

# Research on the Coordination of Bank Capital Adequacy Ratio and Monetary Policy

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**Abstract:** Capital adequacy ratio and monetary policy are important control measures of financial supervisory authority and monetary authority, respectively. The effective coordination of the two has greatly affected the effectiveness of monetary policy. The article selects the annual data of 16 listed commercial banks in China from 2003 to 2018, and studies the impact of capital adequacy ratio on monetary policy transmission by constructor. listed commercial banks in China from 2003 to 2018, and studies the impact of capital adequacy ratio on monetary policy transmission by constructing a panel regression model. The results show that large state-owned commercial banks play a major role in bank credit channels for monetary policy, and banks with higher capital adequacy ratios are more likely to have a higher capital adequacy ratio. The results show that large state-owned commercial banks play a major role in bank credit channels for monetary policy, and banks with higher capital adequacy ratios are more vulnerable to monetary policy shocks. In addition, the external capital constraint of minimum capital adequacy will cause a multiplier effect when monetary policy is transmitted through credit channels. The multiplier effect produced by joint-stock commercial banks is much smaller than that of large state-owned banks. The multiplier effect produced by joint-stock commercial banks is much smaller than that of large state-owned banks. Therefore, financial supervisory departments must fully consider the interference caused by the capital adequacy ratio on monetary policy, strengthen policy coordination, and unblock the transmission mechanism of Therefore, financial supervision departments must fully consider the interference caused by the capital adequacy ratio on monetary policy, strengthen policy coordination, and unblock the transmission mechanism of monetary policy.

**Keywords:** Capital adequacy ratio; Monetary policy; Bank credit; Commercial banks.

## 1. Introduction

Capital Adequacy Ratio (CAR) is the ratio of total capital and risky assets of commercial banks, which can reflect the ability of banks to bear losses with their capital, and the regulators have set the minimum capital adequacy ratio and the minimum core capital adequacy ratio to inhibit the excessive capital adequacy of commercial banks. their capital and the regulators have set the minimum capital adequacy ratio and the minimum core capital adequacy ratio to inhibit the excessive expansion of risky assets of commercial banks, and to reduce the probability of bankruptcy and failure of commercial banks. Monetary policy is the core macroeconomic control tool of the monetary authority. Monetary policy is the core macroeconomic control tool of the monetary authority, and its transmission path and policy effect will be affected by a variety of factors. With the deepening of financial regulation, the implementation of monetary policy and the supervision of commercial banks are different from the main body of the policy objectives but intertwined with the main body of financial regulation. With the deepening of financial regulation, the implementation of monetary policy and the supervision of commercial banks are different from the main body of the policy objectives but intertwined with each other, which is increasingly showing a more complex character.

Basel III raises the core capital adequacy ratio of commercial banks to 7 percent and sets a certain proportion of protective and counter-cyclical buffers, indicating that bank regulators have made the capital adequacy ratio an important standard and tool for supervision. The risk appetite, asset structure, and credit policy of commercial banks will

greatly affect the level of capital adequacy, as they will adjust their risky assets and compress their credit scale to meet the minimum capital requirements of the financial regulators. This, in turn, will lead to the demand for financing outstripping the supply of funds in the credit market, pushing up market interest rates, and bringing certain external shocks to the traditional monetary policy transmission mechanism.

China is a financial system dominated by commercial banks, and in this context, monetary policy is bound to change in terms of channel and structure because of the strict constraints on bank capital adequacy. Therefore, this paper focuses on two questions: first, what are the respective roles of large state-owned commercial banks and joint-stock banks in the bank credit channel of monetary policy? Second, when capital adequacy is a constraint, what are the effects of monetary policy when it is transmitted through the credit channel? To answer these two questions, this paper selects 16 listed commercial banks in China as the research sample and empirically studies them using a panel data model. This is of great significance for further understanding the interaction and joint impact between monetary policy and commercial bank regulatory policy.

## 2. Literature Review

The earliest foreign research focuses on the impact of capital adequacy on macroeconomics, and as the research goes deeper, academics begin to study what role capital adequacy plays in the process of monetary policy transmission, as well as the pro-cyclicality of capital adequacy and other aspects. Most foreign scholars have shown that commercial banks with different capital adequacy

levels have large differences in their responses to monetary policy, and generally speaking, commercial banks with lower capital adequacy levels are more sensitive to tight monetary policy. Vanden Heuvel (2002)<sup>[1]</sup> constructed a forward-looking dynamic model, and analysed the maturity mismatch between deposits and loans as well as the likelihood of deterioration of loan quality in the future. analysed. The results find that the credit supply of commercial banks under regulatory constraints on capital adequacy responds differently to monetary policy regulation, and that there is a large difference in the size of credit between low and high capital adequacy banks. Under loose monetary policy, commercial banks with high capital adequacy levels prefer to increase more credit supply. Kishan and Opiela (2000, 2006)<sup>[2]</sup> categorised commercial banks according to capital adequacy ratios, based on which they investigated the responses of commercial banks with different capital adequacy levels in the face of monetary policy adjustments, and found that commercial banks with a smaller scale of operation and lower capital adequacy ratios are more responsive to monetary policy adjustments. The results found that commercial banks with smaller operating scale and lower capital adequacy ratio react more sensitively to the adjustment of monetary policy. In addition, they found that after the emergence of the capital regulation policy based on managing risk, in terms of credit supply, the monetary easing policy had the largest positive impact on banks with high capital adequacy levels, while the banks with low capital adequacy levels increased their credit supply by a very limited amount when they were in an environment of monetary easing policy. Gambacorata (2004)<sup>[3]</sup> in a study of Italian commercial banks, found that commercial banks with high capital adequacy levels were more sensitive to the adjustment of monetary policy. Gambacorata (2004), in a study of Italian commercial banks, finds that commercial banks with higher capital adequacy ratios are more stable in the face of monetary policy or other macroeconomic shocks.

China's academia has conducted many studies on the impact of capital adequacy on the economy and credit supply, but the studies on the relationship between capital adequacy and monetary policy transmission are mostly theoretical analyses, with relatively few empirical studies. Li Yang and Peng Xingyun (2005)<sup>[4]</sup> included both the legal reserve ratio and the capital adequacy ratio in the factor model in their study of monetary policy transmission channels, and found that the capital adequacy ratio affected the transmission channels of monetary policy in many ways. Hu Ying and Zhong Weizhou (2010)<sup>[5]</sup> analysed the impact of monetary policy shocks on the optimal behaviour of commercial banks in China when they are subject to the dual constraints of the deposit reserve ratio and the minimum capital adequacy ratio at the same time. The results show that under a monopolistically competitive market structure, the credit transmission channel of monetary policy is most effective when both the capital adequacy ratio and the deposit reserve ratio are satisfied. Chen Longteng, He Jianyong (2011)<sup>[6]</sup> In analysing the relationship between monetary policy, capital adequacy and risk-taking, it is argued that capital constraints enrich and diversify the transmission channels of monetary policy, and as a result, the capital channel and the risk-taking channel of monetary policy are created. Huang Xian (2012)<sup>[7]</sup> extended the IS-LM model under bank capital constraints and found that bank capital constraints can produce asymmetric effects of monetary policy by affecting the bank credit

channel, and that the joint efficiency of monetary policy and Eagle Airlines capital regulation is low. Wang Lulu (2013)<sup>[8]</sup> pointed out that capital adequacy regulation belongs to the scope of microprudential, and the impact of capital adequacy regulation on credit, bank risk appetite, economic cycles and the transmission mechanism of monetary policy is essentially a reflection of the inconsistency between microprudential regulation and macroeconomic objectives. Wang Zhouwei and Wang Heng (2016)<sup>[9]</sup> construct a partial equilibrium system between banks-vendors from bank heterogeneity, and find that the overall level of liquidity creation of large state-owned banks and national joint-stock banks with larger asset sizes and higher capital adequacy ratios is not significantly affected by monetary policy, and the same conclusion is obtained by Wang Xin<sup>[10]</sup> (2018). Guan Yanfeng and Xu Qili<sup>[11]</sup> (2019) showed that commercial banks' capital constraints are significantly related to credit risk, the higher the capital adequacy, the lower the credit risk, and the impact of capital constraints and monetary policy on credit risk will have a "complementary effect".

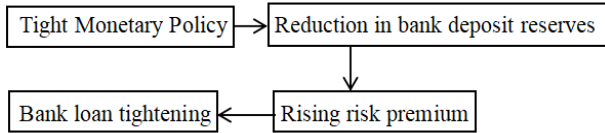
### 3. Mechanisms of the Impact of Capital Adequacy on The Transmission of Monetary Policy

When a commercial bank responds optimally to monetary policy, it adjusts its capital adequacy level by changes in its balance sheet, and commercial banks have to take into account new changes in capital adequacy when making credit investment decisions, a two-way dynamic change that affects the regulatory effect of monetary policy.

Treating all banks as a unified whole - a single bank - this single bank is the representative bank. To study the transmission of monetary policy, the behavior of the representative bank can be studied. Based on the assumption of representative banks, capital adequacy affects the transmission of monetary policy through three main channels: the bank lending channel, the bank capital channel, and the interest rate channel.

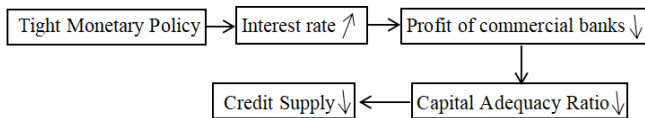
Commercial bank lending channels are greatly influenced by the risk premium effect. The capital adequacy ratio reflects a bank's ability to absorb and withstand risks, and because of the imperfections of the credit market, the lower the capital adequacy ratio of a commercial bank, the higher the perceived risk of the bank's operations by external investors, who will inevitably ask for more compensation for the risks, thus pushing up the level of the bank's risk premium. When the monetary authority implements a tight monetary policy, the ability of commercial banks to absorb deposits decreases with the reduction of excess reserves. To keep the structure of their asset portfolio unchanged, commercial banks need to raise funds for liabilities, such as large negotiable fixed certificates of deposit (CDS), bank bonds, etc. Such bank funds for liabilities are not subject to deposit reserves. If the capital adequacy ratio of a commercial bank is below the minimum regulatory standard, it can neither bear the potential operational risk nor increase its position by way of liabilities, so in a tight monetary environment, the capital adequacy constraint ultimately leads to a reduction in the supply of credit by commercial banks. Although commercial banks can increase their excess reserves under monetary easing, the new excess reserves will not be able to release the potential lending capacity of banks because of the capital adequacy constraint. Thus, the specific transmission path of the bank

lending channel is shown in Figure 1.



**Figure 1.** Bank lending channel transmission path

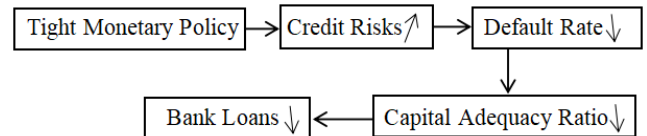
From the point of view of the transmission channel of bank interest rates, the maturity of bank deposits and liabilities is shorter while the maturity of loan assets is longer, so although banks can make short deposits and long loans to earn high spreads, the maturity mismatch will, on the one hand, reduce the liquidity of the liabilities, which is prone to liquidity risk, and on the other hand, widen the exposure to interest rates. If the loan default rate rises or market interest rates move unexpectedly, the liquidity crisis of such banks will be exposed. In a tight monetary policy environment with rising interest rates, the difference between the return on interest rate-sensitive assets and the cost of interest rate-sensitive liabilities is flattened as money market interest rates adjust relatively faster than capital market interest rates, resulting in a reduction in net interest income for banks. In the long run, the decline in bank profitability gradually drags down and erodes capital growth, ultimately leading to a decline in the capital adequacy ratio while risky assets remain unchanged. As mentioned above, a decline in the capital adequacy ratio of commercial banks will, in turn, increase their overall financing costs, exacerbating the difficulties of external financing, and the supply of credit will be reduced in the next installment, thus making the effects of tight monetary policy more apparent, a process known as the "Bank Capital Accelerator". This process is known as the "Bank Capital Accelerator". The transmission path of the bank interest rate channel generated by the maturity mismatch effect is shown in Figure 2.



**Figure 2.** Bank Rate Channel Transmission Path

The most common risk faced by commercial banks is the risk of debtor default. It affects capital adequacy in two ways:

on the one hand, in a tight monetary policy environment, the default rate on commercial bank loans usually increases, and commercial bank losses rise; on the other hand, tight monetary policy, in addressing the problem of excess liquidity, is also increasing the risk of non-performing loans, which in turn raises the risk weight. Both of these have a negative impact on commercial bank profitability, leading to declining capital adequacy ratios, which in turn suppresses bank credit supply, thus further amplifying the effects of tight monetary policy. Commercial banks with low capital adequacy levels are less liquid than those with high capital adequacy levels, so when they face the same credit risk, the credit supply of commercial banks with low capital adequacy levels will be more affected. In a period of tight monetary policy, lower market liquidity, increased likelihood of debtor defaults, higher bad debt ratios and deterioration of assets and liabilities of commercial banks, lower capital adequacy will dampen their lending impulses. Enterprises are unable to raise funds successfully from the credit market and their business activities are restricted, which in turn further reduces the demand for loans. The transmission path of credit risk effects in the bank capital channel is shown in Figure 3.



**Figure 3.** Credit risk transmission path through the bank capital channel

## 4. Research Design

### 4.1. Data sources

In this paper, the financial statements of 16 listed commercial banks from 2003 to 2018 are compiled in the Wind Financial Database. The banks' year-end total loans, reserve requirement ratios, and GDP growth rates are selected for the study, where the data of legal reserve requirement ratios and GDP growth rates are obtained from the People's Bank of China and the National Bureau of Statistics, the National Bureau of Statistics, and the National Bureau of Statistics. The banks' year-end total loans, reserve requirement ratios, and GDP growth rates are selected for the study, where the data on legal reserve requirement ratios and GDP growth rates are obtained from the People's Bank of China and the National Bureau of Statistics, respectively.

**Table 1.** Classification of banks in the sample

Type	Bank Name	NUM
State owned large commercial banks	BOC、ABC、ICBC、BOCOM、CCB	5
National joint-stock commercial banks	CIB、SPDB、PAB、CMBC、CMB、ECITIC、CEB、 HXB、BJBANK、NJCB、NBBANK	11

### 4.2. Modelling

The specific expression of the model in this paper is as follows.

$$DLoad_{i,t} = \alpha_i + \beta_1 MP_t + \beta_2 GDP_t + \beta_3 CAP_{i,t} + \beta_4 CAP_{i,t} MP_t + \varepsilon_{i,t}$$

(i denotes the sample size of the study banks and t denotes the year.)

In the model, Load denotes the bank's total loans at the end of the year, expressed in logarithmic terms. DLoad denotes the annual growth rate of total loans after first-order. This variable can reflect the impact of capital adequacy ratio on the credit behaviour of commercial banks, which facilitates further analysis of the credit channel of monetary banks. This variable can reflect the impact of capital adequacy ratio on the credit behaviour of commercial banks, which facilitates further analysis of the credit channel of monetary policy transmission.

MP denotes the statutory reserve requirement ratio, and the statutory reserve requirement ratio announced by the People's Bank of China is used as a proxy variable for monetary policy. An increase in the statutory reserve ratio represents a tight monetary policy, while a decrease represents a monetary policy. An increase in the statutory reserve ratio represents a tight monetary policy, while a decrease represents a monetary policy.

GDP denotes the annual growth rate of gross domestic product, and this macroeconomic variable is introduced to better examine the different responses to monetary policy of large commercial banks and joint-stock banks in China during the economic cycle. GDP denotes the annual growth rate of gross domestic product, and this macroeconomic variable is introduced to better examine the different responses to monetary policy of large commercial banks and joint-stock banks in China during the economic cycle.

CAP denotes the capital adequacy ratio of each commercial bank.

## 5. Empirical Analysis

The sample interval is divided into two categories: one category is large state-owned banks, which have a clear advantage in terms of operation scale, total assets, and market share, including Bank of China, Industrial and Commercial Bank of China, Agricultural Bank of China, Construction Bank of China, and Bank of Communications. The other category is joint-stock commercial banks, including other 11 listed banks. Therefore, three panel data models are established: the aggregate model, the large state-owned bank model, and the joint-stock commercial bank model.

The three models were then subjected to covariance tests as well as Hausman tests as a means of determining the form of each model. Firstly, the model is set as a constant coefficient model, and the overall model, the model of large state-owned banks and the model of joint-stock commercial banks are estimated, and the residual sums of squares of the three models are obtained separately. Secondly, the model is set as a variable intercept model and Hausman test is conducted, and the test results are shown in Table 3 below:

**Table 3.** Hausman test results

modelling	test statistic	P-value	in the end
overall model	11.8645	0.0149**	Rejection of the original hypothesis
Modelling of large state-owned banks	10.1274	0.0381**	Rejection of the original hypothesis
Joint-stock commercial bank model	5.9272	0.2664	Original hypothesis cannot be rejected

As can be seen from Table 3 above, the overall model and the state-owned large bank model passed the test at the 5% significant level, so the original hypothesis was rejected and the overall model and the state-owned large bank model were set as fixed-effects variable-intercept models. The joint-stock commercial bank model corresponds to a P-value of 0.2664,

which does not pass the Hausman test, so it is set as a random-effects variable-intercept model. Finally, the model was set as a variable coefficient model to obtain the residual sum of squares. After passing the Hausman test, the analysis of covariance was performed and the results are shown in Table 4 below:

**Table 4.** Results of the analysis of covariance for the overall model, the large state-owned bank model and the joint-stock bank model

	overall model	Modelling of large state-owned banks	Joint-stock commercial bank model
F2	3.2748	2.0499	1.7502
F Threshold for2	1.7468	2.0035	1.5914
F1	2.7617	1.5836	1.2513
F Threshold for1	1.3621	2.0731	1.7152
in the end	variance coefficient model	Varying Intercept Model (VIM)	Varying Intercept Model (VIM)

In summary, according to the results of Hausman test, it can be seen that the model of large state-owned banks and the model of joint-stock commercial banks  $F_2$  are greater than the critical value of  $F_2$  the critical value of  $F_1$  are smaller than the critical value of  $F_1$  Therefore, the model of large state-owned banks is set as a fixed-effects variable-intercept model, and the model of joint-stock commercial banks is a random-effects variable-intercept model. The overall model of  $F_1$ ,  $F_2$  are respectively larger than their corresponding

critical values, so it is set as fixed effect variable coefficient model.

The results of the parameter estimates for the aggregate model, the large state-owned bank model and the joint-stock bank model are shown in Table 5 below, where the differences in the incremental loan volume of large commercial banks reflecting the differences among the state-owned banks are shown in Table 6.  $\alpha_i^*$  The estimation results are shown in Table 6.

**Table 5.** Model parameter estimation results

variable name	explanatory variable		
	overall model	Modelling of large state-owned banks	Joint-stock bank model
Annual growth rate of GDP $GDP_{it}$	-0.5811** (-2.5018)	-0.9178*** (-3.3310)	-0.7226*** (-3.4845)
statutory reserve requirement ratio $MP_{it}$	-0.4737** (2.1743)	-0.1196** (-2.7730)	-0.8582** (-2.1286)
Capital adequacy of commercial banks $CAP_{it}$	0.0474** (2.2560)	0.0796** (2.6182)	0.0224** (2.1636)
Interaction term between capital adequacy level and monetary policy $CAP_{it} \times MP_{it}$	-0.3926*** (-3.5696)	-0.6153** (-2.6663)	-0.1240** (-1.7287)
C	-0.1193* (-1.2549)	-0.7566** (-2.0054)	0.1703* (1.5386)

Note: "\*\*\*\*", "\*\*\*", "\*\*" indicate significant at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

**Table 6.** Difference in Incremental Loans of Commercial Banks with State-owned Loans

Banki	$\alpha_i^*$ estimated value
Bank of China (BoC)	0.0217
Construction Bank of China	0.0074
Industrial and Commercial Bank of China	-0.0491
Agricultural Bank of China	-0.0750
Bank of Communications	0.0536

From the estimation results of the overall model, we can see that the coefficient of GDP growth rate, which represents the change of the real economic level, is -0.5811 and is significant at 95% confidence level, which indicates that when the economy is in an upward cycle, the growth rate of the credit scale will be slowed down, and the bank credit has a counter-cyclical characteristic; the coefficient of the legal reserve ratio is -0.4737.  $MP_{it}$  The coefficient of legal reserve ratio is -0.4737, when the central bank implements tight monetary policy, every 1 unit increase in the legal reserve ratio, the total loan size of the 16 listed commercial banks will be reduced by 0.4737 units, while the central bank relaxes the monetary fund to inject liquidity into the market will stimulate the impulse of the bank's credit expansion, which indicates that the bank lending channel exists in China's monetary policy; the coefficient of capital adequacy is positive, for the loan growth rate will be slowed down, which indicates that bank credit has counter-cyclical characteristics.  $CAP_{it}$  has a positive coefficient, which has a positive effect on the growth rate of loans, and as the capital adequacy ratio of banks increases, the size of their loans expands; moreover, the coefficient of the interaction term between the level of capital adequacy and monetary policy ( $CAP_{it} \times MP_{it}$ ) has a coefficient of -0.3926, and the coefficient of the statutory reserve ratio ( $MP_{it}$ ) has a coefficient of -0.4737, which has the same sign and is statistically significant. This implies that the level of bank capital has a multiplier amplification effect on the credit channel of monetary policy, and that the higher the level of capital adequacy, the greater the impact of monetary policy on commercial banks.

Comparing the model of state-owned large commercial banks and the model of joint-stock banks, the capital adequacy coefficients of the former and the latter are 0.0796 and 0.0224, respectively, and the impact of changes in capital adequacy levels on state-owned large commercial banks is much larger than that on joint-stock type banks. At the same time, the multiplier effect of capital adequacy on the credit

channel of monetary policy is also greater among large state-owned banks than among joint-stock type banks. This suggests that the bank lending channel of monetary policy in China is mainly channelled through large state-owned banks, which are more sensitive to changes in monetary policy under the condition of capital adequacy constraints. This is due to two reasons: firstly, joint-stock commercial banks are more flexible and have more ways and means to cushion monetary policy shocks. Second, large state-owned commercial banks dominate the credit market in China, so once large state-owned banks are hit by an external shock, loan supply and demand will play a significant role at the same time. This is consistent with the findings of Chen Weiping and Zhang Na (2019).

## 6. Conclusions and Policy Recommendations

This paper focuses on two questions: first, what are the effects of large state-owned banks and joint-stock banks on the credit channel of monetary policy? Secondly, what is the effect of monetary policy when it is transmitted through the credit channel as affected by the capital adequacy ratio? To answer these two questions, this paper conducts an empirical analysis using a panel data model based on data from 16 listed commercial banks from 2004-2019. The results show that the bank lending channel of monetary policy exists in China and is mainly transmitted through large state-owned banks. Differences in capital adequacy levels lead to heterogeneous effects of the bank lending channel of monetary policy on the banking sector, with large state-owned banks with high capital adequacy levels being more sensitive to monetary policy, while monetary policy causes less external shocks to joint-stock commercial banks with lower capital adequacy levels. At the same time, faced with the same capital constraints, the multiplier effect of the credit channel of monetary policy transmission through joint-stock commercial banks is much smaller than that of large state-owned banks.

To sum up, this paper puts forward three suggestions: firstly, dredging the credit channel of monetary policy transmission, the regulator should strictly follow the Basel III Agreement to supervise and evaluate the business activities of commercial banks, improve the risk management system, increase the intensity of audit work, focus on the disposal of risky assets by large state-owned banks, and regulate the behavior of the joint-stock commercial banks in expanding the scale of their assets through financial innovations. Second, weighing commercial bank supervision methods and macro-control tools, as capital adequacy has a multiplier amplification effect on the credit transmission channel of monetary policy when the central bank injects liquidity into the market, it should also take into account the regulator's requirement of minimum capital adequacy for commercial banks. Third, large state-owned banks should accelerate the innovation of their service models, iron out the external shocks brought about by monetary policy by enhancing their core competitiveness, and improve their operational stability.

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