Bank Profitability and the Bank Lending Channel : Evidence from China

GUNJI, Hiroshi / 袁, 媛 / 郡司, 大志 / YUAN, Yuan

(出版者 / Publisher)
Institute of Comparative Economic Studies, Hosei University / 法政大学比較経済研究所

(雑誌名 / Journal or Publication Title)
比較経済研究所ワーキングペーパー

(巻 / Volume)
134

(開始ページ / Start Page)
1

(終了ページ / End Page)
26

(発行年 / Year)
2007-11-13

Bank Profitability and the Bank Lending Channel: Evidence from China*

Hiroshi Gunji† and Yuan Yuan‡

September 20, 2007

Abstract

This paper uses bank-level data to investigate whether the impact of monetary policy on bank lending depends on the characteristics of Chinese banks during the period 1985–2004. We find that the impact of monetary policy on lending is weaker for large or capital-scarce banks, and that banks' responses to monetary policy do not necessarily vary according to their liquidity. Furthermore, to identify the bank lending channel more clearly, we test whether the impact of monetary policy varies according to banks' profitability. The results show that profitable banks tend to be less sensitive to monetary policy. The reason is that when tight monetary policy leads to the reduction of deposits, less profitable banks face a higher cost of capital.

Keywords: Monetary policy, bank lending channel, China, panel data.
JEL classification: E52, G21.

*An earlier version of this paper was presented at the Ninth International Convention of the East Asian Economic Association and the 2006 Conference of the Japanese Society of Monetary Economics. The authors would like to acknowledge Woon Yee Ho, Yuzo Honda, Akira Kohsaka, Jong-Wha Lee, Colin McKenzie and seminar participants at Tokyo International University for their helpful comments.
† School of Economics, Tokyo International University, Saitama, Japan.
‡ Graduate School of Economics, Hosei University, Tokyo, Japan.

1. Introduction

In the last two decades, the Chinese economy has rapidly developed, while the People's Bank of China (hereafter PBC), as the central bank, began to conduct monetary policy in order to cool off the recent investment boom. The PBC raised interest rates gradually from November 2005. A continuation in the conduct of tight monetary policy during the short term is unusual in China. One belief is that, despite the tight monetary policy, the economy is still overheating and investment is booming because bank lending continues to increase. Of course, the recent lending boom is partly the result of a rapid increase in the demand for loans. On the other hand, these facts also give rise to doubts concerning the effectiveness of monetary policy in China.

It would appear that the aim of the PBC's tight monetary policy is to curb bank lending (the bank lending channel) rather than depress investment with high interest rates (the interest rate channel). If borrowers could access substitutes for bank loans, the bank lending channel may be trivial. However, since the stock and bond markets in China are not sufficiently developed, the most important financing sources for firms are retained earnings and bank loans. In 2002, bank loans accounted for 61 percent of fund raising, whereas the share of stocks and bonds was only 22 percent and 17 percent, respectively. Allen et al. (2005) suggests that during the earliest stages of a firm's life cycle, financing strongly depends on bank loans. This is one of several reasons the PBC regards the bank lending channel as important.

In this paper, we analyze the different responses of bank lending to monetary policy in China using balance sheet data. There are some earlier studies concerning monetary policy in China. Xie (2004) uses aggregate data from 1998 to 2002 to test whether money supply Granger-causes macroeconomic variables. The result is that money is neutral with regard to economic growth in the long run, but is related to inflation. In addition, Zhang (2004) uses a vector autoregressive (VAR) model with six variables to test Granger causality and estimate the impulse response

functions during the period 1990–2003. She shows that both money supply and interest rates have only a limited effect on price. Meanwhile, Hsing and Hsieh (2005) use five variables to estimate impulse response functions from 1980 to 2000. They suggest that fiscal policy has a strong effect on output in the short term, while monetary policy has a strong effect in the long term. Several other studies also consider the impact of monetary policy in China. For example, Qin et al. (2005) analyzes the impact of various monetary policy instruments on monetary aggregates and the price level, while Liu et al. (2006) examines the long-term relationship between deposit rates and inflation. However, both of these studies employ aggregate data. To the authors' best knowledge, there is no extant work that uses bank level data to analyze the bank lending channel in China.

Earlier studies of the bank lending channel often utilize aggregate data and estimate VAR models. Unfortunately, this method cannot identify the demand and supply of bank loans. Therefore, bank level data are used to analyze the monetary transmission mechanism in more recent work. In their pioneering study, 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 tend to reduce loans relatively more with a tight monetary policy. This phenomenon arises from the following mechanism. If deposits fall through tight monetary policy (such as increasing the required reserve ratio), banks have to reduce their loans unless they turn to other methods of financing. It is then comparatively easier for large-scale banks to borrow in interbank markets or issue certificates of deposit. For this reason, even if a tight monetary policy is implemented, large-scale banks do not have to reduce loans.

Moreover, Kashyap and Stein (2000) find that the effect of monetary policy is stronger for U.S. banks with less liquid assets during the period 1976–1993. In other words, monetary policy has limited effect on banks that can turn to liquid assets to cover the reduction of deposits. As an

alternative, Kishan and Opiela (2000) emphasize the role of bank capital in the bank lending channel. From a theoretical viewpoint, banks with fewer liabilities, which are more or less risky, have much more capital and can cover the reduction in deposits. Kishan and Opiela (2000) use U.S. bank data from 1980 to 1995 to conclude that banks with less capital tend to reduce loans following tight monetary policy. This empirical result is consistent with their theoretical model.

Together, these studies have stimulated much research on the bank lending channel in other economies. Altunbaş et al. (2002) use banks' balance sheets in European countries from 1991 to 1999 to analyze the effect of monetary policy on bank lending. They divide banks by assets and capital, and find that the effect of monetary policy is stronger for banks with less capital, notwithstanding scale. Gambacorta (2005) employs Italian bank level data from 1986 to 2001 and shows that bank scale is unrelated to the impact of monetary policy, and that the impact of monetary policy on banks with more liquid assets is weaker. This result is consistent with Kashyap and Stein (2000).

Hosono (2006) makes use of bank level data from 1975 to 1999 in Japan to estimate bank response to monetary policy. He finds that monetary policy has a weaker effect on the lending of banks with less capital. This finding is different from Kishan and Opiela (2000) and Altunbaş et al. (2002). Importantly, while these studies investigate the bank lending channel in industrial countries, no studies refer to developing countries where information asymmetry is a serious problem and there are few alternative financing resources for deposits. Accordingly, the bank lending channel of monetary policy should be more important for developing countries. Using bank-level data of a developing country permits us to analyze the bank lending channel more definitely. At present, there are no studies on monetary policy in China using bank level data, so our analysis has an important role in developing new findings concerning the lending channel as well as having an important regional dimension.

In addition, we provide estimates for two different banking groups in China. The first group comprises state-owned commercial banks (SOCBs): these remain under strong government control. The second group includes joint-stock commercial banks (JSCBs): these are managed relatively freely. Indeed, Yuan (2006) argues that competition between the JSCBs is greater than that found in the banking industry in many other countries. Since there are two different groups in the same market, we can consider their differing responses to monetary policy.

Moreover, we develop the method used in Hosono (2006) to show the nature of banking more clearly. Previous studies have shown that the effect of monetary policy on bank lending depends on each bank's total assets. The mechanism of this path is that a contractionary monetary policy reduces deposits. These are used ostensibly for lending financing, though banks with more assets can easily obtain financing in order to cover the reduction in deposits. However, an important factor for financing is not only bank size, but also profitability. Consequently, we use total asset turnover ratio and the ratio of total revenue to total assets as indexes of profitability, and investigate whether differences in the index lead to differences in the effect of monetary policy.

The main results of this study are as follows. First, we find that banks with more total assets tend not to reduce loans with monetary policy shocks. This result is consistent with previous theoretical and empirical work. Second, banks with more liquid assets are not necessarily sensitive to monetary policy. This finding differs from some previous studies. Third, the impact of monetary policy is greater for banks with more equity. The result is inconsistent with many previous analyses, with the exception of Hosono (2006) who shows that banks with abundant capital are more sensitive to monetary policy. Fourth, less profitable banks tend to reduce loans under a contractionary monetary policy. This is because profitable banks can obtain financing outside deposits more easily, so the impact of monetary policy is weaker.

The remainder of the paper is organized as follows. Section 2 reviews the banking system and monetary policy in China. Sections 3 and Section 4 respectively present the model and the characteristics of the data. Section 5 demonstrates the estimated results. Finally, we conclude in Section 6.

2. The Banking System and Monetary Policy in China

Because China was a central planned economy until 1979, the banking system in the country was very simple. The PBC was the only bank allowed in China. It conducted monetary and foreign exchange policy, and was responsible for the management of foreign reserves, deposits, loans, and so on. However, from 1984 onwards the PBC began to change its role as a central bank. Following financial reforms in 1994, SOCBs were encouraged to operate independently from the government, and three policy banks were established for the purpose of policy-based financing.[1]

The banking system in China includes SOCBs, other commercial banks (JSCBs and city commercial banks), policy lending banks, credit cooperatives, and foreign banks. The four SOCBs—the Industrial and Commercial Bank of China, the Agricultural Bank of China, the China Construction Bank, and the Bank of China—have a longer history than the JSCBs, though they are still to some extent under government control. SOCBs are excluded from the securities business, the management of investment trusts, and investment in nonbank institutions and real estate. However, the government's influence on the banking industry has gradually fallen. The China Construction Bank and the Bank of China publicly listed in Hong Kong in October 2005 and June 2006, respectively. Moreover, the Industrial and Commercial Bank of China won approval for an initial public offering (IPO) in July 2006, and the Agricultural Bank

[1] See García-Herrero and Santabárbara (2004) and García-Herreo et al. (2005) for a review of the banking market and recent financial reform in China.

of China has plans to go public. Nonetheless, because the government still owns a large part of their shares, the SOCBs are not yet fully free of government control.

The other commercial banks consist of the JSCBs and city commercial banks (CCBs). Most of the JSCBs are partially owned by the government, and comparatively younger than the SOCBs. They have absorbed management experiences from foreign banks. In fact, the market among the JSCBs is quite competitive (Yuan, 2006). Although there were 112 CCBs in 2004, their size is quite small because of management regulation.

Policy lending banks were established in 1994 to accomplish the state's policy for industrial or regional development, and not principally for posting large profits. Credit cooperatives play a role in complementing the other banking institutions, and mainly lend to small and medium-sized enterprises in rural and urban areas. Table 1 provides a classification of banks in China.

As described earlier, the PBC was the only bank in China in the past, and has specialized in its activities as a central bank since 1984. Officially, the PBC was authorized as a central bank by the law of the People's Bank of China in 1995. Although the government had decided monetary policy, in 1997 the Monetary Policy Committee (MPC) of the PBC was established. However, most members of MPC are administration officials, so the PBC is still not independent. Interest rates are not liberalized. To implement monetary policy, the PBC uses deposit and lending rates and the official discount rate (bank rate), and the required reserve ratio. Rediscount lending and open market operations commenced in 1994 and 1998, respectively. Since the trading size of bond markets in China is still small, however, these operations have a limited effect on the economy.[2] Although the PBC implements 'window guidance' to SOCBs and some of the JSCBs, the mandatory power of the PBC has become weaker because of the

[2] For further discussion, see Green (2005).

enforcement of the Law of Commercial Bank and the IPOs of some commercial banks.

3. Model

We estimate the following equation for bank i and time t ($i = 1,\ldots,N$ and $t = 1,\ldots,T$):

$$\ln(loan_{it}) = \alpha_i + \beta_1 size_{i,t-1} + \beta_2 liquidity_{i,t-1} + \beta_3 equity_{i,t-1} + \beta_4 profitability_{i,t-1}$$
$$+ \beta_5 r_{t-1}*size_{i,t-1} + \beta_6 r_{t-1}*liquidity_{i,t-1} + \beta_7 r_{t-1}*equity_{i,t-1} + \beta_8 r_{t-1}*profitability_{i,t-1}$$
$$+ \beta_9 Year_t + \varepsilon_{it},$$

where

$\ln(loan_{it})$: natural logarithm of total loans

$size_{i,t-1}$: natural logarithm of lagged total assets

$liquidity_{i,t-1}$: lagged liquid assets to total assets ratio

$equity_{i,t-1}$: lagged equity to total assets ratio

$profitability_{i,t-1}$: lagged total revenue to total assets ratio

r_{t-1}: lagged monetary policy variable

$Year_t$: a set of year dummies

α_i: individual effect

ε_{it}: disturbance with mean zero.

The second row on the right-hand side of the equation represents the effect of monetary policy. The sixth term is the interaction of interest rates and the log of total assets. Large banks can easily diversify risks. Additionally, when a monetary contraction leads to the reduction of deposits, large banks can obtain financing from instruments other than deposits at a lower cost. In other words, it is suggested that banks with larger assets respond less to monetary policy (Kashyap and Stein, 1995). Many previous studies have shown results consistent with this prediction. Therefore, we also expect that the sign of this interaction is positive.

The seventh term is the interaction of interest rates and the liquid assets to total assets ratio (liquidity ratio).[3] In a monetary contraction, banks with a high liquidity ratio can compensate for the reduction in deposits with liquid assets (Kashyap and Stein, 2000, and Gambacorta, 2005). Therefore, it is hypothesized that the sign of the interaction is positive. The eighth term is the interaction of interest rates and equity to total assets ratio (capital ratio). Banks with sufficient capital tend to have good management discipline, so the problem of asymmetric information is not serious. Therefore, monetary policy shocks should have less effect on the loans of well-capitalized banks (Kishan and Opiela, 2000, and Altunbaş et al., 2002). On the other hand, if capital adequacy requirements are imposed, or if bank managers are risk averse, then banks may be less sensitive to monetary policy (Hosono, 2006). In China, capital adequacy requirements were introduced for all commercial banks in 1995.[4] As a result, the sign of the interaction can be either positive or negative.

Although the sixth to eighth terms are the same as the equation used by Hosono (2006), we introduce a ninth term, the interaction of interest rates and bank profitability, which is the ratio of total revenue to total assets (i.e., the total asset turnover ratio). For example, when tight monetary policy causes a reduction in banks' reservable instruments, profitable banks could easily finance from other sources. This path is similar to that for bank size, but we believe that bank profitability is a better measure than bank size. If this path exists, the sign of the coefficient should be positive.

The right-hand side variables of the first row in the equation are control variables. The tenth term is a vector of year dummies. It controls idiosyncratic shocks to all banks, e.g., the effect of macroeconomic variables and structural breaks on banking system. The year dummies allow us

[3] We define liquid assets as the sum of cash, reserves with the PBC, and call loans.
[4] For bank regulations including capital adequacy requirements, see García-Herrero and Santabárbara (2004) and García-Herrero et al. (2005).

to eliminate the effect of loan demand, so we can focus only on the supply of loans. However, if the dummies are introduced, the interest rate cannot be introduced simultaneously; that is, the effect of monetary policy shock itself cannot be identified.

We use policy interest rates (the bank rate, the lending rate and the deposit rate), which are directly controlled by the PBC, as monetary policy variables. These particular variables have been specified in previous studies to study monetary policy in China using the VAR approach. However, the types of interest rates used in these studies differ. For instance, Hsing and Hsieh (2004) specify bank rates (official discount rates), Zhang (2004) uses lending rates, and Liu and Xie (2006) employ deposit rates. Therefore, in this paper we use three policy interest rates. There is also an interbank market in China, but many firms and nonbank institutions had access to this market during the 1980s. As a result, until the late 1990s it was not considered a well-functioning market.[5] Since the time horizon of our sample is about two decades, we consider that policy interest rates are better for monetary policy variables than interbank rates. In addition, the required reserve ratio may also be an alternative measure for monetary policy. Since the PBC remunerates excess reserves along with required reserves, however, banks tend to have no small excess reserves.[6] Therefore, the required reserve ratio would not be an appropriate index. It is important to note that these rates are not specified as *interest rates*, rather as *monetary policy variables*, thereby revealing the policy stance of the PBC. Figure 1 presents the policy interest rates over the period 1985–2004. Each interest rate has changed similarly over the sample period. Although the PBC repeatedly eased monetary policy in the latter half of our sample period, our hypotheses still hold. In the case of easing monetary policy, banks are freed from their constraints and can lend easier.

[5] For details of China's interbank market, see Imam (2004).
[6] For the argument concerning excess reserves, see Green (2005) and Goodfriend and Prasad (2006).

4. Data

We use data from the balance sheets and income statements reported in the China Financial Yearbooks from 1986 to 2005, edited by the PBC and published each November. In the yearbooks, some of the balance sheet and income statement contents differ across banks, so we eliminate those cross-sectional observations (i.e., banks) that do not have all variables: that is, we employ unbalanced panel data. Due to data availability, we only include the SOCBs and JSCBs. Table 2 presents the summary statistics from 1985 to 2004. We obtain interest rates from the International Monetary Fund's International Financial Statistics (IFS) and the People's Bank of China Quarterly Statistical Bulletin.

5. Results

5.1 Fixed-Effects Estimation

Table 3 shows the estimated results. In columns (1)–(3), we use the bank rate as a monetary policy variable. Column (1) is the result of the entire sample. The interactions are not statistically significant, but the coefficient of the interaction of the bank rate and total assets is positive. This is consistent with previous work. However, since the coefficients of the interactions of interest rates and liquidity and the capital ratio are negative, these are not consistent with previous findings. Column (2) is the estimated result for the SOCBs. Once again, the interaction coefficients are not statistically significant. In column (3), where we estimate the subsample of JSCBs, the coefficient of the interaction of bank rates and total assets is significantly positive. Furthermore, since the interaction of bank rates and profitability is significantly positive, less profitable banks tend to reduce loans with a contractionary monetary policy.

Columns (4)–(6) in Table 3 are the results obtained using the lending rate. The estimated

result of the whole sample, column (4), is similar to column (1), but the interaction of the lending rate and the liquidity ratio is significantly negative. This implies that banks with enough liquid assets tend to reduce loans following a monetary contraction. This finding is different from that of Kashyap and Stein (2000) and Gambacorta (2005). The result for the SOCBs is shown in column (5). Along with column (2), none of the interactions is significant. The result for JSCBs in column (6) is similar to column (3).

The estimated results using the deposit rate as a monetary policy variable are shown in columns (7)–(9) in Table 3. The estimation for all banks, column (7), demonstrates that the interaction of the deposit rate and the liquidity ratio is significantly negative. In column (8), which is the result for SOCBs, all of the interactions are not statistically significant, similarly to columns (2) and (5). However, the signs of the interactions in columns (2), (5) and (8) are the same, so the results for the SOCBs may be reliable to some extent. The results for the JSCBs using the deposit rate are shown in column (9). It is also the same as columns (3) and (6).

The summary of the estimations is as follows. First, the coefficient for the interaction of the monetary policy variable and total assets tends to be negative for SOCBs and positive for JSCBs. However, the coefficient is statistically significant only for JSCBs, so large banks generally tend not to reduce loans with a monetary contraction. This result does not conflict with previous findings in the literature. Second, the interaction of the monetary policy variable and the liquidity ratio has a negative coefficient: this is statistically significant in some cases. Even if we use the subsamples or any of the interest rates, we obtain the same results. This contrasts with the results of previous studies, including Kashyap and Stein (2000). This suggests that monetary policy does not necessarily have fewer effects on banks with sufficient liquidity. Third, the coefficient of the interaction of the monetary policy variable and the capital ratio tends to be negative. Following the hypothesis of Hosono (2006), the sign of this interaction can be either

positive or negative. Hosono (2006) uses Japanese bank data to obtain a statistically negative coefficient, while our data shows that while the coefficient is not significant, it is negative. Fourth, we find that the interaction of the monetary policy variable and bank profitability, which is one of our new contributions, has a positive coefficient. Even if tight monetary policy leads to a reduction in deposits, banks with higher profitability can easily obtain financing from the interbank market, so these banks do not reduce their loans. As a result, the interaction coefficient for JSCBs tends to be positive.

5.2 Using Other Monetary Policy Variables

In recent years, the PBC has employed open market operations, required reserves and window guidance. Accordingly, these instruments may be more appropriate for monetary policy variables rather than the three variables specified above. However, Green (2005) and Liu et al. (2006) suggest that open market operations and the reserve requirement system are not effective because most banks have ample excess reserves in their accounts with the PBC. Further, the window guidance instrument has no legal force. Given these facts, we specify interbank market interest rates (30 days), interest rates paid on required reserves and the reserve requirement ratio as alternative monetary policy variables to confirm the robustness of the results in Table 3. These rates are expressed in annual averages.

The results are shown in Table 4. In column (15), the sign of the interaction of interest rates and total assets is significantly positive; this is the same as Table 3. Moreover, the interaction of interest rates and profitability are significantly positive in columns (11), (12), (15) and (18). While the other interactions are insignificant, the interaction of interest rates and liquidity ratio has a negative coefficient. These results bear out those in Table 3. On the other hand, the sign of the interaction of interest rates and capital ratio is ambiguous.

5.3 Subsample Estimation

The time horizon of our sample is about two decades. This relatively long sample period may be associated with structural breaks in at least some of the variables specified. For instance, a nationwide interbank market commenced in 1996. In 1997, the Monetary Policy Committee was created in the PBC, and the PBC began to independently implement monetary policy. In 1998, open market operations begun and directed lending was reduced (Goodfriend and Prasad, 2006). Therefore, we use a subsample of 1998–2004.

The estimated results are shown in Table 5. Unlike Tables 3 and 4, many of the interactions are significant. In particular, in all of the cases, the coefficient of the interaction of interest rates and total assets is significantly positive. This is consistent with previous work where tight monetary policy has little effect on the reduction in large banks' loans. Moreover, the interaction of interest rates and profitability is positive in all cases. Most importantly, the sign for JSCBs is statistically significant. Put differently, profitable banks tend to be less sensitive to monetary policy.

On the other hand, the interaction of interest rates and the liquidity ratio is significantly positive for SOCBs. This means that monetary policy has less effect on banks with more liquid assets. While consistent with previous findings in the literature, as this is different from the results detailed in Tables 3 and 4, it is necessary to confirm its robustness.

5.4 Model with Lagged Dependent Variables

To check the robustness in the last subsection, we estimate the model with a lagged dependent variable. Following Hosono (2006), we extend the model as follows.

$$\ln(loan_{it}) = \alpha_i + \beta_1 size_{i,t-1} + \beta_2 liquidity_{i,t-1} + \beta_3 equity_{i,t-1} + \beta_4 profitability_{i,t-1}$$

$$+ \beta_5 r_{t-1} * size_{i,t-1} + \beta_6 r_{t-1} * liquidity_{i,t-1} + \beta_7 r_{t-1} * equity_{i,t-1} + \beta_8 r_{t-1} * profitability_{i,t-1}$$

$$+ \beta_9 Year_t + \beta_{10} \ln(loan_{i,t-1}) + \varepsilon_{it}.$$

Since the least squares estimation of panel data models with lagged dependent variables is biased, we estimate this equation in two ways. The first approach is fixed-effects instrumental variable (IV) estimation. We assume that the lagged dependent variable, $\ln(loan_{i,t-1})$, is endogenous, and that the other explanatory variables and the log of loans at t–2, $\ln(loan_{i,t-2})$, are predetermined. The second approach is Arellano–Bond GMM estimation (Arellano and Bond, 1991). In this case, we assume that the year dummies are strictly exogenous, and that the other variables are predetermined. Since our sample size is moderate, we perform one-step generalized method of moments (GMM) estimation.

The results of the IV estimation are shown in Table 6. The coefficient of the interaction of interest rates and total assets is positive in all the cases, and the coefficient for SOCBs is significant. This is consistent with previous studies. The interaction of interest rates and the liquidity ratio for the SOCBs is significantly positive. This is the same as that in Table 5 and suggests that the impact of monetary policy is weaker for banks with more liquid assets. However, since the coefficient for JSCBs is not significant, the result is ambiguous. The interaction of interest rates and the capital ratio is significantly negative for SOCBs. Consequently, well-capitalized SOCBs tend to be sensitive to monetary policy.

The results of the Arellano–Bond estimation are shown in Table 7. The sign of the interaction of interest rates and total assets is ambiguous, but that for JSCBs is significantly positive. The interaction of interest rates and the liquidity ratio tends to be negative, though some are insignificant. The interaction of interest rates and the capital ratio is significantly negative for the whole sample. This is consistent with Hosono's (2006) analysis of Japanese banks. However, the sign is not definitive for the subsamples of SOCBs and JSCBs. Furthermore, the interaction

of interest rates and profitability tends to be significantly positive.

The results of this subsection present the following facts. First, large or less capitalized banks respond less to monetary contractions. This particular finding is shown in all of the equations and is quite robust. Second, the effect of monetary policy on bank lending does not necessarily depend on liquid assets. In some cases, the interaction of the monetary policy variable and the liquidity ratio is significant, but the sign is not stable. Third, the effect of monetary policy is weaker for banks that are more profitable. This is confirmed with all of monetary policy variables and for the subsamples of SOCBs and JSCBs.

6. Conclusions

This paper uses bank-level data in China from 1985 to 2004 to discover whether there are cross-sectional differences in the response to monetary policy among banks. The main results of the analysis are as follows. First, the impact of monetary policy is greater for small banks. This is consistent with earlier theoretical models and identical to previous empirical work in this area. Second, the effect of monetary policy does not necessarily depend on bank liquidity. Earlier studies are split over the issue of the effect of monetary policy on banks with more liquidity. Our result is statistically significant in a few cases, but the sign is not stable. The reason for this trend could be that banks in China have different incentives than banks in other countries since the PBC pays a higher interest rate on reserves. Many researchers suggest that the high interest rates for reserves are one of the more serious problems in China's banking system. Our result indicates that it is necessary to lower the interest rate paid on reserves in order to make monetary policy more effective. Third, well-capitalized banks tend to be sensitive to monetary policy. However, this result is not statistically significant in some estimation so this trend may be weak.

Finally, we use the interaction of monetary policy variables and profitability to investigate whether the effect of monetary policy depends on profitability. In almost all cases, we find that the impact of monetary policy is smaller for banks with higher profitability. The reasoning is that while tight monetary policy leads to a fall in deposits, profitable banks should be able to finance this shortfall relatively easily.

References

Allen F., Qian J., Qian M., 2005. Law, finance, and economic growth in China. Journal of Financial Economics 77, 57–116.

Altunbaş, Y., Fazylov, O., Molyneux, P., 2002. Evidence on the bank lending channel in Europe. Journal of Banking & Finance 26, 2093–2110.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies 58, 277–297.

Gambacorta, L., 2005. Inside the bank lending channel. European Economic Review 49, 1737–1759.

García-Herrero, A., Gavíla, S., Santabárbara, D., 2005. China's banking reform: An assessment of its evolution and possible impact. Banco de España Occasional Paper No. 0502.

García-Herrero, A., Santabárbara, D., 2004. Where is the Chinese banking system going with the ongoing reform? Banco de España Occasional Paper No. 0406.

Goodfriend, M., Prasad, E., 2006. A framework for independent monetary policy in China. IMF Working Paper WP/06/111.

Green, S., 2005. Making monetary policy work in China: A report from the money market front line. Stanford Center for International Development Working Paper No. 245.

Hosono, K., 2006. The transmission mechanism of monetary policy in Japan: Evidence from banks' balance sheets. Journal of the Japanese and International Economics 20, 380–405.

Hsing, Y., Hsieh, H.J., 2004. Impacts of monetary, fiscal, exchange rate policies on output in China: A VAR approach. Economics of Planning 37, 125–139.

Imam, M., 2004. The Chinese interbank markets: Cornerstone of financial liberalization. China and World Economy 12, 17–33.

Kashyap, A., Stein, J., 1995. The impact of monetary policy on bank balance sheets.

Carnegie-Rochester Conference Series on Public Policy 42, 151–195.

Kashyap, A., Stein, J., 2000. What do a million observations on banks say about the transmission of monetary policy? American Economic Review 90, 407–428.

Kishan, R., Opiela, T., 2000. Bank size, bank capital, and the bank lending channel. Journal of Money, Credit, and Banking 32, 121–141.

Liu, M.H., Margaritis, D., Tourani-Rad, A., 2006. Monetary policy and deposit rates rigidity in a transitional economy: the case of China. Prepared for the 30th Anniversary Conference of the Journal of Banking & Finance.

Liu, P., Xie, T., 2006. The monetary policy transmission in China: "Credit channel" and its limitations. Business Institute of Berlin at the FHW Berlin (Berlin School of Economics) Working Paper No. 22.

Qin, D., Quising, P., He, X., Liu, S., 2005. Modeling monetary transmission and policy in China. Journal of Policy Modeling 27, 157–75.

Xie, P., 2004. China's Monetary Policy: 1998–2002. Stanford Center for International Development Working Paper No. 217.

Yuan, Y., 2006. The state of competition of the Chinese banking industry. Journal of Asian Economics 17, 519–534.

Zhang, Y. 2004. Chugoku no bukka teimei ni taisuru kinyu seisaku jitsubutsu keizai no kouka (The effects of monetary policy and real economy on prices in China). Waseda Commercial Review 401, 549–248 (in Japanese).

Figure 1: Policy Interest Rates

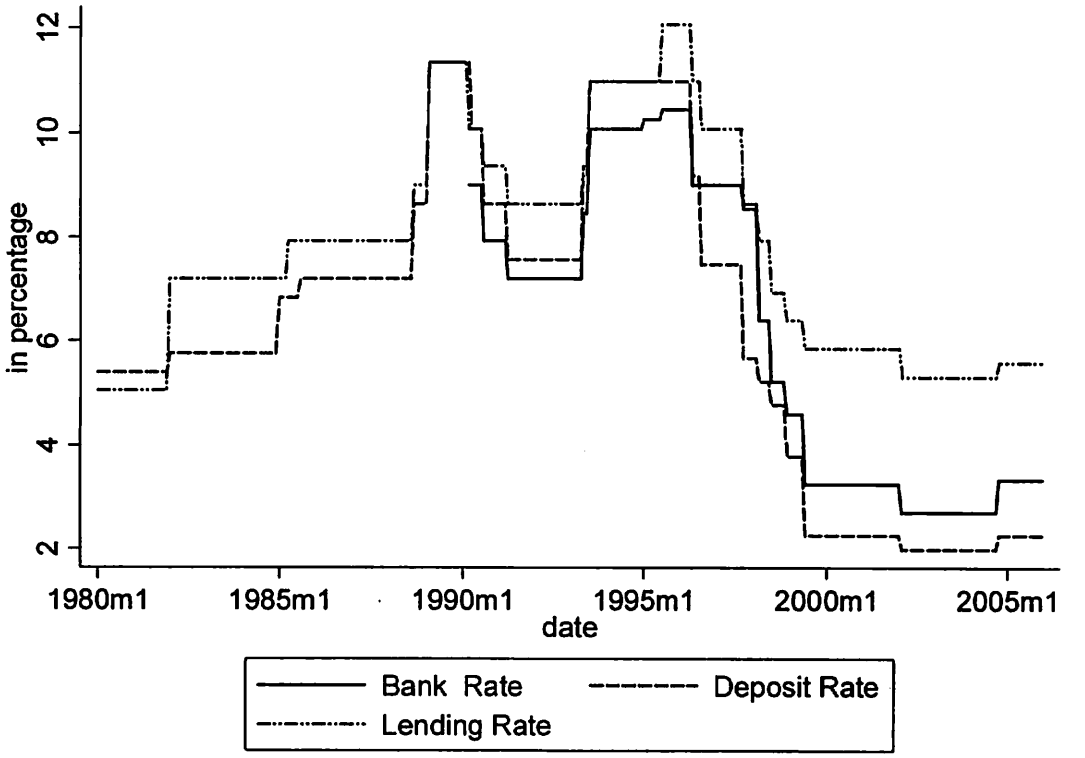

Table 1: Classification of banks in China

Type	Name	Share of loans (%)	Total loans (millions of yuan)
Central bank	The People's Bank of China	---	---
Policy lending banks	China Development Bank	9.52	1389000
	Agricultural Development Bank of China	4.93	718920
	The Export–Import Bank of China	0.86	125286
State-owned commercial banks (SOCBs)	Industrial and Commercial Bank of China	25.39	3705000
	Agricultural Bank of China	17.75	2590000
	China Construction Bank	13.67	1994530
	Bank of China	12.32	1797000
Joint-stock commercial banks (JSCBs)	Bank of Communications	3.90	568526
	China Merchants Bank	2.03	295587
	Shanghai Pudong Development Bank	1.90	277549
	CITIC Industrial Bank	1.83	267564
	China Minsheng Banking Corp., Ltd.	1.74	253506
	Industrial Bank Co., Ltd.	1.27	185225
	Guangdong Development Bank	1.11	161605
	Huaxia Bank	1.07	155662
	Shenzhen Development Bank Co., Ltd.	0.66	95642
	Evergrowing Bank Co., Ltd.	0.05	7198
	China Zheshang Bank	0.03	4623
City commercial banks (CCBs)	112 banks	---	---
Credit cooperatives	Rural and urban credit cooperatives	---	---
Foreign banks	Branches, subbranches, and subsidiaries	---	---

Sources: China Financial Yearbook, 2004.

Table 2: Descriptive statistics

Panel A: Full Sample

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Ln(loan)	194	16.2350	1.9697	10.3362	19.7304
ln(ast)	194	16.7453	1.9814	10.7235	20.0844
liquidity	194	0.2858	0.1578	0.0306	0.8270
equity	194	0.0592	0.0520	0.0009	0.3911
turnover	194	0.0589	0.0337	0.0006	0.2100

Panel B: State-Owned Commercial Banks

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ln(loan)	72	18.1206	0.9888	15.6113	19.7304
ln(ast)	72	18.6046	0.9370	16.6419	20.0844
liquidity	72	0.3132	0.2129	0.0753	0.8056
equity	72	0.0534	0.0244	0.0009	0.1558
turnover	72	0.0654	0.0454	0.0006	0.2100

Panel C: Joint-Stock Commercial Banks

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ln(loan)	122	15.1222	1.5001	10.3362	17.8560
ln(ast)	122	15.6480	1.5735	10.7235	18.3466
liquidity	122	0.2696	0.1115	0.0306	0.8270
equity	122	0.0626	0.0627	0.0019	0.3911
turnover	122	0.0550	0.0237	0.0080	0.1359

Table 3: Fixed-effects estimation

	Bank Rate			Lending Rate			Deposit Rate		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	All	SOCBs	JSCBs	All	SOCBs	JSCBs	All	SOCBs	JSCBs
size	0.572***	1.724	0.477***	0.592***	1.239*	0.403***	0.622***	0.892*	0.512***
	(0.179)	(1.100)	(0.117)	(0.199)	(0.727)	(0.146)	(0.163)	(0.464)	(0.117)
liquidity	0.770	2.530	1.021**	1.817***	3.965	1.651**	1.106***	1.646	1.465**
	(0.469)	(3.444)	(0.448)	(0.590)	(3.076)	(0.688)	(0.400)	(1.257)	(0.572)
equity	2.318	12.296	2.259	-0.318	3.174	1.634	0.858	5.665	1.103
	(3.203)	(10.976)	(2.656)	(3.180)	(11.028)	(2.734)	(1.990)	(8.617)	(2.015)
profitability	-1.068	-9.566	-6.366*	0.585	-14.235	-9.312*	5.162*	-2.810	-1.194
	(3.595)	(10.382)	(3.509)	(3.894)	(17.428)	(4.975)	(2.764)	(5.447)	(2.870)
rb * size	0.006	-0.105	0.022***						
	(0.008)	(0.101)	(0.007)						
rb * liquidity	-0.058	-0.297	-0.037						
	(0.069)	(0.503)	(0.064)						
rb * equity	-0.295	-1.489	-0.222						
	(0.382)	(1.386)	(0.359)						
rb * profitability	0.288	1.170	1.824***						
	(0.458)	(1.368)	(0.583)						
rl * size				0.003	-0.049	0.023***			
				(0.012)	(0.073)	(0.009)			
rl * liquidity				-0.151**	-0.382	-0.101			
				(0.069)	(0.383)	(0.073)			
rl * equity				-0.008	-0.521	-0.175			
				(0.352)	(1.326)	(0.318)			
rl * profitability				0.083	1.486	1.833***			
				(0.454)	(1.972)	(0.678)			
rd * size							0.001	-0.009	0.015***
							(0.006)	(0.043)	(0.005)
rd * liquidity							-0.084*	-0.137	-0.100
							(0.048)	(0.207)	(0.063)
rd * equity							-0.167	-1.013	-0.106
							(0.248)	(1.248)	(0.253)
rd * profitability							-0.449	0.268	1.231**
							(0.280)	(0.629)	(0.489)
Observations	165	52	113	194	72	122	194	72	122
Number of id	18	4	14	18	4	14	18	4	14
R-squared	0.87	0.75	0.96	0.92	0.90	0.97	0.92	0.90	0.97

Note: Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Fixed-effects estimation using other monetary policy variables

	Interbank Market Rate			Interest Rates on Reserves			Reserve Requirement Ratio		
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Variable	All	SOCBs	JSCBs	All	SOCBs	JSCBs	All	SOCBs	JSCBs
size	0.678***	0.676	0.617***	0.654***	1.700	0.566***	0.697***	0.638	0.579***
	(0.211)	(1.933)	(0.141)	(0.174)	(1.010)	(0.113)	(0.207)	(0.741)	(0.151)
liquidity	1.146	2.298	0.865*	0.969***	2.455	0.942**	1.439***	2.080	1.192**
	(0.774)	(3.624)	(0.466)	(0.330)	(1.669)	(0.363)	(0.510)	(2.002)	(0.588)
equity	-0.001	-1.426	0.463	0.140	9.148	-0.263	-2.010	0.635	-1.033
	(3.668)	(16.254)	(2.745)	(1.873)	(10.664)	(1.866)	(2.961)	(6.906)	(3.667)
profitability	2.108	-29.182	-3.851	-0.457	-3.093	-3.639	2.110	7.309	-5.476
	(4.033)	(19.910)	(3.616)	(2.526)	(7.092)	(2.624)	(3.452)	(6.941)	(4.081)
rc * size	-0.005	-0.293	0.008						
	(0.012)	(0.219)	(0.009)						
rc * liquidity	-0.060	-0.224	0.002						
	(0.084)	(0.977)	(0.063)						
rc * equity	-0.054	1.056	0.006						
	(0.421)	(3.371)	(0.401)						
rc * profitability	0.176	4.231*	1.274**						
	(0.434)	(2.384)	(0.567)						
ri * size				-0.001	-0.094	0.013*			
				(0.010)	(0.108)	(0.008)			
ri * liquidity				-0.084	-0.337	-0.028			
				(0.067)	(0.326)	(0.059)			
ri * equity				-0.019	-1.473	0.087			
				(0.302)	(1.750)	(0.352)			
ri * profitability				0.252	0.488	1.595***			
				(0.432)	(1.166)	(0.595)			
rs * size							-0.004	0.005	0.006
							(0.008)	(0.055)	(0.007)
rs * liquidity							-0.082	-0.138	-0.037
							(0.051)	(0.214)	(0.056)
rs * equity							0.153	-0.220	0.112
							(0.230)	(0.669)	(0.306)
rs * profitability							-0.046	-0.584	1.134**
							(0.314)	(0.623)	(0.502)
Observations	120	32	88	184	64	120	194	72	122
Number of id	18	4	14	18	4	14	18	4	14
R-squared	0.81	0.72	0.94	0.90	0.87	0.97	0.92	0.90	0.97

Note: Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Fixed-effects estimation: 1998-2004

	Bank Rate			Lending Rate			Deposit Rate		
	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Variable	All	SOCBs	JSCBs	All	SOCBs	JSCBs	All	SOCBs	JSCBs
size	0.520***	-0.403	0.630***	0.455**	-0.653*	0.500***	0.538***	-0.392	0.624***
	(0.178)	(0.326)	(0.137)	(0.203)	(0.350)	(0.160)	(0.178)	(0.322)	(0.129)
liquidity	0.555	-0.606	0.345	0.521	-1.602**	-0.228	0.473	-0.469	0.459
	(0.584)	(0.521)	(0.709)	(0.956)	(0.541)	(1.204)	(0.506)	(0.505)	(0.596)
equity	-1.544	0.883	2.980	-1.457	3.697	5.876	-0.737	0.583	3.228
	(3.527)	(2.998)	(3.628)	(5.083)	(4.248)	(5.148)	(3.145)	(2.713)	(3.058)
profitability	-3.043	-6.008**	-7.379*	-5.795	-7.540**	-13.216**	-2.182	-6.050**	-5.736
	(4.212)	(2.441)	(4.043)	(6.174)	(3.101)	(6.295)	(3.756)	(2.426)	(3.666)
rb * size	0.021***	0.047**	0.020*						
	(0.007)	(0.016)	(0.012)						
rb * liquidity	-0.035	0.235**	0.173						
	(0.126)	(0.088)	(0.152)						
rb * equity	0.438	-0.583	-0.353						
	(0.541)	(0.438)	(0.666)						
rb * profitability	0.886	0.148	2.096***						
	(0.665)	(0.213)	(0.677)						
rl * size				0.024***	0.066***	0.027**			
				(0.008)	(0.016)	(0.013)			
rl * liquidity				-0.018	0.311***	0.196			
				(0.150)	(0.093)	(0.181)			
rl * equity				0.285	-0.801	-0.629			
				(0.581)	(0.480)	(0.674)			
rl * profitability				1.088	0.315	2.437***			
				(0.811)	(0.249)	(0.835)			
rd * size							0.023***	0.056***	0.024*
							(0.008)	(0.017)	(0.013)
rd * liquidity							-0.026	0.277**	0.194
							(0.140)	(0.093)	(0.167)
rd * equity							0.357	-0.681	-0.503
							(0.572)	(0.474)	(0.682)
rd * profitability							1.002	0.205	2.386***
							(0.759)	(0.247)	(0.768)
Observations	104	28	76	104	28	76	104	28	76
Number of id	18	4	14	18	4	14	18	4	14
R-squared	0.89	0.98	0.94	0.89	0.98	0.93	0.89	0.98	0.94

Note: Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6: IV estimation with the lagged dependent variable: 1998-2004

	Bank Rate			Lending Rate			Deposit Rate		
	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)
Variable	All	SOCBs	JSCBs	All	SOCBs	JSCBs	All	SOCBs	JSCBs
size	0.549***	-0.464	0.647***	0.485***	-0.641	0.539***	0.560***	-0.401	0.642***
	(0.116)	(0.365)	(0.151)	(0.125)	(0.400)	(0.182)	(0.113)	(0.349)	(0.145)
liquidity	0.693	-0.717	0.237	0.863	-1.695***	-0.298	0.575	-0.512	0.358
	(0.739)	(0.498)	(0.761)	(1.158)	(0.633)	(1.284)	(0.675)	(0.488)	(0.689)
equity	-1.445	1.959	1.425	-1.341	4.356	3.389	-0.570	1.273	1.538
	(3.623)	(2.589)	(3.723)	(5.138)	(3.692)	(5.379)	(3.348)	(2.333)	(3.440)
profitability	-1.429	-6.011**	-5.590	-3.404	-7.337*	-11.211	-0.623	-6.120**	-4.077
	(4.837)	(2.863)	(5.076)	(6.926)	(4.110)	(7.486)	(4.534)	(2.780)	(4.735)
rb * size	0.017***	0.057***	0.017						
	(0.006)	(0.021)	(0.011)						
rb * liquidity	-0.084	0.304***	0.166						
	(0.110)	(0.107)	(0.126)						
rb * equity	0.470	-0.804*	-0.267						
	(0.469)	(0.417)	(0.503)						
rb * profitability	0.743	-0.034	1.978***						
	(0.563)	(0.349)	(0.643)						
rl * size				0.021***	0.069***	0.023			
				(0.007)	(0.023)	(0.014)			
rl * liquidity				-0.085	0.330***	0.187			
				(0.143)	(0.113)	(0.169)			
rl * equity				0.331	-0.881**	-0.452			
				(0.563)	(0.447)	(0.602)			
rl * profitability				0.875	0.248	2.307***			
				(0.727)	(0.433)	(0.838)			
rd * size							0.019***	0.063***	0.020
							(0.007)	(0.023)	(0.013)
rd * liquidity							-0.084	0.323***	0.185
							(0.126)	(0.115)	(0.145)
rd * equity							0.401	-0.845*	-0.368
							(0.528)	(0.453)	(0.561)
rd * profitability							0.826	0.070	2.252***
							(0.662)	(0.407)	(0.755)
ln(loan_1)	0.195***	-0.037	0.288***	0.207***	-0.015	0.282***	0.200***	-0.027	0.286***
	(0.067)	(0.028)	(0.103)	(0.066)	(0.024)	(0.106)	(0.067)	(0.026)	(0.104)
Observations	103	28	75	103	28	75	103	28	75
Number of id	17	4	13	17	4	13	17	4	13

Note: Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Arellano-Bond estimation with lagged dependent variable: 1998-2004

	Bank Rate			Lending Rate			Deposit Rate		
	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)
Variable	All	SOCBs	JSCBs	All	SOCBs	JSCBs	All	SOCBs	JSCBs
size	0.537	-1.777***	0.358	0.557	-2.781***	0.263	0.623*	-0.315	0.373
	(0.356)	(0.524)	(0.260)	(0.362)	(1.013)	(0.237)	(0.359)	(0.436)	(0.248)
liquidity	1.112*	5.039***	0.800***	1.636*	5.695***	0.975**	1.269**	4.988***	0.929***
	(0.634)	(1.078)	(0.239)	(0.924)	(2.159)	(0.399)	(0.613)	(1.188)	(0.264)
equity	3.382	-3.636	3.480	4.989	2.630	6.242	2.528	-0.936	3.401
	(2.237)	(8.327)	(2.347)	(3.050)	(11.396)	(3.852)	(2.015)	(3.471)	(2.287)
profitability	1.676	-27.553***	-4.858**	4.206	-42.728***	-8.146***	4.746	-15.999***	-3.146*
	(4.000)	(4.046)	(1.929)	(5.286)	(11.682)	(2.571)	(3.329)	(5.692)	(1.664)
rb * size	0.005	-0.136	0.018**						
	(0.008)	(0.141)	(0.008)						
rb * liquidity	-0.080	-0.521	-0.008						
	(0.096)	(0.371)	(0.052)						
rb * equity	-0.406*	0.571	-0.379						
	(0.223)	(1.716)	(0.300)						
rb * profitability	0.200	4.488***	1.368**						
	(0.531)	(1.053)	(0.630)						
rl * size				0.004	-0.082	0.023***			
				(0.008)	(0.129)	(0.008)			
rl * liquidity				-0.120	-0.164	-0.032			
				(0.114)	(0.531)	(0.058)			
rl * equity				-0.515*	-0.679	-0.587			
				(0.274)	(1.546)	(0.403)			
rl * profitability				-0.077	4.785***	1.487**			
				(0.624)	(1.444)	(0.667)			
rd * size							-0.001	-0.223	0.018**
							(0.010)	(0.156)	(0.007)
rd * liquidity							-0.107	-0.882*	-0.041
							(0.103)	(0.501)	(0.050)
rd * equity							-0.399*	0.833	-0.370
							(0.209)	(1.235)	(0.337)
rd * profitability							-0.167	3.980***	1.324**
							(0.531)	(1.078)	(0.652)
ln(loan_1)	-0.002	-0.501***	0.200	-0.009	-0.420***	0.209	-0.008	-0.431***	0.203
	(0.252)	(0.075)	(0.286)	(0.246)	(0.074)	(0.283)	(0.247)	(0.048)	(0.289)
Observations	101	28	73	101	28	73	101	28	73
Number of id	17	4	13	17	4	13	17	4	13

Note: Robust standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.