The effect of equity structure and influence factors on China's banking cyclical behavior and monetary policy

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Several years ago, there were crises on mortgage resulted in a serious thread on financial systems in the United States and other developed and developing countries. However, some scholars are of the view that the procyclical nature of the bank lead to this serious incident. In this study, we focus on China's bank lending behavior whether it falls within the cyclicality of the banking practices. The study realizes that credit distributions are still the managerial way of for transferring government monetary policy. It is not however the actual reasons behind the China's bank counter-cyclical lending. State-owned financial firms within higher ownership are of no doubt of likely to be counter cyclical. Some school of thought are with the view that compared to developed countries, state-owned banks play a major decisions in other developing countries such as Brazil, and they believe that the well performances of this nations are adhering to the financial crises that are highly related to the state-owned banks. For example in China, commercial banks are the main embodiment of China's financial institutions. It is believed that most of these banks have very strong support by the central government and that makes clients pay more attention to their well-being thus implementing the states macroeconomic policies and resisting the financial crises. The study based on other existing researches will take the government monetary policy and commercial banks equity structure into a frame work and under search how they influence the cyclical China's commercial bank lending behavior and project other possible effects for regulatory bodies to take it into account when making a decision.

Keywords: monetary policy, shareholder structure, lending behavior, counter-cyclicality

1. Introduction

Foreign scholars have done a lot of researches on the relationship between the macro-economy and commercial bank lending. They have mostly reached an agreement that except some countries with special reasons, most commercial banks' lending behaviors move in the same direction with the macro-economy, the so-called pro-cyclicality phenomenon. Keynes (1936) finds that commercial bank will adjust its loan standard according to the macro-economy situation to control loan amount, and

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the change of the loan amount will have a positive feedback to the economy.

Chiuri *et al*. (2002) choose 15 countries and divide them into two groups according to if they have experienced the financial crisis. One group contains five countries that have not experienced the financial crisis like India, and the other group consists of ten countries that have not undergone the crisis such as Brazil. They find that the bank' lending of the latter group have more significant pro-cyclicality. Foos (2009) picks the data of 950 banks in Germany, Tabak (2011) picks the data of 134 banks in Brazil, and Stolz and Wedow (2011) pick the data of 2631 banks of West Germany. They all well verify the pro-cyclicality of commercial bank lending behavior. Akinboade and Makina (2009) adopt the descriptive statistical method to study the commercial banks of South Africa from both macro and micro level, and they generally find the pro-cyclicality of lending behavior significant.

When referring to the reasons of pro-cyclicality, different scholars hold different opinions. The main views include the information asymmetry of financial market, the "natural" pro-cyclical characteristic of bank operation, and the theories on the pro-cyclicality of capital regulation. Bernanke and Gertler (1989), Kiyotaki and Moore (1997) find there exists information asymmetry among financial market. When the economy goes down, it will be more difficult for the bank to evaluate the credit of the corporations borrowing money. For the sake of prudence, bank will cut down the loan, leading to the pro-cyclicality of its lending. Famer (1985, 1988), Smith (1995), Asea and Bloomberg (1997, 1998) demonstrate that bank may adjust its loan standard according to the economic condition. When the economy goes up, it will lower the standard, and when the economy goes down, it will raise that standard. This kind of adjustment results in the pro-cyclicality of lending, amplifying the fluctuation of macro-economy. Kashyap and Stein (2004), White (2006), and Tabak (2011) all illustrate that the pro-cyclicality characteristics of loan loss provisions, prices of collaterals, and capital do lead to the pro-cyclicality of bank lending.

Nowadays, some domestic scholars start to study the relationship between the commercial bank lending and the macro-economy, and they get different results. (1) Some scholars find that Chinese bank lending is pro-cyclical. Hua and Xiao (2007) use the multivariate GARCH model, and they suggest that Chinese commercial bank lending behavior is pro-cyclical. Lu and Li (2009) employ fixed-effect model, classify Chinese commercial banks into five classes, and calculate loan loss reserves with discounted future cash flow. They find these banks have obvious pro-cyclical features. Fan and He (2009) suggest that Chinese bank's business expanding speed, asset quality, risk management, operating income, and profit all have apparent pro-cyclical characteristic. Lin (2011) reports that Chinese bank lending is pro-cyclical through Granger causality test. Sun (2012) also gets the same conclusion, and she believes this pro-cyclicality has brought adverse effect to the economy. (2) Some scholars find that Chinese bank lending is counter-cyclical. Chen (2011) uses the cycle filtering method

to analyze the quarterly data of banks' loan amount and the GDP from 1991 to 2010. They find the loan is pro-cyclical sometimes, and it is counter-cyclical during other time especially after subprime mortgage crisis.

Huang and Xiong (2013) pick the annual unbalanced panel data to 45 banks from 2000 to 2010 and use the one step system GMM method, demonstrating that Chinese bank lending behavior is counter-cyclical. Pan (2011) applies the qualitative analysis method and reports that under the effect of a series of financial rescue policies after the subprime mortgage crisis, Chinese banks show typical counter-cyclicality. Pan (2013) picks the annual unbalanced panel data of 23 Chinese banks from 2003 to 2011 and gets the same results as Huang and Xiong (2013).

Shen (2014) uses the two steps system GMM method to study the annual data of 37 Chinese banks from 2003 to 2012 and draws the same conclusion as Pan (2013). Besides that, she classifies the loan into mortgage loan, corporate loan, and individual consumption loan and studies the cyclicality respectively. The result shows that corporate loan and individual consumption loan are counter-cyclical, but the mortgage loan has the opposite feature.

Since the 1930s, different economic genres have put forward different kinds of monetary policy transmission theories. The transmission can be classified into money channel and credit channel according to the substitutability of financial assets except currency.

Many scholars prove that the credit channel for monetary policy transmission does exist. They employ data from different countries and different methodology, and demonstrate that under the prerequisite of information asymmetry and incomplete development of financial market, commercial banks play a critical role in transmitting the monetary policy, and their lending behavior will have significant effect on the consequence. Bernanke (1986) builds VAR model and reports that the shock of American banks' loan has great influence on the total demand. Zhou and Jiang (2002) study the transmission mechanism of Chinese monetary policy between 1993 and 2001. They find that both credit channel and money channel do exist, but the former one plays the main role. Jiang, Liu and Zhao (2005) study the narrow money, broad money and loan amount to find which one is better to be the medium target. In their paper, they build two VAR models with M1 and M2 and use impulse response analysis method. They report that loan amount has the most significant effect on the final target, then the M2, while M1 is the least significant one. However, in terms of stability and persistence, M1 is the best. Sheng and Wu (2008) pick the monthly data from 1998 to 2006 to analyze the transmission channel and medium target of monetary policy. They find M2 can well explain the changes of macro-economy like industrial added value, but interest rate index like interbank rate lacks explanatory power. Besides, they design VAR model and conduct Granger causality test, finding that loan is the Granger reason of M2, and both loan and M2 are the Granger reason of industrial added value.

In a nutshell, credit channel plays key medium role in monetary policy transmission while not interest channel. Zhao and Liu (2013) choose the monthly data from 2004 to 2012 and build several VAR models. They employ Granger causality test and co-integration test to find the transmission mechanism of monetary policy. They report that Chinese loan amount and M2 are the interrelationships of cause and effect, and loan amount can boost investment, GDP, and CPI apparently. Credit channel is of great efficiency. However, there are many researches regarding the banks' equity structure and its lending behavior, but few of them study the cyclicality of bank lending from the ownership structure perspective. Research findings vary based on different methods and samples. In general, state-owned bank lending is less pro-cyclical than that of private bank. Cross-countries study show that equity structure has more significant effect on bank lending cycle in developing countries than that of developed ones. Even though among developing countries, significances are still quite different. Micco and Panizza (2006) use the pooled countries' panel data and report that state owned bank lending is less pro-cyclical compared with private bank. They believe it is not because of the laziness of state-owned banks' managers, while it is because the state-owned bank has the duty to smooth loan and stabilize the economy. Pan and Zhang (2013) analyze the annual unbalanced panel data of 23 Chinese banks from 2003 to 2011 and report that the loan growth rate shows significant counter-cyclical characteristic. The increase in the shareholding ratio of the largest shareholder and the proportion of state-owned shares will strengthen the counter cyclicality of gross loans. The increase in the proportion of foreign shares will weaken this counter-cyclicality. Shen (2014) draws the same conclusion as Pan and Zhang (2013) through studying the annual panel data of 37 Chinese banks from 2003 to 2012. Besides that, she classifies the loan into mortgage loan, corporate loan, and individual consumption loan to study their cyclicality, respectively. She reports that mortgage loan is procyclical while corporate and individual consumption loans are counter-cyclical.

2. Methods

According to Zhang (2011), since China began massive industrialization in 1953, China has undergone 11 business cycles as shown in Table 1. Since the study is about the lending behavior of bank over cycles, these samples at least contain one economic cycle. Most of Chinese banks had finished shareholding reform by 2005. So the study Choses all the 143 banks' data from 2005 to 2014, and rejects those banks whose time span is less than 4 years, and in the end, got a 10-year annual unbalanced data of 33 banks. The sample includes state-owned specialized banks, 11 joint-equity commercial banks, and 18 city commercial banks. The sample again includes 2 business cycles, and the total assets of these 33 banks account for 70.05% of that of the whole Chinese banking, so the sample is representative and can reflect the overall characteristics of

Chinese bank lending.

Among the 33 banks, 16 of them have been listed in a share market, including the 4 state-owned specialized banks, 9 joint-equity banks, and 3 city commercial banks. The 16 listed banks' financial data are collected from Wind database, while that of the rest 17 banks are collected from BVD-Bank scope database. In terms of the equity structure data of the 33 banks, was chosen through their annual reports one by one. From Wind database and the National Bureau of Statistics of the PRC, the study uses the macro-economy data.

Table 1
Business cycles of China

Cycle Order	Period	Duration (Year)
1	1953-1957	5
2	1958-1962	5
3	1963-1968	6
4	1969-1972	4
5	1973-1976	4
6	1977-1981	5
7	1982-1986	5
8	1987-1990	4
9	1991-2001	11
10	2002-2007	6
11	2008-Now	8

Source: Zhang, C. (2011), Why is Inflation in China a Monetary Phenomenon? *China & World Economy*, 19, 1-17. doi:10.1111/j.1749-124X.2011.01239.x.

3. Data description

Referring to Cull (2012), Pan and Zhang (2013), the paper designes the individual fixed effect model as the basic econometric model for empirical analyses, and it is as below.

$$loan_{i,t} = \beta_0 + \beta_1 gdp_t + \sum_{i=2}^{6} \beta_i control_{i,t} + u_i + \varepsilon_{i,t} \quad (1)$$

In the model above, $loan_{i,t}$ represents the real loan growth of bank i in year t, gdp_t means the real GDP growth, $control_{i,t}$ is 5 control variables, u_i shows the fixed effect term of bank i, and $\varepsilon_{i,t}$ is the error term. The study will interpret the definition and calculation of each variable specifically in the following with some basic interpretation and description for the model.

(1) In the sample, N=33, T=10, and it is a short panel dataset.

(2) The current value of GDP is subject to reverse causality, meaning that the current GDP growth and current loan growth could cause each other, which may lead to endogeneity problem.

(3) When analyzing the short panel dataset, the basic problem facing us is that the study should choose the fixed effect model or random effect model. To verify our model, we use Hausman test and prove fixed effect model is better.

Some scholars like Pan (2013) adopt dynamic panel data model, treat the one-year lag of loan growth as the explanatory variable, and use the system GMM method to estimate the coefficients. At the beginning of research, we use the model as Pan (2013) to do regression on the same data, but the estimated sign of $loan_{i,t\text{-}1}$ is negative, which is quite the opposite as previous researches, what's worse, the coefficient is not significant. From the side view, it confirms the validity of individual fixed effect model.

3.1. Variables

As this paper wants to find the relationship between Chinese bank lending and the fluctuation of macro-economy, and how monetary policy and equity structure impose effect on their relationship, the explained variable in our model is the loan growth rate, and GDP growth rate, monetary policy and equity structure are the main explanatory variables. To control the effect of banks' own features, we add five control variables into the model.

3.1.1. Dependent variable

Referring to Foos (2009) and Duprey (2012), we use the growth rate of gross loan to represent the changes of commercial banks' loan scale.

3.1.2. Explanatory variables

When studying the macro-economy issues, current scholars has two kinds of indexes to measure the fluctuation of macro-economy, one is the gross GDP growth rate, the other is the average GDP growth rate. Since in this paper we want to find the relationship between banks' loan scale and the whole economy situation, we employ the gross GDP growth rate to avoid the effect of population. In robustness test part, we will use the growth rate of industrial added value to replace the gross GDP rate.

The target of monetary policy includes operation target and medium target. Compared with the medium objective, the operation target is closer to the policy setting, and is of high operability, so we choose the operation target as the proxy

variable of monetary policy. Specifically, the operation target includes the annual change of the large financial institutions' deposit reservation rate, the annual change of the 1-year benchmark deposit rate, and the annual change of the 1-year benchmark loan rate. In China, the deposit reservation rate and benchmark deposit and loan rates are the most common operating tools with obvious effects.

Equity structure contains two aspects. One is the concentration of shares, and the other is the characteristic of the controlling shareholder. So we will study the effect of equity structure from the two aspects. According to the previous paper, there are several indexed to represent the concentration of shares, including the share of the biggest shareholder, the shares of the top five owners, the HHI of the top five owners, and kind of staff. Referring to Pan (2013), we choose the share of the biggest shareholder, and in the robustness test part, we use the share of the top five shareholders instead. In terms of the characteristic of owner, we want to classify whether the bank is state owned or private. Based on Laporta (1999), in general, shareholder with more than 20% shareholding ratio can take the control position. Thus, we define a bank to be state-owned bank if the largest shareholder is government and government holds more than 20% of total equity, or more than 50% of shares are held by the government and state-owned corporation. The proxy variable of characteristic of shareholders is a dummy variable, which equals 1 when the bank is state-owned, otherwise it is 0.

3.1.3. Control variables

The study adds the financial crisis dummy variable to control the effect of subprime mortgage crisis on banks' loan. In the year 2008 to 2010, it equals 1 and it equals 0 otherwise. To defend against the crisis, during this period, Chinese government took series of investment plans such as the "four trillion plan" to boost the economy.

Other control variables are chosen according to Jia (2009), Cull and Peria (2013), and Berger (2002, 2005), and are as below.

First is the banks' size. Big banks, especially the "Big 4" in China, they have a huge loan base, so the loan growth rate is relatively low. On the contrary, small bank's absolute amount of new loan is less than big bank, but it has a relatively high loan growth rate. The study uses the log of banks' total asset to control the effect of banks' size. The second is capital adequacy ratio. High capital adequacy reflects the managers of banks are risk-averse, and they do not make full use of capital, leading to the loan growth rate slow down. The fourth is liquidity. The ratio of total deposit over total loan is used to represent liquidity. High liquidity means that bank has more deposit source for a certain amount of loan, and the loan scale may expand further. The last is the profitability. The return on asset is used to represent banks' profitability. High return on asset will stimulate the bank to expand their loan scale further.

4. Hypotheses

Based on background review and related data, Chinese banks show different lending over cycles compared with other developed countries. So the study puts forward the first hypothesis.

H1: Chinese bank lending behavior is counter-cyclical. Commercial banks are still the main component of Chinese financial system; loan from commercial banks is still the main source of external financing for most Chinese enterprises, and the credit channel is the most important way for Chinese government to transmit its monetary policies. Pan (2013) and Shen (2014) do not take the monetary policy factor into consideration when they study Chinese bank lending over cycles, and they do not explain the counter-cyclicality phenomenon of their findings. Under this circumstance, the second hypothesis is put forward.

H2: Credit channel is effective for transmitting government's monetary policy, and this is the critical reason for the counter-cyclicality of Chinese bank lending. High leverage ratio is one of the main features of banks, and the shareholders are less risk averse and have more incentive to pursue profit (White, 2011). In contrast, the managers of banks are more risk averse and prudent because they care more about their occupational risk and the effects of performance on their reputation (Fahlenbrach and Stulz, 2011). If there is no controlling shareholder and the equities are relatively decentralized, the daily business of bank will manifest the managers' will more. To be specific, when the economy goes up, they will strictly control the quantity and quality of new loan and avoid expanding business blindly, when the economy drop down, they suffer from less loan losses. That kind of lending reflects less pro-cyclicality. So we put forward the third hypothesis.

H3: Lending of banks with low shareholding concentration is more counter-cyclical than that of banks with high shareholding concentration. Chinese state-owned banks, especially the big four specialized banks, are more than just commercial banks. Besides maximizing profit, state-owned banks still carry social and political functions. They are responsible to smooth economic fluctuation to maintain the stability of macro-economy. So we put forward the fourth hypothesis.

H4: State-owned bank lending is more counter-cyclical than non-state-owned banks.

5. Results and discussion

Referring to Wong (2012) and Pan (2013), the study first designs the basic model to study the relationship between bank lending and macro-economy fluctuation. The model is as below.

$$loan_{i,t} = \beta_0 + \beta_1 gdp_t + \sum_{i=2}^{6} \beta_i control_{i,t} + u_i + \varepsilon_{i,t} \quad (2)$$

Where the explained variable $loan_{i,t}$ represents the loan growth of bank i in year t. gdp_t means the GDP growth rate of China at year t. According to H1, Chinese bank lending is counter-cyclical. When the economy accelerates, the growth rate of loan will decrease, when the economy slows down, the growth rate of loan will increase. The estimated sign for β_1 is negative.

$control_{i,t}$ represents other control variables concerning banks own features, including $crisis_t$, $car_{i,t}$, $dtl_{i,t}$, $size_{i,t}$ and $roa_{i,t}$.

$crisis_t$ is the financial crisis dummy variable. When the year is 2008 to 2010, it equals 1 and it equals 0 otherwise. To defend against the crisis, during this period, Chinese government took series of investment plans such as the "four trillion plan" to boost the economy, and the loan scale increases significantly. The estimated sign of β_2 is positive.

$car_{i,t}$ is capital adequacy ratio. High capital adequacy reflects the managers of banks are risk-averse, and they do not make full use of capital, leading to the loan growth rate slow down. The estimated sign of β_3 is negative.

$dtl_{i,t}$ is liquidity. High liquidity means that bank has more deposit source for a certain amount of loan, and the loan scale may expand further. The estimated sign of β_4 is negative.

$size_{i,t}$ represents the total asset of bank. Small banks' loan growth rate is higher than big banks. The estimated sign of β_5 is negative.

$roa_{i,t}$ is the profitability. The return on asset is used to represent banks' profitability. High return on asset will stimulate the bank to expand their loan scale further. The estimated sign of β_6 is positive.

5.1. Monetary policy, macro-economy and bank lending

$$loan_{i,t} = \beta_0 + \beta_1 gdp_t + \sum_{i=2}^{6} \beta_i control_{i,t} + \beta_7 mp_t + u_i + \varepsilon_{i,t} \quad (3)$$

Based on the basic model (2), the study plugs in the proxy variable of monetary policy to prove that the credit channel is effective and try to explain the counter-cyclicality of Chinese bank lending. Other variables are the same as those in basic model.

mp_t means the change of Chinese monetary policy. In China, deposit reservation rate and deposit and loan bench-mark rate is the operation tools which the central bank usually use. In model (3), there are three monetary policy variables, and they are the annul change of the large financial institutions' deposit reservation rate, the annul change of the one-year bench-mark deposit rate and the annul change of the one-year bench-mark loan rate. During the regression, the three variables are plugged in into the model one by one and get three results. In real operation, the central bank often uses joint tools, meaning using the reservation rate and bench-mark interest rate together. So we will use the combination of two tools out of the three to do analyses.

When the economy is in recession, the central bank will decrease the reservation rate and bench-mark interest rate to increase the currency supply. When the economy is prosperous, the central bank will raise these rates to avoid overheated economy and control inflation. The estimated sign of β_7 should be negative. Besides, according to H2, we assume that after adding the monetary policy factor, the coefficient of gdp_t will become not significant or even become positive.

5.2. Equity structure, macro-economy and bank lending

$$loan_{i,t} = \beta_0 + \beta_1 gdp_t + \sum_{i=2}^{6} \beta_i control_{i,t} + \beta_7 mp_t + \beta_8 structure_{i,t} + \beta_9 structure_{i,t} * gdp_t + u_i + \varepsilon_{i,t} \quad (4)$$

Based on the model in (3) and (4), we focus on the effect of banks' equity structure on its lending over cycles. Other variables are the same as those in basic model.

$structure_{i,t}$ represents the proxy variables of equity structure. It contains two variables, the first is $fshare_{i,t}$ which means the biggest owner's share and reflects the concentration of equity, the second is $state_{i,t}$ which is equal to 1 when the bank belongs to the government and equals 0 when it is private.

Since the study wants to demonstrate the effect of equity structure on bank lending over cycles, while not effect on commercial banks' loan growth, the cross term of equity structure and macro-economy will be added into the model, and that is $fshare_{i,t} \times gdp_t$ and $state_{i,t} \times gdp_t$. If the sign of β_9 is positive, that means the equity structure variable will make bank lending less counter-cyclical. If the sign is negative, that means the equity structure variable will increase the counter-cyclicality of bank lending behavior. According to H3, the estimated signs of $fshare_{i,t} \times gdp_t$ and $state_{i,t} \times gdp_t$ should be positive and negative separately.

To get the intuitive relationship between commercial bank lending and the macro-economy fluctuation, we choose the GDP growth data and the total loan of banking from 2000 to 2014, and draw the line graph as below.

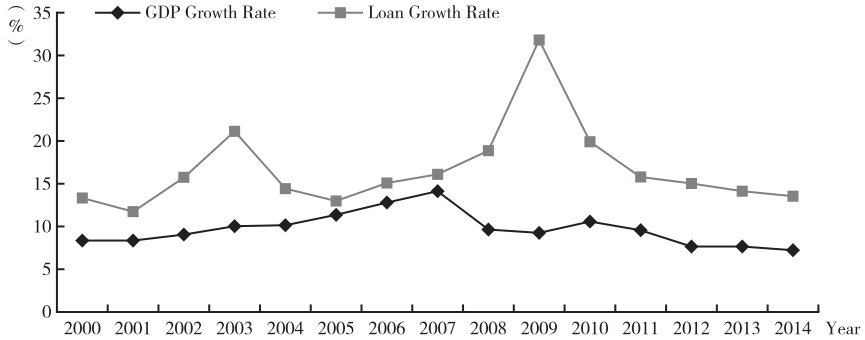

Figure 1. GDP and loan growth rate of China's economy from 2000 to 2014

From Figure 1, we can see that from 2000 to 2007, Chinese economy kept accelerating, and even grew with a speed more than 10% after 2004. During the same period, the total loans show great fluctuations, and dropped significantly from 2000 to 2001 and from 2003 to 2005. Suffering from the financial crisis, Chinese economy decelerated obviously from 2007 to 2009, while the total loans were rocketing, reaching the peak at 2009. After that, benefiting from the "four trillion plan", GDP growth rate increased in the following two years, but the economy downturn was still a serious problem facing the government. In general, the total loan didn't move in the same direction with GDP, but showed apparent counter-cyclical features especially in the following years after the crisis. This phenomenon is quite different from that in some developed countries, so in the following section, the quantitative methods will be used to more precisely study the bank lending over cycles and other factors.

Most of Chinese banks had finished shareholding reform by 2005. So we choose all the 143 banks' data from 2005 to 2014, reject those banks whose time span is less than four years, and in the end we get the ten-year annual unbalanced data of 33 banks. A glance at Table 2 shown below indicate the average loan growth rate for state-owned banks and non-state-owned banks are 0.15 and 0.18 separately, while the average size of state-owned bank is larger than that of non-state-owned banks by 1.94. So size of bank seems to be negatively correlated with loan growth. It is also found that the average share percentage of the biggest owner of state-owned banks is 0.35, which is almost twice the number of non-state-owned b banks. The share of biggest shareholder also seems to have negative relationship with loan growth, and this corresponds to former theoretical analyses. Regarding other variables, no significant differences can we see between the two groups.

Table 2
The average loan growth rate for state-owned banks and non-state-owned banks

	Full Sample				State-owned Sample				Non-state-owned Sample			
Variable	Mean	Sta.Dev	Min	Max	Mean	Sta.Dev	Min	Max	Mean	Sta.Dev	Min	Max
loan	0.17	0.11	0.01	0.68	0.15	0.09	0.02	0.61	0.18	0.11	0.01	0.68
gdp	0.10	0.02	0.07	0.14	0.10	0.02	0.07	0.14	0.10	0.02	0.07	0.14
crisis	0.30	0.46	0	1	0.30	0.46	0	1	0.30	0.46	0	1
car	0.12	0.03	0.04	0.31	0.12	0.02	0.07	0.16	0.12	0.03	0.04	0.31
dtl	1.87	0.32	1.15	3.02	1.84	0.32	1.30	2.85	1.88	0.32	1.24	3.02
size	13.09	1.85	9.65	16.84	14.18	1.69	10.07	16.84	12.24	1.47	9.83	15.37
roa	0.0105	0.0031	0.0003	0.0233	0.0105	0.0022	0.0014	0.0147	0.0108	0.0035	0.0015	0.233
dep_r	0.0003	0.0079	-0.0164	0.0162	0.0003	0.0079	-0.0164	0.0162	0.0003	0.0079	-0.0164	0.0162
loan_r	0.0000	0.0089	-0.0216	0.0135	0.0000	0.0089	-0.0216	0.0135	0.0000	0.0089	-0.0216	0.0135
res_r	0.0125	0.0185	-0.0100	0.0550	0.0125	0.0185	-0.0100	0.0550	0.0125	0.0185	-0.0100	0.0550
fshare	0.25	0.17	0.06	1.00	0.35	0.19	0.07	1.00	0.17	0.08	0.059	0.50
state	0.46	0.49	0	1	1	0	1	1	0	0	0	0

5.3. Variables correlation test

Before econometric regression, this section will in advance analyze the correlation of variables involved, and the test result is shown in Table 3. The study shows that except the correlation between the 1-year benchmark deposit rate and loan rate is as high as 0.9591, other correlations between any two variables are no more than 0.6927. So when the combination of monetary policy tools are taken into the model, the benchmark deposit rate and benchmark loan rate will not be put together in order to avoid the multicollinearity problem.

Table 3
Test result of correlation coefficient matrix

	loan	*gdp*	*crisis*	*car*	*dtl*	*size*	*roa*	*dep_r*	*loan_r*	*res_r*	*fshare*	*state*
loan	1.0000											
gdp	0.0155	1.0000										
crisis	0.2716*	-0.0550	1.0000									
car	-0.0752	-0.1603*	0.0804	1.0000								
dtl	0.3879*	-0.0169	0.1142	0.1866*	1.0000							
size	-0.2372*	-0.1827*	-0.0901	-0.0149	-0.1702*	1.0000						
roa	-0.1396*	-0.2667*	0.0040	0.5185*	0.0866	0.0471	1.0000					
dep_r	0.1567*	-0.3468*	0.2554*	0.0815	0.0101	0.0181	0.0306	1.0000				
loan_r	0.2079*	-0.3554*	0.3023*	0.0513	0.0400	0.0224	0.0150	0.9591*	1.0000			
res_r	0.1583*	-0.6052*	0.2067*	0.1612*	0.0818	0.0467	0.1912*	0.6927*	0.6019*	1.0000		
fshare	-0.0338	-0.0135	0.0163	-0.0065	-0,0682	0.5538*	-0.0249	-0.0054	-0.0006	0.0201	1.0000	
state	-0.1697*	-0.0949	-0.0389	-0.0341	-0.0680	0.5236*	-0.0444	0.0102	0.0022	0.0662	0.5405*	1.0000

Note: * denotes significance at 5% confidence level.

The correlation between *gdp* and *loan* is 0.0155, showing the pro-cyclical feature, but it is not significant. Except capital adequacy ratio, other control variables are significantly correlated with loan growth rate, and the sign of correlation is the same as we assume in the above. Through analyzing the relationship between loan and monetary policy factor, we conclude that credit channel for policy transmission is effective in China, but the correlation coefficient is positive, which is different from what we know. In the end, we report the correlations between loan and equity structures are all negative, but only the correlation between state and loan is significant.

According to the three econometric models designed, the first is to study the basic model (2), and report the relationship between Chinese bank lending and macro economy. Then plug the three monetary policy variables and their combinations into the basic model and get model (3), in order to demonstrate that monetary policy has great effects on bank lending over cycles. In the end, the study takes the equity structure variables and the cross term of equity structure and GDP into consideration

and get model (4), trying to find the characteristics of bank lending with different equity structure.

Table 4
Effect of monetary policy on bank lending over business cycles

Variables	(1)	(2)	(3)	(4)	(5)	(6)
gdp	-2.6929***	-3.1378***	-3.1451***	-4.0962***	-4.0920***	-4.0970***
	(-8.79)	(-9.34)	(-9.23)	(-10.06)	(-9.38)	(-10.08)
crisis	0.0364***	0.0411***	0.0441***	0.0488***	0.0488***	0.0504***
	(3.51)	(3.94)	(4.20)	(4.28)	(4.21)	(4.53)
car	-0.6160**	-0.6732**	-0.6603**	-0.6463**	-0.6470**	-0.6603**
	(-2.48)	(-2.64)	(-2.61)	(-2.68)	(-2.64)	(-2.67)
dtl	0.1430***	0.1507***	0.1449***	0.1629***	0.1629***	0.1611***
	(4.87)	(5.00)	(4.79)	(5.32)	(5.27)	(5.08)
size	-0.1165***	-0.1227***	-0.1213***	-0.1242***	-0.1242***	-0.1251***
	(-6.05)	(-6.24)	(-6.26)	(-6.30)	(-6.26)	(-6.35)
roa	8.9119**	8.6661**	8.3480**	9.0760**	9.0695**	8.8251**
	(2.28)	(2.22)	(2.12)	(2.37)	(2.34)	(2.25)
dep_r		-1.4844***			-0.0301	
		(-5.86)			(-0.05)	
loan_r			-1.3192***			-0.5369
			(-4.61)			(-1.28)
res_r				-1.5158***	-1.5014***	-1.3178***
				(-4.95)	(-2.83)	(-3.22)
R-squ (within)	0.4035	0.4493	0.4493	0.4659	0.4659	0.4678
Observations	241	241	241	241	241	241
No of Banks	33	33	33	33	33	33
Hausman Test p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: ***, ** and * denotes the significance at 1%, 5% and 10% confidence level. The value in the bracket below reports the t-value in t test. R-squ means the goodness of fit. The Hausman Test p-value shows the p in Hausman test, which is employed to prove if the fixed effect model is better than random effect model.

From the first column the study finds the coefficient between gdp and loan growth rate is -2.6929, and it is significant at 1% confidence level. Once the gdp increases 1%, banks' loan growth rate will drop 2.6929%, and this reports the counter-cyclicality of bank lending. The result corresponds to H1, and is the same as what Pan (2013) finds with different model.

Column 2 to column 4 demonstrate that all the coefficients of the three monetary policy variables are significant at 1% confidence level, and the estimated value are -1.4844, -1.3192 and -1.5158 separately. When plugging in the monetary policy variables, the coefficient of gdp drop from -2.6929 to -4.0962, and it is still significant at 1%.

The goodness of fit increases from 0.4035 to 0.4659. Through the description above, the study concludes that credit channel is still effective for Chinese government to use monetary policy tools to control banks' loan scale, but it is not the reason why Chinese bank lending is counter-cyclical. This conclusion differs from H2.

From the fifth and sixth column, the study finds that when the combination of monetary policy variables are taken into the model, *dep_r* and *loan_r* become not significant, but *res_r* keeps significant at 1% level. This is because deposit reservation rate is the more essential and direct factor on loan than bench-mark interest rate. When the combination is put into the model, the explanatory power of *dep_r* and *loan_r* is absorbed by *res_r*. So in the following regression concerning the equity structure, only *res_r* is used as the monetary policy variable.

The *p*-value of Hausman test is 0.0000, so the null hypopaper is rejected, and verify that the fixed effect model is more suitable than random effect model.

5.4. Equity structure, macro-economy and bank lending

In Table 5 below, the first column shows the results without the equity structure factor, which is the same as the fourth column in the table. In the second column, we added the *f*share and the cross term of *f*share and *gdp*. In the third column, the state and the cross term of state and *gdp* are added. In the last column, the *f*share and state and their cross terms with *gdp* put together into the model.

In this section, the study mainly focuses on the coefficient of the cross term. In the column 2, the coefficient of *fshare*×*gdp* is -1.6071, and significant at 5% confidence level. The results report that banks with high share concentration show more counter-cyclical lending behavior that banks with low concentration. The result is quite the opposite as the H3.

In the column 3, the coefficient of *state*×*gdp* is -1.2404, and significant at 1% confidence level. The results correspond to the H3. State-owned banks, especially the "Big 4", are playing an important role in smoothing the loan scale and promoting the economy a stable increase. So the lending of state-owned bank is more counter-cyclical than that of non-state-owned bank.

In column 4, when *fshare* and *state* are put together into the model, changes happen. The coefficients of *state* and *state*×*gdp* are still significantly negative, which are the same as column 3, but the coefficients of *fshare* and *fshare*×*gdp* become not significant. Regarding the reasons, the study believes *fshare* and *state* are relatively highly correlated, the correlation coefficient is 0.5405. When they are put together, the explanatory power of *fshare* is absorbed by *state*. This explanation can also account for the results in column 2 which is different from H3. In China, state-owned bank usually has high share concentration, while the share of the biggest owner in non-state-owned bank is relatively small.

Table 5
Effects of equity structures on bank lending over business cycles

Variables	(1)	(2)	(3)	(4)
gdp	-4.0962***	-3.6539***	-4.1117***	-3.9382***
	(-10.06)	(-8.01)	(-9.33)	(-8.73)
crisis	0.0488***	0.0481***	0.0428***	0.0434***
	(4.28)	(4.26)	(3.61)	(3.72)
car	-0.6463**	-0.6866***	-0.7341**	-0.7322***
	(-2.68)	(-2.79)	(-2.43)	(-2.77)
dtl	0.1629***	0.1673***	0.1786***	0.1733***
	(5.32)	(5.22)	(4.99)	(4.90)
size	-0.1242***	-0.1229***	-0.1388***	-0.1366***
	(-6.30)	(-6.38)	(-6.13)	(-7.37)
roa	9.0760**	8.8865**	7.1814*	6.5943*
	(2.37)	(2.26)	(1.84)	(1.74)
res_r	-1.5158***	-1.5330***	-1.5710***	-1.5168***
	(-4.95)	(-4.75)	(-4.73)	(-4.69)
fshare		0.3347***		0.2289
		(2.90)		(1.66)
state			0.1218***	0.1292***
			(3.04)	(3.26)
fshare×gdp		-1.6071**		-0.2045
		(-2.06)		(-0.22)
state×gdp			-1.2404***	-1.4489***
			(-2.84)	(-3.21)
R-squ (within)	0.4659	0.4758	0.4887	0.5058
Observations	241	238	237	237
No of Banks	33	33	33	33
Hausman Test p-value	0.0000	0.0000	0.0000	0.0000

Notes: ***, ** and * denote the significance at 1%, 5% and 10% confidence level respectively. The value in the bracket below reports the t-value in t test. R-squ means the goodness of fit. The Hausman Test p-value shows the p in Hausman test, which is employed to prove if the fixed effect model is better than random effect model.

Regarding the control variables, the results are almost the same as previous analyses. The coefficient of crisis keeps around 0.04, and significant at 1%. *dtl* and size are all significant at 1% level, with coefficient of 0.15 and -0.12. After plugging in *car* and *roa*, their coefficients decrease from -0.6 to -0.7 and decrease from 8.9 to 6.6 respectively, and are becoming less significant.

6. Robustness Test

In order to ensure the validity, in this section we will do some robustness tests. The GDP growth rate is replaced with industrial added value growth rate and replace the share of the biggest owner with the shares of the top 5 shareholders to test if the results in the above still hold the form of our explanatory variables are changed.

6.1 .Replace the GDP with industrial added value

Similarly, the *gdp* is replaced with *iav*. The basic model (2), is the first study and report the relationship between Chinese bank lending and macro-economy. The three monetary policy variables and their combinations into the basic model are plugged it and get model (3), in order to demonstrate that monetary policy has great effects on bank lending over cycles. In the end, the equity structure variables and the cross term of equity structure with the industrial added value are taken into consideration and get model (4), trying to find the characteristics of bank lending with different equity structure. The results are reported in Table 6 and Table 7, and then verify the robustness of the model.

6.2. Replace the share of biggest shareholder with that of top 5 shareholders

In this section, the share of top 5 shareholders instead of the share of the biggest shareholders is used. The results are reported in Table 8, and robustness is checked.

Table 6
Robustness test for effect of monetary policy on bank lending over business cycles

Variables	(1)	(2)	(3)	(4)	(5)	(6)
iav	-1.2488***	-1.6186***	-1.7002***	-1.9325***	-1.9043***	-2.0999**
	(-5.63)	(-6.09)	(-6.30)	(-6.14)	(-6.01)	(-6.68)
crisis	0.0192*	0.0189*	0.0221**	0.0187*	0.0187*	0.0212**
	(1.83)	(1.79)	(2.12)	(1.77)	(1.77)	(2.04)
car	-0.7806***	-0.8448***	-0.8338**	-0.8306***	-0.8521***	-0.8589***
	(-2.81)	(-2.94)	(-2.92)	(-2.98)	(-2.98)	(-2.99)
dtl	0.1551***	0.1651***	0.1594***	0.1738***	0.1729***	0.1720***
	(5.24)	(5.35)	(5.22)	(5.36)	(5.23)	(5.16)
size	-0.0958***	-0.1053***	-0.1061***	-0.1026***	-0.1060***	-0.1088***
	(-4.28)	(-4.49)	(-4.59)	(-4.41)	(-4.48)	(-4.62)
roa	9.5372**	9.5020**	9.1372**	10.0551**	9.8335**	9.5914**
	(2.24)	(2.25)	(2.16)	(2.34)	(2.28)	(2.22)
dep_r		-1.5747***			-0.6822	
		(-5.11)			(-1.42)	
loan_r			-1.5888***			-0.7075
			(-5.08)			(-1.38)
res_r				-1.1088***	-1.2598***	-1.2645***
				(-3.44)	(-3.24)	(-3.22)
R-squ (within)	0.3638	0.3983	0.3980	0.4015	0.4018	0.4081
Observations	241	241	241	241	241	241
NO. of Banks	33	33	33	33	33	33
Hausman Test p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: ***, ** and * denote the significance at 1%, 5% and 10% confidence level respectively. The value in the bracket below reports the t-value in t test. R-squ means the goodness of fit. The Hausman Test p-value shows the p in Hausman test, which is employed to prove if the fixed effect model is better than random effect model.

Table 7
Robustness test for effect of equity structure on bank lending over business cycles

Variables	(1)	(2)	(3)	(4)
iav	-1.9325**	-1.4950***	-1.8127***	-1.6315***
	(-6.14)	(-4.56)	(-5.30)	(-4.80)
crisis	0.0187*	0.0199*	0.0191*	0.0209*
	(1.77)	(1.84)	(1.71)	(1.97)
car	-0.8306***	-0.8542***	-0.8989**	-0.8919***
	(-2.98)	(-3.08)	(-2.65)	(-2.95)
dtl	0.1738***	0.1779***	0.1912***	0.1858***
	(5.36)	(5.25)	(4.99)	(4.97)
size	-0.1026***	-0.0991***	-0.1130***	-0.1100***
	(-4.41)	(-4.61)	(-4.34)	(-5.23)
roa	10.0551**	9.6492**	6.5080	6.0394
	(2.34)	(2.24)	(1.60)	(1.54)
res_r	-1.1088***	-1.1442***	-1.1505***	-1.1160***
	(-3.44)	(-3.29)	(-3.20)	(-3.13)
fshare		0.4260***		0.2928**
		(4.16)		(2.32)
state			0.1780***	0.1704***
			(5.55)	(5.58)
fshare×iav		-1.6603***		-0.4995
		(-2.95)		(-0.82)
state×iav			-1.3049***	-1.3518***
			(-5.82)	(-6.28)
R-squ (within)	0.4015	0.4132	0.4515	0.4720
Observations	241	238	237	237
NO. of Banks	33	33	33	33
Hausman Test p-value	0.0000	0.0000	0.0000	0.0000

Notes: ***, ** and * denote the significance at 1%, 5% and 10% confidence level respectively. The value in the bracket below reports the t-value in t test. R-squ means the goodness of fit. The Hausman Test p-value shows the p in Hausman test, which is employed to prove if the fixed effect model is better than random effect model.

Table 8
Robustness test for effect of equity structure on bank lending over business cycles

Variables	(1)	(2)	(3)	(4)
gdp	-4.0962**	-3.8419***	-4.1117***	-4.4322***
	(-10.06)	(-6.11)	(-9.33)	(-7.07)
crisis	0.0488***	0.0460***	0.0428***	0.0434***
	(4.28)	(3.94)	(3.61)	(3.72)
car	-0.6463**	-0.7202***	-0.7341**	-0.7322***
	(-2.68)	(-2.78)	(-2.43)	(-2.77)
dtl	0.1629***	0.1786***	0.1786***	0.1733***
	(5.32)	(4.86)	(4.99)	(4.90)
size	-0.1242***	-0.1284***	-0.1388***	-0.1366***
	(-6.30)	(-6.75)	(-6.13)	(-7.37)

Variables	(1)	(2)	(3)	(4)
roa	9.0760**	8.4784**	7.1814*	6.5943*
	(2.37)	(2.08)	(1.84)	(1.74)
res_r	-1.5158***	-1.6241***	-1.5710***	-1.5168***
	(-4.95)	(-4.89)	(-4.73)	(-4.69)
share5		0.2266		0.1187
		(1.29)		(0.63)
state			0.1218***	0.1321***
			(3.04)	(3.16)
share5×gdp		-0.6865		0.6806
		(-0.71)		(0.68)
state×gdp			-1.2404***	-1.5096***
			(-2.84)	(-3.17)
R-squ (within)	0.4659	0.4801	0.4887	0.5014
Observations	241	238	237	237
No of Banks	33	33	33	33
Hausman Test p-value	0.0000	0.0000	0.0000	0.0000

Notes: ***, ** and * denote the significance at 1%, 5% and 10% confidence level respectively. The value in the bracket below reports the t-value in t test. R-squ means the goodness of fit. The Hausman Test p-value shows the p in Hausman test, which is employed to prove if the fixed effect model is better than random effect model.

7. Conclusions

In this paper, the study chooses the annual unbalanced panel data of 33 Chinese commercial banks from 2005 to 2014, designs individual fixed effect model, and combine the literature researches with empirical analyses. The study reports the characteristics of Chinese bank lending behaviors over business cycles and reported the effects of monetary policy and equity structure on the cyclicality of lending. The study made three main conclusions as below.

(1) Compared with other countries, Chinese bank lending behaviors are countercyclical. That is to say the fluctuation in bank lending is generally in the opposite direction with the fluctuation of macro-economy. When the economy is prosperous, banks will tighten lending to avoid over-heated economy, and when the economy is in recession, banks will expand loans to boost economy.

(2) Credit channel as the main way of transmitting monetary policies is effect and efficient, but this is not the reason why Chinese bank lending show counter-cyclicality characteristic. When we plug the monetary policy factor into the model, the counter-cyclicality of lending behavior does not change.

(3) Lending of banks within higher ownership concentration is more countercyclical than banks with lower ownership concentration. Lending of state-owned banks is more counter-cyclical than non-state-owned banks.

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