The Bank-lending Channel of Monetary Policy Transmission in China: A Comparison between Chinese and Foreign Banks[*]

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This paper comparatively examines the bank-lending channel of monetary policy transmission in China between Chinese and foreign banks. We consider 22 foreign banks and 67 domestic banks that account for about 82-88% of total bank assets in China. We focus on the period 2007-2013 during which foreign banks in China had dramatically increased, following the liberalization of the entry of foreign banks at the end of 2006.

In our models, we allow for heterogeneity in banks' characteristics such as size, capitalization, liquidity, credit risk and efficiency. Using a fixed effect model, we find that bank ownership plays a critical role in determining bank's response to monetary policy. In specific, foreign banks are found to be less sensitive to China's monetary policy than Chinese banks, but they are sensitive to the real interest rate of U.S. This finding points to the existence of internal capital markets in case of foreign banks. Foreign banks can use internal capital market to buffer the impact of monetary policy on loans. As a result, they could reduce their loans by less than Chinese banks in response to tight monetary policy. When the Chinese monetary authority conducts monetary policies, therefore, it should keep in mind that larger changes in monetary policy instruments are required to obtain the same desired change in aggregate demand in the presence of the buffering effects of foreign banks.

We also find that the effects of price instruments and quantitative

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instruments of monetary policy on Chinese banks' lending behavior are different.   For example, Chinese banks' lending is more sensitive to policy lending rate than to required reserve ratio.

1. INTRODUCTION

Monetary policy is the macroeconomic policy laid down by the central bank, which is used to achieve macroeconomic objectives oriented towards the growth and stability of the economy. The main transmission channels of monetary policy shocks to the real economy are the traditional interest rate channels, the other assets price channels, and the credit channels.

In China, the credit channels (particularly, bank lending channels) are the most important part of the monetary transmission mechanism. Interest rate channels and the other assets price channels are unimportant relative to credit channels in China because interest rates are not liberalized, stock and bond markets in China are not well developed, and bank loans and retained earnings are the most important financing sources for firms.

Interest rate channels in China are not working as well as in developed countries. In China, interest rate can't reflect the relationship between supply and demand of market funds because interest rate is heavily regulated by central bank to achieve macroeconomic stability. Typical regulations on interest rate include the deposit-rate ceiling and lending-rate floor. The other assets channels could work well when complete capital market exits as their prerequisite. But stock and bond markets in China are not well developed. The censorship on companies which want to go public is so strict that the capital market in China can't play a decisive role in resource allocation. It's difficult for small and medium-sized firms to finance in the capital market. Moreover, the share of speculation is higher than that of value investment in the Chinese capital market, so that the correlation between capital market and real economy is weaker in China than in other countries. In contrast, banks' lending is the most important financing source in China. The total social financing is 16.4 trillion RMB in 2014, among which bank loan financing accounts for 58.9%, while the share of debt financing is only 14.5%. Most firms, particularly small and medium-sized firms, depend on banks' lending to finance. In addition, the profit structure of banks shows that the share of interest income is as high as

63.6% in 2013, implying that lending is the most important source of profits for banks in China.

The credit channel is broken down into two components: the balance-sheet channel and the bank lending channel.   This paper focuses on the bank lending channel, which holds that monetary policy works in part by affecting the supply of loans offered by banks.   The bank lending channel of monetary policy transmission assumes that bank deposits and other sources of bank finance are imperfect substitutes.   When the central bank tightens the money supply, banks cannot fully substitute reduced deposits with other funding source.   So the banks have to contract lending which will reduce the firm's investment and output by limiting credit availability.

As more emerging economies opened their financial markets to foreigners in the 1990s, foreign banks' presence in emerging economies has been rapidly rising during this period.   China, as the largest emerging market, has opened up its finance system step-by-step since it allowed foreign banks to set up representative offices in 1979.   In order to comply with the commitment of WTO, China progressively had removed regulatory obstacles for foreign banks since 2001.   The banking market was liberalized for the entry of foreign banks at the end of 2006.   After then, the number of foreign banking institutions in China dramatically increased from 274 in 2007 to 419 in 2013.   The total assets of foreign banking institutions increased to RMB2.56 trillion in 2013 from RMB0.92 trillion in 2006.   The loans issued by foreign banking institutions totaled RMB1.11 trillion with a year-on-year growth of 7.45%.

Foreign bank entry to China has many significant effects on the Chinese banking system.   Most empirical studies have examined the impact of foreign bank entry on the performance of domestic banks.   However, the possible difference of the lending behavior between foreign and domestic banks in response to monetary policy has been examined very sparsely. Foreign banks which are affiliated with their parent bank abroad may take advantage of internal capital markets to buffer the impact of monetary policy on loans.   Whether the foreign banks entry in China changes the

transmission of monetary policy has become an important question for policy makers.

This paper comparatively examines the bank lending channel of monetary policy transmission in China between Chinese banks and foreign banks. We focus our analysis on 22 foreign banks and 67 Chinese banks in China during the period from 2007 to 2013. In our model, we allowed for heterogeneity in banks' characteristics such as size, capitalization, liquidity, credit risk and efficiency, which are believed to be the determinants of banks' loan supply. Our findings provide evidence for the existence of the bank lending channel, but also reveal that foreign banks are less responsive than Chinese banks to monetary policy shocks in China.

The rest of this paper is organized as follows. Section 2 introduces literature on the bank-lending channel of monetary policy transmission and discusses regression models. Section 3 provides descriptive statistics of the data. Section 4 provides the empirical results. Finally, section 5 concludes.

2. ECONOMETRIC MODEL

2.1. Literature Review

In China, the bank lending channels are the most important part of the monetary transmission mechanism. The bank lending channels assume that deposits and other sources of finance of banks are imperfect substitutes (Bernanke and Blinder, 1992; Kashyap and Stein, 1995).

Most empirical studies have examined the existence of the bank lending channel in industrialized countries. Bernanke and Blinder (1992) and Kashyap *et al*. (1993) find that a monetary contraction tends to be followed by a reduction in aggregate bank credit in U.S., which is consistent with the existence of a bank lending channel. Hancock and Wilcox (1998) use bank-level data for U.S. banks, and find the existence of the bank lending channel.

Loupias *et al*. (2002) examines the bank lending channel in France. Gambacorta (2005) finds evidence of a bank lending channel for Italy. Following the empirical studies of Edwards and Végh (1997), researcher started to examine the existence of a bank lending channel in emerging markets (Agung, 1998; Alfaro *et al*., 2004; Wu *et al*., 2011; Mora, 2013).

Most empirical studies exploit cross-sectional heterogeneity in bank's characteristics such as liquidity, capitalization, and size, which are believed to affect bank's response to monetary shocks. Kashyap and Stein (1995) use a very large set of quarterly data for U.S. banks to analyze the bank lending channel. They find that banks with fewer total assets are more responsive to monetary policy shocks than banks with more total assets. It is comparatively easier for large-scale banks to borrow in interbank markets or issue certificates of deposit under tight monetary policy so that large-scale banks do not have to reduce loans. Kashyap and Stein (2000) find that the effect of monetary policy is stronger for U.S. banks with less liquid assets than banks with more liquid assets during the period 1976-1993 since the former cannot easily liquidate assets to preserve credit growth. Kishan and Opiela (2000) use U.S. banks data from 1980 to 1995 to examine the role of bank capital in the bank lending channel. They find that banks with less capital tend to reduce loans following tight monetary policy. This is because banks with more capital can cover the reduction in deposits more easily than banks with less capital. Gambacorta (2005) uses Italian bank-level data from 1986 to 2001. He finds no bank scale effect on monetary policy transmission, but finds that capitalization and liquidity levels of banks affect the effectiveness of the bank lending channel of monetary policy transmission, which is consistent with Kashyap and Stein (2000). Loupias *et al*. (2002) find that liquidity plays a similar role in the bank lending channel, as is found by Kashyap and Stein (2000), but find no significant impact of size and capitalization.

Another important bank characteristic for the bank lending channel could be bank efficiency. Jeon and Miller (2005) find that foreign banks' high profitability is driven by high efficiency and management which is due to the

parent banks' governance and resources.

In addition to the above-mentioned bank characteristics, banks' ownership structure can also affect banks' lending behavior. Houstan and James (1998) find that the loan growth of affiliated banks is less sensitive to their cash flow, liquidity and capital position than that of unaffiliated banks. Ashcraft (2006) finds that lending of affiliated banks is largely unaffected by changes in monetary policy, but stand-alone banks' lending supply is more sensitive to monetary shocks. Cetorelli and Goldberg (2008) find evidences for the lending channel for monetary policy only in banks that are domestically-oriented without international operations. They also show that the existence of internal capital markets contributes to an international propagation of monetary policy shocks to lending by affiliated banks abroad. De Haas and Naaborg (2005, 2006) find that parent banks use internal capital markets to steer the credit of their subsidiaries which are located in other countries. When foreign bank cannot raise new funding in the host country, the parent bank can establish internal capital markets to allocate capital among their subsidiaries in foreign countries. Arena *et al*. (2006) examine the differences in the behavior of domestic and foreign banks in 20 emerging countries except China during 1989-2001. They find that foreign banks have a lower sensitivity of loans to monetary policy shocks than domestic banks. Wu *et al*. (2011) investigate the loan granting behavior of banks in the emerging economies of Asia, Latin America, and Central and Eastern Europe except China. They find that foreign banks are less responsive to monetary shocks in host countries.

There have been some empirical studies concerning the conduct of monetary policy in China. Xie (2004) uses aggregate data and find that money is neutral with regard to the long run economic growth, but is related to inflation. Qin *et al*. (2005) analyze the impact of various monetary policy instruments on monetary aggregates and the price level. Liu *et al*. (2009) examine the long-term relationship between deposit rates and inflation. However, all of the above-mentioned studies which utilize aggregate data and Granger causality test to examine the relationship

between money supply and macroeconomic variables only consider the impact of monetary policy in China. These studies do not examine the monetary policy transmission mechanism, especially the bank lending channel which is the most important part of the monetary policy transmission in China.

Only recently, some empirical studies analyze the bank lending channel of monetary policy transmission in China. Sun *et al*. (2010) use a VECM model to find the existence of a bank lending channel for monetary policy transmission. They document that bank loan supply is negatively related to required reserve ratios and official one-year lending rate in the long run and show that the bank lending channel plays an important role in China's monetary policy transmission. But this study uses aggregate data. Gunji and Yuan (2010) use bank-level data to examine whether the impact of monetary policy on bank lending depends on the characteristics of Chinese banks. The result suggests that the impact of monetary lending is weaker for larger banks and banks with lower levels of liquidity, and that bank's responses to monetary policy do not necessarily vary according to the level of their capital.

However, empirical study about the difference of the lending behavior between foreign and domestic banks in response to monetary policy in China has been examined very sparsely. Arena *et al*. (2006) and Wu *et al*. (2011) both use bank-level data to examine the differences in the loan behavior of domestic and foreign banks to monetary policy shocks in emerging economies. But Arena *et al*. (2006) and Wu *et al*. (2011) do not include China because of the lack of data on foreign banks in China. The China's banking market was liberalized for the entry of foreign banks at the end of 2006, so the bank-level data of foreign banks were limited until 2007.

2.2. Regression Models

This paper empirically examines the bank lending channel of monetary policy transmission in China, focusing on whether the banks' ownership is

another important determinant of banks' lending behavior.   Specifically, we comparatively examine the bank lending channel of monetary policy transmission in China between Chinese and foreign banks.   For this purpose, we provide separate estimates for three different types of ownership structure: foreign banks, state-owned banks and the other commercial banks. In contrast to domestic banks, foreign banks have abundant opportunities to use the internal capital market to buffer the impact of monetary policy on loans.   The state-owned banks are under strong government control, and the other commercial banks are managed relatively freely.   So we can expect their different lending responses to monetary policy shocks.

We consider growth rates of banks' loans as a dependent variable.   As for the monetary policy variables, we use both the policy lending interest rate and required reserve ratio which are all directly controlled by the People's Bank of China.   The policy lending rate is price instruments, while required reserve ratio is quantitative instruments.   Both instruments are better monetary policy variables than others.   Policy interest rate and required reserve ratio are the most frequently used by the People's Bank of China and are considered to be well functioning during the 21st century.   He and Wang (2012) find that policy rate has the largest effect in monetary policy transmission than the other monetary policy instruments; reserve requirement also has a significant effect, but open market operation does not have a significant effect.

While most of the previous studies relied on aggregate data, our paper uses bank-level data to demonstrate the bank lending channel of monetary policy transmission in China.   Using balanced panel data, this paper examines whether the banks' lending behavior differs, depending on their ownership structure.   For the purpose, we construct the following two regression equations.

$$\Delta loan_{i,t} = \alpha + \beta mp_t + \Phi bank\ characteristics_{i,t-1} + \delta_t + u_i + \varepsilon_{i,t}, \quad (1)$$

$$\Delta loan_{i,t} = \alpha + \beta_1 mp_t + \beta_2(foreign_{i,t} \times mp_t) + \beta_3(state_{i,t} \times mp_t)$$
$$+ \Phi bank\ characteristics_{i,t-1} + \delta_t + u_i + \varepsilon_{i,t},$$

(2)

where $\Delta loan_{i,t}$ is the growth rate of bank i's loans at time t, and mp_t is the policy lending rate or required reserve ratio, used as the monetary policy variable. *Bank characteristics*$_{i,t-1}$ is a vector of bank characteristics including liquidity, capitalization, size, efficiency, and riskiness. We use one-year lagged values of bank characteristics in order to avoid the potential endogeneity problem that may arise from a contemporaneous causality running from loan growth rate to bank characteristics. α is the intercept term. δ_t is the time effect which is a set of year dummies and u_i is the unobserved bank-fixed effect. $\varepsilon_{i,t}$ is the error term.

$Forein_{i,t}$ and $state_{i,t}$ are the bank ownership dummies, which are used to divide all banks into three categories: foreign banks, state-owned banks, and the other commercial banks which is the benchmark category.[1] $Forein_{i,t}$ is a foreign ownership dummy which is equal to 1 when the bank is foreign-owned, and 0 otherwise. $State_{i,t}$ is a state ownership dummy which is equal to 1 when the bank is state-owned, and 0 otherwise.

In the first equation, we examine the effect of monetary policy on the growth rates of bank lending across the banks' ownership. We divide the banks into five groups: all banks in China, Chinese banks, state-owned banks, the other commercial banks and foreign banks.

In the second equation, we use all banks to examine the effect of monetary policy on the bank lending channel, but we include interaction terms between monetary policy and ownership dummies, $forein_{i,t}$ and $state_{i,t}$. In this way, we can differentiate responses of foreign-owned banks or state-owned banks to changes of monetary policy from those of the other commercial banks.

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[1] State-owned banks include policy lending banks and state-owned commercial banks which are under strong government control. The other commercial banks include joint-stock commercial banks and city and rural commercial banks which are managed relatively freely. We hypothesize that the Chinese banks' lending behavior could be different between the state-owned banks and the other commercial banks.

Although the previous research maintains that the lending channel of monetary policy transmission may differ, depending on bank characteristics such as liquidity, capitalization, and size, this paper does not incorporate interaction terms between such bank characteristics and monetary policy. This is because we focus on whether the lending channel of monetary policy transmission differs by bank ownership rather than by bank-specific characteristics. Instead we allow bank specific characteristics to affect their lending supply, independently of monetary policy. Banks with a higher liquidity ratio are expected to have a higher loan growth rate because they have more liquid assets. We hypothesize that the well-capitalized banks could have a higher loan growth rate than others. The well-capitalized banks have a good financing capability and solvency so that they can lend much more than the others. Large banks can obtain financing from instruments other than deposits at lower cost, and can easily diversify risks. In other words, banks with larger assets could have lower lending growth rate than the other banks.

In addition, we include two more bank characteristics that have been paid little attention in the previous literature: efficiency and riskiness. Efficiency used in this paper is measured by the ratio of non-interest expenses to assets, implying that efficiency is higher when the ratio is lower. Riskiness denotes the credit risk faced by a bank, measured by the ratio of loan loss provisions to total loans.

We allow for the year effect in the two equations. Like Arellano and Bond's application (1991), this term is to control for idiosyncratic shocks to all banks. The year dummies allow us to eliminate the effects of demand of all banks' loans which may be affected by macroeconomics variables and structural breaks, thereby enabling us to focus on the supply of loans. We allow for the individual heterogeneity in the bank-level panel model by introducing bank fixed effects, denoted by u_i in the model.

Based on the internal capital market theory, we take a closer look at foreign banks' lending behavior by examining whether real interest rate of U.S. and

real GDP of foreign countries[2] are significant determinants of the foreign banks' loans. For this purpose, we replace the Chinese monetary policy variables with the real interest rate of U.S. in equation (1).

$$\Delta loan_{i,t} = \alpha + \beta_1 rius_t + \beta_2 \Delta rgdp_{i,t} + \Phi bank\ characteristics_{i,t-1}$$
$$+ \delta_t + u_i + \varepsilon_{i,t},$$

(3)

where $\Delta loan_{i,t}$ is the growth rate of foreign banks' loans, $rius_t$ is the real interest rate of U.S. and $\Delta rgdp_{i,t}$ is the growth rate of real GDP of foreign countries.

3. DATA

This paper constructs a balanced panel dataset including both bank-level and macroeconomic data. Based on data availability, we select 22 foreign banks and 67 Chinese banks in China during the period from 2007 to 2013 when the China's banking market had been liberalized for the entry of foreign banks.

The banking system in China includes policy lending banks, state-owned commercial banks, joint-stock commercial banks, city and rural commercial banks, and foreign banks as reported in table 1. Policy lending banks and state-owned commercial banks remain under strong government control, and their targeted borrowers are state-owned firms and large firms.   On the other hand, joint-stock commercial banks, and city and rural commercial banks are managed relatively freely. So we classify total banks into three different groups: foreign banks, state-owned banks (including Policy lending banks and state-owned commercial banks) and the other commercial banks (including joint-stock commercial banks and city and rural commercial banks)

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[2] The 22 foreign banks considered in our sample belong to 9 foreign countries and regions which include France, Germany, Hong Kong SAR, Japan, Korea, Singapore, Taiwan Province of China, United Kingdom and United States.

Table 1   Classification of Banks in China (2013)

Type	Numbers of Total Banks in China	Number of Selected Banks in our Sample
Policy Lending Banks	3	3
State-owned Commercial Banks	5	5
Joint-stock Commercial Banks	12	10
City and Rural Commercial Banks	more than 100	49
Foreign Banks	42	22

Source: China Banking Regulatory Commission.

Table 2   Foreign Banks' Operations in China (2007-2013)

Item / Year	2007	2008	2009	2010	2011	2012	2013
Number of Banking Institutions	274	311	338	360	387	412	419
Assets (RMB100 million)	12,525	13,448	13,492	17,423	21,535	23,804	25,628
As of the Total Banking Assets in China (%)	2.38	2.16	1.71	1.85	1.93	1.82	1.73

Source: China Banking Regulatory Commission 2013 Annual Report.

in China.   The selected banks in this paper account for about 82-88% of total bank assets in China.

A bank is defined as 'foreign' if more than 50% of its capital is owned by foreign individuals, foreign banks, or international organizations.   The China's banking market was liberalized for the entry of foreign banks at the end of 2006.   As the local incorporation policy was adopted in 2006, locally incorporated foreign banks were approved to conduct RMB business.   As a result, many foreign banks have chosen to transform their branching network into locally incorporated entities.   By the end of 2013, banks from 51 countries and regions established 42 locally incorporated institutions (LII), 285 LII branches and subsidiaries, and 92 foreign bank branches, adding up to 419 foreign banking institutions in China.   As reported in tables 2, the

total assets of foreign banking institutions increased to RMB2.56 trillion in 2013, making an increase of 104.6% from 2007 when the total assets was RMB1.25 trillion.   In spite of the rapid increase in the assets of foreign banks, their proportion in the total banking assets in China remains low at 1.7% in 2013.[3]   This is mainly because the assets of Chinese banks increase more rapidly than those of foreign banks.   In view of the dramatic increase in the number and the total assets of foreign banks, however, they will play an increasingly important role in the Chinese banking industry as time goes on.   Therefore, it is worthwhile to pay attention to the effects of foreign banks' entry on the bank-lending channel of monetary policy in China.

The bank-level characteristics data are from *BankScope* database, the policy lending rate and required reserve ratio are from *National Bureau of Statistics of China*, and the macroeconomic data for the real interest rate of U.S. and real GDP of foreign countries are from *IMF* and *World Bank*.   As discussed in many other studies, the banks' characteristics data we used are calculated as follows.   Liquidity is measured by the ratio of liquid assets to total assets, capitalization is the ratio of equity to total assets, size is natural logarithm of total assets, efficiency is the ratio of non-interest expenses to total assets, and riskiness which denotes the credit risk faced by bank is measured by the ratio of loan loss provisions to total loans.

Figure 1 shows the growth rates of loans in our sample banks by ownership types: Chinese banks, foreign banks, state-owned banks, and the other commercial banks.   The growth rates of loans of state-owned banks and the other commercial banks tended to move together over the entire period in accordance with the Chinese monetary policy in the aftermath of the 2007-08 global financial crisis.   To cope with the global financial crisis, China adopted the easy monetary policy in 2008 and 2009 (figure 2),[4] leading to an increase in the growth rates of Chinese banks' loans.

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[3] The shares of state-owned banks and other commercial banks to the total bank assets in 2013 are 51.6% and 46.6%, respectively.

[4] The central bank of China has adjusted the required reserve ratio and policy lending rate for 35 times and 19 times from 2007 to 2015.   The large financial institutions which include state-owned commercial banks have a higher required reserve ratio than the small and medium-sized banks.

Figure 1   Growth Rates of Banks' Loans by Ownership Types

(a) Chinese Banks   (b) Foreign Banks

(c) State-owned Banks   (d) Other Commercial Banks
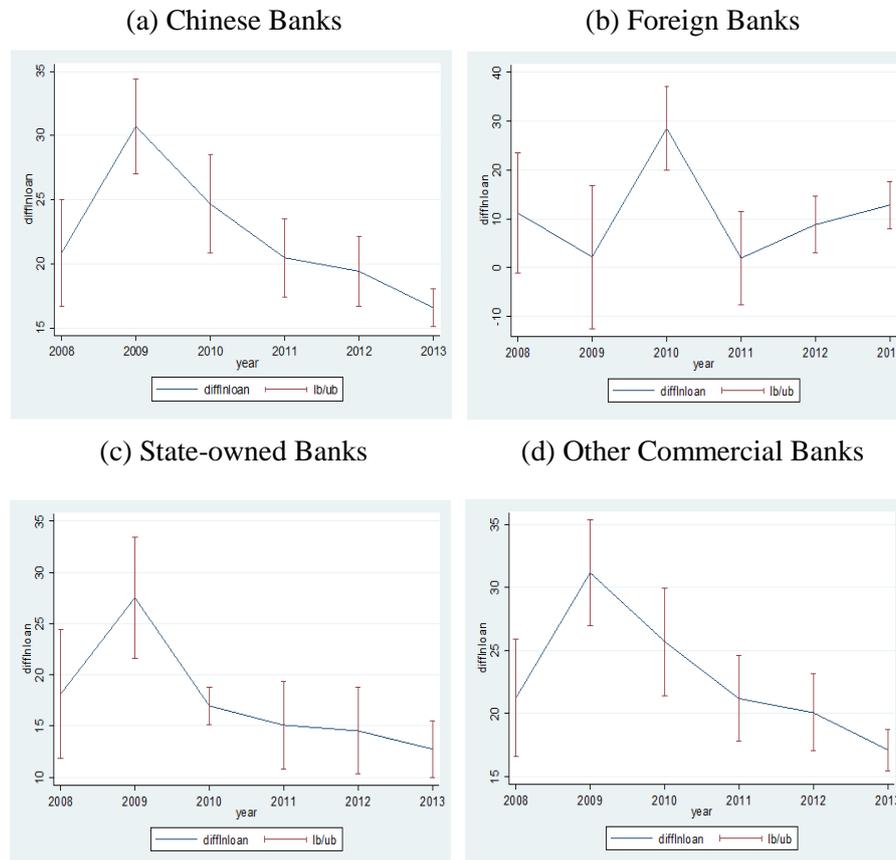
Note: Difflnloan is the growth rate of loans and ib/ub denotes the 95% confidence interval.

In 2010, a moderately accommodative monetary policy was adopted to maintain a steady growth of monetary supply, and the growth rate of broad money supply decreased by 8 percentage points.   From 2011, the prudent monetary policy was implemented, and credit expansion experienced a gradual slowdown.   In contrast, the growth rates of foreign banks' loans had moved differently from those of Chinese banks over the sample period.   The growth rates of foreign banks' loans decreased in 2009 in spite of the Chinese easy monetary policy.   From 2011, the growth rates of foreign banks'

Figure 2   Changes in the Chinese Monetary Policy

(a) Required Reserve Ratio   (b) Policy Lending Rate
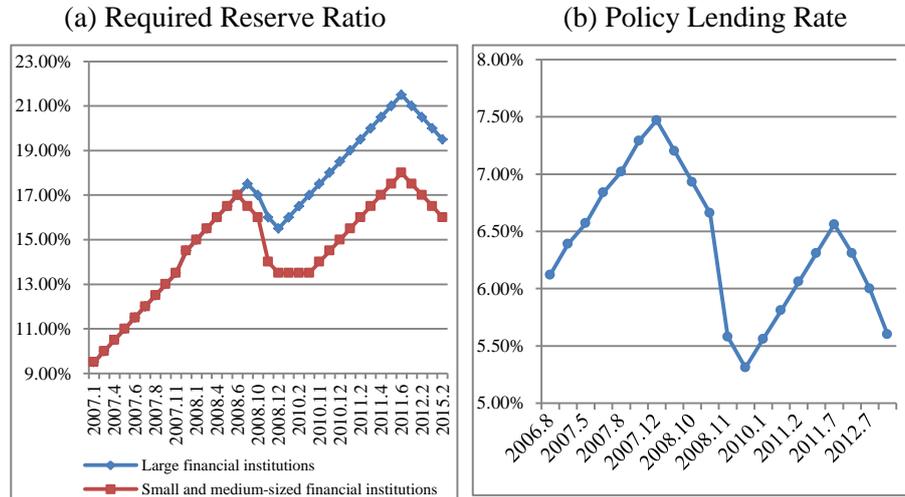
loans tended to increase in spite of the prudent monetary policy.   This fact suggests that foreign banks' lending is not sensitive to China's monetary policy.

4. EMPIRICAL RESULTS

We first perform Hausman tests to make a choice between random and fixed effects model.   Hausman tests show that fixed effects model is appropriate in all of our panel models.   The Wald test reveals that year effects significantly exist in all models, so that we include year dummies in all regressions.

Tables 3 and 4 report the estimation results of equations 1 and 2, respectively, for the case that the policy lending rate is used as the monetary policy variable.   In tables 5 and 6, we report the estimation results for the case that the required reserve ratio is applied as the monetary policy.   As reported in table 7, we replace the Chinese monetary policy variables with the real interest rate of U.S. to analyze the foreign banks' lending behavior.

Table 3   Banks' Loan Growth Response to Policy Lending Rate across Ownership Structures

	All Banks	Chinese Banks	State-owned Banks	Other Commercial Banks	Foreign Banks
C	371.94[***] (8.84)	268.28[***] (7.44)	450.67[*] (1.95)	272.26[***] (6.95)	488.97[***] (3.69)
Policy Lending Rate	−4.80[***] (−3.63)	−7.11[***] (−6.93)	−7.84[***] (−4.16)	−7.32[***] (−6.35)	3.58 (0.78)
Liquidity(t–1)	0.55[***] (6.31)	0.16[**] (2.04)	0.26 (1.20)	0.15[*] (1.76)	1.06[***] (4.93)
Capitalization(t–1)	1.02 (0.23)	1.16[***] (3.56)	0.40 (1.45)	1.55[***] (3.55)	0.31 (0.67)
Size(t–1)	−30.82[***] (−9.14)	−17.06[***] (−5.87)	−26.39 (−1.77)	−18.13[***] (−5.57)	−54.61[***] (−4.96)
Efficiency(t–1)	−4.18 (−1.48)	−12.75[***] (−4.19)	10.10 (0.79)	−14.01[***] (−4.32)	−1.79 (−0.25)
Riskiness(t–1)	2.75[*] (1.90)	0.19 (0.16)	2.08 (0.44)	0.41 (0.32)	4.07 (1.02)
R^2-within	0.32	0.34	0.70	0.34	0.52
Observations	534	402	48	354	132
Hausman Test Prob-Chi^2	0.00	0.00	0.02	0.00	0.00

Notes: The numbers in parentheses are t-statistic values.   [***], [**], and [*] indicate significance at 1%, 5% and 10% levels.

Table 3 provides the results of banks' loan growth response to the policy lending rate across ownership structures which include all banks, Chinese banks, state-owned banks, other commercial banks, and foreign banks.   The coefficient of policy lending rate is significantly negative in Chinese banks' model, implying that lower policy lending rate tends to reduce the banks' loan growth rate in all Chinese banks.   The coefficients of the policy lending rate are not much different between the state-owned and the other commercial banks.   In contrast, there is no significant effect of the policy lending rate on foreign banks' loans as its coefficient in foreign banks' model is not statistically significant.

Table 4   Banks' Loan Growth Response to Policy Lending Rate

	Model 1	Model 2	Model 3	Model 4
C	361.37*** (8.52)	361.30*** (8.52)	351.36*** (9.36)	347.35*** (9.46)
Policy Lending Rate	−5.70*** (−3.93)	−5.55*** (−4.01)	−5.57*** (−4.14)	−6.17*** (−4.65)
Foreign*policy Lending Rate	4.62* (1.83)	4.48* (1.80)	5.25** (2.29)	4.08* (1.82)
State*policy Lending Rate	1.22 (0.35)	–	–	–
Liquidity(t−1)	0.56*** (6.48)	0.56*** (6.47)	0.56*** (6.48)	0.51*** (6.21)
Capitalization(t−1)	1.07*** (4.67)	1.06*** (4.66)	1.03*** (4.58)	1.02*** (4.80)
Size(t−1)	−30.34*** (−8.99)	−30.33*** (−9.00)	−29.71*** (−9.45)	−28.63*** (−9.27)
Efficiency(t−1)	−2.14 (−0.70)	−2.08 (−0.68)	–	–
Riskiness(t−1)	2.73* (1.89)	2.73* (1.89)	2.45* (1.71)	–
R^2-within	0.32	0.32	0.32	0.31
Observations	534	534	534	534
Hausman Test Prob-Chi^2	0.00	0.00	0.00	0.00

Notes: The numbers in parentheses are *t*-statistic values. ***, **, and * indicate significance at 1%, 5% and 10% levels.

None of the coefficients on banks' characteristics are statistically significant in state-owned banks, but in the other Chinese commercial banks, liquidity, capitalization, efficiency have a significantly positive effect on the banks' lending behavior.   The coefficient of size is significantly positive in the other Chinese commercial banks.   These results are consistent with expected signs as previously stated.   Banks with high liquidity and efficiency tend to extend more loans.   Well-capitalized banks also tend to

extend more loans.   Banks with larger assets have less lending growth rate than the other banks.   What is especially noteworthy is that all of these bank characteristics affect only the other Chinese commercial banks' loans. State-owned banks are controlled by government, so their lending behavior may be more affected by the government's influence rather than the bank characteristics.   In foreign banks, liquidity and size turn out to significantly affect the banks' lending behavior.

To check the robustness of the results, we utilize all banks' data by incorporating interaction terms between policy lending rate and ownership dummies.   We apply interaction terms of 'Foreign*policy lending rate' and 'State*policy lending rate' to divide all banks into three groups: foreign, state-owned and other commercial banks (benchmark category).   The empirical results are reported in table 4 and consistent with those in table 3.

In Model 1, the coefficient on policy lending rate is −5.70, meaning the other commercial banks' loan supply response to policy shocks.   The coefficient on the interaction term of 'Foreign*policy lending rate' is +4.62 and statistically significant.   This implies that foreign banks adjust their growth rate of loans by a smaller extent (−1.08 = −5.70+4.62) than the other commercial banks do, resulting in a lower sensitivity to monetary policy.   In Models 2 and 3, we only apply interaction terms of 'Foreign*policy lending rate' to divide all banks into two groups: foreign and Chinese banks (benchmark category).   In Model 2, the coefficient on policy lending rate is −5.55 and the coefficient on the interaction term of 'Foreign*policy lending rate' is +4.48 and statistically significant.   This also implies that foreign banks adjust their growth rate of loans by a smaller extent (−1.07 = −5.55 +4.48) than the Chinese banks do.   We also employ alternative specification by excluding efficiency and riskiness in Models 3 and 4, but the results does not change in any significant way.

We replace policy lending rate with required reserve ratio as the monetary policy variable as is reported in tables 5 and 6.   The results in table 5 and table 6 do not much differ, respectively, from those in tables 3 and 4 except that the coefficients on required reserve ratio and 'Foreign*required reserve

Table 5   Banks' Loan Growth Response to Required Reserve Ratio across Ownership Structures

	All Banks	Chinese Banks	State-owned Banks	Other Commercial Banks	Foreign Banks
C	403.74*** (7.33)	284.13*** (6.28)	392.11* (1.73)	311.21*** (7.29)	469.89*** (3.12)
Required Reserve Ratio	−3.65* (−1.63)	−3.41** (2.12)	0.27 (0.16)	−5.76*** (−6.35)	2.82 (0.78)
Liquidity(t–1)	0.54*** (6.17)	0.15* (1.90)	0.27 (0.16)	0.15* (1.76)	1.06*** (4.93)
Capitalization(t–1)	1.07*** (4.68)	1.27*** (3.88)	0.37 (1.13)	1.55*** (3.55)	0.31 (0.67)
Size(t–1)	−31.51*** (−9.29)	−18.11*** (−6.17)	−26.57 (−1.74)	−18.13*** (−5.57)	−54.61*** (−4.96)
Efficiency (t–1)	−5.00* (1.74)	−13.66*** (−4.47)	12.27 (0.76)	−14.01*** (−4.32)	−1.79 (−0.25)
Riskiness(t–1)	2.82* (1.95)	0.32 (0.28)	2.30 (0.46)	0.41 (0.32)	4.07 (1.02)
R^2-within	0.32	0.35	0.70	0.34	0.52
Observations	534	402	48	354	132
Hausman Test Prob-Chi^2	0.00	0.00	0.00	0.00	0.00

Notes: The numbers in parentheses are t-statistic values.   ***, **, and * indicate significance at 1%, 5% and 10% levels.

ratio' in table 6 turn out to be statistically insignificant in most Models.   In table 5, the coefficient on required reserve ratio is significantly negative in the other commercial banks' model, and there is no significant effect of required reserve ratio on the foreign banks' lending behavior. Unexpectedly, however, there is also no significant effect of required reserve ratio on the state-owned banks' lending behavior.   State-owned banks are large and have good financing capability so that they could have higher excess reserve rates than other banks.   So the required reserve ratio does not affect the state-owned banks' loan supply significantly.

Table 6   Banks' Loan Growth Response to Required Reserve Ratio

	Model 1	Model 2	Model 3	Model 4
C	384.28[***] (6.26)	396.76[***] (6.90)	360.16[***] (6.88)	353.12[***] (6.86)
Required Reserve Ratio	−2.47 (−0.83)	−3.60[*] (−1.60)	−2.99 (−1.35)	−3.32 (−1.49)
Foreign*required Reserve Ratio	0.28 (0.28)	0.42 (0.43)	0.60 (0.62)	0.78 (0.81)
State*required Reserve Ratio	−0.85 (−0.59)	−	−	−
Liquidity(t–1)	0.53[***] (6.07)	0.54[***] (6.17)	0.53[***] (6.11)	0.49[***] (5.79)
Capitalization(t–1)	1.09[***] (4.48)	1.11[***] (4.55)	1.04[***] (4.30)	1.08[***] (4.78)
Size(t–1)	−31.45[***] (−8.88)	−31.14[***] (−8.89)	−29.09[***] (−8.98)	−27.98[***] (−8.91)
Efficiency(t–1)	−4.86[*] (−1.68)	−4.86[*] (−1.68)	−	−
Riskiness(t–1)	2.83[*] (1.94)	2.78[*] (1.91)	2.32[*] (1.61)	−
R^2-within	0.32	0.32	0.32	0.30
Observations	534	402	48	354
Hausman Test Prob-Chi^2	0.00	0.00	0.00	0.00

Notes: The numbers in parentheses are *t*-statistic values. [***], [**], and [*] indicate significance at 1%, 5% and 10% levels.

The signs of the coefficients on bank characteristics in table 5 and 6 are basically the same as those in tables 3 and 4, respectively.   It is worthwhile to note that the effects of policy lending rate and required reserve ratio on Chinese banks are different.   The effect of policy lending rate on Chinese banks' lending behavior is larger than those of required reserve ratio, as is reported in tables 3 and 5.   This finding is consistent with the previous study of He and Wang (2012) which suggests that markets care more about signals via policy lending rate than required reserve ratio in China's monetary policy transmission.

**Table 7   Foreign Banks' Loan Growth Response
to Real Interest Rate of U.S.**

	Model 1	Model 2	Model 3	Model 4	Model 5
C	581.69[***] (4.60)	539.69[***] (4.33)	522.43[***] (5.03)	547.70[***] (5.45)	523.36[***] (5.24)
Real Interest Rate of U.S.	−11.608[**] (−2.07)	−8.18 (−1.57)	−7.26[*] (1.95)	−11.08[***] (−2.83)	−8.57[**] (−2.39)
Liquidity (t–1)	1.06[***] (4.97)	1.06[***] (4.93)	1.05[***] (5.00)	0.86[***] (4.41)	0.86[***] (4.38)
Capitalization (t–1)	0.32 (0.71)	0.31 (0.67)	0.30 (0.66)	0.07 (0.16)	0.07 (0.15)
Size (t–1)	−57.49[***] (−5.20)	−54.61[***] (−4.96)	−53.25[***] (−5.57)	−53.82[***] (−5.80)	−52.31[***] (−5.63)
Efficiency (t–1)	−3.37 (−0.48)	−1.79 (−0.25)	–	–	–
Riskiness (t–1)	4.52 (1.14)	4.07 (1.02)	4.00 (1.01)	–	–
Real GDP of Foreign Countries	−1.78 (−1.60)	–	–	−1.70 (−1.53)	–
R^2-within	0.53	0.53	0.52	0.48	0.47
Observations	534	534	534	534	534
Hausman Test Prob-Chi^2	0.00	0.00	0.00	0.00	0.00

Notes: The numbers in parentheses are t-statistic values.   [***], [**], and [*] indicate significance at
           1%, 5% and 10% levels.

In sum, our findings imply that foreign banks decrease their loan growth
rates less than Chinese banks, when a tightening monetary policy takes place.
The foreign banks' lending behavior may be affected by other reasons than
bank characteristics or China's monetary policy.   To address this issue, we
examine the foreign banks' lending behavior separately by equation 3.
Table 7 reports the estimation result.   We find that the coefficient on the
U.S. real interest rate is negative and significant.   This result suggests that

foreign banks' lending is sensitive to the real interest rate of U.S., implying that foreign banks increase lending in host countries when the real interest rate of U.S. decreases.

The findings suggest that bank ownership plays a critical role in determining bank's response to monetary policy.   In specific, foreign banks are found to be less sensitive to China's monetary policy than Chinese banks, but they are sensitive to the real interest rate of U.S.   This finding points to the existence of internal capital markets in case of foreign banks.   Foreign banks can use the internal capital market to buffer the impact of monetary policy on loans.   As a result, they could reduce their loans by less than Chinese banks in response to contractionary monetary policy shocks.   There may be some other reasons for the insensitivity of foreign banks to Chinese monetary policy.   The target borrowers of foreign banks are almost foreign firms, large Chinese firms, and high-income earners with solid credit records, being different from those of Chinese banks.   So foreign banks can control risks better and will have a more stable supply of loans than Chinese banks. Besides, the proportion of loans in the assets of foreign banks is lower than that of Chinese banks, and the businesses of foreign banks are very diverse, so that they do not have to reduce many loans in response to contractionary monetary policy in China.

5. CONCLUSION

This paper uses bank-level data in China from 2007 to 2013 to examine whether there are differences in response to monetary policy across bank's ownership structures, in particular, between Chinese banks and foreign banks.   Although foreign banks entry in China has increased drastically from 2007, there have been few researches that examine the role of foreign banks in the bank lending channel of monetary policy transmission in China.

Foreign banks are found to be less sensitive to China's monetary policy than Chinese banks, but they are sensitive to the real interest rate of U.S.

We think this is the evidence for the internal capital markets hypothesis. Foreign banks' parent bank in home country decreases lending when there is an increase in the U.S. real interest rate, so that foreign banks in China are affected by the increase in the U.S. real interest rate and decrease their lending as well.

We also find that the effects of policy lending rate (price instruments) and required reserve ratio (quantitative instruments) on Chinese banks' lending behavior are different.   The effect of policy lending rate on Chinese banks' lending is larger than that of required reserve ratio.   And required reserve ratio does not have a significant effect on the state-owned banks' lending behavior, because the state-owned banks could have higher excess reserve rates than other banks.

We also find that bank characteristics such as liquidity, capitalization, efficiency and size, affect the other commercial banks' lending behavior and liquidity and size affect the foreign banks' loan supply.   In contrast, there are no significant effects of bank characteristics on state-owned banks' loans. State-owned banks are controlled by government, so their lending behavior may be more affected by government's influences rather than bank characteristics.

With the rapidly increasing entry of foreign banks in China since 2007, keeping the effectiveness of monetary policy will become an important issue for Chinese monetary policy makers in the future.   When Chinese monetary authority conducts monetary policies, it should take into consideration the buffering effects of foreign banks on the effectiveness of the monetary policy transmission mechanism.   In particular, the buffering effects of foreign banks imply that larger changes in monetary policy instruments are required to obtain the same desired change in aggregate demand.

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