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To cite this article: Chi-Wei Su, Meng Qin, Syed Kumail Abbas Rizvi & Muhammad Umar (2021) Bank competition in China: a blessing or a curse for financial system?, Economic Research-Ekonomika Istraživanja, 34:1, 1244-1264, DOI: [10.1080/1331677X.2020.1820361](https://doi.org/10.1080/1331677X.2020.1820361)

To link to this article: <https://doi.org/10.1080/1331677X.2020.1820361>



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Published online: 19 Sep 2020.



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Bank competition in China: a blessing or a curse for financial system?

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ABSTRACT

Owing to a lack of consensus on whether the competition among the banks brings stability, or vulnerability in the financial system, this research is aimed towards investigating the Chinese banking industry. For this purpose, we have used the Granger and sub-sample time varying rolling window, in order to estimate the dynamic causality of the competition in the banking sector, and the systematic risk factors that follow, in China. The purpose of exploring the two-way causality is to make the banking system more stable, and also to provide new and first-hand evidence that can aid in reducing the occurrence of systematic risks. The results show that the competition in the banking sector has a negative impact on the systematic risk. This means that the increased competition in the banking sector will eventually lead to a reduction in the systematic risk. The results of the study are supported by the competition-stability hypothesis. Also, following the results, the policy direction we propose is that the banks may aim at reducing their systematic risks. They may achieve this by increasing their market share and accelerating transformation, in order to improve their competitiveness, which will help the banking system in China to achieve a sustainable form of stability. Moreover, our findings will also be helpful for the Chinese Ministry of Commerce (MOFCOM), which has been, over the years, in the process of developing an assessment framework for bank mergers, while also trying to minimize the tradeoff between competition and financial stability.

ARTICLE HISTORY

Received 22 March 2020
Accepted 2 September 2020

KEYWORDS

Banking competition; bootstrap; China; rolling window; systematic risk

JEL CODES

C32; G21; E44

1. Introduction

The role of banks in the overall economic and financial management of global markets has never been as critical as it is today. Moreover, several instances have made it clear that the stability of the banking system plays a pivotal role in the smooth functioning of the entire economic system (Jayakumar et al., 2018). The global subprime

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mortgage crisis in the years 2007–2008, caused a large number of commercial banks to file for bankruptcy, which led to a new round of financial turmoil in the world (Acharya & Richardson, 2012; Batrancea et al., 2013; Beck, 2008). The governments across the globe were not only forced to provide deposit insurance, but were also pressurized into injecting significant amounts of capital into the banks. This was especially true for those banks which were considered “too big to fail”. It is noteworthy that, the magnitude of such bailout packages was colossal, and it exacerbated the situation more by aggravating it into a global financial crisis. This eventually accelerated the process of the global recessionary downturn that was experienced in almost all the economies of the world (DeYoung & Torna, 2013).

The wrath the financial crisis brought upon the economies could not have been ignored. Moreover, the aggravating role of the banking system in triggering the systematic risk factors, during the crisis, made the policy makers realize how important it was to maintain the stability of the banking sector. These policies were aimed at possibly curtailing the systematic risks put forth by the banking sector, in the future as well (Ellis et al., 2014; Vazquez & Federico, 2015; Guan et al., 2020). Nonetheless, commercial banks have always faced a complex market environment, and operate on unique business models, which force them to compete against each other, so as to improve their competitiveness and market share. This competition, sometimes, may yield healthy and positive results, such as a more diversified product line and business innovation (Batrancea et al., 2018b; Akins et al., 2016; Tian et al., 2020). Yet, it may also have a significant impact on the systematic risk factors that exist in the market, and can be exploited (Fu et al., 2014).

This paper formulates its research objectives around the two main competing views on the relationship between the banking sector competition and the systematic risk. The first one of these views is the competition-vulnerability hypothesis, that is supported by (Keeley, 1990; Méon & Weill, 2005; Rajan, 1992); and the second one is the competition-stability hypothesis, endorsed by (Beck et al., 2004; Boyd & De Nicolo, 2005; Kane, 2010; Rosenblum, 2011). The competition-vulnerability hypothesis revolves around the idea that the competition in the banking sector leads to an increased amount of systematic risk. In this regard, Keeley (1990) finds that an increase in the banking competition will weaken the market power of the individual banks, and hence, cause an increase in the risk factor of the banks’ operations and liquidity. Rajan (1992), Meon and Weill (2005) also proved that the improvement of competition in the banking sector will increase the risks that are associated with the other banking activities. At another instance, Beck et al. (2013) argued that there is a negative correlation between the market forces and the risk taking decision. However, the strength of this relationship varies, depending on the power the institution exercises, at a national level. The competition-stability hypothesis, on the other hand, presents an alternative view. It propagates that competition is more conducive in order to achieve financial stability. Boyd and De Nicolo (2005) point out that, as long as banks can control their own risk levels, the increased competition in the banking sector will tend to strengthen the stability. Moreover, Beck et al. (2004) argue that the increase in the banking competition will reduce the loan rates of the banks that exercise a monopolistic position, and will also reduce the moral hazards¹ and the adverse

selection² of the banking business that might follow. Kane (2010) and Rosenblum (2011) noted that when there are fewer banks in the financial system, the existing ones are more likely to receive public guarantees or subsidies. This may eventually lead to morally hazardous activities, and could possibly encourage risk-taking behavior as well, which could increase their financial vulnerability. In this study we are primarily interested in exploring the existence of any causal relationship between the banking competition, and the systematic risk in China. We also aim to find out whether the dynamic causality model provides any critical information that could be deemed helpful in understanding the nature of this relationship. Moreover, another point of interest, in carrying out this study, is in knowing the direction of the causality between the two defined variables. This would help in answering whether it is the competition that causes systematic risk, or is it the systematic risk that forces banks to change their strategies, that result in a higher or lower level of competition in the banking sector.

Our study contributes to the existing literature by taking into account the time variation in the causal links bind the banking competition and systematic risk factors. Most of the previous studies have so far focused on how the competition among banks (aka banking competition), a factor that is exogenously defined, affects systematic risks, and have suggested measures that are based on the static relationship between the two variables (González et al., 2017; Leroy & Lucotte, 2017). We, on the other hand, propose that the changes in the external environment may have an impact on banking competition, growth and the development trajectory, and also the strategies of different banks in response to these changes. As a result, the causality running from the banking competition to the systematic risk may also be affected by these external factors, and should be estimated through the time varying causality model. The results reveal that there is a bidirectional causal relationship between banking competition and the systematic risk factor. In 2015, banking competition helped in reducing the systematic risk, a revelation that was in line with the competition stability hypothesis. However, there have also been evidences of reverse causality running from the systematic risk, extended to the banking competition. Moreover, the sign of this reverse causality is dynamic, and tends to change in different sub-periods, thus implying that the systematic risk may have positive, as well as negative effects on the banking competition.

In order to go into further detail, this study proceeds as follows. Section 2 provides an overview of the banking sector in China. While section 3 presents the literature review, based on the relevant studies pertaining to this discipline. Then, section 4 explains the data and the methodology that was followed, while section 5 presents the results and the empirical findings. Towards the end, section 6 discusses the results, with the policy implications and finally, section 7 concludes the study.

2. An overview of Banking Sector in China

With the acceleration of China's interest rate liberalization, Renminbi (RMB) internationalization, the banking reform, as well as the financial disintermediation³, the traditional business model of commercial banks, with their deposit-loan spread income, is increasingly becoming unsustainable (Tan, 2016). Therefore, in order to

broaden and diversify the revenue stream, so as to have greater market share, and to improve the competitiveness, the Chinese commercial banks have shifted to the development models which pertain to business and service diversification. Moreover, the number and the scale of the Chinese banks are also expanding (J. R. Barth et al., 2013), which will gradually transform the traditional monopoly market structure to be centered on the four major, state-owned banks,⁴ into multi-level and all-round competitive market structures. This transformation will significantly help the commercial banks to increase their competitiveness, and occupy a larger market share.

The banking industry in China has been fully open to the outside world since the year 2007. Also, the banking industry, still accounts for much of China's financial market. In addition to this, with the increase of overseas investment in China's banking industry, the U.S. subprime mortgage crisis has brought colossal losses to the Chinese banking industry (Nguyen, 2011). This makes the banking industry's stability even more important to the financial markets (Cornett et al., 2011; Batrancea et al., 2018a). Due to the obvious negative externalities attached with the banking institutions, the banking sector is susceptible to the development of other economic entities as well. In the process of the banking operations, the difficulty of securing and paying off the loans, reduces the possibility of crediting, which will inevitably have a negative impact on the deposit business. This, in turn, leads to illegal loans, or Shadow Banking Operations, which can easily lead to the financial crisis and further on, into a deeper economic crisis (Cornett et al., 2011). Shadow banking in China is an ominously different concept, as compared to the U.S. In China, the involvement of commercial banks, in shadow banking activities, is so prevalent that it is often dubbed as "Shadow of the Banks" (Ehlers et al., 2018). China's banking industry has high barriers to entry, and the competition among the banks, as well as the pursuit of high yielding assets by the depositors, could increase the demand for shadow banking products in the future. This development could be extremely detrimental for the financial stability, owing to its contribution towards the systematic risks (Hachem, 2018; Lysandrou & Nesvetailova, 2015; Xu et al., 2019). In the context of the above explanation, we believe that it is extremely critical to study the dynamics of banking competition, and the systematic risks in China. This must be done, not only to minimize the potential catastrophic effects of any future crisis, but also to ensure the robustness of the industry on sustainable footings. Moreover, our study could also be helpful for the Chinese Ministry of Commerce (MOFCOM), which is in the process of developing an assessment framework for bank mergers, while trying to minimize the tradeoff between competition and the financial stability that is required for the banking system to survive (Healey & Chenying, 2017).

3. Literature review

The competition-vulnerability hypothesis was first proposed by Keeley (1990). This hypothesis suggested that the banking competition could possibly hamper financial stability. Under a highly regulatory, and protected system in-place, banks can rely on their franchise value to obtain a monopolistic profit (Marcus, 1984). Also, in this scenario, in order to ensure the long-term holding of this monopoly profit, banks will regulate their own risky behavior as well. However, it is noteworthy that the higher competition will

weaken the value of the bank's franchise, prompting banks to chase riskier assets, in order to boost their profits and, thereby, raising the probability of systematic risk (Yeyati & Micco, 2007). By establishing a dynamic model of morally hazardous situations and activities in banks, Hellmann et al. (2000) find that the enhancement of the banking competition also affect the bank's franchise value. Thus, the temptation of banks to enter into high-risk ventures increases, leading to a simultaneous increase in the systematic risk. Marquez (2002) points out that the reduction of the banking competition makes it difficult to guarantee the quality of borrowers that borrow money, which also leads to an increase in the systematic risk that a bank can come face to face with. Moreover, according to Allen and Gale (2004), the improvement of the banking competition may be favorable for the banks' operational efficiency, but at the same time, it is not propitious for its financial stability. Salas and Saurina (2003) and Bătrânceanu et al. (2008) found that the larger market forces lead to higher liquidity ratios and a lower credit risk. Ariss (2010) also established that over time, the financial stability and the market power of the banks have changed simultaneously. In the same stride, González et al. (2017) propagated the idea that the increase in the competitive environment of banks, leads to a decline in the financial stability of the overall banking system.

The competition-stability hypothesis, as opposed to the competition-vulnerability hypothesis means that, when the banking competition increases, it helps in reducing the systematic risk and subsequently improves the financial stability as well (Mishkin, 2009). Amidu & Wolfe, (2013) and Boyd et al. (2006) argued that there is a conversion effect between the banking competition and the risk factor involved. Under the influence of the market environment (Vizcaíno-González et al., 2017), the increase in the competition reduces the bank's loan rate, decreases the moral hazard put forth by the debt enterprise, and also makes the systematic risk lower. In fact, the work of Boyd and De Nicolo (2005) is seminal, in a way, that it explores the impact of the changes, in the market structure of the banks, on the asset allocation in the deposit and the loan markets. When an N number of banks compete in the deposit and loan markets simultaneously, the changes in the value of N will leave an impact on both the markets. According to the dynamic game that is developed, the mutual relationship between the banks and the enterprises makes the banking competition less likely to lead to any systematic risks. This development would ideally be in line with the competition-stability hypothesis as well. An almost similar conclusion was drawn by De Nicoló et al. (2006) who pointed out that, in a less competitive market environment, larger banks can raise their loan rates independently, and also on the basis of the voting behavior of the investors that are attached with them (Pineiro-Chousa et al., 2016). Interestingly, as the cost of borrowing rises, the probability of the borrower's morally hazardous behavior also increases. This reduces the stability of the banking industry, and makes the financial market prone to more fluctuations as well. On the governance side of this phenomenon, Beck et al. (2004) prove that the supervision of the regulatory authorities mainly depends on the information feedback that comes from the banks. Moreover, James R. Barth et al. (2009) also find that banking competition reduces the corruption that is experienced in the borrowing and lending of the bank loans, thus ensuring some financial stability. In another instance, Anginer et al. (2014) prove that banking competition has a correlation with the stability of the

banking system. Also, Leroy and Lucotte (2017) state that competition between the banks enhances the financial stability, by reducing the systematic risk that is extended towards these institutions. This result can be justified with the explanation that a relatively weaker competition tends to increase the relevance of the bank's risk-taking behavior. Moreover, Bandaranayake et al. (2018) point out that a greater portion of the banking competition is associated with smaller systematic risks.

A deeper look into the extant literature shows that there is an emerging trend that investigates the dynamics of banking competition and the systematic risk in China. The first one of these studies, according to our knowledge, is a study under taken by Chen (2013). Chen (2013) argued that a concentrated market structure, along with moderate competition, are more likely to be conducive to the stability of the banking industry in China. Following in the same stride, Yang and Zhong (2013) concluded that systematic risk is positively correlated with banking competition; In addition to this, the bank's competition increases, when the risks that are borne by the commercial banks tend to show a spike, irrespective of their size – may it be large, medium or small. Also, in the process of China's interest rate marketization, the competition in the banking sector, may increase the probability of such events that provoke systematic risks, at least in the short term. However, Shujiea et al. (2011) point out that the Chinese banks, through continuous competition, have usually been able to reduce the probability of systematic risk, and have also improved their financial stability along the way. Yin and Gan (2011) believe that commercial banks, which possess a strong market power, can choose high-credit enterprises, especially when providing credit services. This alone can improve the security of their loan product portfolio. Following on to this, Huang and Liu (2014) effectively demonstrated that the increase in the loan competition can reduce the bankruptcy risks, and may further improve the stability of the financial system. The observations made by Healey and Chenying (2017) reveal that the competition between the listed banks tends to have a significantly negative impact on the systematic risks experienced by banks. Hence, they propose the introduction of targeted policies, in order to not only stabilize the operations of the banking industry, but also to reduce the systematic risks in the industry. In light of the extensive review of the literature, one can concur that the relationship between the competition among banks, and its impact on the robustness and stability of the financial system, through a systematically riskier channels, is not conclusive across the globe, let alone in china. This gap alone is sufficient to provide a strong justification to conduct this study. This is primarily due to the reason that without the understanding of the true nature of this relationship, no policy can be prove to be optimal in ensuring the financial sustainability of the banking system in China, as well as other countries.

Secondly, we have also found that when the banks raise the loan rate, the enterprise will simultaneously increase the risk of its investment projects (Topor et al., 2016; Zhang et al., 2020). This will lead to the bank resetting the loan rate according to the enterprise's behavior. This mutual relationship favors the maintenance of financial stability. Thirdly, by studying the impact of the banking competition on the systematic risk, this paper observes that the stability of the competition between the banks is non-linear in nature. Based on this observation, we can agree that the main

competition between the banks is to actually reduce the systematic risks, and that different competition policies have different effects on the financial stability of a particular bank. At last, the previously written literatures only considered the full-sample causality, but when there are structural changes that cause parameter instability, this is likely to lead to misleading results and conclusions in the analysis. When structural changes occur between the full-sample time series, the results of the empirical study are no longer accurate (Balcilar & Ozdemir, 2013). Therefore, this can be solved by allowing the provision of a causal relationship between the two series, to be time-varying.

4. Data and Methodology

4.1. Data Description

For the purpose of this study, we have used data from a quarterly time period, starting from 2004:Q1 to 2019:Q4, which was the most recent one available. The reason why the analysis starts from the year 2004 is because, it is the year in which the floating range of loan rates for various banking financial institutions started expanding in China. The Party Central Committee, and the State Council decided to select the Bank of China, and the Construction Bank as pilots, and use the state's foreign exchange reserves and other supplementary capital to carry out the shareholding system reform. Since China maintains a strict access policy for the banking institutions, we can measure the banking competition using the market structure indicator, i.e., the four-banks concentration ratio (CR) (Agoraki et al., 2011).

Selecting the right proxy for the systematic risk is a nontrivial task. In this regard, banks usually operate in an environment which is dynamically interconnected and complexed. Therefore, a single event can potentially impact the balance sheet of different banks, in a manner that varies with each bank. Realizing this fact, the researchers have proposed different proxies for the systematic risks that range from ex-ante concepts, which are balance sheet based ratios, to ex-post concepts, which are market based default indicators (Akins et al., 2016; Segoviano & Goodhart, 2009). We measure the systematic risks that are brought under consideration in this study, through the non-performing loan ratios, (NPLR) by following the work of (Jakubik, 2007) and (Acemoglu et al., 2015; Allen & Gale, 2000; Bottazzi et al., 2020). Another reason to choose the NPLR as a proxy of the systematic risks, is the sound argumentation in favor of the channels that actually link it with the systematic risk. When the actual allocation of the credit resources deviates from the ideal equilibrium state, a credit resource mismatch occurs. This will tend to reduce the repayment probability of the bank loans, and turn these loans into non-performing loans, which will lead to systematic risks (Hsieh & Klenow, 2009). We have obtained both the CR and the NPLR, for this study, from the National Bureau of Statistics of China.

4.2. Granger Causality: A Measure of Causality

Moreover, it has also been observed, quite often, that the causal relationships and the spillovers among the variables, particularly in the financial markets, are dynamic and

change over time. Sometimes, it is the structural change in the overall economy (Anghelache et al., 2019), or the industry, while at other times it may be some significant events that alter the behavior of the market participants. These dynamic changes are generally reflected in the estimated parameters of any causal relationship, and must not be ignored (Rizvi et al., 2013, 2014; Su et al., 2020b, 2020d). The popularity of the Granger causality, in this context, is undisputed and remains the first choice of the researchers, especially while evaluating causal relationships. Immediately after its introduction by (Granger, 1969), and the adoption by (Sims, 1972), this approach became the gold standard for evaluating variables for causality. Nonetheless, this approach is plagued by the assumption of static causal relationships, and several researchers have proposed that it should be altered and evolved to incorporate the dynamism which is prevalent in real world situations (Aaltonen & Östermark, 1997; Cogley & Sargent, 2001, 2005; Lu et al., 2014). The advantage of the time varying causality estimation is that it not only examines the causal relationship between the banking competition and systematic risk in a dynamic manner, but it also captures the changing or bidirectional causality effect, that is immensely useful in understanding the real causes of contagion and the systematic risks that are put forth.

4.3. Bootstrap Full-Sample Causality Test

One of the major gaps that we have found in the previous literatures is that most of the studies consider only the option of full-sample causality. However, when there are structural changes that cause parameter instability, it is likely to give misleading results and conclusions in the forthcoming analysis. When structural changes occur between the full-sample time series, the results of the empirical studies are no longer guaranteed to be accurate (Su et al., 2020c). The problem can only be resolved by allowing the causal relationship between the two series to be time-varying in nature, thus, this is the path that we will follow in this study.

Since the underlying time series is stationary in nature, there may be no standard asymptotic distribution. Therefore, the Granger-causality test will experience difficulty in estimating the vector autoregressive (VAR) models (Toda & Phillips, 1993). Shukur and Mantalos (1997) point out that the results are more accurate if the residual-based bootstrap (RB) method is applied. Moreover, the RB method displays an excellent performance, over the standard asymptotic tests, regardless of whether the two variables are cointegrated or not (Balcilar et al., 2010). In particular, Shukur and Mantalos (2000) demonstrated that the standard tests, without the RB method, could not achieve good cointegration, especially when looked at in small samples. As a consequence, this study uses the RB-based modified-LR statistic, in order to test the causal relationship between the systematic risk and the banking competition.

To highlight the results of the causality test, we have used the bivariate VAR, (p) which is a process that is being considered in order to find the results of the causality test. The equation that has been formulated is as follows:

$$y_t = \varphi_0 + \varphi_1 y_{t-1} + \dots + \varphi_p y_{t-p} + \varepsilon_t, \quad t = 1, 2, \dots, T \quad (7)$$

Where $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})'$ is a white noise process with zero mean and covariance matrix. The optimal lag length 'p' is determined by the Schwarz information criteria (SIC). Also, we use the n-firm⁵ concentration ratio (CR)⁶ to measure the banking competition, and the non-performing loan ratio (NPLR) to measure the systematic risk. By splitting it into two sub-vectors, i.e., y_{CR} and y_{NPLR} , the equation (7) can be further be represented as:

$$\begin{bmatrix} y_{CRt} \\ y_{NPLRt} \end{bmatrix} = \begin{bmatrix} \varphi_{10} \\ \varphi_{20} \end{bmatrix} + \begin{bmatrix} \varphi_{11}(L) & \varphi_{12}(L) \\ \varphi_{21}(L) & \varphi_{22}(L) \end{bmatrix} \begin{bmatrix} y_{CRt} \\ y_{NPLRt} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (8)$$

Where y_{CR} and y_{NPLR} , indicate the banking competition and the systematic risk, respectively. $\varphi_{ij}(L) = \sum_{k=1}^{p+1} \varphi_{ij,k} L^k$, $j = 1, 2$ and $L^k x_t = x_{t-k}$ is to define L .

From equation (8), by imposing the restriction, $\varphi_{12,k} = 0$ and $\varphi_{21,k} = 0$ for $k = 1, 2, p$ respectively, we will be able to test whether the systematic risk and the banking competition can be considered as the null hypothesis of the Granger causality test. When the null hypothesis is rejected, it proves that there exists an imperative causal relationship between the systematic risk factor and the factor taken for the competition among the banks. If the systematic risk can promote and cause banking competition, the bank can then take measures to reduce its systematic risks, in order to control the variable of competition among the different banking institutions.

4.4. Parameter Stability Test

One of the assumptions of the full sample test, in the VAR model, is that the parameters remain constant. However, if the full sample time series, exhibits its true potential in terms of the structural changes that are experienced, the causal links then become unstable (Balcilar & Ozdemir, 2013). Therefore, we consider the rolling-window bootstrap estimation, so as to avoid the problem of the parameters that reflect non-constancy. In addition to this, the short-term stability of the parameters is tested by using the Sup-F, Mean-F and Exp-F tests (Andrews & Ploberger, 1994) which are required for a15% trimming (Andrews, 1993). Moreover, we have also used the L_c test (Hansen, 1992; Nyblom, 1989) in order to check the stability of the long-term parameters as well. It is noteworthy that these tests are calculated from the LR statistic sequence. Moreover, through the parameter bootstrap program, we have obtained the p-values and the critical values as well {Citation}(Andrews, 1993; Andrews & Ploberger, 1994).

4.5. Sub-Sample Rolling-Window Causality Test

For the purpose of this study, we have used the rolling-window bootstrap estimation, to overcome the above stated problem (Balcilar et al., 2010). The rolling-window techniques depend on the fixed-size sub-samples. Therefore, we have set up a fixed-size rolling window, including an observation value of l . This sequentially rolls from the beginning to the end of the full-sample (Balcilar et al., 2010). And the full-sample is divided into $T-l$ sub-samples, that is, $i-l+1, i-l, \dots, T$ for $i = l, l+1, \dots, T$. Next, we performed the RB-based modified-LR causality test for the above defined sub-sample.

We also calculated the bootstrap p-values of the observed LR statistics, by rolling the sub-samples, and observe the possible changes in the causal relationship between banking competition and the systematic risk. The impact of the banking competition on the systematic risk can be described by the equation, $N_b^{-1} \sum_{k=1}^p \hat{\phi}_{12,k}^*$, where N_b represents the number of bootstrap repetitions. The impact of the systematic risk on the banking competition is similar to that in the above mentioned equation. Other than this, the 90% confidence intervals are computed where the lower limit equals the 0.05 quantiles of the $\hat{\phi}_{12,k}^*$, and the upper limit equals the 0.95 quantiles of the $\hat{\phi}_{21,k}^*$ (Balcilar et al., 2010; Su et al., 2019b; Qin et al., 2020a). A large window size can ensure the accuracy of parameter estimates. However, a window size that is too large may increase the risk of including these multi-shifts in the window sample. Also, choosing a smaller window size can lead to inaccuracies, but this can be solved by using the bootstrap technique.

5. Empirical Results

In 2004:Q1, the major commercial banks' NPLR accounted for 16.6% of the total loans that were taken. Up till the end of June 2018, the NPLR went down to 1.86%. After the global financial crisis in 2008, the NPLR dropped sharply, which meant that the probability of the systematic risk was significantly reduced. At the end of the year 2008, the NPLR fell sharply by a 3.71%⁷. This meant that the quality of the commercial banks' assets indeed improved significantly, and that the systematic risk also went down by a considerable amount. The loose monetary policy that was rolled out in the year 2009 led to a deposit of a relatively sufficient capital in the banking industry, which weakened competition in the short term; but in the long run, banks increased their competition, in order to occupy additional market share.

Hence, for this study, we first tested the full-sample causality, through the VAR model of the two variables. Then, we considered an optimal lag period of 1, based on the Schwarz information criterion (SIC).

Table 1 shows the results of causality tests, based on the RB-based modified-LR. The results reveal that the hypothesis "CR does not Granger cause NPLR" cannot be rejected, indicating that the variable of banking competition, measured through the concentration ratio, has no impact on the NPLR. However, the hypothesis that "NPLR does not Granger Cause CR" is rejected at a 5% significance level, implying that the NPLR does in fact impact the banking competition in China. Although these results are statistically significant, yet they are in conflict with the existing extant literature (Schaeck et al., 2009).

In the presence of the structural changes, the relationship between the banking competition and the systematic risk is unstable. Therefore, a full-sample causality test, using the parameter constant hypothesis, makes a single causal relationship throughout the sampling period, no longer reliable (Zeileis, 2005). To counter this, we considered the bootstrap rolling causality, in order to ensure the reliability of the result. We performed the parameter stability test, and the results are shown in Table 2.

However, we found that using the full-sample data, in order to estimate the VAR model, is an unsustainable practice, especially when there is a structural change. This

Table 1. Full-sample Granger-causality tests.

Tests	H0: CR does not Granger cause NPLR		H0: NPLR does not Granger cause CR	
	Statistics	p-value	Statistics	p-value
Bootstrap LR test	0.015	0.728	4.589**	0.042

Notes: **denote significance at the 5%. These tests are used by Eviews software.

Data Source: National Bureau of Statistics of China.

Table 2. Parameter stability tests.

	CR Equation		NPLR Equation		VAR System	
	Statistics	p-value	Statistics	p-value	Statistics	p-value
Sup-F	22.572***	0.000	33.843***	0.000	21.580**	0.022
Mean-F	15.110***	0.000	16.789***	0.000	9.992**	0.035
Exp-F	11.781***	0.000	18.582***	0.000	6.958**	0.012
L_c^b					2.582**	0.019

Notes: *, **, *** denote significance at the 10%, 5% and 1% level, respectively. Hansen-Nyblom parameter stability test for all parameters in the VAR jointly.

Data Source: National Bureau of Statistics of China.

means that the consequences of the no causal relationship between the banking competition and the systematic risks, are not accurate. Therefore, we applied the RB bootstrap-based modified-LR causality test, in order to check the causality. The null assumption of the test is that the NPLR does not result in CR, and vice versa. We have also used the VAR model in Equation (8), so as to estimate the bootstrap p-values of the LR statistics. It must be known that there is no uniform standard for selecting the window sizes, in the rolling-window estimation (Balcilar et al., 2010), and the optimal window size depends on the persistence and size of the interrupt (Pesaran & Timmerman, 2005; Su et al., 2020b, 2020d). Based on Monte Carlo simulations, it was found that when frequent interruptions occur, the deviation of the auto-regressive (AR) parameters tend to minimize, and the window size may reduce to as low as 20. Thus, we balanced the two conflicting goals when choosing the window size. The rolling estimates from the year 2004:Q1 to 2019:Q4 in China, and 20-quarters⁸ from the full sample, have been taken as the observations.

Figure 1 highlights that the null hypothesis that, “NPLR does not have Granger cause CR”, is rejected at a significance level of 10%, during several sub-sample periods, including 2010:Q1-2012:Q1, 2014:Q2-2014:Q3 and 2018:Q1-2018:Q4. As it can be seen from Figure 2, during these sub-periods, the direction of the influence of the NPLR, on the CR, is both positive and negative.

Figure 3 indicates that banking competition left an impact on the systematic risk during the time period of 2015:Q2–2016:Q1. Furthermore, Figure 4 reveals that there is also a negative correlation between them.

6. Discussion and Policy Implications

The results that we observed in the previous section are interesting, and can be supported and justified based on the policy actions taken and the responses by the

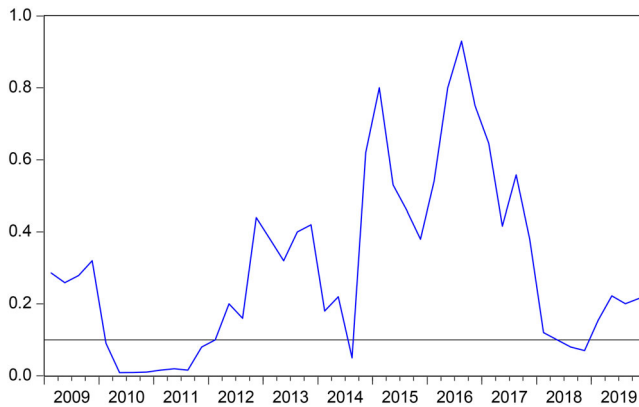


Figure 1. Bootstrap p-value of rolling test statistic testing the null that NPLR does not Granger cause CR. Source: All diagrams draw from EViews software.

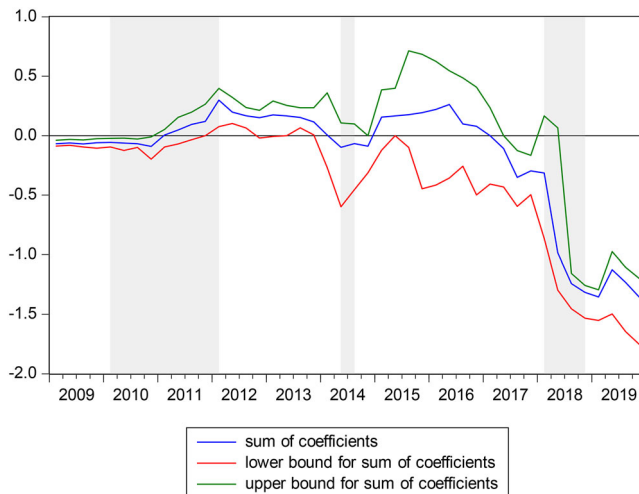


Figure 2. Bootstrap estimates of the sum of the rolling window coefficients for the impact of NPLR on CR. Source: All diagrams draw from EViews software.

Chinese authorities. First of all, there is a need to discuss the changing and dynamic effect of the systematic risks on the banking competition, since it is the main focus of this study. It is common knowledge that immediately after being affected by the global financial crisis in 2008 (Yuan et al., 2010), the Chinese economy introduced and announced a stimulus plan of 4 trillion Yuan in the month of November of the same year. The positive fiscal policies imposed by the Chinese government drove a substantial increase in the bank loans and accelerated the infrastructure investment. This investment led to further long-term loans at the time when the competition between the banks was relatively weaker. At the same time, China implemented a policy of lowering the benchmarked interest rate as well, which enabled the banks to aggressively expand their loan portfolios, and initiate further measures to compete vigorously. Together, the moderately loose monetary policy and the expansionary fiscal policy led to a rapid increase in the size of banking assets and liabilities, albeit

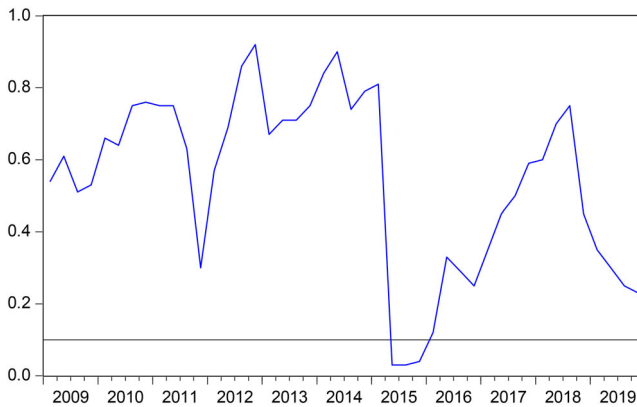


Figure 3. Bootstrap p-value of rolling test statistic testing the null that CR does not Granger cause NPLR. Source: All diagrams draw from EViews software.

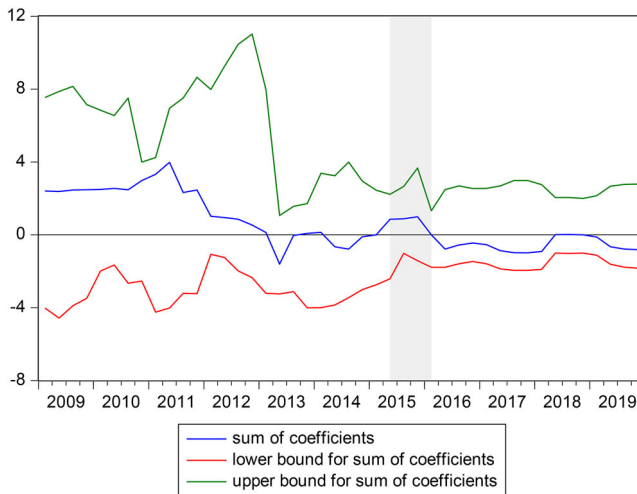


Figure 4. Bootstrap estimates of the sum of the rolling window coefficients for the impact of CR on NPLR. Source: All diagrams draw from EViews software.

following the strategy of stiff competition. Therefore, during the time period of 2010:Q1-2010:Q4, we saw that the systematic risk left a positive impact on the banking competition.

This was counterbalanced in between the year 2011-2012, when we observe that the systematic risk left a negative impact on the banking competition. The main drivers were the lag effects of the expansionary policies that were implemented in the past, that started to emerge gradually, and the banks realized that aggressive expansion may lead to an increase in the risk factors (Goetz et al., 2016).

In 2014, however, a large amount of capital, ahead of the risks, gradually emerged in the market. The downward pressure on the economy led to a gradual increase in the NPLR. In addition to this, the China Banking Regulatory Commission (CBRC)

issued a notice to allow five private banks⁹ to carry out their own risks. The banks then began to consider different alternatives in order to improve their competitiveness through various channels, so as to mitigate the potential risks involved in doing so (Peihani, 2016). This is the time when we again observed that the systematic risk is one of the main promoters of banking competition. Since the year 2018, the principle of the bank credit has been based on mortgages and guarantees, and the above mentioned, two risk control methods have further accumulated the systematic risks and added to the list. In addition to this, in the recent years, the diversification of the financial system¹⁰, and the continuous expansion of the banking industry have led to increased competition in the banking industry. Therefore, the systematic risk left a positive impact on the banking competition in the first half of the year 2018 (Afshan et al., 2018).

Other than this, another important feature of our results, is the support and the indication of the reverse causality, transitioning from the banking competition to the systematic risk, particularly during the time period between 2015:Q2–2016:Q1. Figure 4 further elaborates that the banking competition could actually mitigate the systematic risks, as highlighted by the negative correlation between them. To understand why this reverse causality is plausible, we needed to first discuss the reasons that make the banking competition in China, exogenous in nature. In May 2012, the CBRC announced that it would encourage and guide the private capital enterprises to enter the banking industry. This announcement, and the steps taken in response to it, were of great significance for accelerating the construction of a multi-level banking system, establishing a fair competitive banking market environment, and the sustainable development of China's banking financial institutions. The first major step was taken in July 2013, when a comprehensive liberalization of the loan rate control of the financial institutions caused the transformation, and the upgradation of large, state-owned commercial banks (Hartarska & Nadolnyak, 2007). In addition to this, in the year 2014, there were several substantial changes in the external environment (Su et al., 2019a). These included the slowdown of economic growth, the sluggish real estate market, the rapid rise of third-party payment¹¹, and the expansion of deposit interest rate, which eventually pushed banks to attract more customers, and improve their market share through stiff competition, exhibited via lowering the loan rate. The interest rate of the loan is related to the probability of the borrower's moral hazard and defaults. So, the probability of a lower moral hazard further reduced the systematic risk of the bank, and in turn, the stability of the bank showed improvements. These explanations about how the banking competition may reduce the systematic risk, make our results not only fully consistent with the findings presented in Boyd and Nicoló's model, but also put them in the category of findings that support the competition-stability hypothesis.

Through the above analysis, the two-way causal relationship between the banking competition, and the systematic risk has been classified, adding to the literature on this discipline. On one hand, we have noticed that the diversification of the financial system, and the continuous expansion of the banking industry will prompt the banks to accelerate their transformation, and will eventually mitigate the probability of the systematic risks. While, On the other hand, the competition among banks will

establish a fair market environment. A diversified market competition mechanism will promote the sustainable development of the banking industry, as well as financial stability. We believe that these results could help the relevant policy makers and the practitioners considerably, especially during those times when there are tradeoffs between promoting competition and reducing the systematic risk. However, on the basis of the discussion above, one cannot rule out whether the data is in favor of the competition-stability hypothesis. This is because in reality, the policy makers and practitioners face no trade-offs at all. By sanctioning policies that are conducive, and encouraging for the banks, so that they can indulge in healthy competition, policy makers can not only increase the efficiency of the banking system, but can also curtail the systematic risk where possible.

7. Conclusion

In order to fill in the void in the existing literature, on the ongoing yet unresolved debate on the relationship between the banking competition, and its impact on the systematic risk or financial stability, this study explores the causal relationship between the two variables in China.

Based on the argument that better performance comes from higher market concentration, we have applied the market structure, in order to measure the competitiveness of the banking institutions (Mirzaei et al., 2013; Park & Weber, 2006). According to the competitive market theory, put forth by (Baumol et al., 1983), the most important condition for the market structure, in order to measure the competitiveness, is to consider whether there are barriers to entry in the market or not. Because China's banking industry is at a stage where it is experiencing deepening reforms, the state still maintains a strict access system for the banking market. Therefore, the concentration can proxy the market competition as well, and the banking concentration and competition are simply an inverse of each other (Vives & Matutes, 1995).

Moreover, the bootstrap, full-sample causality test proves that there is an existence of a one-way causality when it comes to the systematic risk posed to the banking competition. More specifically, in the year 2015, the banking competition was conducive to the reduction of the systematic risks, a fact that is completely in line with the competition stability hypothesis. These results establish that banking competition can improve the financial stability of banking institutions via reducing the systematic risks involved. When a bank has a competitive advantage, it will tend to consider whether the enterprise will increase the risk of its investment projects or not, due to higher interest rates. Hence, it will then decide on an appropriate loan rate, in order to reduce the systematic risks. On the other hand, the loose or lenient monetary policy makes the bank funds reach an abundant level, that too in the short term. Therefore, the NPLR will temporarily decrease as well. However, excessive borrowing will, inevitably, lead to an increased probability of the systematic risk occurring in the future. Consequently, the banking competition will weaken in the short term, but in the long run, the competition will expand in order to maintain the market share of these institutions. In addition to this, we have also found that the changes in the external

environment will leave an impact on the banking industry's competition, and also contribute to the rapid development of the commercial banks.

As opposed to the bootstrap full-sample causality test, the results with the sub-sample causality test confirm the existence of the bidirectional causal relationships between the banking competition and the systematic risk. Furthermore, the impact of the systematic risk on the banking competition, in varying sub-periods, has both positive and negative effects. This kind of nonlinear relationship can be enlivening for the stable development, and the transformation of banks. In general, this study does not only conclude that the relationship between banking competition and systematic risk is consistent with Boyd and Nicoló's proposed model, but also confirms that there exist interrelated transmission mechanisms between them, which can be conducive to the prevention of the systematic risks.

Our results can be strongly supported and justified on the basis of the policy actions and the stance taken by Chinese authorities, during the sample time period considered in this study. We observed that, immediately after the global financial crisis of 2008, the policy actions taken by the regulators, that were based on the expansionary fiscal and monetary policies not only reduced the systematic risks, but also set the stage for banks in China to engage in healthy competition. Similarly, some of the steps taken by the regulators so as to increase the banking competition exogenously, which pushed the banks to adopt policies, curtailed the cost of loans for the borrowers. This reduced cost of loans usually reduces the borrower's probability of default, and also the moral hazard resulting in the reduced systematic risk. On the basis of our results, we believe that enacting the policies that are conducive, and encouraging the banks to involve in healthy competition is possible, and the policy makers could achieve the dual targets of increased efficiency (through competition) and financial stability (through lower systematic risk) in China.

Notes

1. Moral hazard is the act of economically active people who do not benefit others while maximizing their effectiveness.
2. Reverse selection refers to the phenomenon that the inferior goods generated by the information asymmetry of the two parties and the market price are degraded to expel quality products, and then the average quality of market trading products declines.
3. Financial disintermediation means that in the case of financial regulation, the supply of funds bypasses the commercial banking system and is directly transmitted to the demanders and financiers to complete the extracorporeal circulation of funds.
4. The four major state-owned banks include: Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, and China Construction Bank.
5. N represents the top n companies in the industry.
6. Measured as the total assets of the four large state-owned banks, as a percentage of the total assets of all banks.
7. The large-scale credit investment, after the financial crisis in 2008, caused the credit scale of the commercial banks to increase substantially, which in turn led to a significant drop in the NPLR.
8. When we choose the window size, one can consider that the large window size may bring more precision; the other is that the small window size will eliminate the risk of interruption in the window size sample. Therefore, we chose a small window size of 20

quarters. We also selected window sizes of 24 quarters and 30 quarters, for the empirical analysis. The results proved very similar to the results of the 20 quarter window size. Therefore, the windows size of 20 quarters is deemed to be appropriate.

9. Five private banks are included the Shenzhen qianhai weizhong bank, Wenzhou civil and commercial bank, Tianjin jincheng bank, Zhejiang e-business bank and Shanghai huarui bank.
10. The financial system includes a financial institution system that is indirectly financed, a financial market system that directly finances, and a financial regulatory institution system that implements the supervision and management.
11. Third-party payment refers to an independent organization with certain strengths and credit guarantees, which facilitates the online payment mode of transactions between the two parties, through docking with the network.

Disclosure statement

No potential conflict of interest was reported by the authors.

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