

The Empirical Study on the Relationship between Bank Liquidity Creation and Capital

—Based on Empirical Data from 2004 to 2014 in Chinese Banks

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Abstract

This paper investigates the relation between bank liquidity creation and capital in China. This issue is interesting because of the potential impact on “credit weakness” problems from tighter capital requirements which proposed by new capital rules in China. We perform regress analysis in a simultaneous equations model on the panel data of Chinese banks, which mainly includes 28 commercial banks from 2004 to 2014. On the whole, we find very different relations for different types of bank. State-owned commercial banks do not have significant relationship between liquidity creation and capital. National shareholding commercial banks’ liquidity creation and capital are positive correlation. The capital of regional commercial banks has a strongly positive effect on liquidity creation, but liquidity creation has negative impact on capital. These findings support the point that the new capital rules in China do not detrimentally influence “credit weakness” problems.

Keywords

Liquidity Creation, Bank Capital, Simultaneous Equations Model, Chinese Commercial Banks

1. Introduction

China banking faces “credit weakness” that mainly caused by infrastructure underpinning and recession of real-state and absence of new growth point in macro-environment. From the theory of supply and demand, “credit weakness” is caused by the oversupply of liquidity funds. And liquidity creation is that bank transfers the liquidity funds to invest in illiquid assets. “Credit weakness” problem is an insufficient liquidity creation. Before that, the China Banking Regulatory Commission based on the actual operation of their banks and “Basel III” issued the new capital rules for tighter capital requirements. The objective is to improve the resiliency of the

banking industry. However, the regulatory agency seems to neglect the possibility that bank capital and liquidity creation might have a reverse influence. A negative impact from capital on liquidity creation suggests that greater capital requirements would hamper liquidity creation. Obviously, a positive effect on liquidity creation provides support for the implementation of new rules. The positive impact from liquidity on capital means that banks might initiatively improve capital after expansion of liquidity creation. Therefore, the empirical study on the relation between bank liquidity creation and capital helps to assess the economic contributions of the new rules. This paper referred to the China banking only refers to bank of China and excludes the foreign banks in China.

2. Related Literatures

Western scholars mainly analyze the relationship between bank liquidity creation and capital with two theories which include “financial fragility-crowding out effect” theory and “risk absorption effect” theory. Scholars who support “fragility-crowding out effect” theory think that bank capital has a reverse effect on liquidity creation. Higher capital requirements would re-strict banks’ liquidity creation. Gorton [1] focuses the crowding out effect. They argue that cash providers have two kinds of investment options which are saving and directly investing in illiquid assets. Thus, higher capital ratios shift funds from relatively liquid deposits to illiquid bank capital from investors, reducing overall liquidity creation from bank. Dimaond [2] finds that the expansion of banks’ liquidity creation comes from the vulnerable capital structure. Banks make money by collecting liquid funds from deposits and convert to invest in illiquid assets. However, early withdraw for depositors fill with uncertainty. If there are any consumption shocks, banks might have to sell off illiquid assets to rigid honor. For this possibility, the lower capital ratio which is the so-called fragile capital structure will encourage banks to raise super-vision strength of the borrower, constantly absorb deposits and expand the loan business. As a result, banks create more liquidity. Scholars who support “risk absorption effect” theory believe that liquidity creation is positively correlated with capital. Bhattacharya [3] and Von Thadden [4] show that the increase of capital can enhance capacity of absorbing risks and taking risks for banks. Under the expectation, banks could increase lending, and create more liquidity. Allen [5] [6] argues that the greater liquidity creation, the greater liquidity risk. Banks will raise the capital ratios in order to avoid high losses of liquidity risk.

Chinese scholars mainly based on these two theories and examine the effect of bank capital on liquidity creation. Lulu Wang and Junxun Dai [7] find that the influence of capital on liquidity creation for different sorts of banks is asymmetrical from theoretically analysis. This paper constructs the measures of liquidity creation and describes the ability of bank’s liquidity creating in China banking industry. They use the data set of China banks from 2005 to 2008 and show the higher capital adequacy ratios improve the ability of national shareholding commercial banks’ liquidity creation. But for regional commercial banks, the effect on liquidity creation is contrary. Ai-min Zhou and Chen Yuan [8] based on China’s 151 commercial Banks balance sheet data from 2007 to 2011 to test the so-called “financial fragility-crowding out effect” and “risk absorption effect” theory on different banks. They find out that “financial fragility-crowding out effect” is more significant than “risk absorption effect” for regional banks and foreign banks in China. In the end, state-owned banks have the impact of capital on liquidity creation which is positive.

Existing literatures focused on the influence from bank capital on liquidity creation. Our paper can also propose a mechanism through which the relation moves from liquidity creation to bank capital. And most of Chinese scholars directly apply Berger’s “fat cat” index to measure Chinese bank liquidity creation, and not consider the difference of Chinese bank and American bank. We construct “LC” index by reference to the Berger’s method, and solve the problem encountered by Chinese scholars in the same time.

3. Hypotheses

Chinese banking industry mainly concludes own-stated commercial banks, national shareholding commercial banks, city commercial banks and rural commercial banks. There are differences in invisible indemnity of government, stability of deposit source, asset scale and loan customer. Five own-stated commercial banks play a dominate role in Chinese banking industry. They have stronger indemnity of government, stable deposit source and large asset scale. Their loan customers are mostly big business. So we classify five own-stated commercial banks as a type of Chinese bank. Compared with Chinese regional banks, the scale and business scope of national shareholding commercial banks are obviously large. So we classify non own-stated commercial banks as

two types which are national shareholding commercial banks and regional commercial banks. The business scope of city commercial banks and rural commercial banks has obvious regional characteristic. We consider the both type of bank as regional commercial banks. According to the existing literature, we know that financial fragility-crowding out effect and risk absorption effect produce opposing predictions on the relationship between liquidity creation and bank. We argue that the relation between creation and capital has significant differences for different kinds of Chinese bank.

Financial fragility effect establishes from the hypothesis that incomplete deposit insurance system cause the enhancement in the banking supervision of the lender incentives and behaviors. Own-stated commercial banks have implicit state credit guarantee. Thus it is not accord with theoretical assumption. Most of their deposits are fixed term and source stability, so do not compliance with the situation of crowding out effect. “Risk absorption effect” theory argues that banks can create more liquidity only in the higher capital ratios. State-owned commercial banks have “too big to fail” status and absolute predominance in China banking system. This capital constraint is limited for them. From the above, both of theory might do not exist in own-stated commercial banks. Therefore, we put forward the following hypothesis:

- Hypothesis 1: The change of capital ratio has limited influence on state-owned commercial banks’ liquidity creation.
- Hypothesis 2: After the expansion of liquidity creation, state-owned commercial banks will not take the initiative to improve the level of capital.

Financial fragility-crowding out effect is perhaps effective to national shareholding banks and regional commercial banks. Compared with state-owned commercial banks, the whole scales of these two types of banks are smaller, and the recessive guarantee from government is more limited. During the sample time, China has not been implemented deposit insurance. They confirm to the hypothesis of incomplete deposit insurance system in this theory. Hence, the two types of commercial banks would strengthen the supervision of their borrower, and then maximize the liquidity creation level. On the other hand, most of their borrowers are non stated-owned and non big-sized enterprises. They have stronger incentive to improve the level of capital to suffer the potential risks caused by over liquidity creation. Based on the above analysis, we present the following hypothesis:

- Hypothesis 3: Tighter capital requirement would lead to a reduction in liquidity creation for national shareholding banks and regional commercial banks.
- Hypothesis 4: National shareholding banks and regional commercial banks would initiatively increase the level of capital after the expansion of liquidity creation. This motivation is stronger for regional commercial banks.

4. Measures of Chinese Banks’ Liquidity Creation

4.1. Construction of Our Liquidity Creation Measures

Referring to Berger [9] on “fat cat” index construction methods, starting from the angle of the business of commercial banks, we focus on analyzing of assets business, liabilities business and off balance sheet activities. Combined with the classification features of BANKSCOPE database in balance sheet and off balance sheet accounting, we construct the index *LC* for reasonably measuring liquidity creation in Chinese banks.

Berger’s “cat-fat” index is not suitable for banking industry of China. There are following reasons. First, the data source is different that two databases have a big difference classification in financial statement. Second, the China banking and the United States banking are different in banking business and environment. Although the same type of business in both countries may not be the same. However, Berger concluded classification standard which is suitable for any type of bank business. Therefore, our paper will use the related theory in Berger (2009) to classify activities as liquid, semi-liquid or illiquid for Chinese banks. Next, we explain the construct of our liquidity creation measures for Chinese banks.

The operations of commercial banks almost reflect in the balance sheet. The liquidity of assets business depends on how difficult banks sell assets to meet the needs of liquidity funds for depositors. Liabilities business mainly includes two parts which is equity capital and absorption of external capital. The liquidity of liabilities business relies on how difficult banks acquire liquidity funds and how easy depositors withdraw funds. The liquidity of off-balance sheet is functionally similar to on-balance sheet business. Reference to the above standard, we classify and assign weight for the business of Chinese banks, and the results show in **Table 1**.

And the formula of index *LC* as follows:

Table 1. The results of classifying and assigning weights.

Assets business		
Illiquid assets (weight 0.5)	Semi-liquid assets (weight 0)	Liquid Assets (weight -0.5)
Residential mortgage loans Other mortgage Corporate & commercial loans At-equity investments in associates Derivatives Fixed assets Other assets	Consumer/Retail loans Other personal loans Reverse repos Held to maturity securities Other securities	Cash and due from banks Loans and advances to banks Available for sale securities Trading securities
Liability business		
Illiquid liabilities (weight -0.5)	Semi-liquid liabilities (weight 0)	Liquid liabilities (weight 0.5)
Senior debt maturing after 1 year Subordinated borrowing Derivatives Other liabilities Equity	Customer deposits-term Deposits from banks Repos	Customer deposits-current Other deposits and short-term borrowings Trading liabilities
Off-balance-sheet business		
Illiquid off-balance-sheet items (weight 0.5)	Semi-liquid Off-balance-sheet Items (weight 0)	Liquid off-balance-sheet items (weight -0.5)
Guarantees Committed credit lines Other contingent liabilities	—	—

$LC = 0.5*(\text{Illiquid Assets} + \text{Liquid Liabilities} + \text{Illiquid Off-balance-sheet Items}) + 0*(\text{Semi-liquid Assets} + \text{Semi-liquid Liabilities} + \text{Semi-liquid Off-balance-sheet Items}) - 0.5*(\text{Liquid Assets} + \text{Illiquid Liabilities} + \text{Liquid Off-balance-sheet Items})$.

4.2. Analysis of Chinese Banks' Liquidity Creation

We divide the Chinese banks into “state-owned commercial Banks”, “national shareholding commercial bank”, “city commercial bank”, “rural commercial bank” four categories in this section. And we calculate the total liquidity creation in every category of bank, and use the data of 113 commercial bank of China from 2004 to 2014. The source of data comes from BANKSCOPE database. The results show in **Figure 1**. The five lines from top to bottom of **Figure 1** respectively represent the results of total banks, state-owned banks, national shareholding banks, city banks and rural banks.

The total liquidity creation of Chinese commercial Banks is up to 3.64 trillion yuan by the end of 2004. In 2014, this number is up to 35.52 trillion yuan. During this period, this figure nearly increases 887 times. From the Graph1 shown that during the sample period, the total liquidity creation of Chinese commercial Banks is rising. But the pace was different. From 2004 to 2005, the total liquidity creation of Chinese commercial Banks was rapidly growth. Between 2006 and 2008, the growth had slowed down gradually. Until 2008 to 2010, the growth accelerated again. Then it went slow after 2011. This result corresponds to the actual situation of China. Chinese state-owned banks started joint-stock reform began at the end of 2003. After the five biggest Chinese state-owned Banks completed their reform and went public. It was a huge enhance in business performance and competitiveness. The assets restructured and reallocated had fundamental changes the liquidity creation ability. Therefore, the total liquidity creation of Chinese commercial Banks is mainly created by the state-owned commercial bank. That is why the total liquidity creation of Chinese commercial Banks raised in 2004. The growth went slow between 2006 and 2008 and the growth accelerated between 2009 and 2010. According to relevant data show that the central bank in the first half of 2008 had frequently increased legal deposit reserve ratio which would suppress the growth of liquidity creation. During the second half of 2008 to 2010, in order to stimulate the economy out of the financial crisis, the central bank released a lot of liquidity, which is beneficial to

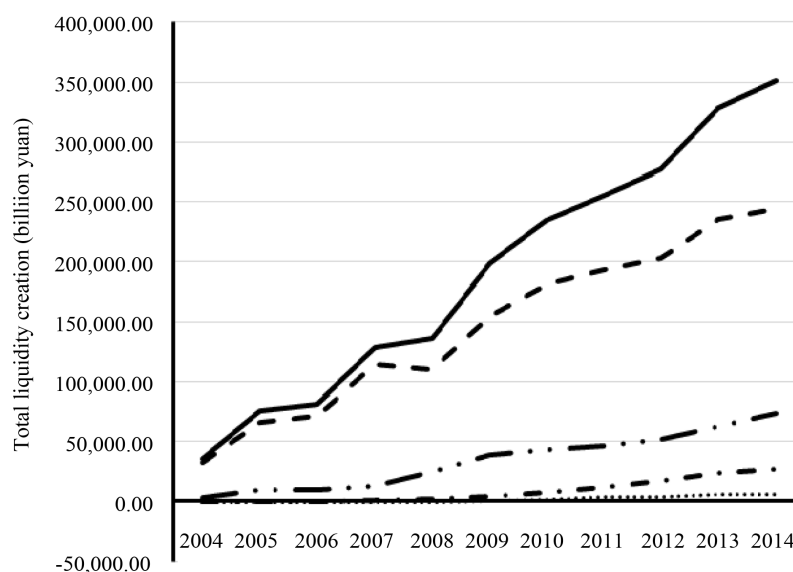


Figure 1. Total liquidity creation of Chinese banks.

China's commercial Banks' liquidity creation. Since 2011, the central bank was monthly raised the deposit reserve rate four times in a row and totally six times of the year. This ratio adjustment had a reverse effect on the growth of the commercial bank liquidity creation. At the end of 2004, national shareholding commercial bank, city commercial bank, rural commercial bank of bank liquidity of commercial Banks to create the number accounts for only 8.79% of the total. At the end of 2014, this proportion has reached 30.38%. On the one hand, China's commercial Banks liquidity creation is no longer only relying on five big state-owned commercial Banks. Also it shows that as Chinese banking industry developed, national shareholding commercial bank, city commercial bank and rural commercial bank can be another force of liquidity creation which will improve the structure of Chinese financial system in the future.

5. Regressions

5.1. Model Specification

We next turn to construct a simultaneous equations model to test the hypotheses that we assumed in chapter 3. And we examine the inter-temporal links between bank liquidity creation and capital by estimating the following equations:

$$\begin{cases} LC_{it} = \alpha_0 + \alpha_1 Cap_{it} + \alpha_2 Size_{it} + \alpha_3 Risk_{it} + \alpha_4 M_{it} + \alpha_5 INDEX_{it} + \varepsilon_{it} \\ Cap_{it} = \beta_0 + \beta_1 LC_{it} + \beta_2 ROEE_{it} + \beta_3 ROAA_{it} + \beta_4 Size_{it} + \eta_{it} \end{cases} \quad \forall i, t \quad (1)$$

where the subscript i denotes the individual bank, t represents the year of observations, endogenous variables LC and Cap denotes the ability of liquidity creation and the level of capital for individual bank, exogenous variables $Size$, $Risk$, $ROEE$, $ROAA$ respectively represent scale, level of risk assets, return on equity and return on assets, control variables M and $INDEX$ respectively represent monetary policy in China and the development level of China capital market, ε and η are error terms. And we called the above of equations as "liquidity creation equation" and the below is "the level of capital equation".

5.2. Data Source

The bank samples of this section are 28 Chinese commercial banks and time interval is from 2004 to 2014. We select 5 stated-owned commercial banks, 7 seven national shareholding commercial banks, 13 city commercial banks and 3 rural commercial banks at last from 113 banks closed in Chapter 4 which based on the consideration of the continuity and integrity of data. And macro data mainly collected from National Bureau of Statistics and Securities Regulatory Commission in China.

5.3. Variables Description

We still divide sample banks into three categories: stated-owned commercial banks, national shareholding banks and regional commercial banks. And then we make statistical analysis of main variable in different categories by sample data. The results show in [Table 2](#).

It shows that the category of stated-owned commercial banks is the highest, and the second is the category of national shareholding banks, and the lowest is regional commercial banks about the mean value of liquidity creation index. According the point of quantity in liquidity creation, we rank stated-owned commercial banks, national shareholding banks and regional commercial banks from high to low. But after standardizing liquidity creation index by total assets, the mean and maximum value are almost close between stated-owned commercial banks and national shareholding commercial banks. It means their efficiencies of liquidity creating are approximate. About total capital ratio and tier 1 ratio index, three kinds of bank have reached the capital requirements of the new capital rules. The mean value for regional commercial banks is even higher than stated-owned commercial banks, and the situation of national shareholding commercial banks is the worst.

5.4. Empirical Results and Analysis

We use the 3SLS method to regression analysis of the simultaneous equations model in Section 5.1. We use the total capital ratios and tier 1 ratio respectively as the index of variable Cap to regression. The results of regressions

Table 2. The statistical results of main variables.

Category	Variable	Index	Mean	Std. Dev.	Min	Max	Obs	
Stated-owned Commercial Banks	LC^*	Liquidity creation (Ten billion yuan)	310.41	165.22	14.84	639.19	52	
	LC	Liquidity creation per unit of assets (%)	34.70	7.42	10.34	59.115	52	
	Cap_1	Total capital ratio (%)	12.52	1.34	9.41	14.87	52	
	Cap_2	Tier 1 ratio (%)	9.94	1.21	9.41	14.87	52	
	$Size$	Log value of the business volume	98.94	0.29	8.14	9.36	52	
	$Risk$	Adjusted risk weighted assets/total assets (%)	57.65	5.65	48.42	71.70	50	
	$ROAA$	Return on average total assets (%)	1.09	0.27	0.155	1.48	52	
	$ROEE$	Return on average total equity (%)	15.74	10.26	4.57	25.63	52	
	National Shareholding Commercial Banks	LC^*	Liquidity creation (Ten billion yuan)	39.88	39.02	0.33	150.92	71
		LC	Liquidity creation per unit of assets (%)	32.92	11.21	11.66	59.05	71
Cap_1		Total capital ratio (%)	12.06	6.92	6.70	62.62	71	
Cap_2		Tier 1 ratio (%)	9.30	7.21	4.30	62.62	67	
$Size$		Log value of the business volume	7.92	0.61	6.18	8.83	71	
$Risk$		Adjusted risk weighted assets/total assets (%)	10.53	6.96	43.29	72.83	65	
$ROAA$		Return on average total assets (%)	0.77	0.51	0.191	1.46	71	
$ROEE$		Return on average total equity (%)	15.35	7.91	0.946	28.35	71	
Regional Commercial Banks		LC^*	Liquidity creation (Ten billion yuan)	2.91	4.58	-1.76	28.66	118
		LC	Liquidity creation per unit of assets (%)	23.26	15.91	-21.60	79.55	118
	Cap_1	Total capital ratio (%)	12.84	3.17	4.19	30.14	118	
	Cap_2	Tier 1 ratio (%)	11.08	2.92	4.12	26.85	111	
	$Size$	Log value of the business volume	6.96	0.47	5.86	8.25	118	
	$Risk$	Adjusted risk weighted assets/total assets (%)	59.46	14.53	6.60	78.91	103	
	$ROAA$	Return on average total assets (%)	1.29	0.49	0.167	2.64	117	
	$ROEE$	Return on average total equity (%)	19.15	7.76	2.83	54.14	117	

for different kinds of bank show in **Table 3**.

Panel A of **Table 3** shows the estimated results of liquidity creation equation. For state-owned commercial banks, the results show that capital has no significant effect on liquidity creation. It verifies the Hypothesis 1 in Chapter 3. Zhang Jie (2003) argues that the capital of state-owned commercial banks still has participation from the national credit, and so the impact from book value of capital on liquidity creation could be neglected. But for national shareholding banks and regional commercial banks, the coefficient of variable *Cap* is obviously positive. Therefore, the Hypotheses 3 in Chapter 3 is false. The risk absorption effect is stronger in those two types of bank. Compared with state-owned banks, their deposit source is not stable, and the risk of lending is large. When the capital ratio is relatively low, they would accordingly reduce liquidity creation for the sake of discrete risk controlling. The coefficient of control variables *M* and *INDEX* are significantly negative in state-owned commercial banks and national shareholding banks, and are not significant. This shows that state-owned and national shareholding banks are more sensitive to monetary policy and the development of capital markets. There are two reasons. Most of the two types are listed banks which are relatively sensitive to the policy and markets. And the regulatory agencies manage them very strict.

Panel B of **Table 3** shows the level of capital equation estimation results. We can see that the state-owned commercial Banks' liquidity creation has limited significant impact on its capital. This result verifies the Hypothesis 2 in Chapter 3. We argued that "risk absorption effect" has limited impact on state-owned commercial Banks, and that matches in this situation. National shareholding commercial Banks' liquidity creation has positive effects on the capital. Regional commercial banks' liquidity creation has significantly negative effects on the capital. These are partly matched with Hypothesis 4. Compared with a national shareholding commercial

Table 3. Regression results of the model.

Variable	Stated-owned commercial banks		National shareholding commercial banks		Regional commercial banks	
	(1)	(2)	(1)	(2)	(1)	(2)
	<i>Cap</i> ₁	<i>Cap</i> ₂	<i>Cap</i> ₁	<i>Cap</i> ₂	<i>Cap</i> ₁	<i>Cap</i> ₂
<i>Panel A: liquidity creation equation</i>						
<i>Cap</i>	1.0913 (0.7936)	1.7403 (0.8350)	0.1591** (2.0908)	0.1771** (2.1055)	0.2447* (2.9270)	0.1052* (1.8137)
<i>Size</i>	-3.0896* (-2.7798)	-6.2671* (-3.3377)	2.8331 (0.9639)	3.0589 (1.0321)	-11.1257* (-2.9370)	-10.4111** (-2.3876)
<i>Risk</i>	-0.0927** (-2.5896)	-0.0696*** (-1.7684)	0.1787 (1.1289)	0.1711 (1.0837)	0.2719* (2.7589)	0.2953* (2.8546)
<i>M</i>	0.6207* (2.6567)	0.6355** (2.5323)	0.8761* (3.5250)	0.8911* (3.5749)	0.3270 (0.9013)	0.3243 (0.9329)
<i>INDEX</i>	5.7367*** (1.7007)	7.3652** (2.3562)	15.7902* (3.0120)	15.7222* (3.0068)	9.3195 (1.2305)	6.6506 (0.8653)
<i>Panel B: the level of capital equation</i>						
<i>LC</i>	-0.0474 (-0.8911)	-0.0807 (-1.4118)	0.1976*** (-1.6544)	0.2354*** (-1.6606)	-0.1460*** (-1.7859)	-0.1386*** (-1.8863)
<i>ROEE</i>	0.0344 (1.6129)	0.0209 (0.9430)	0.0910 (0.4276)	-0.0390 (-0.1595)	-0.4199* (-6.3902)	-0.4779* (-7.7133)
<i>ROAA</i>	2.9502** (2.4093)	1.9924*** (1.7673)	3.0138* (3.0941)	2.9845* (2.8160)	7.0918* (6.3963)	6.8246 (7.0240)
<i>Size</i>	-0.1821 (-0.2292)	-0.1743 (-0.1312)	-0.5461 (-0.2826)	-0.4347 (-0.2140)	0.0973 (0.1005)	-1.2020 (-1.2627)
<i>N</i>	50	50	59	59	103	100
<i>R</i> ² - 1	0.779	0.832	0.872	0.872	0.598	0.627
<i>R</i> ² - 2	0.835	0.534	0.801	0.809	0.662	0.725

The *t* values after the adjustment of robust standard error are shown in brackets. *, **, *** respectively represent significance at 10%, 5%, 1% interval.

Banks, depositors of regional commercial banks are mostly the local governments and rural customers. Both of customers have those characteristic that they are saving path dependence and saving period is stable. After the expansion of liquidity creation, regional commercial banks not have enough power to improve the corresponding capital levels because of the stability of the deposit source. However, most national shareholding commercial banks are listed Bank. The openness of financial data and the caution management of liquidity risk, they must raise the level of capital after the expansion of liquidity creation.

5.5. Stable Test

In order to ensure the reliability of simultaneous equation model, we carry the two kinds of stable test. First of all, capital levels adopt different index to regress again which transferred from total capital ratio to core capital ratio represents the level of capital, and estimation results are basically consistent, that result is shown in the **Table 3**. It shows that the regression result of the relation between liquidity creation and bank capital is stable. Second, we use different data samples to regress again, the index liquidity creation of bank samples have been dealt with 5% shrinkage tail, and the estimated results are consistent as the paper illustrates above. It also helps to enhance the reliability of our conclusions.

6. Conclusion

This paper studies the relationship between liquidity creation and capital, and gets following conclusions: 1) It has significant differences for different kinds of Chinese bank; 2) The state-owned commercial Banks' capital and liquidity creation do not have significant relationship; 3) When national shareholding commercial banks improve the level of capital, it will lead to rising its liquidity creation, and the expansion of liquidity creation will initiatively raise capital level; 4) When the city commercial banks and rural commercial banks raise the level of capital, it helped to increase their liquidity creation. However, when the liquidity creation raises, the initiative to improve the level of capital power is not strong; 5) The new capital rules in China do not detrimentally influence "credit weakness" problems.

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