

An Empirical Analysis on China's Banking Market Structure and Systemic Financial Risk

Huadong Xiao^{1, 2,*}

¹Business school, Jiangnan University, Wuhan, Hubei, 430056, China

²Manufacturing Industry Development Research Center on Wuhan City Circle, Wuhan, Hubei, 430056, China

*Corresponding author.email:hd_xiao@163.com

ABSTRACT

For a long time, banking institutions play the most important role in China's financial system. In the context of three critical battles against major risks, poverty and pollution, how to prevent and defuse systemic financial risk by optimizing the banking market structure has become the concern of scholars and policy makers. In this paper, based on the data from 2008 to 2019, we measure China's banking structure and systemic financial risk, and find that the competitiveness of China's banking market is constantly enhanced, while the systemic financial risk fluctuates with the change of economic situation. After cointegration analysis, we believe that there is a long-term equilibrium relationship between banking market structure and systemic financial risk. The reduction of banking concentration will help to reduce systemic financial risk.

Keywords: Banking market structure, systemic financial risk, market concentration

1. INTRODUCTION

It is still the banking industry that dominates China's financial system. According to the data released by the People's Bank of China, as of December 2019, the stock of social financing to the real economy was 251.41 trillion yuan, of which the scale of various loans was 176.64 trillion yuan, accounting for 70.26%. In recent years, it is China's key task to firmly fight the critical battles against major risks, poverty and pollution. Preventing and defusing financial risks is relevant to national security, overall development, and the security of people's property, and is a key threshold that the country must cross to achieve high-quality growth.

Since the 1970s, scholars began to explore the relationship between the banking market structure and financial risk or financial stability. Unfortunately, up to now, there is no consensus [1]. Some people think that a high banking market concentration is conducive to increasing bank income, reducing banking risk, alleviating information asymmetry, and improving the efficiency of financial supervision, which is conducive to preventing financial risks. However, others believe that when the market concentration is high, it is easier for banks to generate and accumulate risks, aggravate information asymmetry, and is not conducive to banking diversification. In addition, some people believe that the relationship between banking market structure and systemic financial risk is uncertain [2].

In this paper, using China's data from 2008-2019, we attempt to explore whether the banking market structure with high concentration or low concentration is conducive to the prevention of systemic financial risk in China. The paper is proceeding as follows. Section 2 describes the

current situation of China's banking market structure. Section 3 describes the status of China's systemic financial risk. Section 4 is empirical research. Some conclusions are contained in Section 5.

2. CHINA'S BANKING STRUCTURE

Generally, the decision of market structure depends on factors such as market concentration, product differentiation and entry barriers, among which market concentration is the main factor that determines market structure [3]. In this paper, we mainly use market concentration to analyze the market structure. We used three indicators, such as market share, CR_n (Concentration Ratio) and HHI (Herfindahl-Hirschman Index) to measure market concentration.

2.1. Market Share

The higher the market share of a certain bank, the higher the degree of control of the bank over the market and the stronger the competitiveness. When discussing the banking market share, the asset ratio, deposit ratio, and loan ratio are three commonly used indicators.

The commercial bank system is composed of large-scale commercial banks, national joint-stock banks, urban commercial banks, rural financial institutions, private banks and foreign banks in China. In the paper, we collected data from 2008 to 2019, calculated the market share of China's large commercial banks which contains Industrial and Commercial Bank of China, China Construction Bank, Bank of China, Agricultural Bank of China, and Bank of Communications, and shown them in Table 1. The calculation result shows, from 2008 to 2019,

the asset ratio, deposit ratio, and loan ratio of large-scale commercial banks had all fallen dramatically.

2.2. Concentration Ratio

Concentration ratio, also known as CR_n, refers to the total market share of the top n largest companies in the relevant market of the industry.

In this paper, we select the data of the four largest banks in China's banking industry, namely Industrial and Commercial Bank of China, China Construction Bank, Bank of China, and Agricultural Bank of China, to calculate CR₄. As shown in Table 2, since 2008, the CR₄ indicators have been declining year by year, which shows that the degree of competition in China's banking industry is increasing.

Herfindahl-Hirschman index, also known as HHI, is a comprehensive indicator used to describe the relative size of market share, that is, to indicate the degree of dispersion of manufacturers in the market. The calculation formula is:

$$HHI = \sum_{i=1}^N (X_i/X)^2 \tag{1}$$

In the formula, X is the total market size of the industry, N is the total number of all companies in the industry, and X_i is the size of company i.

Considering the difficulty of collecting data, we use the data of 20 banks to calculate HHI, and the results are shown in Table 3. These 20 banks include 5 large commercial banks, 11 national joint-stock commercial banks except Hengfeng Bank (Because Hengfeng Bank did not publish financial data for 2016-2018), and 4 city commercial banks including Bank of Beijing, Bank of Shanghai, Bank of Jiangsu, and Bank of Nanjing.

2.3. Herfindahl - Hirschman Index

Table 1 Market share of large-scale commercial banks

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Asset ratio	0.5444	0.5328	0.5145	0.4933	0.4694	0.4539	0.4344	0.4131	0.3929	0.3881	0.3991	0.3900
Deposit ratio	0.5799	0.5608	0.5392	0.5318	0.5171	0.4941	0.4764	0.4272	0.4694	0.4158	0.4190	0.3985
Loan ratio	0.4933	0.4952	0.4887	0.4885	0.4811	0.4781	0.4669	0.4487	0.4561	0.4237	0.4047	0.4148

Source: Calculated based on the data from China Financial Yearbooks and annual reports of banks.

Table 2 CR₄ of China's Banking Industry

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CR₄ of asset	0.5014	0.4907	0.4725	0.4524	0.4298	0.4144	0.3979	0.3771	0.3566	0.3522	0.3636	0.3558
CR₄ of deposit	0.5408	0.5221	0.5000	0.4920	0.4775	0.4552	0.4420	0.3950	0.4392	0.3829	0.3873	0.3682
CR₄ of loan	0.4526	0.4528	0.4456	0.4454	0.4382	0.4363	0.4281	0.4120	0.4202	0.3880	0.3714	0.3813

Source: Calculated based on the data from China Financial Yearbooks and annual reports of banks.

Table 3 HHI of China's Banking Industry

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
HHI by asset	0.0572	0.0568	0.0555	0.0556	0.0539	0.0536	0.0515	0.0478	0.0499	0.0434	0.0398	0.0370
HHI by deposit	0.0687	0.0658	0.0615	0.0568	0.0523	0.0488	0.0454	0.0415	0.0377	0.0565	0.0384	0.0388
HHI by loan	0.0793	0.0738	0.0683	0.0663	0.0631	0.0577	0.0545	0.0436	0.0529	0.0416	0.0418	0.0417

Source: Calculated based on the data from China Financial Yearbooks and annual reports of banks.

3. SYSTEMIC FINANCIAL RISK

According to the definition given by IMF (International Monetary Fund), FSB (Financial Stability Board) and ECB (European Central Bank), systemic financial risk refers to the risk that endangers financial stability, which will damage most of the functions of the financial system and it has a serious negative impact on the wider economy [4]. Researchers often measure systemic financial risk by constructing financial pressure index (FSI). The financial pressure index is a comprehensive index composed of a series of indicators reflecting the pressure situation of various subsystems of the financial system. Based on the research of Xu Dilong and Chen Shuanglian (2015), Zhang Xingjun et al. (2017) [5, 6], we select 16 sub-indicators to construct the indicator system for estimating FSI. Among these sub-indicators, bank loan-to-deposit ratio, bank non-performing loans ratio, P/E ratio, export dependence, inflation rate, fiscal deficit/GDP, proportion of real estate loans to bank loans, real estate investment growth rate, residential sales price index, ratio of Short-term External Debt have positive relationship with systemic financial risk, and core capital adequacy ratio of financial institutions, bank's asset profit ratio, GDP growth rate, total financing of real economy/GDP, FDI/GDP, purchasing Managers' Index (PMI), have negative relationship with systemic financial risk. Using China's data from 2008 to 2019 the equal variance weighting method, we synthesize the FSI, as shown in Table 4. The calculation formula is:

$$FSI_t = \frac{1}{n} \sum_{i=1}^n \frac{X_{it} - u_i}{\delta_i} \quad (2)$$

In the formula, FSI_t represents the financial stress index in period t , n is the total number of sub-indicators, X_{it} is the value of sub-indicator i in period t , u_i is the mean value of sub-indicator i , and δ_i is the sample standard deviation of

sub-indicator i . High financial pressure index means high systemic financial risk, and vice versa.

4. EMPIRICAL ANALYSIS

4.1. Variables

In the empirical analysis, we choose banking market structure as independent variable, including CR_4 of asset, CR_4 of deposit, HHI by asset and HHI by deposit, and systemic financial risk as dependent variable measure by FSI. In addition, we choose the financial market liquidity as the control variable, measured by TED spread, which is equal to one-year Shibor interest rate minus Treasury bond interest rate in the same period, shown in Table 5.

4.2. Model

We construct the following empirical model after referring to various literature [7].

$$FSI = \alpha + \beta_1 X + \beta_2 TED + \varepsilon \quad (3)$$

In the formula, FSI is the dependent variable; α is the intercept; X is the independent variable- CR_4 or HHI; TED is the control variable; and ε is a random disturbance term; β_1 shows the impact of market structure indicators on systemic financial risk. When $\beta_1 > 0$ and it is significant, it indicates that the higher the banking concentration will increase the systemic financial risk. On the contrary, when $\beta_1 < 0$ and it is significant, the higher the banking concentration will reduce the systemic financial risk. And when β_1 is not significant, it indicates that the banking market structure has no significant impact on systemic financial risk in China. The software used in our empirical analysis is Eviews 7.2.

Table 4 China's financial stress index from 2008 to 2019

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
FSI	0.185	0.333	0.431	0.205	-0.074	0.009	-0.172	-0.225	-0.321	-0.123	-0.139	-0.108

Table 5 TED spread

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TED	1.400	0.742	0.747	1.794	2.071	1.129	1.468	1.316	0.814	0.975	1.007	0.562

Source: Calculated based on the data published by The People's Bank of China.

Table 6 Results of OLS

Independent variable	α	β_1	β_2	R ²	F-Statistic
CR ₄ of asset	-1.486760 (-6.235130)	4.020942 (6.862084)	-0.151219 (- 2.137977)	0.840258	23.67038
CR ₄ of deposit	-1.349321 (- 3.719225)	3.420365 (4.086893)	-0.163001 (- 1.535135)	0.651412	8.409220
HHI by asset	-1.102387 (- 2.669230)	26.65464 (2.975121)	-0.200926 (- 1.500180)	0.498096	4.465865
HHI by deposit	-0.824930 (- 3.956146)	18.47827 (4.909960)	-0.100784 (- 1.115202)	0.729379	12.12840

Note: The numbers in brackets are t-statistics.

4.3. Cointegration Analysis

4.3.1. Unit root test

Firstly, we use ADF test method to test the unit root and judge whether the time series are stationary. The null hypothesis is that the original data is non-stationary. I Through the test, we found that the ADF test t-statistic of FSI, CR₄ of deposit and TED are greater than the critical value of the significance level of 5%, indicating the null hypothesis can be accepted and the time series are non-stationary. When we do first-order difference on these time series, we find that CR₄ of asset, CR₄ of deposit and HHI by asset are still nonstationary. After second order difference is performed on them, at significance level of 1%, the null hypothesis can be rejected, that is, all the series are stationary and integrated of order 2.

4.3.2. Engle-Granger test

[8]We sequentially introduce CR₄ of asset, CR₄ of deposit, HHI by asset, and HHI by deposit into the regression model to estimate the parameters and perform ADF test on the residual series. As shown in Table 6, in all cases, β_1 is greater than zero, which means that as the concentration of banking market increases, systemic financial risk increases. And the goodness of fit of regression equation and the significance of regression coefficient are relatively high, and there is no spurious regression.

5. CONCLUSIONS

In this paper, we conduct an empirical research on the relationship between banking market structure and systemic financial risk by using cointegration analysis,

based on the data of 2008-2019 in China. The main conclusions of the study include: Whether measured in terms of market share indicators, CR₄ indicators, or HHI, competition in China's banking market has increased significantly since 2008. Since 2008, systemic financial risk has fluctuated with the change of economic situation in China. The increased competition in China's banking market has helped prevent systemic financial risk.

ACKNOWLEDGMENT

This work was supported by Manufacturing Industry Development Research Center on Wuhan City Circle (WZ2018Y02).

REFERENCES

- [1] Fan Lei. A literature review of the influence of banking market structure on financial stability. *Journal of Liaoning Normal University (Social Science Edition)*, (1) (2016) 84-88
- [2] Chen Yulu, Ma Yong. The myth of the optimal bank concentration. *Finance Forum*, (3) (2012) 4-15
- [3] Zhang Fang, Li long. Measurement index and analysis of China's banking market structure. *Macroeconomics*, (10) (2012) 77-83
- [4] Tao Ling, Zhu Ying. On China's systemic financial risks. *Journal of Financial Research*, (6) (2016) 18-36
- [5] Xu Dilong, Chen Shuanglian. Measurement of systemic financial risk based on financial pressure index. *Economic Perspectives*, (4) (2015) 69-78

[6] Zhang Xingjun, Ren Ya, Xue Xiaoqian. The study on measurement of china's systematic financial risks. *Journal of Contemporary Financial Research*, (3) (2017) 59-70

[7] Yu Daoxian, Hu Huimin. Banking structure and systemic risk. *Hubei Social Sciences*, (3) (2018) 115-121

[8] Engle R. F., Granger C. W. J. Co-integration and error correction: representation, estimation and testing. *Econometrica*, 55(2) (1987) 251-276. DOI: <https://doi.org/10.2307/1913236>