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An Empirical Study on the Capital Buffer of Rural Commercial Banks in China

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Abstract As the product of China's unique economic system and economic transformation, China's rural commercial bank is a special kind of banks which is a combination of the rural credit cooperatives and stock system reform. In recent years, due to the Chinese government's emphasis on "three rural issues", the rural commercial banks have experienced a rapid development in the asset size, the number of institutions, and so on. However, rural commercial banks are facing the market competition pressure and limited capital source, and therefore, experts and scholars have been concerned about how to supervise this kind of special banks. In this study, 44 of the panel data of rural commercial banks in 2010-2014 are collected and a dynamic model is adopted to analyze the behavior of capital supervision of China's rural commercial banks. The research results show that rural commercial banks have taken strict measures to supervise capital by maintaining a high capital adequacy ratio to avoid shocks of external exposures. However, the non-performing loan rate is much higher than the counterparts', 3 times higher than that of city commercial banks in China, which means there exist serious credit risks. Accordingly, this study suggests that rural commercial banks should have a correct understanding of credit risk and its control, keep the balance between immediate interests and long-term goals, make full use of peers and macro economic indexes to forecast risks, give the early warning information and guard against risks.So far few studies in China have adopted a dynamic model to deal with rural commercial banks, so the findings in this study are more valuable and can provide more constructive suggestions to help implement the Chinese government document issued recently to speed up the innovation of rural financial system.

Keywords: *Rural Commercial Bank, capital buffer, capital adequacy ratio, non-performing loan ratio, City Commercial Bank*

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1. Introduction

Banks play a key role in effective allocation of economic resources in society, but banks themselves are fragile and opaque. If regulations are not efficient enough, it is likely to bring instability to the entire financial system and high cost to the society. The global financial crisis breaking out in the United States in 2008 revealed the shortcomings of current financial supervision. Therefore, international organizations such as the Financial Stability Board, the Basel Committee, the International Monetary Fund, actively pursue macro prudential models, attempting to curb capital procyclical behavior of all kinds of financial institutions. In accordance with the requirements of Basel III, banks must have adequate net assets to cover risky mortgage assets, keep capital buffer, reduce banks' speculation to the minimum, and protect banks from financial shocks. In response to the implementation of Basel III, the people's Bank of China began to carry out "the Capital Management of Commercial Banks (Trial implementation)" in 2013, requiring systemically important banks and non-systemically important banks in China to keep corresponding capital adequacy ratio respectively, working together with the China Banking Regulatory Commission to promote the new capital accord.

Since the implementation of the Basel III, both academia and the banking industry attach much importance to capital buffers, the macro prudential measures. They have addressed the following questions in theory and practice, such as Are banks' capital buffers procyclical or countercyclical? What factors affect the capital buffer behavior of commercial banks? What is the appropriate capital buffer for commercial banks? Research findings show that there is no consistent answer to these questions as different countries and regions, different economic environment and business models will affect the capital buffer in a different way.

As the product of China's unique economic system and economic transformation, the Rural Commercial Bank of China is classified as a special bank, whose predecessor was a rural credit cooperative with joint-stock system. With Chinese government giving priority to the "three rural issues"[1] in recent years, these cooperatives have been transformed into rural commercial banks (RCB), which have got rapid developments in terms of asset size and the

[1] The so-called "three rural" issue refers to the agriculture, the countryside, and the farmers. The aim of the policy is to increase farmers' income, speed up agricultural development and maintain rural stability. As a large agricultural country, China gives priority to "three rural" issue to enhance the citizens' quality, economic development, social stability, national prosperity, and national rejuvenation.

number of institutions. For instance, by the end of 2013, the total number of RCB was 468, with the total assets taking up 13.10% of the banking industry, and balance of assets increasing by 35.49% year on year. However, compared with city commercial banks (CCB), RCBs are still very weak in capital regulation. Given the nature of RCB, no ready-made regulations can be directly taken from existing research results. Therefore, this research will fill the gap by analyzing empirically the status quo and the influencing factors on RCB capital supervision. In the end, this paper will recommend a moderate capital buffer interval for RCBs to improve RCB capital supervision and even China's macro prudential supervision.

The paper has the following structure. Section 2 provides a literature review of capital buffer. Section 3 introduces the model adopted in this paper while Section 4 describes the database. Section 5 presents the empirical results and analyzes them. Section 6 concludes the paper.

2. Literature Review

Researches on capital buffer can be classified into 3 categories: banks' motivation for holding capital buffer, the relationship between capital buffer and economic cycle, and the influence of external factors on capital buffer.

Banks' holding capital buffer means that actual capital adequacy ratio is higher than the minimum capital adequacy ratio required by regulatory authorities. It seems to be rational that banks prefer to keep a lower capital adequacy ratio to expand their business. However, there is evidence showing that current banks' capital adequacy ratio is far higher than the required. Therefore, many researchers have attempted to find out what motivates banks to hold capital buffer. For instance, Milne & Whalley [20], Milne [19] established dynamic models to analyze the banks' capital decision, and they found that bankers are evaluating costs and profits on the entire balance sheet just like making a list. Usually, they make decisions according to the following capital standards: 1) the punishment and other kinds of suppression when violating the provisions on minimum management requirements; 2) the cost of holding surplus capital; 3) the cost and time constraints for adjusting the level of capital. Generally speaking, banks keep capital buffer to guard against external exposures and reduce the risks to the minimum. Thus, banks with high chartered value have a greater incentive to hold capital buffer, otherwise they would suffer greater loss once breaching the regulations.

In fact, whether banks will suffer from the risks depends on the economic environment [22], so another series of research on capital buffer is related to the economic cycle. Many researchers, like Borio et al. [5], Ayuso et al. [2], Wong et al. [25], found that capital buffer has the pro-cyclical characteristics because the bank credit risks will change the economic fluctuation. In the rising phase, the default probability, default loss rate and risk factors of valuation are low, so banks tend to ignore the regulatory capital requirements, which stimulates the short-sighted banks to further expand the scale of the credit. When the economy is in the recession, the borrower defaults, loan losses increase, and banks have to increase capital buffer by tightening lending. However, contrary to their conclusions, Crockett [6] found that during the rising phase, a lot of credit funds have pushed up asset prices and help the accumulation of systemic risk, so forward-looking banks will increase capital buffers to absorb the economic downward legs due to exposure, and to reduce large amounts of the expected losses. Jokipii & Milne [13,14] also found an inverse cycle in the countries which had just joined the EU, and Francis & Osborne [10] obtained similar results by focusing on the British banks. Estrella [8] designed a model to explain the feature of the capital buffer and found that banks will keep capital buffer when expecting loan loss. The loan loss itself lags behind the economic cycle, so capital buffer will rise in the recession period. The bank failure is endogenous.

In addition, many researchers are exploring the external factors that affect the capital buffer. Both capital cost and profit earning capacity are found to be the most correlated factors, but different researches give different opinions about the correlation. Ayuso et al. [2], Lindquist [16] used return of equity (ROE) to evaluate the financing cost and found that ROE is negatively correlated with capital buffer, because the high cost of capital will directly affect banks' capital decisions. However, Stolz & Wedow [23] came to the opposite conclusion that they can be positively correlated as higher earning capacity can increase capital buffer by retaining the profits. The risk rate of the assets is another type of external factors found to affect the capital buffer. Lindquist [16] carried out an empirical study and found that capital buffer is positively correlated with the risk rate of assets. However, Ayuso et al. [2] found their relationship is negative as fire sales of bad loan can erode the capital buffer. Still another type of external factors is bank size. Big banks have good opportunities to invest, so their expected asset loss probability is small. Besides, these big banks are more likely to get the rescue from the government in the crisis, so it is less likely for them to keep capital buffer. Stolz & Wedow [23] came to the similar conclusions. Fonseca & Gonzalez [9] found many other external factors such as supervision systems in different countries, accounting disclosure system, and deposit insurance system.

Researchers in China did a lot of studies too, mainly concentrating on cycle characteristics in the capital buffer (see Kong et al. 2012; Xiang, 2013; Huang, 2014), influencing factors on the capital buffer (see Xu et al. 2011; Li, 2012; Yong, 2014; Li, 2014), buffer capital operation mechanism (see [7,11,27,28]), but few studies dealt with RCBs. As a new type of financial institutions, RCBs face the pressure of market competition, limited capital, diverse forms of ownership, great regional differences, so it is more likely to reflect the relationship among market competition, capital sources, regional differences and capital buffer with RCBs as the research samples.

3. Method

3.1. Dynamic Model of Capital Buffer

Based on the capital buffer regulation model designed by André et al. [1], we measure the determinants of banks' capital buffer behavior by calculating the cost of capital

regulation and control. In view of the previous studies, this study argues that capital optimization $\Delta BUF_{i,t}$ is dynamic, that is, $bank_i$ only partially reaches its optimal buffer $\Delta BUF^*_{i,t}$ during the period between t-1 and t, which can be regarded as the function of four determinants of the bank's decision, bank business model (MNG), supervision pressures (SUP), market pressures (MKT), economic environment (CYCLE) (see equation (1)).

$$BUF^*_{i,t} = f(MNG, SUP, MKT, CYCLE). \quad (1)$$

The first three factors are corresponding to the three regulations in Basel II while the fourth factor is the basis of macro prudential management in the new Basel agreement, with every factor having specific indexes (see the following equation).

$$\begin{aligned} BUF^*_{i,t} &= \alpha_1 ROE_{i,t} + \alpha_2 NPL_{i,t} + \alpha_3 SIZE_{i,t} \\ &+ \alpha_4 LIQUID_{i,t} + \beta_1 SUPERV_{i,t-1} \\ &+ \gamma_1 PEER_{i,t} + \mu_1 GDPG_t + \mu_2 BBOOM_{i,t} \\ &+ \mu_3 BCONFIDENCE_{i,t}. \end{aligned} \quad (2)$$

3.2. Explanatory Indexes

Capital requirement and capital management include the following indexes:

The return on equity (ROE) is expected to be negative in view of trade-off theory as the cost of capital is higher. However, it is also expected to be positive in view of pecking order theory since retained earnings can be an important source of capitalization.

Non-performing loans (NPL) is Proxy for a firm's risk exposure, expected to be negative.

Size is represented by total assets. Large size means broader access to capital markets, higher diversification and better investment opportunities, so it is less likely to keep capital buffer. It is expected to be negative.

In the case of **Liquid assets** (LIQUID), the stronger the liquidity is, the lower the liquidation cost is. It is expected to be positive.

Supervisory pressure contains supervision index:

Supervision is mainly represented by $SUPERV_{t-1}$, that is, supervisory CAMEL ratings, expected to be negative.

Market pressure includes the following indexes:

Peer is represented by buffer average of the peer group, another variable reflecting market discipline, expected to be positive.

Economic environment contains the following 3 indexes:

GDP growth (GDPG) is one of the Economic environment indexes. In the case of prudent capital management, it is expected to be positive while it is expected to be negative in the case of shorted sighted capital management.

This paper includes another two economic environment indexes, that is, banking boom index and banker confidence index.

The expected value of these indexes is given according to the results of previous studies. For example, existing researches indicate that there are three main factors that influence the capital buffer: the adjustment cost, capital profit rate and bank risk preference. Like other firms, a profit maximizing bank may balance holding surplus capital cost and the cost of business failures. When the opportunity cost of capital is higher, the banker may hold a lower capital ratio. However, if violating regulation leads to bankruptcy, bankers may choose higher capital standards. Therefore, as regulatory authorities expected, banks with greater risks will hold greater capital buffers. Thus, in terms of trade-off, return on equity (ROE) can be used to represent payment equity cost, expected to be negative.

In terms of trade-off, expected equity returns (ROE) value is negative. However, when the retained earnings become the main source of capitalization, expected value should be positive, especially in the market where external capital must be increased due to asymmetric information, which is consistent with the pecking order theory. In fact, Berger [3] found out 3 reasons for the positive relations between bank profits and capital ratio. First, in a multivariate framework, as long as marginal profit is not in the form of dividend distribution, higher profits will lead to capital increase. Second, if investors do not want to risk, and if the market is not perfect, the capital increase will reduce the bankruptcy cost, which will increase the expected earnings. Finally, as far as the asymmetric information is concerned, a better performance of banks may be represented by a higher rate of capital.

4. Database

Data include all the sample banks' quarterly information from the first quarter of 2010 to the fourth quarter of 2014, and the final data come form 880 observations of unbalanced data of 44 banks, distributing in 20 quarters. Specific data include the descriptive statistics of institutions, accounting information from balance sheets and financial statements, the operating parameters sent periodically to the Central Bank.

Bank capital buffer, BUF, is calculated as a percentage of excess regulatory capital over the risk-weighted assets. Its value can also be obtained by subtracting the prescribed minimum capital adequacy ratio from actual capital adequacy ratio.

Equity returns (ROE) is calculated as quarterly net income over average net equity, which is represented by asset profit margin in this paper. As part of the bank's risk profile, the non-performing loan rate (NPL), is defined as the ratio of non-performing loans to total loans. A loan is considered non-performing when payments of interest and principal are past due by 90 days or more.

The size of a bank is defined by the total amount of assets. The amount of uninsured funds was first measured by the ratio of subprime loans to total debt, and then is measured as the ratio of bank deposits to total deposits. Given the limitations of the data sources, this study takes the total liabilities to replace the amount of the uninsured funds.

Clearing buffer refers to the ratio of liquid assets to total assets, with liquid assets limited to cash and government bonds held in the form of combination.

Table 1 presents the basic data of the variables described. Table 2 describes the relationship between these variables.

Database also includes the CCB regulatory rating indexes. Camel rating (SUPERV) is calculated based on the average quarterly rating provided by the regulatory

authorities. We use the local camel rating standards, including the capital adequacy ratio, asset quality, management, profit, liquidation ability and other assessment. This study attempts to find out the effects of peer banks on RCB by means of the correlation between RCB indexes and CCB indexes (see Table 3).

In addition, this study also includes macroeconomic data, namely GDP growth, the banking climate index, banker confidence index, to reflect the impact of macroeconomic environment on capital regulation of RCBs. GDP growth is calculated by real GDP growth in a quarter versus the same quarter a year earlier. This variable reflects China's economic cycle, with its specific influence degree shown in Table 4.

5. Results and discussion

5.1. Descriptive Statistical Analysis

From Table 1, it can be seen that the stringent regulatory measures are taken by the rural commercial banks, with capital adequacy ratio reaching 13.41%, far higher than 8%, proposed by Basel III standards, higher than the counterparts' of CCBs (12.32%), even higher than China's capital adequacy ratio (12.56%). To a certain extent, this is due to the high rate of non-performing loans of RCBs (3.25%), which is three times higher than that of CCBs (1.06%). This result supports the findings of previous studies, that the more unstable institutions are, the higher capital ratios they will keep to avoid the punishment for eventually exceeding capital regulation. For instance, based on Brazil's banks, Andre (2015) found that the Brazilian banks' non-performing loan ratio is as high as 5.4%. Similarly, Brazil's capital adequacy ratio is also very high, reaching 17.4%.

Given the current situation, RCBs should improve the provision coverage. Steady financial policy requires that bank provision coverage should reach up to 300%, but RCB's is only 235.55%, below that of its peer, CCB (253.44%). However, in general, RCBs are still relatively stable. Both the liquidity ratio and loan deposit ratio are relatively high, with the former 50.20%, 5.95% higher than that of CCB, and the latter 68.92%, 3.96% higher than its peer's.

Compared with CCBs, RCBs are small in size, and have a short history of about 10 years on average, so non-performing loans are limited and their asset profit rate is relatively high. The profit margin of RCBs is 1.46% while that of CCBs is 1.34%. Similarly, the ratio of cost to income is relatively high, reaching 33.44%, but that of CCBs is only 30.20%.

Table 1. Descriptive statistics (quarterly statistics from 2010 to 2014)

variable	unit	mean	standard deviation	minimum	maximum
RCB capital adequacy ratio	%	13.41	.23	13.09	13.81
RCB non-performing loan ratio	%	3.25	1.78	1.52	6.96
RCB provision coverage	%	235.55	17.84	206.38	257.69
RCB asset profit margin	%	1.46	0.10	1.32	1.60
RCB liquidity ratio	%	50.20	2.00	47.36	53.56
RCB cost income ratio	%	33.44	1.68	32.12	36.68
RCB deposit-loan ratio	%	68.92	1.52	66.24	71.00
RCB non-performing loan ratio balance	Billion	38.661	34.264	3.620	147.400
RCB total debt	billion	724.575	832.210	9.500	2648.850
CCB capital adequacy ratio	%	12.3230	.60833	11.10	13.25
CCB non-performing loan ratio	%	1.0600	.13773	.90	1.40
CCB provision coverage	%	253.44	24.55	219.53	290.02
CCB asset profit margin	%	1.3435	.08418	1.10	1.43
CCB liquidity ratio	%	44.2580	2.20304	41.10	48.53
CCB cost income ratio	%	30.20	2.18	26.67	35.30
CCB deposit-loan ratio	%	64.9624	.62868	64.00	66.08
CCB non-performing loan ratio balance	billion	59.070	23.148	32.600	112.000
GDP growth	%	8.5900	1.44510	7.20	12.20
Banking boom index	%	80.1450	4.91544	70.70	87.20
Banker confidence index	%	60.4450	7.96026	42.00	73.10

5.2. Empirical Results and Analysis

5.2.1. The Influence of Other RCB Indexes on the Capital Adequacy Ratio

According to Table 2, it can be seen that in addition to the loan-deposit ratio, RCB capital adequacy ratio is highly correlated with several other RCB indexes. For instance, the coefficient with liquidity ratio reaches up to 0.97, with non-performing loan ratio reaching up to 0.83. As to other indexes like provision coverage, asset profit ratio, total deposits, the coefficient is also high, for example, the coefficient with total deposits reaching 0.90, and the coefficient with assets profit rate is the lowest, which is 0.57. The results also prove the trade-off theory that banks do not want to take risks in management by holding too much capital or cash flows as the cost of capital is high.

By referring to the studies done by Andre et al. (2015), it can be found that the influence of other RCB indexes on the capital adequacy ratio is far greater than that in Brazil's banking industry. For example, in Brazil, the coefficient of the capital adequacy ratio with non-performing loan rate is only 0.14, significant at 5%, 0.69 lower than that of RCB in China. In Brazil, the coefficient of the capital adequacy ratio with liquidity ratio is 0.44, while RCB's in China is 0.97. These differences are due to different economic developments of the two countries. In

recent years, the rapid development of Chinese economy, especially the development of rural economy, expanded the RCB deposit loan business and enhanced the RCB anti-risk capacity. In Brazil, banking liquidity ratio is only 17.7% while in China RCB liquidity ratio has reached 50.20%, nearly 6% higher than that of its counterparts, CCB.

Table 2. RCB correlation matrix

variable	1.	2.	3.	4.	5.	6.	7.	8.
1.capital adequacy ratio	1							
2.non-performing loan ratio	.831**	1						
3.provision coverage	- .657**	- .910**	1					
4.asset profit margin	- .573**	- .793**	.963**	1				
5.liquidity ratio	.971**	.927**	- .794**	- .689**	1			
6.cost income ratio	.526*	.909**	- .906**	- .783**	.701**	1		
7.deposit-loan ratio	- .437	- .833**	.732**	.582**	- .585**	- .935**	1	
8.total deposit	- .896**	- .806**	.639**	.480*	- .931**	- .594**	.458*	1

Correlation results between variables are based on the quarterly data of the sample banks.

* * denotes statistical significance at the 1% level, and * denotes statistical significance at the 5% level. It is the same with the tables below.

5.2.2. The Peer Influence on RCB

In order to find out whether RCBs are subject to the peer pressure, this study detected correlations between 8 basic RCB indexes and 5 CCB's (see Table 3). It can be seen from Table 3 that RCB capital adequacy ratio and liquidity ratio are only correlated with CCB's non-performing loan ratio. The coefficient of the RCB capital adequacy ratio with CCB's non-performing loan ratio is 0.59 while the coefficient of the RCB liquidity ratio is 0.68. In fact, CCB's non-performing loan ratio is correlated with 7 RCB indexes of 8, and all the coefficients are high. For example, the coefficient with RCB provision coverage is 0.79, and the coefficient with RCB assets profit rate is 0.70. The coefficients between the two non-performing loan ratios, between the two asset profit margins are high, too. The only exceptional is the Loan-deposit ratio. Thus, it can be said that the CCB activities is a strong predictor of the RCB's non-performing loan ratio and asset profit rate.

Table 3. Correlation between RCB and CCB

variable		CCB				
		capital adequacy ratio	non-performing loan ratio	asset profit margin	liquidity ratio	deposit-loan ratio
RCB	capital adequacy ratio	- .248	.588**	- .272	- .159	- .376
	non-performing loan ratio	- .598**	.657**	- .632**	- .485*	- .309
	provision coverage	.645**	- .785**	.746**	.345	- .004
	asset profit margin	.519*	- .769**	.627**	.115	- .153
	liquidity ratio	- .430	.682**	- .418	- .316	- .386
	cost income ratio	- .754**	.615**	- .679**	- .648**	- .096
	deposit-loan ratio	.649**	- .381	.434	.691**	.125
	total deposit	.460*	- .626**	.291	.447*	.458

5.2.3. The Influence of the Macro Economic Environment on RCB

In order to reflect China's overall economic environment influence on the rural commercial bank, the study tests the correlation between 8 RCB indexes and GDP growth, the banking climate index and banker confidence index (See Table 4). It is found that each RCB index is highly correlated with GDP growth, and that the coefficients between GDP growth and RCB non-performing loan ratio and RCB total deposits reached more than 0.75. The only insignificantly related index is asset profit rate. There are two reasons for this insignificant relation: 1) Chinese government gives priority to RCB; 2) RCB return on assets is relatively high as the scale is small and the non-performing loan balance is limited. Banking climate index cannot predict RCB capital adequacy ratio as the correlation between the two is not obvious, but the coefficients between banking climate index and RCB non-performing loan ratio, cost-income ratio, loan-deposit ratio, total deposits are significantly high. However, the correlation between all RCB indexes and the banker's confidence index is not significant.

Table 4. The correlation between RCB and macro economic environment

variable		GDP growth	banking climate index	banker's confidence index
RCB	capital adequacy ratio	.561*	.416	- .159
	non-performing loan ratio	.750**	.598**	.182
	provision coverage	- .589**	- .321	- .336
	asset profit margin	- .372	- .072	- .339
	liquidity ratio	.683**	.502*	- .025
	cost income ratio	.755*	.615**	.397
	deposit-loan ratio	- .719**	- .728**	.352
	total deposit	- .768**	- .591**	.091

6. Conclusions and Implications

So far few studies in China have adopted a dynamic model to deal with rural commercial banks, so the findings in this study are more valuable. Based on the panel data of 44 RCBs lasting from 2010 to 2014, this study analyzed the features of the capital regulation of Chinese rural commercial banks, and came to the following conclusions. First of all, rural commercial banks take tough capital regulation measures to maintain a higher capital adequacy ratio in order to avoid the risk shocks. The ratio is much higher than minimum capital requirements indicated in the Basel III. Since the ratio has been steadily kept high during the time span (2010-2014), it can be seen from the findings that RCBs' capital buffer shows no pro-cyclical characteristics. Secondly, rural commercial banks' non-performing loan rate is far higher than the peers', the city commercial banks, more than three times higher, which means that there exist serious credit risks.

In 2014, Chinese government issued a document, which aims "to speed up the innovation of rural financial system, to establish the 'farmers' specialized agencies and independent operating mechanism". This study can provide more constructive suggestions to help implement this document. It is suggested in this study that the rural commercial banks should perfect credit risk management in the following two aspects. Firstly, all rural commercial banks should be cautious in undertaking loan activities and try to maintain the balance between immediate interests and long-term objectives. Secondly, all rural commercial banks should make full use of large data of counterparts and the macroeconomic index to make the correct judgment of the risk, give the early warning information, and take effective preventions.

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