74	1.96
Price of capital (the ratio of non-interest expenses to fixed assets)	450	1.92	0.26	0.68	2.83
Total loans	450	4.59	0.99	0.34	7.95
Securities	450	4.21	1.04	-0.41	7.87
Non-interest income	450	2.34	1.1	-2.4	5.81
Total deposits	450	4.85	0.98	0.66	8.26

Table 4 description of the variables in the current study, data source and expected impact

Variables	Measurement	Data source	Expected impact
Competition in the loan market	Boone indicator	Bankscope and fitchconnect	shadow banking (+)
Competition in the deposit market	Boone indicator	Bankscope and fitchconnect	shadow banking (+)
Competition in the non-interest income market	Boone indicator	Bankscope and fitchconnect	Shadow banking (+)
Shadow banking	Volume of shadow banking	Elliott et al. (2015), CNBC and Bloomberg	competition in loan market (+) competition in deposit market (+) competition in non-interest income market (+)
Banking sector development	The ratio of total assets in the banking industry to GDP	CBRC	competition in loan market (-) competition in deposit market (+)
Stock market development	The ratio of market capitalization of listed companies to GDP	World Bank	competition in loan market (+) competition in non-interest income market (+) shadow banking (-)
Inflation	Annual inflation rate	World Bank	Competition in deposit market (-) Shadow banking (-)
GDPG	Annual GDP growth rate	World Bank	Shadow banking (+)
Bank profitability	Ratio of net interest income to earning assets	Bankscope and Fitchconnect	Competition in the non-interest income market (-)
Bank risk	Ratio of non-performing loans to total loans	Bankscope and Fitchconnect	Competition in the loan market (-)
Bank diversification	Ratio of non-interest income to gross revenue	Bankscope and Fitchconnect	Competition in the deposit market (-)
Bank size	Natural logarithm of total assets	Bankscope and Fitchconnect	Shadow banking (-)

Table 5 descriptive statistics of the variables

Variables	observations	Mean	Standard deviation	Minimum	Maximum
BooneLoan	450	-0.003	0.006	-0.02	0.002
BooneDeposit	450	-0.002	0.005	-0.015	0.002
BooneNII	450	-0.007	0.02	-0.05	0.004
Shadow banking	450	8073.364	7843.101	784	24952
Bank profitability	450	2.66	0.83	0.54	3.29
Bank risk	450	2.78	4.48	0	13.86
Bank diversification	450	13.98	13.31	-12.94	79.4
bank size	450	4.9	0.992	0.71	8.51
Banking sector development	450	2.22	0.24	1.98	2.66
Stock market development	450	71.19625	43.48973	31.9	184.1
inflation	450	2.859796	1.923602	-.77	5.86
GDP growth rate	450	10.19091	1.869885	7.7	14.2

• BooneLoan indicates the competitive condition in the loan market, BooneDeposit represents the competitive condition in the deposit market and BooneNII stands for the competitive condition in the non-interest income market.

Table 6 3SLS empirical results on the inter-relationships between competition and shadow banking (deposit market)

	Equation 1: BooneLoan as the dependent variable	Equation 2: BooneDeposit as the dependent variable	Equation 3: BooneNII as the dependent variable	Equation 4: shadow banking as the dependent variable
Shadow banking	0.13*** (4.48)	0.15*** (5.51)	0.11*** (4.56)	
BonneDeposit				-0.05** (-7.22)
Banking sector development	0.015 (0.38)	-0.09*** (-7.03)		
Stock market development	0.0001*** (8.18)		0.001*** (8.97)	-0.08*** (8.83)
inflation		-0.009*** (-6.69)		
GDP growth rate				0.61*** (5.53)
Bank profitability			0.11*** (7.17)	
Bank risk	0.05*** (4.93)			
Bank size				-0.11*** (-4.94)
Bank diversification		0.07*** (4.13)		
constant	-0.19*** (-4.12)	0.11*** (6.11)	-0.08*** (-10.33)	-0.22*** (-11.14)
Chi 2	779.53***	700.33***	850.28***	779.18***
Individual bank effect	Controlled	Controlled	Controlled	Controlled
Time trend	Controlled	Controlled	Controlled	Controlled

Notes: T-Statistics in ().

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2 \*Statistical significance at 10%.

3 \*\*Statistical significance at 5%.

4 \*\*\*Statistical significance at 1%

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6 BooneLoan indicates the competitive condition in the loan market, BooneDeposit represents the competitive condition in the deposit market and  
7 BooneNII stands for the competitive condition in the non-interest income market.  
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10 Table 7 3SLS empirical results on the inter-relationships between competition and shadow banking (loan market)  
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	Equation 1: BooneLoan as the dependent variable	Equation 2: BooneDeposit as the dependent variable	Equation 3: BooneNII as the dependent variable	Equation 4: shadow banking as the dependent variable
Shadow banking	0.13*** (4.48)	0.15*** (5.51)	0.11*** (4.56)	
BonneLoan				-0.19*** (-5.49)
Banking sector development	0.015 (0.38)	-0.09*** (-7.03)		
Stock market development	0.0001*** (8.18)		0.001*** (8.97)	-0.09*** (-7.87)
inflation		-0.009*** (-6.69)		
GDP growth rate				0.58*** (5.88)
Bank profitability			0.11*** (7.17)	
Bank risk	0.05*** (4.93)			
Bank size				-0.12*** (-5.15)
Bank diversification		0.07*** (4.13)		

constant	-0.19*** (-4.12)	0.11*** (6.11)	-0.08*** (-10.33)	-0.25*** (-12.11)
Chi 2	779.53***	700.33***	850.28***	822.61***
Individual bank effect	Controlled	Controlled	Controlled	Controlled
Time trend	Controlled	Controlled	Controlled	Controlled

Notes: T-Statistics in ().

\*Statistical significance at 10%.

\*\*Statistical significance at 5%.

\*\*\*Statistical significance at 1%

BooneLoan indicates the competitive condition in the loan market, BooneDeposit represents the competitive condition in the deposit market and BooneNII stands for the competitive condition in the non-interest income market.

Table 8 3SLS empirical results on the inter-relationships between competition and shadow banking (non-interest income market)

	Equation 1: BooneLoan as the dependent variable	Equation 2: BooneDeposit as the dependent variable	Equation 3: BooneNII as the dependent variable	Equation 4: shadow banking as the dependent variable
Shadow banking	0.13*** (4.48)	0.15*** (5.51)	0.11*** (4.56)	
BonneNII				-0.17*** (-5.53)
Banking sector development	0.015 (0.38)	-0.09*** (-7.03)		
Stock market development	0.0001*** (8.18)		0.001*** (8.97)	-0.08*** (-7.93)
inflation		-0.009*** (-6.69)		
GDP growth rate				0.55*** (4.93)
Bank profitability			0.11*** (7.17)	
Bank risk	0.05***			

	(4.93)			
Bank size				-0.13*** (-4.91)
Bank diversification		0.07*** (4.13)		
constant	-0.19*** (-4.12)	0.11*** (6.11)	-0.08*** (-10.33)	-0.2 (-7.88)
Chi 2	779.53***	700.33***	850.28***	843.23***
Individual bank effect	Controlled	Controlled	Controlled	Controlled
Time trend	Controlled	Controlled	Controlled	Controlled

Notes: T-Statistics in ().

\*Statistical significance at 10%.

\*\*Statistical significance at 5%.

\*\*\*Statistical significance at 1%

BooneLoan indicates the competitive condition in the loan market, BooneDeposit represents the competitive condition in the deposit market and BooneNII stands for the competitive condition in the non-interest income market.

Table 9 Summary of empirical results for the relationship between shadow banking and competition in different banking markets

	Competition in loan market	Competition in deposit market	Competition in non-interest income market	Shadow banking
Shadow banking	Significant and negative	Significant and negative	Significant and negative	
Competition in loan market				Significant and positive
Competition in deposit market				Significant and positive
Competition in non-interest market				Significant and positive

Banking sector development		Significant and positive		
Stock market development	Significant and negative		Significant and negative	Significant and negative
Inflation		Significant and positive		
GDP growth				Significant and positive
Bank profitability			Significant and negative	
Bank risk	Significant and negative			
Bank size				Significant and negative
Bank diversification		Significant and negative		



Revision for manuscript IJOEM-04-2020-0401

## Competitions in different banking markets and shadow banking: evidence from China

Dear Editor

Hope you are very well. Thank you very much for the opportunity to revise the manuscript and we have carefully and thoroughly considered and addressed the comments from the three reviewers on a one-by-one basis. The manuscript benefited from the comments substantially and the clarity and quality of the manuscript have been significantly improved.

Please see below the responses to the comments.

I look forward to hearing from you the outcome of the refereeing process.

Yours Sincerely

Dr Yong Tan

Reviewer 1

- 1. In the introduction, we suggest that the author simplify the description of the background and make the introduction more logical.**

**Response to the comment: Thank you very much for this comment. The description of the background has been simplified and the now it has been more logical.**

The Chinese government has initiated several rounds of banking reforms since 1978. The main purpose of these banking reforms has been to increase competitive conditions, enhance stability and improve the performance of the Chinese banking sector (Tan, 2016a). With regards to the competitive condition in the Chinese banking industry, it is noticed that the state-owned commercial banks (SOCBs)<sup>1</sup> still dominate the industry. However, according to statistics from the China Banking Regulatory Commission (CBRC), the share of SOCB assets in total banking sector assets decreased between 2003 and 2017 to a low point of 36.77%. On the other hand, the joint-stock commercial banks (JSCBs) and city commercial banks (CCBs) have kept increasing in size in a general trend and in 2017 they held 17.81% and 12.57% of total banking sector assets. Therefore, this statistic shows that the competitive condition is still quite low given that the five largest banks hold nearly 40% of total banking sector assets. Table 1

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<sup>1</sup> There are five state-owned commercial banks in China now, including Bank of China, Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China and Bank of Communication.

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2  
3 summarises the assets of SOCBs, JSCBs, CCBs and total banking institutions in China over  
4 the period 2003-2017.  
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8 <<Table 1---about here>>  
9

10 The lower level of competition in the Chinese banking industry is not only represented by the  
11 concentration ratio in terms of total assets as illustrated before, this can also be reflected from  
12 different types of businesses engaged in by the Chinese commercial banks. In order to improve  
13 the competitive conditions in the deposit market and the loan market, the Central Bank of China  
14 (the Peoples' Bank of China) had made efforts to liberalise the interest rate since 1996. From  
15 20<sup>th</sup> July 2013 and 23<sup>rd</sup> October 2015, the loan interest rate, as well as the deposit interest rate  
16 in China, had been liberalized. The effectiveness of interest rate liberalisation, in other words,  
17 the impact of interest rate liberalisation on the competitive conditions in the deposit market,  
18 the loan market, as well as the non-interest income market in China, has been a concern for the  
19 Chinese government and banking regulatory authorities in China. Recently, the issue has been  
20 investigated by Tan (2017). The results of the research show that over the period 2003-2013,  
21 the non-interest income market has a higher level of competition compared to the deposit  
22 market and loan market in the Chinese banking industry.  
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35 Although the financial reform in China, as characterised by the interest rate liberalisation, is  
36 supposed to increase the competitive conditions in different banking markets in China, because  
37 of the specific and special characteristics of the Chinese banking industry, the banking sector  
38 still allocates the credits (providing loan services) focusing on large or state-owned enterprises  
39 and the medium and small size enterprises find obtaining loans difficult, and thus, it is very  
40 difficult for them to be competitive and survive in the market (Elliott et al. (2015). This biased  
41 treatment to the micro, small and medium-sized enterprises has a significant and negative  
42 impact on Chinese economic growth. Most of the funds for small and medium-sized enterprises  
43 are from shadow banking<sup>2</sup>. Table 2 shows the size and composition of China's shadow banking  
44 over the period 2003-2017 (Elliot et al., 2015, CNBC and Bloomberg). The table shows that  
45 the shadow banking is becoming more and more important in China.  
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54 <<Table 2---about here>>  
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59 <sup>2</sup> The Financial Stability Board (2013) defines shadow banking as credit intermediation involving entities and  
60 activities outside the regular banking system.

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3 Although there are few pieces of research studies investigating the relationship between  
4 shadow banking and interest rate liberalization in China (Wang et al., 2016; Hu, 2014), there  
5 is no study examining the inter-relationship between shadow banking and competition in  
6 different banking markets (loan market, deposit market and non-interest income market) in  
7 China. Investigating this issue is very important from two different perspectives. First, the  
8 examination on the impact of competition in three different markets on shadow banking will  
9 provide more policy implications to the Chinese government and financial authorities in related  
10 to how to further solve the issue of difficulty for the small and medium sized enterprises to get  
11 funding, i.e. through further regulation on the environment for traditional banking businesses  
12 and non-traditional activities engaged in by the banks, the resulted influence on the growth of  
13 shadow banking can further increase the funding channels for the small and medium sized  
14 enterprises. Second, the investigation on the influence of shadow banking on competition in  
15 different banking markets can provide additional channel to adjust the level of competition in  
16 the banking market through better and proper regulation on the non-banking financial market.

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18 On the one hand, the increase in the size of shadow banking takes away large amounts of loan  
19 businesses engaged in by the Chinese commercial banks, as the main source of bank income,  
20 this will increase the competition among Chinese commercial banks in the loan business. In  
21 addition, stronger competition in the loan market indicates that it is more difficult for the banks  
22 to grant credits to businesses. In other words, the volume of loan businesses engaged in by the  
23 Chinese commercial banks will be decreased, this further leads to a decline in the level of  
24 competition in the deposit market. Finally, a large amount of shadow banking not only takes  
25 away the loan business from commercial banks, but takes away the non-interest income  
26 generating business as well, this will lead to an increase in the level of competition among  
27 Chinese commercial banks in the non-interest income market.

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29 On the other hand, lower level of competition in the loan market in the Chinese banking  
30 industry indicates that a large number of firms need the loans, this gives a big opportunity for  
31 the development of shadow banking in China. In other words, lower level of competition in the  
32 loan market leads to an increase in the size of shadow banking in China. In addition, increase  
33 in the level of competition in the deposit market in the Chinese banking industry reflects the  
34 fact that the Chinese commercial banks are short of funds to make loans, this will further lead  
35 to an expansion of shadow banking in China. Finally, lower level of competition in the non-  
36 interest income market in the Chinese banking industry indicates that Chinese commercial

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3 banks still focus on providing loan services to different enterprises, this is supposed to restrain  
4 the development of shadow banking in China.  
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9 In summary, the current study fills the gaps in the empirical literature in the following three  
10 ways: 1) as the literature review section indicates, we will contribute to the existing studies by  
11 investigating the inter-relationships between competition in different banking markets and  
12 bank competition, this will be useful for the Chinese government and financial regulatory  
13 authority to regulate the shadow banking system through making relevant policies in the  
14 banking industry and also regulate the competition in different banking markets through  
15 making relevant policies to control the size of shadow banking ; 2) as far as we are concerned,  
16 there has been no published empirical study examining the determinants of competition in  
17 different banking markets (loan market, deposit market and non-interest income market); we  
18 will investigate this issue in the current study; 3) besides the examination on the impact of  
19 competition on shadow banking as reflected from the first contribution, we will also investigate  
20 the factors that influence the size of shadow banking system in China. The latter two  
21 contributions are very useful for the government and financial regulatory authority to make  
22 specific policies to regulate either bank competition or/and shadow banking in China.  
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34 The findings show that an increase in the volume of shadow banking leads to a decline in the  
35 competitive condition in the loan market, deposit market and non-interest income market, while  
36 the increase in the level of competition in the loan market, deposit market and non-interest  
37 income market leads to an increase in the volume of shadow banking in China. We find that  
38 higher bank risk and higher developed of stock market reduce the competitive condition in the  
39 loan market, the competition in the deposit market will be enhanced by higher levels of banking  
40 sector development and higher levels of inflation, but bank diversification will reduce the level  
41 of competition in the deposit market. We further find that higher bank profitability and higher  
42 stock market development reduce bank competition in the non-interest income market. Finally,  
43 the results show that larger bank size and higher development of stock market reduce the size  
44 of shadow banking in China, but higher economic growth increases the size of shadow banking.  
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55 This paper will be structured as follows: section 2 will review the empirical literature on bank  
56 competition, shadow banking and its relationships, which is followed by section 3, describing  
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the data and methods. Section 4 reports the results, followed by discussing the robustness check in section 5. Finally, section 6 provides a summary and conclusion of the whole paper.

2. **The motivation of investigating the inter-relationships between competitions in different banking markets (deposit market, loan market and non-interest income market) and shadow banking is not explained clearly. The introduction carefully reveals some research and the analysis. However, there is little discussion of why we study this issue and investigate Chinese banking industry from three aspects (deposit market, loan market and non-interest income market).**

Response to the comment: Thank you very much for this comment. More discussions have been provided as why we study this issue and investigate Chinese banking industry from three aspects.

Although there are few pieces of research studies investigating the relationship between shadow banking and interest rate liberalization in China (Wang et al., 2016; Hu, 2014), there is no study examining the inter-relationship between shadow banking and competition in different banking markets (loan market, deposit market and non-interest income market) in China. Investigating this issue is very important from two different perspectives. First, the examination on the impact of competition in three different markets on shadow banking will provide more policy implications to the Chinese government and financial authorities in related to how to further solve the issue of difficulty for the small and medium sized enterprises to get funding, i.e. through further regulation on the environment for traditional banking businesses and non-traditional activities engaged in by the banks, the resulted influence on the growth of shadow banking can further increase the funding channels for the small and medium sized enterprises. Second, the investigation on the influence of shadow banking on competition in different banking markets can provide additional channel to adjust the level of competition in the banking market through better and proper regulation on the non-banking financial market.

3. **We suggest to sort out papers in the literature review section to make it logical instead of simply classifying and reviewing them.**

Response to the comment: Thank you very much for the comment. The literature review section has been re-drafted.

There are a number of studies investigating the competitive conditions in the Chinese banking industry using different methods including Lerner index (Tan and Floros, 2013; Tan and Floros, 2014; Tan, 2016a; Tan et al., 2017; Tan and Anchor, 2017b; Tan and Floros, 2018a; Fungacova et al., 2013); Panzar-Rosse H statistic (Tan, 2014; Tan, 2016b); Efficiency-adjusted Lerner index (Tan and Anchor, 2017a; Tan and Floros, 2018b), concentration ratio and Hirfindahl-Hirschmann index (Tan and Floros, 2012b, Tan and Floros, 2012c; Tan, 2016, Tan, 2014)

Although the above-mentioned studies use different methods to estimate the level of competition in the Chinese banking industry, none of the above-mentioned methods evaluates the competitive conditions in different banking markets in China.

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2  
3 Tan (2017a) innovatively uses the Boone indicator to investigate the competitive conditions of  
4 different banking markets (deposit market, loan market and non-interest income market) in  
5 China over the period 2003-2009 and further tests the effects of competition and shadow  
6 banking on bank profitability in China. The results indicate that non-interest income market in  
7 the Chinese banking industry has a higher level of competition compared to deposit market and  
8 loan market, and a lower level of competition in the deposit market leads to an increase in the  
9 profitability of Chinese banks.  
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17 Using the Boone indicator as the competition measurement, Tan (2017b) investigate the  
18 competitive condition in the loan market, deposit market and non-interest income market in the  
19 Chinese banking industry over the period 2003-2013 and further tests its inter-relationships  
20 with different types of risk (credit risk, liquidity risk, capital risk and insolvency) and different  
21 types of efficiency (cost efficiency, revenue efficiency and profit efficiency) of Chinese  
22 commercial banks under a three-stage least square estimation. The results indicate that higher  
23 level of competition leads to higher credit risk, higher liquidity risk and higher capital risk,  
24 while a higher level of competition leads to lower level of efficiency of Chinese commercial  
25 banks.  
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## 34 2.2 Literature review on shadow banking in China 35 36 37

38 Although data on shadow banking in China is available, the research in this topic has not  
39 received enough attention from academia and there are very limited research studies examining  
40 this important issue. Allen et al. (2019) collected the data from all public nonfinancial firms'  
41 annual reports over the period 2004-2013 and had a close look at the largest component of  
42 shadow banking in China, which is entrusted loans. The performance of transaction level  
43 analysis shows that the level of interest rate charged by nonaffiliated loans is twice as high as  
44 the one offered by the official bank loan rate, while the level of interest rate charged by the  
45 affiliated loans is roughly the same as the one of the official bank loan rate. The findings further  
46 show that there is a level of difference between the nonaffiliated loans and the affiliated loans  
47 with nearly half of the former flow into real estate and construction and the latter are within-  
48 industry loans. Finally, the results report that although borrowers' fundamental and information  
49 risks are the determinants of pricing of both these two types of loans, the risk is incorporated  
50 in the rate of nonaffiliated loans in a more efficient way.  
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3 Rather than looking at the specific component of Chinese shadow banking, Chen et al. (2018)  
4 examine the influence of monetary policy on Chinese shadow banking activities over the period  
5 2009-2015. The study contributes to the empirical literature by developing and estimating the  
6 endogenously switching monetary policy rule and the findings suggest that the shadow banking  
7 loans rise rapidly under the contractionary monetary policy, this increased in the volumes of  
8 shadow banking loans does not only offset the expected decline of the traditional banking loans,  
9 but reduce the level of effectiveness of monetary policy on banking credit allocation.

10  
11 Different from the above two studies investigate the specific component of shadow banking  
12 and the relationship between monetary policy and shadow banking, Chen et al. (2020)  
13 investigate the impact of China's stimulus package in 2009 on the growth of shadow banking.  
14 Therefore, this study differentiates itself from the previous two studies by analyzing the  
15 influence on the shadow banking activities from the local government perspectives. The  
16 findings suggest that the provinces with higher degrees of loan growth in 2009 not only  
17 experience an increase in the volumes of municipal bond issuance over the period 2012-2015,  
18 but also experience a boom in the level of shadow banking activities including trust loans and  
19 wealth management products.

### 20 21 22 2.3. the investigation on the relationship between shadow banking and bank competition

23  
24 There are few pieces of research examining the relationship between shadow banking and bank  
25 competition. The studies focused on the issue both within the Chinese financial system as well  
26 as the one outside of China. Using the US data, Ann and Breton (2014) examine the impact of  
27 loan securitization on competition in the loan market. This study suffers from the limitation  
28 that the shadow banking is represented by the securitization and the results can not be  
29 generalized to the whole shadow banking markets, another limitation of the study lies to the  
30 fact that there is no explicit consideration on the level of competition in different banking  
31 markets.

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34 There are also few studies evaluating the relationship between shadow banking and bank  
35 competition in China. On top of Tan (2017) examining the shadow banking as well as its impact  
36 on bank profitability, Guo and Zhao (2017) used 16 Chinese commercial banks during 2008-  
37 2015 to assess the relationship between deposit competition and shadow banking. The study  
38 failed to identify the level of competition in another two important areas in banking operation

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3 which are competition in the loan market as well as competition in the non-interest income  
4 market, therefore, the study also missed the investigation on the inter-relationship between the  
5 competition in these different banking markets and bank competition.  
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10 Instead of investigating the relationship between shadowing banking and deposit competition  
11 with a additional analysis of the intermediate role played by shadow banking in the influence  
12 of bank competition on risk-taking behavior, Zhou (2019) examined the relationship between  
13 bank competition and shadow banking using a sample of listed Chinese commercial banks over  
14 the period 2007-2017. The study further evaluate the effect of shadow banking on the  
15 effectiveness of monetary policy. This study suffers the same limitation as the one of Guo and  
16 Zhao (2017).  
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24 In summary, through the review of empirical literature on investigating the competitive  
25 condition in the banking sector in China as well as the empirical research studies on the  
26 investigation of shadow banking in China, it is noticed that there is no empirical research  
27 examining the relationship between bank competition and shadow banking. The current  
28 research fills in the gap of the empirical literature from this perspective. In addition, this will  
29 be the first piece of research examining the determinants of competition in different banking  
30 markets and also the factors influencing the size of shadowing banking in China.  
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36 **4. In the literature review, the author does not highlight the research significance of this**  
37 **paper on the basis of reviewing the existing literature and we suggests the author to**  
38 **supplement it.**  
39

40 *Response to the comment: Thank you very much for this comment. The research significance has*  
41 *been provided by the end of the literature review section.*  
42

43 In summary, through the review of empirical literature on investigating the competitive  
44 condition in the banking sector in China as well as the empirical research studies on the  
45 investigation of shadow banking in China, it is noticed that there is no empirical research  
46 examining the relationship between bank competition and shadow banking. The current  
47 research fills in the gap of the empirical literature from this perspective. In addition, this will  
48 be the first piece of research examining the determinants of competition in different banking  
49 markets and also the factors influencing the size of shadowing banking in China.  
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56 **5. When we select variables for empirical analysis(like equation(6)), is there any literature**  
57 **support or theoretical basis?**  
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59 *Response to the comment: Thank you very much for this comment. We have addressed this issue.*  
60



The selection of the variables that have potential influence on the level of competition in different banking markets is in line with Tan (2017b). with regard to the selection of the controlled variables that have potential influence on shadow banking, we mainly have the following considerations: higher levels of stock market development will provide an additional channel for the small and medium sized enterprises to raise funding besides the traditional banking loans, this will also crowd out the role of shadow banking in the process of credit allocation and further reduce the size of shadow banking. In terms of inflation, we argue that higher levels of inflation result in a contraction of credits, this will include the traditional banking credits as well as the one provided in the shadow banking sector.

6. In the second paragraph of section 6(Summary and conclusion),we recommend making recommendations based on the findings of this paper rather than citing others’.

Response to the comment: Thank you very much for this comment. We have re-written this part.

The findings provide important policy implications to the Chinese government and regulatory authorities as follows: 1) the Chinese banks should further enhance the risk management practice, the reduction in the risk level will increase the competition in the loan market and further increase the size of shadow banking, this will provide more fundings to the small and medium sized enterprises; 2) the government and financial regulatory authorities should consider to control the stock market development, because a lower level of stock market development will increase the competitive condition in the banking market and further increase the size of shadow baking, the expansion of shadow banking can further increase the funding channels for the small and medium sized enterprises; 3) the government and financial regulatory authority should further consider to improve the banking sector development by encouraging more innovation in financial products, this will be also helpful for the shadow banking expansion.

7. Some words are misspelled like “Equeation” in Table 8; “ BooneNII as the deposit variable” in Table 6 & Table 7 &Table 8

Response to the comment: Thank you very much for this comment. This has been corrected.

Reviewer 2:

1. The topic of this paper is not new. Overseas (such as Ahn and Breton, 2014) and domestic (such as Guo and Zhao, 2017; Zhou, 2019, Tan, 2017) all have relevant research to analyze the relationship between competition and shadow banking. It is necessary to elaborate the research characteristics of this paper, the differences between the previous research and the new contributions.

Response to the comment: Thank you very much for this comment. These suggested citations have been provided in the literature review section and the research contributions have been summarized. Please see section 2.3 for detail.

### 2.3. the investigation on the relationship between shadow banking and bank competition

There are few pieces of research examining the relationship between shadow banking and bank competition. The studies focused on the issue both within the Chinese financial system as well as the one outside of China. Using the US data, Ann and Breton (2014) examine the impact of loan securitization on competition in the loan market. This study suffers from the limitation that the shadow banking is represented by the securitization and the results can not be generalized to the whole shadow banking markets, another limitation of the study lies to the fact that there is no explicit consideration on the level of competition in different banking markets.

There are also few studies evaluating the relationship between shadow banking and bank competition in China. On top of Tan (2017) examining the shadow banking as well as its impact on bank profitability, Guo and Zhao (2017) used 16 Chinese commercial banks during 2008-2015 to assess the relationship between deposit competition and shadow banking. The study failed to identify the level of competition in another two important areas in banking operation which are competition in the loan market as well as competition in the non-interest income market, therefore, the study also missed the investigation on the inter-relationship between the competition in these different banking markets and bank competition.

Instead of investigating the relationship between shadowing banking and deposit competition with a additional analysis of the intermediate role played by shadow banking in the influence of bank competition on risk-taking behavior, Zhou (2019) examined the relationship between bank competition and shadow banking using a sample of listed Chinese commercial banks over the period 2007-2017. The study further evaluate the effect of shadow banking on the effectiveness of monetary policy. This study suffers the same limitation as the one of Guo and Zhao (2017).

In summary, through the review of empirical literature on investigating the competitive condition in the banking sector in China as well as the empirical research studies on the investigation of shadow banking in China, it is noticed that there is no empirical research examining the relationship between bank competition and shadow banking. The current research fills in the gap of the empirical literature from this perspective. In addition, this will

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3 be the first piece of research examining the determinants of competition in different banking  
4 markets and also the factors influencing the size of shadowing banking in China.

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7 **2. Research contribution needs to be refined: the first point is that there are relevant researches on**  
8 **research contribution, and it is necessary to explain the innovation compared with it; The second**  
9 **point is that shadow banking influences the competition of various markets of banks in the research**  
10 **contribution? The third point is not different from the first point.**

11  
12 **Response to this comment: thank you very much for this comment. The research contributions in**  
13 **the introduction have been refined.**

14  
15 In summary, the current study fills the gaps in the empirical literature in the following three  
16 ways: 1) as the literature review section indicates, we will contribute to the existing studies by  
17 investigating the inter-relationships between competition in different banking markets and  
18 bank competition, this will be useful for the Chinese government and financial regulatory  
19 authority to regulate the shadow banking system through making relevant policies in the  
20 banking industry and also regulate the competition in different banking markets through  
21 making relevant policies to control the size of shadow banking ; 2) as far as we are concerned,  
22 there has been no published empirical study examining the determinants of competition in  
23 different banking markets (loan market, deposit market and non-interest income market); we  
24 will investigate this issue in the current study; 3) besides the examination on the impact of  
25 competition on shadow banking as reflected from the first contribution, we will also investigate  
26 the factors that influence the size of shadow banking system in China. The latter two  
27 contributions are very useful for the government and financial regulatory authority to make  
28 specific policies to regulate either bank competition or/and shadow banking in China.

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31 **3. In the literature review section 2.2. Empirical Literature on bank competition in China is simple**  
32 **stacking, which requires comprehensive analysis and summary.**

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34 **Response to the comment: thank you very much for this comment. The literature review section**  
35 **has been drafted.**

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38 There are a number of studies investigating the competitive conditions in the Chinese banking  
39 industry using different methods including Lerner index (Tan and Floros, 2013; Tan and Floros,  
40 2014; Tan, 2016a; Tan et al., 2017; Tan and Anchor, 2017b; Tan and Floros, 2018a; Fungacova  
41 et al., 2013); Panzar-Rosse H statistic (Tan, 2014; Tan, 2016b); Efficiency-adjusted Lerner  
42 index (Tan and Anchor, 2017a; Tan and Floros, 2018b), concentration ratio and Hirfindahl-  
43 Hirschmann index (Tan and Floros, 2012b, Tan and Floros, 2012c; Tan, 2016, Tan, 2014)

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3 Although the above-mentioned studies use different methods to estimate the level of  
4 competition in the Chinese banking industry, none of the above-mentioned methods evaluates  
5 the competitive conditions in different banking markets in China.  
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10 Tan (2017a) innovatively uses the Boone indicator to investigate the competitive conditions of  
11 different banking markets (deposit market, loan market and non-interest income market) in  
12 China over the period 2003-2009 and further tests the effects of competition and shadow  
13 banking on bank profitability in China. The results indicate that non-interest income market in  
14 the Chinese banking industry has a higher level of competition compared to deposit market and  
15 loan market, and a lower level of competition in the deposit market leads to an increase in the  
16 profitability of Chinese banks.  
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24 Using the Boone indicator as the competition measurement, Tan (2017b) investigate the  
25 competitive condition in the loan market, deposit market and non-interest income market in the  
26 Chinese banking industry over the period 2003-2013 and further tests its inter-relationships  
27 with different types of risk (credit risk, liquidity risk, capital risk and insolvency) and different  
28 types of efficiency (cost efficiency, revenue efficiency and profit efficiency) of Chinese  
29 commercial banks under a three-stage least square estimation. The results indicate that higher  
30 level of competition leads to higher credit risk, higher liquidity risk and higher capital risk,  
31 while a higher level of competition leads to lower level of efficiency of Chinese commercial  
32 banks.  
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## 41 2.2 Literature review on shadow banking in China 42 43 44

45 Although data on shadow banking in China is available, the research in this topic has not  
46 received enough attention from academia and there are very limited research studies examining  
47 this important issue. Allen et al. (2019) collected the data from all public nonfinancial firms'  
48 annual reports over the period 2004-2013 and had a close look at the largest component of  
49 shadow banking in China, which is entrusted loans. The performance of transaction level  
50 analysis shows that the level of interest rate charged by nonaffiliated loans is twice as high as  
51 the one offered by the official bank loan rate, while the level of interest rate charged by the  
52 affiliated loans is roughly the same as the one of the official bank loan rate. The findings further  
53 show that there is a level of difference between the nonaffiliated loans and the affiliated loans  
54 with nearly half of the former flow into real estate and construction and the latter are within-  
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3 industry loans. Finally, the results report that although borrowers' fundamental and information  
4 risks are the determinants of pricing of both these two types of loans, the risk is incorporated  
5 in the rate of nonaffiliated loans in a more efficient way.  
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10 Rather than looking at the specific component of Chinese shadow banking, Chen et al. (2018)  
11 examine the influence of monetary policy on Chinese shadow banking activities over the period  
12 2009-2015. The study contributes to the empirical literature by developing and estimating the  
13 endogenously switching monetary policy rule and the findings suggest that the shadow banking  
14 loans rise rapidly under the contractionary monetary policy, this increased in the volumes of  
15 shadow banking loans does not only offset the expected decline of the traditional banking loans,  
16 but reduce the level of effectiveness of monetary policy on banking credit allocation.  
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24 Different from the above two studies investigate the specific component of shadow banking  
25 and the relationship between monetary policy and shadow banking, Chen et al. (2020)  
26 investigate the impact of China's stimulus package in 2009 on the growth of shadow banking.  
27 Therefore, this study differentiates itself from the previous two studies by analyzing the  
28 influence on the shadow banking activities from the local government perspectives. The  
29 findings suggest that the provinces with higher degrees of loan growth in 2009 not only  
30 experience an increase in the volumes of municipal bond issuance over the period 2012-2015,  
31 but also experience a boom in the level of shadow banking activities including trust loans and  
32 wealth management products.  
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### 41 2.3. the investigation on the relationship between shadow banking and bank competition 42 43

44 There are few pieces of research examining the relationship between shadow banking and bank  
45 competition. The studies focused on the issue both within the Chinese financial system as well  
46 as the one outside of China. Using the US data, Ann and Breton (2014) examine the impact of  
47 loan securitization on competition in the loan market. This study suffers from the limitation  
48 that the shadow banking is represented by the securitization and the results cannot be  
49 generalized to the whole shadow banking markets, another limitation of the study lies to the  
50 fact that there is no explicit consideration on the level of competition in different banking  
51 markets.  
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3 There are also few studies evaluating the relationship between shadow banking and bank  
4 competition in China. On top of Tan (2017) examining the shadow banking as well as its impact  
5 on bank profitability, Guo and Zhao (2017) used 16 Chinese commercial banks during 2008-  
6 2015 to assess the relationship between deposit competition and shadow banking. The study  
7 failed to identify the level of competition in another two important areas in banking operation  
8 which are competition in the loan market as well as competition in the non-interest income  
9 market, therefore, the study also missed the investigation on the inter-relationship between the  
10 competition in these different banking markets and bank competition.  
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19 Instead of investigating the relationship between shadowing banking and deposit competition  
20 with a additional analysis of the intermediate role played by shadow banking in the influence  
21 of bank competition on risk-taking behavior, Zhou (2019) examined the relationship between  
22 bank competition and shadow banking using a sample of listed Chinese commercial banks over  
23 the period 2007-2017. The study further evaluates the effect of shadow banking on the  
24 effectiveness of monetary policy. This study suffers the same limitation as the one of Guo and  
25 Zhao (2017).  
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33 In summary, through the review of empirical literature on investigating the competitive  
34 condition in the banking sector in China as well as the empirical research studies on the  
35 investigation of shadow banking in China, it is noticed that there is no empirical research  
36 examining the relationship between bank competition and shadow banking. The current  
37 research fills in the gap of the empirical literature from this perspective. In addition, this will  
38 be the first piece of research examining the determinants of competition in different banking  
39 markets and also the factors influencing the size of shadowing banking in China.  
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45 4. There are Lerner Index, H statistic, Boone index, HHI index and so on. In this paper, Boone index  
46 is selected directly. Why do we use this index? What are the advantages compared with other  
47 indexes?  
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49 **Response to the comment: thank you very much for this comment. This issue has been addressed**  
50 **in section 3.1**  
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52 As reviewed in the literature review section, Lerner index and Panzar Rosse H statistics are  
53 widely used in the empirical literature to estimate the level of competition in the banking  
54 industry. However, Leuvensteijn et al. (2007) argue that due to the fact that the Panzar-Rosse  
55 H statistics are developed based on the static model, there would be no prediction on the value  
56 and this indicator suffers from the limitation that it can not fulfil the overall market equilibrium  
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requirement (Claessens and Laeven, 2004). The Lerner index is suffered from the limitation in terms of the difficulty to derive the marginal cost, because of different methods can be adopted to measure the marginal cost, therefore, the accuracy and robustness in related to the level of competition are affected (Fukuyama and Tan, 2020). Kwoka (1977) argue that the main limitation suffered by the Hirfindahl-Hirschman index is related to the fact that this indicator embodies both size inequality and firm numbers with weight, which are assumed a priori instead of being derived. Finally, Maksimović & Kostić (2012) argue that the concentration ratio suffers from the limitation of its inability to acknowledge market structure stability, level of product differentiation, entry barriers as well as operating cost.

Although this indicator suffers from the same disadvantage as the Lerner index in terms of the estimation of marginal cost, this indicator is superior to other indicators for its ability to estimate competition in different banking markets and competition for different bank ownership types (Tan, 2018).

**5. The model has a serious problem of reciprocal causality. How to choose tools and how is the effectiveness of tool variables?**

**Response to the comment: Thank you very much for this comment. The model has been reconsidered and new models have been provided in the revised manuscript with relevant discussions on this issue. Please see section 3.2 for detail.**

$$BooneLoan_t = \beta_0 + \beta_1 shadow_t + \beta_2 BSD_t + \beta_3 SMD_t + \beta_3 Risk_{it} \quad (6)$$

$$BooneDeposit_t = \alpha_0 + \alpha_1 shadow_t + \alpha_2 BSD_t + \alpha_3 Diverse_{it} + \alpha_4 INF_t \quad (7)$$

$$BooneNII_t = \delta_0 + \delta_1 shadow_t + \delta_2 SMD_t + \delta_3 Profit_{it} \quad (8)$$

$$shadow_t = \gamma_0 + \gamma_1 Boone_{it} + \gamma_2 SMD_{it} + \gamma_3 GDPG_t + \gamma_4 Size_{it} \quad (9)$$

We control for different bank-specific, industry-specific and macroeconomic variables which are supposed to have an influence on bank competition and shadow banking in China. The bank specific variables include bank profitability, measured by the net interest margin (ratio of net interest income to earning assets); bank risk, measured by the ratio of non-performing loans to total loans, bank diversification, measured by the ratio of non-interest income to gross revenue and bank size, measured by the natural logarithm of total assets.

In order to use the three-stage least square estimator in the analysis, a set of unique variables are needed for a specific equation but not the other three. These instruments are supposed to be exogenous and do not correlate with the error term. We expect that the following variables only affect specific dependent variables, therefore, they only appear in one specific equation but not the other three.

Equation 6 only

Bank risk is used in this equation, it is measured by the ratio of non-performing loans to total loans. We expect that higher levels of credit risk will induce the banks to be more cautious in making the credit allocation decisions, they will be more selective and raising the requirement on the loan applications made by different businesses, comparing to the scenario when there is a very low level of credit risk during which the banks would compete very strongly in the loan market, the higher levels of risk will reduce the level of competition in the loan market.

Equation 7 only

Bank diversification is used in this equation, it is measured by the ratio of non-interest income to gross revenue. We argue that higher levels of diversification will reduce the reliance on the traditional deposit and loan businesses engaged in by the banks, more resources and efforts will be diverted to other businesses, this is supposed to reduce the level of competition in the deposit market.

Equation 8 only

Bank profitability is used in this equation. It is measured by the net interest margin (the ratio of net interest income to earning assets). The whole banking business can be generally divided into two parts, the traditional interest generating businesses as well as the non-traditional non-interest generating activities. Bank profitability, as measured by the net interest margin, reflect the level of profitability in the traditional interest generating businesses, a higher level of profitability indicates that banks would be able to get more profits from engaging in this specific activity, more resources will be allocated to this business area and this is supposed to lead to a decrease in the level of competition in the non-traditional non-interest generating businesses.

Equation 9 only

Bank size is used in this equation. It is measured by the natural logarithm of total assets. Large banks would be able to reduce the costs from economies of scale and economies of scope, the reduction would be helpful to reduce the level of loan price. In other words, lower levels of cost derived from economies of scale and scope would expand the credits available



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3 from the traditional banking, this will also constraint the amount of credits from the shadow  
4 banking sector.

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7 We conduct the over-identification test and the test statistics show that the instruments used  
8 are valid.  
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12 6. There are too few control variables, and the individual characteristics of the bank, such as asset  
13 size, profitability, risk status and other indicators, should be controlled at least.

14  
15 **Response to the comment: Thank you very much for this comment. This issue has been addressed**  
16 **in the previous point.**

17  
18 7. Does shadow banking have economic significance because it has a little impact on the  
19 competition of loan, deposit and non interest market?

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21 **Response to the comment: Thank you very much for this comment. The new updated results show**  
22 **that shadow banking has a significant impact on the competition in the loan, deposit and non-**  
23 **interest income market. Please see tables, 6, 7 and 8 for detail.**

24  
25 8. There are great differences in scale, profit and other aspects between individual banks, and  
26 some individual characteristics of banks cannot be observed, so it is necessary to control the  
27 individual effect of banks.

28  
29 **Response to the comment: Thank you very much for this comment. The updated results in tables**  
30 **6, 7 and 8 have controlled for the individual effect.**

31  
32 9. From Figure 1, it can be seen that there is a sudden change in market competition in 2013, and  
33 then there is a trend of gradual increase. Does the results observed in this paper have the  
34 influence of time trend? In this paper, we need to further investigate the market mutation in 2013,  
35 and add time effect variables into the model.

36  
37 **Response to the comment: Thank you very much for this comment. The updated results in tables**  
38 **6, 7 and 8 have controlled for the individual effect.**

39  
40 10. The results in the regression table need to be adjusted by standard error (cluster).

41  
42 **Response to the comment: Thank you very much for this comment.**

43  
44 In order to test the inter-relationships between competition in different banking markets and  
45 shadow banking in an accurate way, we control for the individual bank effect as well as the time  
46 trend in the models. Most importantly, the results reported are adjusted by standard errors.  
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50 Reviewer 3

51  
52 1. The introduction is clear, the authors discuss the significant and importance of the research  
53 topic with contributions and results outlined, while I know that the key theme of the research is to  
54 examine the relationships between bank competition and shadow banking, while in the  
55 contributions, the authors clearly stated that two of the contributions are: 1) investigate the  
56 determinants of competition in different markets; 2) examine the factors of shadow banking size  
57 in China. And both of these two contributions have been shown in the modelling framework, I did  
58 not see that in the introduction, when the authors briefly outline the results, any findings are  
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3 reported about this. In other words, when the authors outline the results, they need to be in line  
4 with the contributions.  
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6 **Response to the comment: Thank you very much for this comment. The results have been**  
7 **provided in the introduction.**  
8

9 The findings show that an increase in the volume of shadow banking leads to a decline in the  
10 competitive condition in the loan market, deposit market and non-interest income market, while  
11 the increase in the level of competition in the loan market, deposit market and non-interest  
12 income market leads to an increase in the volume of shadow banking in China. We find that  
13 higher bank risk and higher developed of stock market reduce the competitive condition in the  
14 loan market, the competition in the deposit market will be enhanced by higher levels of banking  
15 sector development and higher levels of inflation, but bank diversification will reduce the level  
16 of competition in the deposit market. We further find that higher bank profitability and higher  
17 stock market development reduce bank competition in the non-interest income market. Finally,  
18 the results show that larger bank size and higher development of stock market reduce the size  
19 of shadow banking in China, but higher economic growth increases the size of shadow banking.  
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22 **2. Literature review- this section is clear, I have had a search on the empirical literature, there are**  
23 **quite a few papers published during recent couple of years dealing with the issues of shadow**  
24 **banking in China, I recommend that the authors should cite these publications below in the paper:**  
25 **1)Allen, F., Qian, Y., Tu, G., and Yu, F. (2019). Entrusted loans: a close look at China's shadow**  
26 **banking system. Journal of Financial Economics, 133, 18-41.**  
27 **2) Chen, Z., He, Z., and Liu, C. (2020). The Financing of local government in China: Stimulus loan**  
28 **wanes and shadow banking waxes**  
29 **3) Chen, K., Ren, J., and Jia, T. (2018). Th nexus of monetary policy and shadow banking in China.**  
30 **American Economic Review, 108, 3891-3936.**  
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32

33 **Response to the comment: Thank you very much for this comment. All these recommended papers**  
34 **have been cited in the revised manuscript. Please see section 2.2 for detail.**  
35  
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37 Although data on shadow banking in China is available, the research in this topic has not  
38 received enough attention from academia and there are very limited research studies examining  
39 this important issue. Allen et al. (2019) collected the data from all public nonfinancial firms'  
40 annual reports over the period 2004-2013 and had a close look at the largest component of  
41 shadow banking in China, which is entrusted loans. The performance of transaction level  
42 analysis shows that the level of interest rate charged by nonaffiliated loans is twice as high as  
43 the one offered by the official bank loan rate, while the level of interest rate charged by the  
44 affiliated loans is roughly the same as the one of the official bank loan rate. The findings further  
45 show that there is a level of difference between the nonaffiliated loans and the affiliated loans  
46 with nearly half of the former flow into real estate and construction and the latter are within-  
47 industry loans. Finally, the results report that although borrowers' fundamental and information  
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risks are the determinants of pricing of both these two types of loans, the risk is incorporated in the rate of nonaffiliated loans in a more efficient way.

Rather than looking at the specific component of Chinese shadow banking, Chen et al. (2018) examine the influence of monetary policy on Chinese shadow banking activities over the period 2009-2015. The study contributes to the empirical literature by developing and estimating the endogenously switching monetary policy rule and the findings suggest that the shadow banking loans rise rapidly under the contractionary monetary policy, this increased in the volumes of shadow banking loans does not only offset the expected decline of the traditional banking loans, but reduce the level of effectiveness of monetary policy on banking credit allocation.

Different from the above two studies investigate the specific component of shadow banking and the relationship between monetary policy and shadow banking, Chen et al. (2020) investigate the impact of China's stimulus package in 2009 on the growth of shadow banking. Therefore, this study differentiates itself from the previous two studies by analyzing the influence on the shadow banking activities from the local government perspectives. The findings suggest that the provinces with higher degrees of loan growth in 2009 not only experience an increase in the volumes of municipal bond issuance over the period 2012-2015, but also experience a boom in the level of shadow banking activities including trust loans and wealth management products.

**3. in the methodology section, the author should clearly talk about among 30 banks in the sample, what are the ownership types included?**

Response to the comment: thank you very much for this comment. This has been clarified in the revised manuscript.

Totally, we collect a balanced dataset of 30 Chinese commercial banks over the period 2003-2017 including 5 state-owned commercial banks, 12 joint-stock commercial banks and 13 city commercial banks.

**4. in terms of the results section, the authors argue that in terms of the competition in different banking markets, the findings are in line with Tan (2017), however, Tan (2017) investigated the period of 2003-2013, the current paper uses 2003-2017, this is not an exact comparison. If the authors think that some of the findings are similar between the studies, the authors should claim partly in line with.....**

Also it is recommended that the authors can provide a table summarizing the relationship between bank competition in different banking markets and shadow banking, as well as the determinants of bank competition and influencing factors of shadow banking.

Response to the comment: thank you very much for this comment. This issue has been addressed in the revised manuscript.

This finding is partly in line with Tan (2017).

Table 9 Summary of empirical results for the relationship between shadow banking and competition in different banking markets

	Competition in loan market	Competition in deposit market	Competition in non-interest income market	Shadow banking
Shadow banking	Significant and negative	Significant and negative	Significant and negative	
Competition in loan market				Significant and positive
Competition in deposit market				Significant and positive
Competition in non-interest market				Significant and positive
Banking sector development		Significant and positive		
Stock market development	Significant and negative		Significant and negative	Significant and negative
Inflation		Significant and positive		
GDP growth				Significant and positive
Bank profitability			Significant and negative	
Bank risk	Significant and negative			
Bank size				Significant and negative
Bank diversification		Significant and negative		

**5. in the summary and conclusion, the authors are expected to summarize the results related to the determinants of bank competition and the influencing factors of shadow banking.**

Response to the comment: thank you very much for this comment. The summary is provided in the section in the revised manuscript.

The findings suggest that larger volume of shadow banking leads to a decline in competition in the loan market, deposit market and non-interest income market. The results further show that higher level of competition in the loan market, deposit market and non-interest income market results in an increase in the volume of shadow banking in China. We find that higher bank risk and higher developed of stock market reduce the competitive condition in the loan

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3 market, while the competition in the deposit market will be enhanced by higher levels of  
4 banking sector development and higher levels of inflation, but bank diversification will reduce  
5 the level of competition in the deposit market. We further find that higher bank profitability  
6 and higher stock market development reduce bank competition in the non-interest income  
7 market. Finally, the results show that larger bank size and higher development of stock market  
8 reduce the size of shadow banking in China, but higher economic growth increases the size of  
9 shadow banking.  
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