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MONETARY POLICY AND BANK LENDING IN CHINA — EVIDENCE FROM LOAN-LEVEL DATA

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Monetary Policy and Bank Lending in China
— Evidence from Loan-Level Data*

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Abstract

We investigate how monetary policy in a mixed financial system such as that of China, which is characterized by a juxtaposition of quantity- and price-based policy instruments and the co-existence of regulated and market-determined interest rates, affects bank lending. Using a newly constructed loan-level dataset, we find that loan rates but not loan size are affected by both the regulated and the market-determined interest rates and that loan size is instead affected by an implicit quota that is imposed on aggregate bank lending through window guidance. We interpret this finding to be evidence of credit rationing.

Keywords: Monetary Policy, Bank Lending, The People's Bank of China (PBC)
JEL Classification: E52, E58, G21, G34

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1. Introduction

China is now the world's second-largest economy, yet its monetary policy framework is little understood. The common perception is that financial intermediation in China is overwhelmingly dominated by bank loans and that monetary policy is implemented by targeting the growth of bank credit primarily through quantity-based instruments, such as reserve requirements and window guidance (Lardy 2008; Goodfriend and Prasad 2006; Qin et al. 2005). In fact, channels of financial intermediation have significantly diversified in recent years, and by now, about half of all financing activities are conducted through wholesale money and capital markets and at market-determined interest rates. Reflecting these changes in the financial system, monetary policy in China is implemented under a system of "dual-track" interest rates: benchmark bank deposit and lending rates are regulated, but money and bond market rates are market determined (He and Wang 2012). Monetary policy implementation has been characterized by a juxtaposition of both price- and quantity-based policy instruments, although the operating framework has increasingly focused on guiding market rates toward desired levels (Zhang 2012).

Bank lending is now affected by not only policy instruments that have a direct bearing on banks, such as benchmark deposit rates, but also market interest rates in the free money and bond markets indirectly, because such market-determined interest rates serve as shadow prices of loans, which would affect banks' lending and funding decisions at the margin. However, implicit credit quota still plays a role in controlling loan size, which reflects that fact that the interest rate elasticity of credit demand by borrowers, particularly State-Owned Enterprises (SOEs), is still considered to be low.

Nevertheless, there have been few studies on the transmission of monetary policy to bank lending in a mixed system, such as that of China. This study attempts to fill the void in the literature in two ways: First, we construct a simple theoretical model to illustrate how bank lending is affected by monetary policy under the "dual-track" interest rate system. Second, we use a proprietary hand-collected loan-level dataset to empirically examine bank lending behavior. The panel dataset comprises more than 11,000 loan-level observations from 672 listed firms in the Shenzhen Stock Exchange (SZSE) from 2003 to 2011.[1] In addition, detailed balance-sheet data of these listed firms allows us to control for the financial characteristics of the firms and identify how monetary policy and market interest rates affect bank lending.

We attempt to answer the following questions in this study: Do monetary policy instruments effectively influence bank lending? Is bank lending systematically and significantly affected by signals from money and capital markets? Do monetary policy instruments affect the price and quantity of loans differently? Why do we still need quantity-based monetary policy instruments, such as an implicit

[1] We select listed firms in SZSE to have better coverage of small and medium-sized firms: smaller firms are better represented in SZSE than in the Shanghai Stock Exchange (SHSE).

aggregate loan quota through window guidance, as much of China's financial intermediation is now conducted at market-determined interest rates?

Our theoretical model shows that under the "dual-track" interest rate system, monetary policy transmission does work in China and that the central bank could use multiple instruments to affect bank lending by influencing market interest rates. Moreover, an increase in the benchmark deposit rate and the Reserve Requirement Ratio (RRR) raises market rates, leading to an increase in loan rates and a decrease in loan sizes.

Our empirical results are consistent with our theoretical predictions: the central bank can effectively influence loan rates through the market interest rate after we control for other factors. Interestingly, we find that the impact of the benchmark deposit rate is still very significant after netting out the impact of the market rate, which suggests that the regulated deposit rate affects loan pricing both directly and indirectly. On the other hand, loan size is not sensitive to either the deposit rate or the market rate; instead, loan size seems to be affected by an implicit aggregate quota that is imposed on commercial banks. We interpret this finding to be evidence of credit rationing, reflecting the relatively low interest rate elasticity of credit demand by borrowers, particularly state-owned enterprises.

The rest of the paper is organized as follows. The next section briefly reviews the institutional background of the monetary policy framework and the banking sector in China. Section 3 develops a theoretical model and discusses its predictions. Section 4 describes the specifications of the empirical models and the selected covariates. Section 5 describes the data and discusses the sample selection. Section 6 reports the estimation results and discusses several robustness checks. Section 7 concludes the paper.

2. Institutional Background and Literature Review

2.1 Institutional Background

According to the *Law on the People's Bank of China,* "the aim of monetary policies shall be to maintain the stability of the currency and thereby promote economic growth." Thus, the PBC has a dual mandate, similar to that of the US Federal Reserve. Even though it is not explicitly stated in the law, there is also an understanding that the PBC has the mandate to maintain the stability of the Chinese financial system, reflecting its role as the lender of last resort.

The policy implementation framework has evolved since the mid-1990s from relying on quantity-based instruments to using a mixture of both quantity- and price-based instruments (He and Pauwels 2008). In recent years, the operating framework has increasingly focused on guiding market rates toward desired levels, with a notable de-emphasis on monetary aggregates, according to the most recent official articulation of the monetary policy framework (Zhang 2012). Although the PBC still routinely announces annual targets for monetary aggregates, these quantitative aggregates have increasingly

only served as information variables rather than intermediate targets. With regard to credit targets, the PBC has not imposed bank-specific targets since the late 1990s and, instead, has used window guidance to help move total bank credit toward desired levels. In terms of the frequency and potency of policy instruments, auction of central bank bills is used most frequently for short-term liquidity management, but a sustained change in the issuing rates in one direction typically indicates the policy intentions. Changes in the RRR may or may not indicate the policy intentions because reserve requirements may be used merely to neutralize the consequence of foreign inflows (Zhou 2012a). In contrast, a rise or a reduction in the benchmark deposit and/or lending rates typically sends a strong signal of the policy stance.

Key to a good understanding of China's monetary policy framework is the "dual-track" interest rate system: on the one hand, bank deposit and lending rates are regulated by the central bank (i.e., through the imposition of a deposit rate ceiling and a lending rate floor);[2] on the other hand, interest rates in money and capital markets are market determined. It is notable that the ceiling or the floor may not necessarily be binding in practice: the deposit rate ceiling is generally considered binding, while actual lending data since 2004 suggest that the lending rate floor is not binding in most cases.

The implementation of "dual-track" interest rate system is considered to be part of the process of transitioning from a planned economy to a market economy, and such a system is consistent with China's overall approach to economic reform. At the heart of China's gradualist approach to economic reform is the "dual-track" price system: prices at the margin are allowed to be set by market forces, while a large segment of the demand and supply system continues to function based on controlled prices (Qian 1999). The controlled or regulated sector shrinks overtime, and the whole system then becomes market based.

Indeed, the financial system in China has experienced a fundamental structural transformation since the late 1990s. Although bank credit is still the most important form of financial intermediation, off-balance sheet activities (such as trust and entrusted loans) and market-based financial intermediation have grown very rapidly in recent years. In fact, the share of bank credit in total social financing, a measure of the aggregate volume of financial intermediation through both the banking sector and the capital markets, decreased from more than two-thirds in early 2000s to under 50% in the second half of 2011 (PBC 2012a; PBC 2012b). That is, the majority of financial intermediation in China is now conducted at market-determined interest rates, which explains why the PBC's operating framework has increasingly focused on guiding market rates toward desired levels.

This raises the question, however, why does China still retain controls on benchmark interest rates in the banking sector? There are a number of explanations. According to Lardy (2008), benchmark interest rates were deliberately kept at artificially low levels to extract a transfer or subsidy from

[2] The PBC announced the removal of the lending rate floor on July 20, 2013, as an important step in interest rate liberalization. However, this latest development would not affect the results of this paper since the lending rate floor is assumed to be not binding in both the theoretical and the empirical models.

households to the corporate sector, particularly SOEs. Such transfers and subsidies were part and parcel of a state-led development strategy. In contrast, PBC officials tend to emphasize that interest rate liberalization requires major players in the financial system, particularly the banks, to have hard budget constraints and be in a position to exercise self-discipline in their pricing decisions (Zhou 2010). In addition, the demand for credit by borrowers should be sensitive to changes in interest rates. Up to now, however, the banks and their borrowers, particularly state-owned enterprises, are not quite ready.

Regardless of the policy intentions, in a situation in which the benchmark deposit rate ceiling is persistently below the equilibrium levels, the PBC must also rely on quantity-based instruments to achieve its policy objectives because of the resulting price distortions in the banking system. For example, a lower deposit rate ceiling (compared with its equilibrium level) shifts the loan supply curve of commercial banks to the right (Figure 1, S1→S2), where S1 is the loan supply curve without the deposit rate ceiling. With the shifted loan supply curve (S2), banks are willing to lend to firms at lower loan rates because their funding cost is lower than it should be (P2<P1). Meanwhile, firms' loan demand is also higher than its equilibrium level (Q2>Q1).

However, with the new equilibrium under the deposit rate ceiling (P2, Q2), there would be more credit (Q2>Q1) in the economy compared with its original equilibrium (P1, Q1), which may not be consistent with the PBC's inflation target. To achieve its inflation target, the PBC will have to constrain the credit supply in the economy. At least two measures were introduced for this purpose: First, several quantity-based instruments, such as an aggregate credit quota and the RRR, are used to constrain the credit supply in the banking system. Second, until most recently, a lending rate floor was used to reduce the loan demand from firms through the higher resulting borrowing costs (P3>P2). With this lending rate floor, coupled with the deposit rate ceiling, a decent profit margin was also guaranteed for the banking sector.

This simple analysis demonstrates that distortions that are caused by price regulations have to be corrected by quantity-based instruments, which is why the PBC has used both price- and quantity-based instruments in its monetary policy framework. The importance of quantity-based instruments diminishes when the deposit rate ceiling is close to its equilibrium level. Thus, a necessary step in moving toward a primarily price-based monetary policy framework in the broader context of interest rate liberalization is for the PBC to move and maintain its benchmark or policy interest rate at close to equilibrium levels.

2.2 Literature Review

As indicated above and has been correctly argued by the PBC, a necessary condition for interest rate liberalization is for the banks to have hard budget constraints and to have incentives to make appropriate pricing decisions. That is, banks will need to become more competitive and efficient. However, the findings reported in existing literature on the efficiency of the Chinese banking sector

are mixed. Banks undergoing a foreign acquisition or public listing are found to have a better pre-event performance, but little performance changes are reported after changes of ownership (Lin and Zhang 2009). On the other hand, there is evidence that the Chinese banking system has benefited from the entry of foreign investors, owing to higher profitability and increased efficiency in the banking system (Garcia-Herrero and Santabarbara 2008). City commercial banks are found to outperform state-owned commercial banks, suggesting that ownership diversity is important for banking efficiency in China (Ferri 2009). Changes in ownership also affect the lending behavior of banks, as lending by state-owned banks is found to be less prudent than lending by joint-stock banks (Jia 2009).

However, the benefits and improvements in efficiency from the entry of foreign investors are not distributed evenly across banks and lenders. Smaller, less-regulated financial institutions appear to be more commercially oriented and to have gained a greater market share in some areas after the reforms (Podpiera 2006). Joint-stock banks and city commercial banks are also found to have higher total factor productivity growth than state-owned banks in recent years (Chang et al. 2012). Small and medium-sized enterprises, on the other hand, have also benefited from the entry of foreign investors, as the higher contestability in the banking sector helps alleviate financing constraints for SMEs (Chong et al. 2012).

Given the mixed findings regarding the efficiency of the Chinese banking sector, it is not difficult to understand why interest rate liberalization has been a gradual process. However, there are signs that the pace of liberalization is likely to increase (Zhou 2012b). Nevertheless, even with a faster pace of interest rate liberalization, the “dual-track” system is likely to continue to influence the monetary policy framework in China for quite some time to come.

Early studies on Chinese monetary policy primarily focus on the reduced-form links between monetary policy and the macroeconomy and assume that monetary transmission in China is the same as that in advanced economies (e.g. Qin et al. 2005; Fan and Zhang 2007). In recent years, a number of studies have taken into account China’s structural differences and found that monetary policy signals can be effectively transmitted to money and capital market rates (Porter and Xu 2009; Chen et al. 2011; He and Wang 2012). However, to the best of our knowledge, no study has extended this literature to examine how bank lending is affected by monetary policy under a structural framework that is specific to China.

Our paper is also related to another strand of literature that focuses on the bank lending channel in China, but most those studies also assume that there is no structural difference in monetary transmission between China and advanced economies. Not surprisingly, interest rate and asset price channels are found to exist in China, but the effectiveness of the bank lending channel varies across provinces and banks (Ho 2012). More specifically, the impact of monetary policy on lending is weaker for larger banks and banks with lower levels of liquidity (Gunji and Yuan 2010). However, all of these studies employ bank-level data and focus on how monetary policy affects the quantity of loans.

This study contributes to the literature and elucidates monetary policy implementation in China in two ways: First, we study how bank lending in China is affected by monetary policy under a specific structural framework— the "dual-track" interest rate system. Under this system, banks' lending behavior is significantly and systematically affected by market-determined interest rates, which serve as shadow prices of funds for the banking sector. Market interest rates, in turn, are significantly and systematically affected by monetary policy instruments. Second, using loan-level data, we are able to separately examine how policy instruments affect the price and quantity of loans and which effect is most important for bank lending in China.

3. A Stylized Banking Sector Model of the "Dual-Track" System

The banking sector model under the "dual-track" interest rate system that we use is similar to that in He and Wang (2012), which extends the model of perfect competition in the banking sector that is developed in Freixas and Rochet (2008). The key innovation in this study is the introduction of fund flows between the regulated banking system (the first track) and the money and bond markets (the second track), which connect the two tracks via arbitrage. In our model, the fund flow arbitrage between the two tracks allows the central bank to influence the market interest rate—and hence bank lending—by using policy instruments such as the benchmark deposit rate, the RRR and Open Market Operations (OMOs) under the "dual-track" system. In contrast to He and Wang (2012), which focuses on how monetary policy affects market interest rates, the model in this study shifts the focus to how monetary policy affects bank lending.

3.1 The Behavior of Banks under the "Dual-Track" System

Similar to previous studies, we assume that N independent banks are in a competitive banking sector and that N is sufficiently large so that each bank is a price taker. Each bank takes deposits (D_i) from households and makes loans (L_i) to firms in the loan market. Each bank has to submit required reserves to the central bank according to the RRR (α) set by the PBC. In addition, each bank can buy central bank bills (B_i), on which the interest rate is set by the PBC (exogenous to each bank), and each bank can invest in bonds or other financial products (NR_i) in the money and bond markets.

The key feature of the "dual-track" system is there exist a deposit rate ceiling and a lending rate floor that are imposed by the PBC on the banking sector. The deposit ceiling is generally considered to be binding, while the lending rate floor is not binding in most cases (Feyzioglu et al. 2009; He and Wang 2012). Owing to the binding price control, banks are unable to maximize their profits as they can in a free market. That is, the deposit market cannot be cleared by market forces when the deposit rate ceiling is binding. Therefore, bank *i* maximizes its profit as follows:

$$\Pi_i = \underset{Li,Di,Bi}{Max}\{r_l L_i + r_r \alpha D_i + r_b B_i + r_{nr} NR_i - r_d D_i - C(D_i, L_i)\} \quad (1)$$
$$\text{st. } r_d \le r_d^b$$

where (r_l) is the lending rate, (r_d) is the deposit rate, r_d^b is the deposit rate ceiling, (r_r) is the interest rate paid on required reserves and (r_{nr}) is the market interest rate. $C(D_i, L_i)$ is the bank's managing cost, which is a function of deposits and loans. (NR_i) is the net position of bank i in the money and bond market, which is given by

$$NR_i = D_i - L_i - \alpha D_i - B_i \quad (2)$$

On the other hand, in the money and bond market (here, we treat the money and bond markets as one market), funds do not originate solely in the banking system; governments and firms also invest in or borrow from the market. Therefore, to clear the non-regulated market, the following is required:

$$\sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) = T(r_l, r_{nr}) \quad (3)$$

where $S(r_d, r_{nr})$ is the supply of funds by the non-bank sector in the non-regulated market, which is a function of and r_d and r_{nr}. $T(r_l, r_{nr})$ is the demand for funds by the non-bank sector in the market, which is a function of r_l and r_{nr}.

3.2 The Competitive Equilibrium of the Banking Sector

In this simple partial equilibrium model, there are three markets to be cleared under a competitive equilibrium, which can be represented by three equations:

Loan market: $$L^d(r_l) = \sum_{i=1}^{N} L_i^s \quad (4)$$

Deposit market: $$D^s(r_d) = \sum_{i=1}^{N} D_i^d \quad (5)$$

Money and bond market: $$\sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) = T(r_l, r_{nr}) \quad (6)$$

where $L^d(r_l)$ and $\sum_{i=1}^{N} L_i^s$ are the aggregate loan demand and supply functions, respectively, and $D^s(r_d)$ and $\sum_{i=1}^{N} D_i^d$ are the aggregate deposit supply and demand functions, respectively. Using the expression for NR_i in equation (2), equation (6) can be written as

$$F(\cdot)=\sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) - T(r_l, r_{nr}) = \sum_{i=1}^{N}[(1-\alpha)D_i - L_i - B_i] + S(r_d, r_{nr}) - T(r_l, r_{nr}) \quad (7)$$

The equilibrium interest rate in the non-regulated market can be determined when the interest rate r_{nr} clears the market.

For the sake of brevity, we provide the details of the rest of the model in Appendix A, and here, we only provide the key results that are derived from the model. It can be proved that when the deposit rate ceiling is binding and the lending rate is not binding, the equilibrium loan rate and loan size in the loan market can be written as follows:

$$r_l^* = \frac{\delta_L AD + N r_{nr}}{N + \delta_L \lambda_l} \quad (8)$$

$$L^* = \frac{N(AD - \lambda_l r_{nr})}{N + \delta_L \lambda_l} \quad (9)$$

where AD is the aggregate demand for loans in the economy, δ_L is the managing cost in the banking sector and λ_l is firms' price sensitivity for banking loans. From the above two equations, we can see that the following four factors could directly affect the loan rate and loan size: r_{nr} (the market interest rate), AD, δ_L and λ_l. Interestingly, monetary policy instruments, such as the benchmark deposit rate or the RRR, do not enter the loan equation directly; however, they can affect the loan rate and loan size indirectly because monetary policy affects the market interest rate (He and Wang 2012).[3] Therefore, we can derive the predictions presented in the following section from the model.

[3] The aggregate demand for loans, AD, is considered to be exogenous in this model. However, in practice, AD can be significantly and systematically affected by monetary policy instruments, in which case monetary policy instruments would directly enter the loan equations.

3.3 Theoretical Predictions

When the deposit rate ceiling is binding and lending rate floor is not binding, the loan rate increases with the market interest rate, while the loan size changes in the opposite direction. Monetary policy instruments also affect bank lending through the market interest rate: the loan rate increases with the benchmark deposit rate and the RRR, while the loan size changes in the opposite direction.

4. Empirical Analysis

To test the above theoretical predictions, we construct empirical models according to its structural counterparty and estimate the empirical models using loan-level data with more than 11,000 observations.

4.1 What Determines the Loan Rate and Loan Size?

Following previous studies in the literature (e.g. Bharath, et al. 2011; Lin et al. 2011), a linear empirical model on loan pricing can be written as follows:

$$loanrate_{it} = \mathrm{B}_0 + \mathrm{B}_1 MP_{t-1} + \mathrm{B}_2 MR_{t-1} + \mathrm{B}_3 FC_{it-1} + \mathrm{B}_4 LC_{it} + \mathrm{B}_5 AD_{t-1} + \alpha_i + u_{it} \qquad (10)$$

where $loanrate_{it}$ is the price charged on the bank loans of firm i at time t. All explanatory variables, except loan features, are lagged one quarter in order to avoid endogeneity caused by simultaneousity. MP_{t-1} represents monetary policy instruments, which include the benchmark deposit rate and RRR at time $t-1$. MR_{t-1} represents the market interest rate that is represented by the 7-day repo rate from the money market.[4] FC_{it-1} denotes seven financial indicators of listed firms, such as return on equity, total assets, total employment, total liquid assets, debt-to-asset ratio, equity-to-debt ratio and profit margin, to help us to control for firms' loan price sensitivity.

LC_{it} consists of loan features such as loan maturity, bank type and collateral to capture bank efficiency. AD_{t-1} are macroeconomic variables, such as fixed-asset investment growth, loan growth, inflation rate and foreign assets purchased by the central bank. α_i denotes unobservable firm characteristics, such as the reputation of the firm and the relationship between a firm and a bank. u_{it} is the idiosyncratic shock that is not correlated with any covariate.

[4] The seven-day Repo rate is the most widely used indicator of market-determined interest rates in China. For robustness checks, we also use other interest rates (e.g., one-day Repo rate, one-month Repo rate, one-year Treasury Bond Bill yield) to test the robustness of the model (see the robustness check section).

Similarly, we can express an empirical model for loan size as follows:

$$L_{it} = \Phi_0 + \Phi_1 MP_{t-1} + \Phi_2 MR_{t-1} + \Phi_3 FC_{it-1} + \Phi_4 LC_{it} + \Phi_5 AD_{t-1} + \mu_i + \varepsilon_{it} \quad (11)$$

where L_{it} is the loan size for firm i at time t. μ_i represents some unobservable fixed effect on the loan size, and ε_{it} is the idiosyncratic shock. Other variables are defined as in equation (10).

4.2 Estimation Strategy

Since the dataset is a panel dataset at the loan level, it would be useful to remove observable time-constant features, such as the firm industry and ownership. More importantly, the panel data allow us to eliminate unobservable time-constant features, such as the reputation of a firm and the relationship between a bank and a firm.

Empirically, the easiest way to remove the fixed effect is to take the first difference, which produces identical estimates and inferences with fixed effect estimation. In addition, the first differencing method is less strict in its requirement of an exogeneity assumption and has the advantage of turning an integrated time series process into a weakly dependent process (Wooldridge 2002). Therefore, the first difference of equation (10) can be written in the following way:

$$\Delta loanrate_{it} = \mathrm{B}_1 \Delta MP_{t-1} + \mathrm{B}_2 \Delta MR_{t-1} + \mathrm{B}_3 \Delta FC_{it-1} + \mathrm{B}_4 \Delta LC_{it} + \mathrm{B}_5 \Delta AD_{t-1} + \Delta u_{it} \quad (12)$$

where $\Delta loanrate_{it} = loanrate_{it} - loanrate_{it-1}$. The same first differencing applies to other variables. Incorporating the previous discussion, a full model with all explanatory variables can be written in the following way:

$$\begin{aligned} \Delta loanrate_{it} &= \beta_1 \Delta dr_{t-1} + \beta_2 \Delta RRR_{t-1} + \beta_3 \Delta repo_{t-1} + \beta_4 \Delta maturity_{it} + \beta_5 \Delta bank_{it} \\ &+ \beta_6 \Delta coll_{it} + \beta_7 \Delta FAI_{t-1} + \beta_8 \Delta loan_{t-1} + \beta_9 \Delta \pi_{t-1} + \beta_{10} \Delta fx_{t-1} + \beta_{11} \Delta roe_{it-1} + \beta_{12} \Delta liquid_{it-1} \\ &+ \beta_{13} \Delta ta_{it-1} + \beta_{14} \Delta daratio_{it-1} + \beta_{15} \Delta equity_{it-1} + \beta_{16} \Delta \mathrm{margin}_{it-1} + \beta_{17} \Delta employee_{it-1} + \Delta u_{it} \end{aligned} \quad (13)$$

Detailed definitions for all above variables can be found in Table 1. Similarly, the first difference of equation (12) can be written in the following way:

$$\begin{aligned} \Delta L_{it} &= \gamma_1 \Delta dr_{t-1} + \gamma_2 \Delta RRR_{t-1} + \gamma_3 \Delta repo_{t-1} + \gamma_4 \Delta maturity_{it} + \gamma_5 \Delta bank_{it} \\ &+ \gamma_6 \Delta coll_{it} + \gamma_7 \Delta FAI_{t-1} + \gamma_8 \Delta loan_{t-1} + \gamma_9 \Delta \pi_{t-1} + \gamma_{10} \Delta fx_{t-1} + \gamma_{11} \Delta roe_{it-1} + \gamma_{12} \Delta liquid_{it-1} \\ &+ \gamma_{13} \Delta ta_{it-1} + \gamma_{14} \Delta daratio_{it-1} + \gamma_{15} \Delta equity_{it-1} + \gamma_{16} \Delta \mathrm{margin}_{it-1} + \gamma_{17} \Delta employee_{it-1} + \Delta \varepsilon_{it} \end{aligned} \quad (14)$$

It is notable that the loan-level data also allow us to avoid endogeneity problems due to simultaneity in the estimation. Since the PBC's policy could react to credit growth at the aggregate level, monetary policy would be endogenous if aggregate loan data are used in this study. This is a common problem of many other studies that use aggregate credit data. Fortunately, this endogeneity problem does not arise with loan-level data because the PBC is unlikely to react to changes in individual loans. However, we are aware that other factors, such as the time-varying loan quota, could still be omitted in the error term and hence cause an endogeneity problem. We will further discuss this issue in the robustness tests.

5. Data

We use a unique panel of loan-level data that were collected from WIND financial data service for the estimation. The sample includes 672 firms listed on the Shenzhen Stock Exchange, and the sample period ranges from 2003Q1 to 2011Q4. We chose companies listed on the SZSE because firms listed on the SZSE are more diverse in terms of firm size compared with those listed on the Shanghai Stock Exchange. Therefore, the sample from the SZSE allows us to minimize the potential sample selection bias.[5]

While data on firms' characteristics and financial conditions can be obtained relatively easily from financial reports of listed firms, individual loan data, such as loan rates and loan size, can only be collected manually from the appendices and footnotes of the quarterly financial reports that are published by listed firms. Most details on loans are available after 2007 since the Chinese Securities Regulatory Commission (CSRC) imposed stricter regulations on financial information disclosure in early 2007, requiring listed firms to report any important changes (including fund raising and bank loans) related to their financial conditions.[6]

However, not all listed firms on the SZSE report their loan information in a standard way. Some firms only report information concerning their loans, such as the bank name and loan size but not the loan rate. Incomplete observations are eliminated, leaving only 672 of 1500 listed firms in our sample. In addition, not all loans that are borrowed by the listed firms are reported; only loans that might have important impact on the stock market are reported, as required by the CSRC.

Since the data are collected only from firms listed on the SZSE and not all listed firms or loans are included into the sample, the sample might not reflect the full picture of bank lending in China. Some firms might also choose to purposely report their loans with incomplete information to avoid a negative impact on the stock market. Therefore, a reasonable question concerns whether the sample is

[5] We are aware that we cannot completely avoid the sample selection bias since the firms listed on SZSE are still relatively large compared with small firms in the economy. However, this is the only way that we can obtain loan-level data from public sources in China.

[6] Detailed information on the new regulation (Information Disclosure Regulation for Companies Offering Securities to the Public 2007 No. 9) can be found at http://www.csrc.gov.cn/pub/newsite.

representative of the population.[7] To examine this issue in more detail, we compare our sample with the population statistics that are published by the PBC in Appendix B.

6. Empirical Results

6.1 What Determines the Loan Rate?

As the theoretical model predicts, the market interest rate, as represented by the 7-day Repo rate, significantly affects the loan rate: a 100 basis points increase in the market interest rate causes the loan rate to rise by 4.7 basis points after controlling for the benchmark deposit rate, RRR and other factors (Table 2, Column 3, Row 3). On the other hand, the benchmark deposit rate has a much great influence on loan pricing after controlling for the impact from the market rate and other factors: a 100 basis point rise in the deposit rate causes the loan rate to increase by 26.2 basis points. These results suggest that the regulated benchmark deposit rate is still the most powerful factor in determining loan pricing, which is consistent with previous findings (He and Wang 2012).

On the other hand, the RRR does not significantly affect the loan rate, presumably for the following two reasons. First, the reserve requirement, rather than the issuance of central bank bills, has been used since 2003 to neutralize the consequence of foreign inflows that are caused by a large, persistent trade surplus. Therefore, changes in the RRR may not indicate any intention to tighten or loosen monetary policy, and thus, bank lending does not have to react it. Second, the impact of the RRR may be fully captured by the market interest rate since the RRR affects bank lending through the withdrawal of liquidity from or injection of liquidity into the money and bond market.

The statistically significant but relatively small impact of the market interest rate on the loan rate allows us to understand the bank lending process in Mainland China: changing the benchmark deposit rate is still the most powerful instrument for the PBC to affect loan pricing since the deposit rate mostly determines the funding costs of commercial banks. However, the market interest rate itself is important for loan pricing according to the theoretical predictions, even though its effect is relatively small.[8] This finding suggests that banks do consider movements in the market interest rates to be signals of changes in the shadow price of funding when they make loan pricing decisions.

The coefficient of loan maturity is positive and significant, which suggests that with a longer loan maturity, banks charge a higher interest rate. Different banks make loans at different prices: the benchmark group comprises the big four banks, and the results indicate that joint-venture banks and city commercial banks do not charge higher prices compared with the benchmark.

[7] The population refers to all commercial bank loans in Mainland China.

[8] The relatively small coefficient of short-term interest rate on the loan rate might be due to its larger variance compared with long-run interest rates (for instance, one-year deposit rate), which is consistent with the findings presented in Table 4.

The coefficient of collateral is not significant, presumably because the status of being a listed firm can be implicit collateral for banks. [9] In terms of macroeconomic conditions, higher fixed investment growth may lead to higher demand for loans in the aggregate and would increase the loan rate. Higher loan growth would imply faster growth of the supply of credit in the aggregate and therefore decrease the loan rate. Higher inflation increases the loan rate, since the expectation of higher inflation leads banks to charge more for future debts, while more foreign asset purchases lower the loan rate because of the increased liquidity in the banking sector.

The financial characteristics of firms are supposed to reflect the risk premium that is charged by banks, and both the debt-to-asset ratio and the equity-to-asset ratio affect the loan rate. A higher debt-to-asset ratio increases the loan rate, while a higher equity-to-asset ratio decreases the loan rate, which suggests that banks in China have differentiated between borrowers in loan pricing decisions and the financial conditions of firms that directly affect loan rates.

6.2 What Determines Loan Size?

In contrast to the impact on the loan rate, neither policy instruments nor the market interest rate significantly affects loan size (Table 2, Column 4), even though the signs of the RRR and the market interest rate are correct and they almost reach significance at the 10% level. The, at most, weak impact of the instruments and the market rate on loan size suggests loan size is not sensitive to price-based signals, regardless of whether such signals are from the central bank or from the market. This result indicates that another factor affects loan size.

Loan size increases with loan maturity since long-term projects often require larger sized loans. This result is consistent with the observation that banks usually provide larger sized loans with longer maturities for long-term projects. Loan size is not significantly affected by collateral but increases with foreign asset purchases and loan growth, because having more liquidity and credit supply in the banking system increase loan size, on average.

A more interesting finding is the impact of financial characteristics on loan size. Loan size decreases if firms have more liquid assets and a higher profit margin. Loan size also increases with total assets and the equity-to-asset ratio since large firms often need more loans to support various projects, and a higher equity-to-asset ratio affords lower risk. Thus, banks are willing to lend more to such firms.

[9] We are aware that the collateral could be significant statistically if our sample includes non-listed small and medium-sized firms in the economy, instead of only small listed firms.

6.3 Robustness Checks

a) Omitted Variable: Loan Quota?

The PBC announced that it would abandon official loan quotas on specific commercial banks in 1998. However, an implicit aggregate quota on loans is occasionally used by the PBC as an instrument of window guidance to control aggressive lending. Thus, our estimation may be subject to an omitted variable problem because the loan quota is unobservable and may become a component of the error term.

We examine this problem carefully by using the following three steps. First, from our interviews with commercial banks, we understand that a loan quota is usually assigned implicitly at the beginning of the year, which means the quota could be stable within a specific year. If this is the case, first differencing can solve this problem if loans are made within the same year and the loan quota is constant through the year, because the loan quota will simply be removed as a time-constant fixed effect through differencing. Therefore, our estimation would not suffer from the omitted variable problem.

Second, if loans for a specific firm are made in different years but the loan quota is constant throughout a specific year, we could use yearly dummies to capture the effect from the loan quota. Table 3 shows that the results with yearly dummies are similar to those without the yearly dummies. These results suggest that our empirical models are robust to yearly changes in the loan quota. Interestingly, the dummies for 2010 and 2011 are negative in terms of loan size, which suggests that the loan size was, on average, squeezed in these 2 years.

Third, the above two measures would not solve the problem if the loan quota varies within a specific year. For example, the central bank could tighten the loan quota in a specific quarter or month if credit grew faster than the PBC anticipated. In practice, this often takes place in the second and the fourth quarters of a year because commercial banks have to submit their detailed semi-annual credit supply reports to the PBC during these quarters. That is, the loan quota could become more binding in the second and the fourth quarter of each year. Based on this hypothesis, we introduce quarterly and monthly dummies in our model.

The results in Table 3 confirm our hypothesis: while the loan rate is not significantly different across quarters, loan size in the second and the fourth quarters significantly decreases compared with the benchmark (the first quarter) (Table 3, Columns 3 and 4). The effect of the loan quota becomes more apparent when we replace the quarterly dummies with monthly dummies: loan size significantly decreases in both June and December, while loan pricing is not significantly affected across months.

Thus, because credit growth is typically scrutinized more closely by the central bank in the second and fourth quarters, the loan quota becomes more binding. As a result, loan size significantly

decreases, suggesting that the quarterly and monthly dummies are able to capture the varying impact of the loan quota within the year and allowing us to avoid the omitted variable problem in our estimation. The results also suggest that the implicit loan quota may still play an important role in bank lending, especially in terms of loan size.

It is worth noting that the loan quota may interact with other quantity-based instruments, such as the RRR. For example, if the RRR is raised by a sufficiently large margin and the loan quota does not change, the supply of loans could significantly decrease such that the loan quota is no longer binding. In this case, changes in the RRR affect loan size. On the other hand, if the RRR is decreased and the loan quota is initially binding, then the quantity of loans would not change and changes in the RRR would not affect loan size. In practice, the loan quota seems to be more binding, as shown by the empirical results, likely demonstrating why the RRR has no significant impact on loan size.[10]

b) Alternative Measures of Market Interest Rates

Until now, we have been using the 7-day Repo rate to represent the market interest rate since it is the most popular indicator in practice. However, we need to check whether the empirical results are robust with alternative measures of the market interest rate. For example, the overnight Repo rate, one-month Repo rate and one-year Treasury bill yield are important indicators for practitioners.

The results using alternative indicators are similar to what we obtained using the 7-day Repo rate: the loan rate increases with the overnight Repo rate, while loan size decreases with the overnight Repo rate (Table 4, Columns 1 and 2); for the one-month Repo rate, the impact on the loan rate is also positive and significant, while the impact on loan size is not significant (Table 4, Columns 3 and 4). The results for the one-year Treasury bill yield are quite similar to those for the one-month Repo rate. However, it is notable that the coefficients of those indicators become larger as they move to the longer-end of the yield curve. This result presumably is observed because longer-term interest rates are more stable than short-term ones.

c) Are the Loan Rate and Loan Size Determined Simultaneously?

It can be argued that the loan rate and loan size could be determined simultaneously, hence creating an endogeneity problem from simultaneity and introducing bias in our estimation. In econometric language, we need to estimate loan supply and demand functions together using an appropriate identification strategy. Table 5 illustrates the estimation results from using two different identification strategies. In panel A, we assume that total assets and employment affect loan size but not the loan rate. In panel B, we assume that the debt-to-asset ratio and equity-to-asset ratio affect the loan rate but not loan size.

[10] Since we have included both the RRR and loan quota in the empirical model, the model is able to capture the impact of both factors simultaneously.

The results are similar to our results from estimating the two equations separately: both the benchmark deposit rate and the market interest rate still have a positive and significant effect on the loan rate, and loan size is not sensitive to these two factors. This exercise shows that simultaneity is not a severe problem in our analysis even if it has an impact on our estimation. The simultaneous estimation does provide one interesting observation: loan size decreases with the RRR in both specifications at a marginally significant level, suggesting the RRR could affect loan size to some extent.

d) The Role of Open Market Operations

In recent years, the PBC has attached increasing importance to the issuing rate of central bank bills as one of its policy instruments to guide market interest rates toward more desired levels (Zhang 2012). The working mechanism of the issuing rate could be similar to those of instruments implemented in advanced economies: simply by announcing their intentions, central banks can move rates without undertaking any operations because the threat to adjust liquidity as needed to change the rate is enough to make markets adjust to the new rate (Disyatat 2008). Therefore, the issuing rate of central bank bills, in theory, can be a valid policy instrument as long as the central bank's intention is clear and creditable enough to the market.

Against this backdrop, we may need to include the issuing rate of central bank bills in our empirical models as an additional explanatory variable since it may affect bank lending through the market interest rate (see Figure 2). However, because the issuing rate is highly correlated with the benchmark deposit rate and the RRR (see Figure 3), we may have a severe multicollinearity problem if we simply add it into the regressions. The best way to address this issue is to choose a subsample period in which both the benchmark deposit rate and the RRR were unchanged in order to identify the impact from the issuing rate of central bank bills. Fortunately, such subsample periods do exist, and they range from October, 19, 2004, to July 4, 2006, and from December 25, 2008, to January 17, 2010 (see Figure 3).

In the empirical models, we include the 3-month and one-year issuing rates of central bank bills in the regressions since they are the most active issuing rates that are used by the PBC. First, we test the hypothesis that the PBC can move the market rate using the issuing rates of central bank bills. To do this, we run regressions with the market rate as the dependent variable and the issuing rate as an explanatory variable during the subsample periods in which the benchmark deposit rate and RRR were unchanged. We use yearly dummies and monthly dummies to control for the potential impact of the loan quota, and the results in Table 6 show that the issuing rates do have a significant impact on the market rate. This finding indicates that the issuing rate of the central bank bills is a valid policy instrument.

Next, we include the issuing rates into the loan making models for the two subsample periods. The results in Table 7 indicate that the 3-month issuing rate does not have a significant impact on either

the loan rate or loan size but that the one-year issuing rate has a significant impact on the loan rate during the subsample period.[11] The above results suggest that the PBC's intention conveyed by the issuing rate can be captured by the market interest rate and that when the PBC keeps the benchmark deposit rate and the RRR unchanged, it can effectively influence bank lending by moving the issuing rate of central bank bills because such changes to the issuing rate signal policy intentions to the market.

7. Concluding Remarks

We have attempted in this study to elucidate how monetary policy in China affects bank lending under the current monetary policy framework. We have constructed a theoretical model to illustrate how monetary policy transmission works under the "dual-track" interest rate system. The theoretical model predicts that the central bank could use multiple policy instruments to influence bank lending through the market interest rate.

We use a unique loan-level dataset to test the theoretical predictions. The empirical findings are consistent with the theory: the loan rate is affected by not only the regulated benchmark deposit rate but also market-determined interest rates. On the other hand, loan size does not appear to be sensitive to either the regulated rate or the market rate; instead, loan size seems to be affected by an implicit aggregate quota that is imposed on the banking sector. This effect is probably a reflection of the relatively low interest rate elasticity of credit demand by borrowers, particularly state-owned enterprises. We can interpret the use of the implicit aggregate loan quota to be evidence of credit rationing.

These findings suggest that the monetary policy framework in China is still in a state of transition. Traditional policy instruments such as the benchmark deposit rate and loan quota still play important roles in influencing bank lending. However, market-determined interest rates have already started to play a significant role in influencing banks' pricing decisions, although loan size does not appear to be sensitive to movements in market interest rates. The sensitivity of loan size to market interest rates is expected to increase and the importance of quantity-based policy instruments is expected to diminish as the PBC moves and maintains its benchmark bank rate or policy rate closer to equilibrium levels. Overall, with further commercialization of state banks and state-owned enterprises and interest rate liberalization, the role of market interest rates in determining banks' lending behavior is expected to increase.

[11] The results in Table 7 still hold after adding yearly and monthly dummies.

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Table 1. Definition of Variables

Name of variables	Variable definition
Loan rate ($loanrate_{it}$)	Loan interest rate
Loan size(L_{it})	Loan size
Benchmark deposit rate(dr_t)	Benchmark deposit rate set by the PBC
RRR (RRR_{it})	Reserve requirement ratio set by the PBC
7-day Repo rate ($repo_t$)	7-day repurchase agreement rates in the money market
Maturity($maturity_{it}$)	Loan maturity
Bank type ($bank_{it}$)	Dummies for different banks (1=the big four state-owned bank[a], 2=joint-venture banks, 3=foreign banks, 4=rural credit cooperation, 5=city commercial banks, 6=private credit companies, 7=other financial companies, 8=development banks, 9=others
Collateral ($coll_{it}$)	Dummy variable to indicate whether the loan is backed by collateral (Yes=1, No=0)
Investment (FAI_t)	Fixed asset investment year-on-year growth
Loan growth ($loan_t$)	loan growth year-on-year
Inflation (π_t)	Consumer Price Index (CPI)
Foreign asset (fx_t)	Total foreign asset purchased by PBC
Return on equity (roe_{it})	Return on equity
Liquidity ($liquid_{it}$)	Total liquid assets
Total asset (ta_{it})	Total assets of the firm
Debt-to-asset ratio ($daratio_{it}$)	Ratio of total debt to total assets
Equity-to-debt ratio ($equity_{it}$)	Ratio of equity to total assets
Profit margin($margin_{it}$)	Ratio of earnings before interest rate and tax to total revenue
Total employment ($employee_{it}$)	Total employment of the firm

[a] The big four banks are Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Bank of China (BOC) and Agricultural Bank of China (ABC).

Table 2. What Determines the Loan Rate and Loan Size?

Variables	Dependent variable			
	Loan rate	Loan size	Loan rate	Loan size
Deposit rate	0.223*(0.042)	4.063	0.262**	1.579
		(7.054)	(0.046)	(7.996)
RRR	-0.029	-5.436	-0.024	-5.842
	(0.021)	(3.475)	(0.022)	(3.886)
Repo_7day	0.048*	-2.500*	0.047**	-2.377
	(0.008)	(1.392)	(0.008)	(1.511)
Loan Maturity	0.040**	9.734**	0.039**	9.945**
	(0.002)	(0.423)	(0.003)	(0.453)
	Bank type (benchmark: the big four banks)			
type 2	-0.010	-2.382	-0.008	-3.017
	(0.015)	(2.512)	(0.016)	(2.821)
type 3	0.075	-17.83	0.112	-19.51
	(0.069)	(11.59)	(0.075)	(13.15)
type 4	0.198**	-5.935	0.211**	-7.030
	(0.036)	(6.031)	(0.038)	(6.667)
type 5	0.064*	-1.384	0.036	-0.725
	(0.025)	(4.224)	(0.028)	(4.922)
type 6	0.674	11.04	0.671	11.67
	(0.444)	(74.09)	(0.447)	(77.58)
type 7	0.195**	24.24*	0.154*	26.72*
	(0.074)	(12.28)	(0.077)	(13.34)
type 8	-0.093**	3.994	-0.104**	2.396
	(0.026)	(4.370)	(0.027)	(4.817)
type 9	0.168	-0.043	0.161	4.480
	(0.098)	(16.38)	(0.105)	(18.32)
Collateral	0.014	-0.607	0.030	-0.426
	(0.024)	(4.001)	(0.025)	(4.327)
FAI growth	0.021	0.065	0.017***	0.311
	(0.003)	(0.468)	(0.003)	(0.544)
Loan growth	-0.027**	1.501*	-0.030**	1.427
	(0.004)	(0.651)	(0.004)	(0.752)
Inflation	0.103**	-0.602	0.096**	0.714
	(0.008)	(1.390)	(0.009)	(1.628)
FX purchase	-0.023	11.19**	-0.028*	12.50**
	(0.014)	(2.388)	(0.015)	(2.741)
ROE			-0.001	0.106
			(0.001)	(0.216)
Liquid asset			0.019	-8.406*
			(0.020)	(3.502)
Total asset			-0.001	7.236**
			(0.012)	(2.132)
Debt/total asset			0.005**	-0.016
			(0.002)	(0.339)
Equity/debt			-0.010*	1.991*
			(0.006)	(0.997)
Profit margin			-0.001	-0.333**
			(0.001)	(0.116)
Employment			0.032	-12.13
			(0.051)	(8.821)
Obs	11018	11018	9789	9789
Adj-R^2	0.08	0.05	0.08	0.06

Note: Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively.

Table 3. Loan Quota?—Results After Adding Time Dummies

Variables	Dependent variable					
	Loan rate	Loan size	Loan rate	Loan size	Loan rate	loan size
Deposit rate	0.255**	0.883	0.264**	2.500	0.265**	2.909
	(0.046)	(8.084)	(0.046)	(8.030)	(0.047)	(8.154)
RRR	-0.023	-6.037	-0.025	-5.610	-0.020	-5.404
	(0.022)	(3.910)	(0.022)	(3.890)	(0.023)	(3.970)
Repo_7day	0.047**	-2.248	0.047**	-2.414	0.046**	-2.471
	(0.009)	(1.514)	(0.009)	(1.521)	(0.009)	(1.540)
Loan Maturity	0.039**	9.945**	0.039**	9.994**	0.039**	10.01**
	(0.003)	(0.453)	(0.003)	(0.453)	(0.003)	(0.453)
Bank type dummies	Yes	Yes	Yes	Yes	Yes	Yes
Yearly dummies (Benchmark: 2003)						
2004	-0.027	-16.44				
	(0.182)	(31.71)				
2005	0.023	-13.81				
	(0.093)	(16.19)				
2006	0.062	-3.336				
	(0.062)	(10.79)				
2007	-0.003	-1.746				
	(0.021)	(3.646)				
2008	-0.007	-2.543				
	(0.017)	(3.040)				
2009	0.007	-3.187				
	(0.017)	(2.337)				
2010	-0.018	-6.085*				
	(0.015)	(2.579)				
2011	-0.003	-6.203*				
	(0.015)	(2.630)				
Quarterly dummies (benchmark: the first quarter)						
Second Quarter			0.008	-5.202*		
			(0.012)	(2.095)		
Third Quarter			0.005	2.158		
			(0.019)	(3.286)		
Fourth Quarter			-0.003	-7.371**		
			(0.012)	(2.008)		
Monthly dummies (benchmark: January)						
February					0.015	-0.394
					(0.034)	(5.993)
March					0.019	1.838
					(0.026)	(4.521)
April					0.024	-1.862
					(0.030)	(5.270)
May					0.048	-3.335
					(0.028)	(4.886)
June					-0.004	-6.148*
					(0.014)	(2.448)
July					0.011	1.942
					(0.033)	(5.788)
August					0.017	-0.666
					(0.033)	(5.837)
September					-0.007	4.829
					(0.029)	(5.123)
October					0.016	-8.580
					(0.034)	(5.989)
November					-0.023	1.388
					(0.029)	(5.061)
December					-0.001	-8.563**
					(0.012)	(2.218)
Firm financial characteristics (FC)	Yes	Yes	Yes	Yes	Yes	Yes
Loan features (LC)	Yes	Yes	Yes	Yes	Yes	Yes
Macro-variables(AD)	Yes	Yes	Yes	Yes	Yes	Yes
Obs	9789	9789	9789	9789	9789	9789
Adj-R^2	0.08	0.06	0.08	0.06	0.08	0.06

Note: for the sake of brevity, we do not report detailed results for bank type and yearly dummies since the results of those variables are similar to those in pervious regressions. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively.

Table 4. What Determines the Loan Rate and Loan Size: Using Different Market Interest Rates?

Variables	Dependent variable					
	Loan rate	Loan size	Loan rate	Loan size	Loan rate	Loan size
Deposit rate	0.257**	1.373	0.224**	0.881	0.172**	-3.226
	(0.046)	(8.051)	(0.046)	(8.047)	(0.055)	(9.609)
RRR	-0.019*	-5.926	-0.018*	-6.168	-0.023	-6.341
	(0.022)	(3.890)	(0.022)	(3.880)	(0.022)	(3.890)
Repo_overnight	0.045**	-4.050*				
	(0.009)	(1.615)				
Repo_One-month			0.086**	-1.494		
			(0.010)	(1.762)		
One-year Tbill yield					0.156**	3.339
					(0.038)	(6.609)
Loan Maturity	0.039**	9.828**	0.040**	9.939**	0.039**	9.961
	(0.003)	(0.453)	(0.002)	(0.453)	(0.002)	(0.453)
Bank type dummies	Yes	Yes	Yes	Yes	Yes	Yes
Firm financial characteristics (FC)	Yes	Yes	Yes	Yes	Yes	Yes
Loan features (LC)	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic variables (AD)	Yes	Yes	Yes	Yes	Yes	Yes
Obs	9784	9784	9789	9789	9789	9789
Adj-R^2	0.08	0.06	0.09	0.06	0.08	0.06

Note: for the sake of brevity, we do not report detailed results for bank type dummies, financial characteristics, loan features and macroeconomic variables since the results of those variables are similar to those in Table 2. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively.

Table 5. Loan Rate and Loan Size are Determined Simultaneously (SEM Model)

Variables	Dependent variable			
	Panel A		Panel B	
	Loan rate	Loan size	Loan rate	Loan size
Loan rate		-46.77		-66.32
		(58.49)		(67.48)
Loan size	-0.001		0.001	
	(0.002)		(0.001)	
Deposit rate	0.263**	13.34	0.252**	18.52
	(0.046)	(17.11)	(0.046)	(19.58)
RRR	-0.031	-7.084	-0.019	-7.545
	(0.024)	(4.180)	(0.024)	(4.378)
Repo_7day	0.043**	-0.354	0.049**	0.780
	(0.009)	(3.178)	(0.009)	(3.568)
Loan Maturity	0.052**	11.82**	0.033**	12.57**
	(0.015)	(2.363)	(0.013)	(2.712)
Bank dummies	Yes	Yes	Yes	Yes
Loan features	Yes	Yes	Yes	Yes
Macro variables	Yes	Yes	Yes	Yes
Roe	-0.001			0.012
	(0.001)			(0.216)
Liquid asset	0.024*			-7.835*
	(0.010)			(3.874)
Total asset		3.286*		7.470**
		(1.265)		(2.213)
Debt/total asset	0.004*		0.004*	
	(0.002)		(0.002)	
Equity/debt	-0.011		-0.012*	
	(0.006)		(0.006)	
Profit margin	-0.001			-0.361**
	(0.001)			(0.126)
Employment		-12.82		-11.94
		(8.879)		(9.321)
Obs	9789	9789	9789	9789

Note: In Panel A, the Simultaneous Equation Model (SEM) is identified by assuming the effect of total assets and employment on loan size but not on the loan rate. On the other hand, the other five financial characteristics affect the loan rate but not loan size. In Panel B, we assume that the debt-to-asset ratio and equity-to-asset ratio affect loan rate only, not loan size. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively.

Table 6. Can PBC Influence the Market Rate Using the Issuing Rate of CBBs?

Variables	Dependent variable			
	Repo_overnight	Repo_overnight	Repo_7d	Repo_7d
3-month CBB issuing rate	0.402*		0.419*	
	(0.041)		(0.044)	
One-year CBB issuing rate		0.211**		0.151**
		(0.048)		(0.052)
Yearly dummies	Yes	Yes	Yes	Yes
Monthly dummies	Yes	Yes	Yes	Yes
Obs	1012	1012	1012	1012
Adj-R^2	0.09	0.03	0.10	0.03

Note: for the sake of brevity, we do not report detailed results for yearly and monthly dummies since the results of those variables are similar to those in previous regressions. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively.

Table 7. Does the Issuing Rate of Central Bank Bills Matter for Loan Making?

Variables	Dependent variable			
	Loan rate	Loan size	Loan rate	Loan size
Issuing rate of 3-month CBB	0.067	-2.966		
	(0.064)	(9.770)		
Issuing rate of one-year CBB			0.174**	4.529
			(0.056)	(8.600)
Repo_7day	-0.002	-6.848	-0.016	-10.63
	(0.029)	(8.490)	(0.037)	(5.684)
Loan Maturity	0.057	8.050**	0.057	8.088**
	(0.005)	(0.722)	(0.004)	(0.722)
Bank type dummies	Yes	Yes	Yes	Yes
Loan features (LC)	Yes	Yes	Yes	Yes
Macroeconomic variables (AD)	Yes	Yes	Yes	Yes
Obs	3369	3369	3369	3369
Adj-R^2	0.12	0.04	0.12	0.04

Note: for the sake of brevity, we do not report detailed results for bank type dummies, loan features and macroeconomic variables since the results of those variables are similar to those in Table 2. Asterisks * and/or ** indicate significance at the 5 percent and 1 percent levels, respectively.

Figure 1. Demand for and Supply of Bank Credit

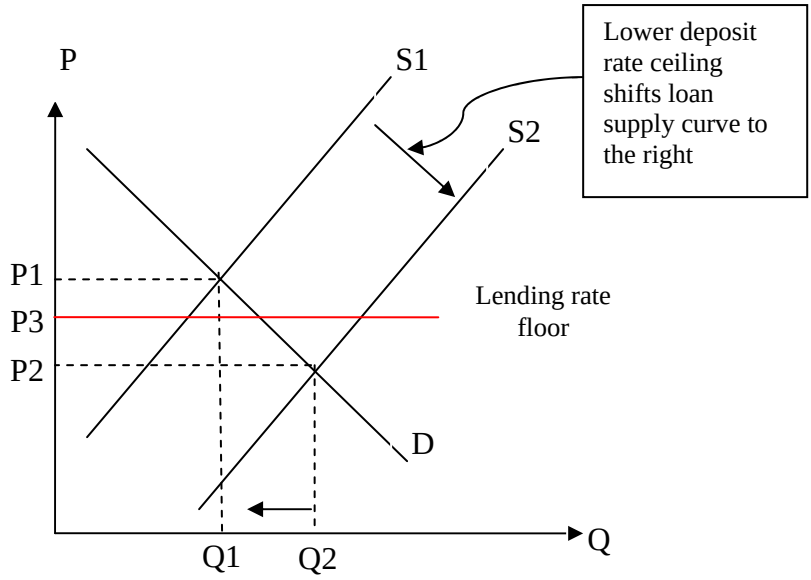


Figure 2. The Issuing Rate and the Market Rate

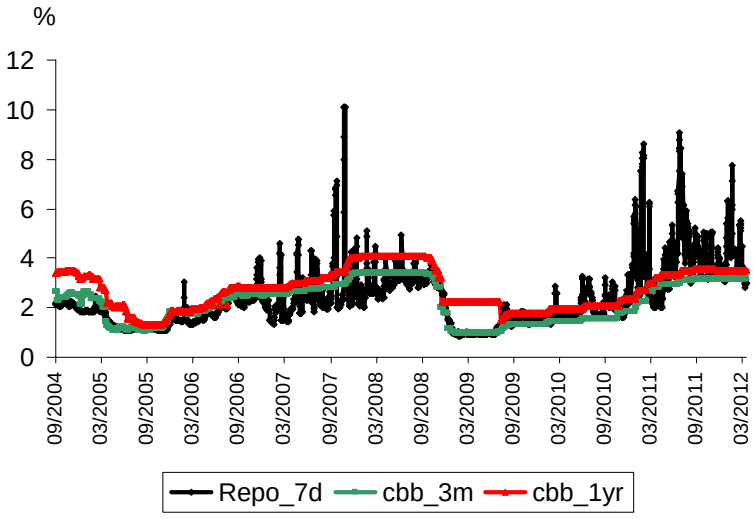
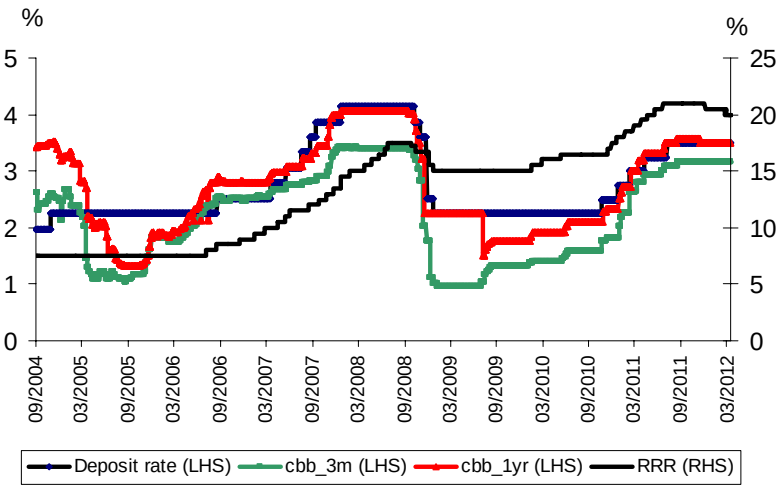


Figure 3. Correlations between the Issuing Rates and Other Policy Instruments



Appendix A. The Theoretical Model

The Benchmark Scenario: no deposit rate ceiling or lending rate floor

As we discussed in the Section 3.1, the profit maximization function for bank i can be written as

$$\Pi_i = \underset{Li,Di,Bi}{Max}\{r_l L_i + r_r \alpha D_i + r_b B_i + r_{nr}(D_i - L_i - \alpha D - B_i) - r_d D_i - C(D_i, L_i)\} \quad \text{(A.1)}$$

First-order conditions with regard to L_i, D_i and B_i are as follows:

For L_i, $$r_l = r_{nr} + C_L^{'}(D_i, L_i) \quad \text{(A.2)}$$

where $C_L^{'}(D_i, L_i)$ is the first derivative of the cost function with respect to L_i, i.e., the marginal managing cost of loans.

For D_i, $$\alpha \cdot r_r + (1-\alpha) r_{nr} = r_d + C_D^{'}(D_i, L_i) \quad \text{(A.3)}$$

where $C_D^{'}(D_i, L_i)$ is the first derivative of the cost function with respect to D_i, i.e., the marginal managing cost of deposits.

For B_i, $$r_{nr} = r_b \quad \text{(A.4)}$$

Equation (A.4) shows that the interest rates on central bank bills must be at least equal to the risk-free market rates (for example, the treasury-bond yield); otherwise, no bank would buy central bank bills voluntarily.

Because we need the cost function $C(D_i, L_i)$ to be strictly convex and twice continuously differentiable, the cost function $C(D_i, L_i)$ is as follows:

$$C(D_i, L_i) = \frac{1}{2}(\delta_{D_i} D_i^2 + \delta_{L_i} L_i^2) \quad \text{(A.5)}$$

where δ_{D_i} and δ_{L_i} are positive constants representing various marginal costs for bank *i*. Substituting the cost function into equations (A.2) and (A.3) and solving the first-order conditions results in functions for the supply of loans and the demand for deposits.

Loan supply function for bank i: $L_i^s = (r_l - r_{nr}) / \delta_{L_i}$ (A.6)

Deposit demand function for bank i: $D_i^d = [\alpha(r_r - r_{nr}) + r_{nr} - r_d] / \delta_{D_i}$ (A.7)

The key to this model is to determine the interest rate in the non-regulated market, r_{nr}, which is determined by the equilibrium in the non-regulated market and is exogenous to each bank. From equation (2), we see that NR_i is the net amount of funds that a bank invests or borrows from the outside. The total net position of banks in money and bond market is $\sum_{i=1}^{N} NR_i$, which could be positive or negative (the banking system lends capital to/ borrows capital from the money and bond market as a whole). On the other hand, in the money and bond market, funds do not originate solely in the banking system; governments and firms also invest in or borrow from the market. Therefore, to clear the non-regulated market, the following is required:

$$\sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) = T(r_l, r_{nr}) \quad \text{(A.8)}$$

where $S(r_d, r_{nr})$ is the supply of funds by the non-bank sector in the non-regulated market, which is a function of r_d and r_{nr}. $T(r_l, r_{nr})$ is the demand for funds by the non-bank sector in the market, which is a function of r_l and r_{nr}. Now, we can proceed to find the competitive equilibrium in the banking sector and the non-regulated market.

Loan market: $L^d(r_l) = \sum_{i=1}^{N} L_i^s = \sum_{i=1}^{N} (r_l - r_{nr}) / \delta_{L_i}$ (A.9)

Deposit market: $D^s(r_d) = \sum_{i=1}^{N} D_i^d = \sum_{i=1}^{N} [\alpha(r_r - r_{nr}) + r_{nr} - r_d] / \delta_{D_i}$ (A.10)

Non-regulated market: $\sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) = T(r_l, r_{nr})$ (A.11)

Using the expression for NR_i in equation (2), equation (A.11) can be written as

$$F(\cdot) = \sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) - T(r_l, r_{nr}) = \sum_{i=1}^{N} [(1-\alpha)D_i - L_i - B_i] + S(r_d, r_{nr}) - T(r_l, r_{nr}) \quad \text{(A.12)}$$

The equilibrium interest rate in the non-regulated market can be determined when the interest rate r_{nr} clears the market.

In this case, the monetary authority does not impose any ceiling or floor on deposit and loan rates. Therefore, deposit and loan markets are all cleared by market forces. In the banking loan market, the equilibrium loan rate r_l^* can be determined as follows:

Loan demand: $$L^d(r_l) = (AD - \lambda_l r_l) \tag{A.13}$$

where AD represents the aggregate demand for loans and λ_l denotes the price sensitivity of loans.

Loan supply: $$\sum_{i=1}^{N} L_i^s = \sum_{i=1}^{N} (r_l - r_{nr})/\delta_{L_i} \tag{A.14}$$

Since the loan market is a competitive market and each bank is a price taker, the equilibrium loan rate and loan level can be written in the following way: [12]

$$r_l^* = h(AD, r_{nr}, \lambda, \delta_L) = \frac{\delta_L AD + N r_{nr}}{N + \delta_L \lambda_l} \tag{A.15}$$

$$L^* = \frac{N(AD - \lambda_l r_{nr})}{N + \delta_L \lambda_l} \tag{A.16}$$

Therefore, $\frac{\partial r_l^*}{\partial r_{nr}} = \frac{N}{N + \delta_L \lambda_l} > 0$ and $\frac{\partial L^*}{\partial r_{nr}} = \frac{-N\lambda_l}{N + \delta_L \lambda_l} < 0$ since δ_L >0 and λ_l >0.

The above results indicate that the equilibrium loan rate r_l^* has a positive relationship with r_{nr}, while the quantity of loans decreases with r_{nr} when all markets are determined by market forces.

Similarly, in the deposit market:

Deposit supply: $$D^s(r_d) = AS + \lambda_d r_d \tag{A.17}$$

[12] For simplicity here, we assume that $\delta_{L_i} = \delta_L$ and that $\delta_{D_i} = \delta_D$.

where AS represents the aggregate savings in the economy and λ_d denotes the price sensitivity of deposits.

Deposit demand: $$\sum_{i=1}^{N} D_i^d = \sum_{i=1}^{N} [(1-\alpha)r_{nr} + \alpha r_r - r_d]/\delta_{D_i} \quad \text{(A.18)}$$

Similarly, the equilibrium deposit interest rate and deposit amount can be written in the following way:

$$r_d^* = \frac{N[(1-\alpha)r_{nr} + \alpha r_r - \delta_d AS]}{N + \delta_d \lambda_d} \quad \text{(A.19)}$$

$$D^* = \frac{N[AS + \lambda_d(1-\alpha)r_{nr} + \alpha\lambda_d r_r]}{N + \delta_d \lambda_d} \quad \text{(A.20)}$$

Therefore, $\frac{\partial r_d^*}{\partial r_{nr}} = \frac{(1-\alpha)N}{N + \delta_L \lambda_d} > 0$ and $\frac{\partial D^*}{\partial r_{nr}} = \frac{N\lambda_d(1-\alpha)}{N + \delta_L \lambda_d} > 0$ since δ_d >0 and λ_d >0.

The above results indicate that the equilibrium loan rate r_d^* also has a positive relationship with r_{nr} and that the quantity of deposits increases with r_{nr} when all three markets are determined by market forces.

In the non-regulated (money and bond) market, r_{nr} is determined by:

$$\sum_{i=1}^{N} NR_i + S(r_d, r_{nr}) = T(r_l, r_{nr}) \quad \text{(A.21)}$$

It can also be proved that: $\partial r_{nr} / \partial \alpha$ >0 and $\partial r_{nr} / \partial B > 0$ (the Proof can be found in Appendix A in He and Wang (2012)).

Scenario 2: The deposit rate ceiling is binding, and the lending rate floor is not binding

When there is a deposit ceiling imposed in the banking sector, bank *i* maximizes its profit as follows:

$$\Pi_i = \underset{Li,Di,Bi}{Max}\{r_l L_i + r_r \alpha D_i + r_b B_i + r_{nr} NR_i - r_d D_i - C(D_i, L_i)\} \quad \text{(A.22)}$$

st. $r_d \le r_d^b$

where r_d^b is the deposit rate ceiling. Given that the deposit is binding and the lending rate is not binding, the profit maximization function changes as follows:

$$\Pi_i = \underset{Li,Di,Bi}{Max}\{r_l L_i + r_r \alpha D_i^s(r_d^b) + r_b B_i + r_{nr} NR_i - r_d^b D_i^s(r_d^b) - C(D_i, L_i)\} \quad \text{(A.23)}$$

Note that, here, the deposit function is determined solely by the supply of savings, and therefore, D^s is a function solely of r_d^b. In the capital wholesale market, the supply function $S(r_d^b, r_{nr})$ is also a function of r_d^b, where r_d^b is exogenous and is determined by the central bank.

In the loan market, $$L^d(r_l) = \sum_{i=1}^{N} L_i^s = \sum_{i=1}^{N} (r_l - r_{nr})/\delta_{L_i} \quad \text{(A.24)}$$

In the deposit market, $$D^s(r_d^b) < D^d(r_d^b) \quad \text{(A.25)}$$

In the interbank market, $$\sum_{i=1}^{N} NR_i + S(r_d^b, r_{nr}) = T(r_l, r_{nr}) \quad \text{(A.26)}$$

Since the lending rate floor is not binding in this case, r_l^* still clears the loan market as we discussed in Case 1 as follows:

$$r_l^* = r_{nr} + C_L^{'}(D_i, L_i) \quad \text{(A.27)}$$

$$r_l^* = h(AD, r_{nr}, \lambda, \delta_L) = \frac{\delta_L AD + N r_{nr}}{N + \delta_L \lambda_l} \quad \text{(A.28)}$$

$$L^* = \frac{N(AD - \lambda_l r_{nr})}{N + \delta_L \lambda_l} \quad \text{(A.29)}$$

From the above equations, we can see that the lending price and quantity in a competitive banking sector will depend on several variables: r_{nr} (the capital price in a free capital market), AD (the aggregate demand for loans in the economy), δ_L (the managing cost in the banking sector) and λ_l (the price sensitive for banking loans). Changes of monetary policy instruments are not likely to affect AD, δ_L and λ_l directly, but they do affect r_{nr} directly in this scenario. Intuitively, changes of

deposit rate ceiling (r_d^b) by the central bank will affect r_{nr} (see equation A.28), and the impact will spill over to the lending rate (r_l) through r_{nr} (see equation A.28).

The above hypothesis can be proved:

$$\frac{\partial r_l^*}{\partial r_d^b} = \frac{\partial r_l^*}{\partial r_{nr}} \frac{\partial r_{nr}}{\partial r_d^b} > 0 \quad \text{since } \frac{\partial r_l^*}{\partial r_{nr}} > 0 \text{ and } \frac{\partial r_{nr}}{\partial r_d^b} > 0. \tag{A.30}$$

Similarly, we can get:

$$\frac{\partial r_l^*}{\partial \alpha} = \frac{\partial r_l^*}{\partial r_{nr}} \frac{\partial r_{nr}}{\partial \alpha} > 0 \text{ and } \frac{\partial r_l^*}{\partial B} = \frac{\partial r_l^*}{\partial r_{nr}} \frac{\partial r_{nr}}{\partial B} > 0 . \tag{A.31}$$

$$\frac{\partial L^*}{\partial r_d^b} < 0 , \frac{\partial L^*}{\partial \alpha} < 0 \text{ and } \frac{\partial L^*}{\partial B} < 0 . \tag{A.32}$$

The above results indicate that raising the deposit rate ceiling (r_d^b) increases r_{nr} and that the impact will pass to the lending rate (r_l) through r_{nr} . Raising the RRR and issuing more central bank bills also increases r_{nr} and r_l . Similarly, it is easy to see that loan size decreases with the benchmark deposit rate and the RRR (Proof can be found in Appendix B in He and Wang (2012)).

Appendix B. What Does the Sample Look Like?

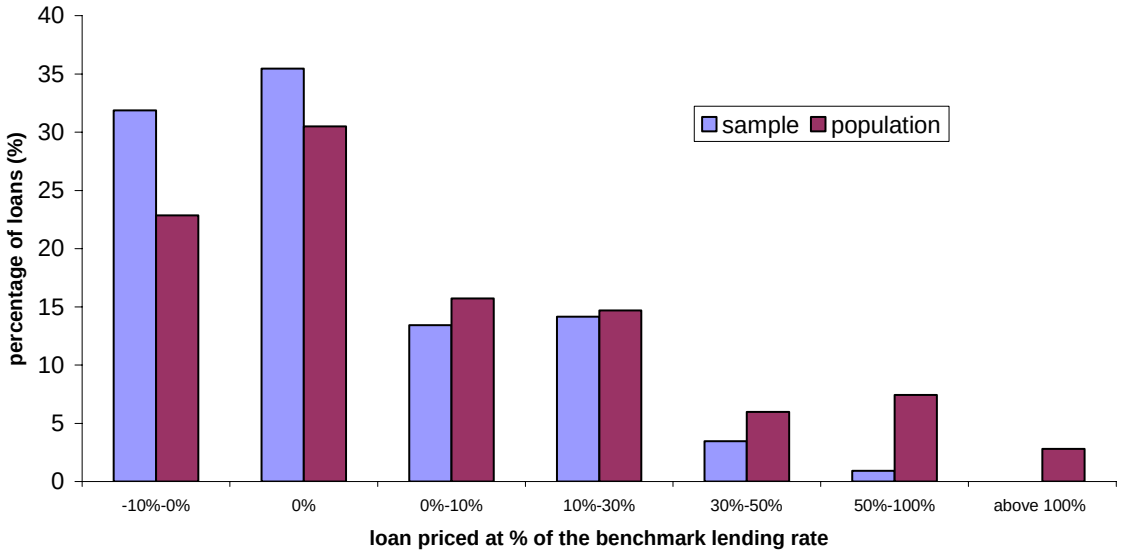
B.1 How Representative is the Sample?

Figure A1 presents a comparison of two distributions in the sample and the population, which is a spread distribution of all bank loans that were published by PBC from 2008Q1 to 2011Q4 (detailed numbers can be found in Table A1 and Table A2). As expected, the spread distribution of the sample is slightly skewed to the left compared with the population, which indicates that banks do not charge very high spreads (for example, a spread over 100% of the benchmark rate) to listed firms in the sample. However, the missing part in the sample, compared with the population, is less than 4% of total loans over time in the sample (the last column in Table A2), suggesting that the skewness has little impact on the estimation.

On the other hand, the pattern of the spread distribution in the sample is consistent with that of the population: most loans are priced at the benchmark or below the benchmark in both the sample and the population (Figure A1). In our sample, more than 60% of loans are priced below or at the benchmark (Columns 3 and 4, the last row in Table A1), while less than 5% of loans are priced at 50% above the benchmark. In the population, the pattern is similar: most loans are priced at either the benchmark rate or close to the benchmark, and only approximately 10% of loans are priced at 50% above the benchmark.

Moreover, the time pattern of the spread distribution is similar between the sample and the population. For example, when the financial crisis broke out in 2008Q3, the share of loans that were priced below the benchmark decreased significantly in both the population and the sample. The share increased again in both the population and the sample when the market conditions stabilized after 2009. From the above discussions, we can conclude that the sample represents the population reasonably well and that the results derived from this sample are applicable to the whole Chinese banking sector.

Figure A1. Distribution of Loan Spread: Sample Vs. Population



B.2 What Can We Observe from the Spread Distribution Over Time?

First, the most significant feature of the spread distribution is that most loans (over 60%) are priced at or below the benchmark, and this pattern seems stable over time. Second, banks tend to charge higher spreads when the market conditions are tight. For example, in the last quarter of 2008, the share of loans that were priced between 30% and 50% of the benchmark increased from less than 5% to 22% when the global financial crisis shocked the Chinese banking sector (Table A1, the last two columns). The share decreased sharply when the market conditions relaxed as Chinese authorities acted quickly to launch the 4-trillion yuan stimulus plan. Third, banks tended to charge higher risk premiums to listed firms during the financial crisis. For example, between 2008Q4 and 2010Q3, more listed firms had to borrow loans priced above 50% of the benchmark (Columns 7 and 8, Table A1), which suggests that the financial conditions of those firms deteriorated significantly during the crisis.

B.3 What Can We Learn from the Loan Size Distribution Over Time?

Table A3 shows that the loan size in the sample is almost normally distributed: the sample includes both small-sized loans and large-sized loans, with the majority between 10 million RMB and 70 million RMB. The distribution of loan size is relatively stable over time compared with variations in loan rates, although there are still some observable patterns, as shown in Table A3. After the global financial crisis, the share of small-sized loans (loan size less than 30 million RMB) declined persistently between 2008Q3 and 2009Q4, implying that banks tended to lend more to large firms when market was tight, which is consistent with anecdotal observations by market analysts. This pattern can also be observed from the number of loans that were larger than 200 million RMB: the share accounted for only approximately 2% of total loans before 2008Q4 but increased to approximately 9% on average after 2009 (the last column in Table A3), which helps explain where the bank credits were allocated after the crisis.

B.4 What Types of Banks Make Loans in the Sample?

Even though the big four banks still dominated bank lending during the sample period, their share declined sharply from almost 90% prior to 2007 to less than 60% in 2011 (Table A4, Column 2), which is consistent with findings in the literature (Allen et al. 2012; Fu and Heffernan 2009). Joint-venture banks, such as the Bank of Communications and China Merchants Bank, grew very quickly, and their market share exceeded 20% by the end of 2011. The market share of foreign banks has not increased, however, and remains less than 1%. Local city commercial banks have also grown substantially in recent years, suggesting that such banks include not only small local firms but also relatively large, listed firms.

B.5 Loan Maturity and Firm Size

Firms in the sample borrow loans mostly at maturities of between 1 year and 5 years, with only less than 5% of loans being shorter than 1 year (Table A5, Row 1). This result suggests most loans in the sample are used for medium- and long-term projects such as fixed asset investments. Moreover, as previously discussed, listed firms are relatively large, and the data confirm this: more than 80% of firms in the sample have total assets of above 1 billion RMB, and just a handful of firms have total assets of less than 100 million RMB (Table A5, Row 2). The relatively large firm size and the left skewness of loan rates in the sample indicate that banks tend to charge lower loan rates to larger firms, suggesting that smaller firms tend to pay higher loan prices. Table A6 provides summary statistics of other variables for our sample.

Table A1. Distribution of Loan Rate in the Sample

Time	Total loans	Share of loans priced at 10% below the bench mark	Share of loans priced at the bench mark	Share of loans priced at 10% above the bench mark	Share of loans priced at 10%-30% above the bench mark	Share of loans priced at 30%-50% above the bench mark	Share of loans priced at 50%-100% above the bench mark	Share of loans priced at 100% above the bench mark
Prior to 2007	265	36.0	52.3	8.0	2.7	1.5	0	0
2007Q1	146	19.9	58.2	6.8	12.3	2.7	0	0
2007Q2	296	44.3	22.6	17.2	15.2	0.7	0	0
2007Q3	108	28.7	28.7	2.8	36.1	3.7	0	0
2007Q4	566	56.4	14.0	6.4	21.0	1.8	0	0
2008Q1	175	20.0	51.4	7.4	20.6	0.6	0	0
2008Q2	461	43.6	38.2	6.3	11.5	0.4	0	0
2008Q3	205	11.7	52.7	5.9	28.3	1.5	0	0
2008Q4	730	11.1	11.6	17.3	33.8	22.1	4.1	0
2009Q1	636	23.9	47.3	16.8	8.5	2.2	1.3	0
2009Q2	1111	31.4	32.4	13.6	11.6	7.0	4.0	0
2009Q3	752	30.7	46.1	15.0	5.7	1.5	0.9	0
2009Q4	1093	28.4	40.2	12.9	10.7	7.0	0.8	0
2010Q1	577	39.9	36.2	17.5	5.4	0.9	0.2	0
2010Q2	846	34.9	34.4	16.4	9.8	4.3	0.2	0
2010Q3	330	30.0	42.7	13.0	8.8	2.1	3.3	0
2010Q4	1053	57.5	17.4	12.5	1.0	0.4	0	0
2011Q1	253	26.1	36.8	17.0	19.8	0.4	0	0
2011Q2	1138	52.5	22.7	17.6	7.1	0.1	0	0
2011Q3	179	18.4	35.8	15.1	27.9	2.8	0	0
2011Q4	953	49.6	21.6	10.5	15.9	2.3	0	0
Full sample	11873	36.9	31.6	13.5	12.7	3.8	0.9	0

Table A2. Distribution of the Loan Rate for the Population (Published by PBC)

Time	Share of loans priced at 10% below the benchmark (the floor)	Share of loans priced at the benchmark	Share of loans priced at 10% above the benchmark	Share of loans priced at 10%-30% above the benchmark	Share of loans priced at 30%-50% above the benchmark	Share of loans priced at 50%-100% above the benchmark	Share of loans priced at 100% above the benchmark
2008Q1	26.0	32.6	16.8	14.3	4.9	4.8	0.6
2008Q2	20.8	30.8	16.8	15.4	6.7	8.1	1.5
2008Q3	20.7	30.8	17.0	15.3	6.9	7.6	1.8
2008Q4	24.1	30.7	14.5	13.8	6.3	7.8	2.7
2009Q1	27.0	34.4	13	11.2	4.7	6.9	2.9
2009Q2	28.2	33.2	12.6	10.9	5.1	7.1	2.9
2009Q3	31.8	31.2	12.6	10.2	4.9	6.5	2.8
2009Q4	31.2	30.6	11.9	10.7	5.2	7.1	3.3
2010Q1	32.7	30.7	12.6	9.6	4.7	6.3	3.4
2010Q2	26.8	30.5	14.4	11.7	5.7	7.3	3.5
2010Q3	26.1	29.7	14.9	12.3	5.4	7.4	3.9
2010Q4	27.3	30	14.2	12.1	5.3	7.7	3.6
2011Q1	18.1	30.5	17.5	15.9	6.2	8.4	3.2
2011Q2	11.3	28.4	19.9	21.4	7.3	8.6	2.9
2011Q3	7.1	25.9	21.6	25.1	8.3	8.9	2.9
2011Q4	6.4	27.8	21.4	24.7	8.1	8.4	3.0

Note: Before 2008, figures in Col. 4 included loans priced at 10% above the benchmark. The quarterly data after 2008 are derived from monthly data using monthly loans as weights.

Source: CEIC and authors' calculations.

Table A3. Distribution of Loan Size in the Sample

Time	Total loans	Loan size less than 1 million RMB	Loan size between 5 and 10 million RMB	Loan size between 10 and 30 million RMB	Loan size between 30 and 70 million RMB	Loan size between 30 and 70 million RMB	Loan size between 70 and 200 million RMB	Loan size larger than 200 million RMB
Prior to 2007	265	1.1	10.2	18.5	28.3	30.2	9.8	1.9
2007Q1	146	0	11.0	27.4	30.1	17.8	12.3	1.4
2007Q2	296	1.0	13.2	17.2	32.8	16.6	19.3	0
2007Q3	108	0	25.9	18.5	33.3	13.9	8.3	0
2007Q4	566	0.2	18.0	21.6	35.2	15.4	8.7	1.1
2008Q1	175	0.6	11.4	22.3	25.1	14.3	21.1	5.1
2008Q2	461	1.1	12.8	22.8	36.9	13.2	10.8	2.4
2008Q3	205	0	13.2	19.0	39.0	15.1	11.2	2.4
2008Q4	730	0	10.8	19.3	30.1	17.8	16.8	5.1
2009Q1	636	0.8	6.6	16.2	34.0	17.0	17.5	8.0
2009Q2	1111	0.7	9.7	17.1	29.6	16.9	18.6	7.3
2009Q3	752	0.4	7.7	11.7	35.2	19.4	18.0	7.6
2009Q4	1093	1.5	6.6	10.1	28.7	21.6	21.0	10.5
2010Q1	577	0.7	7.8	15.3	26.2	10.6	21.8	7.6
2010Q2	846	1.9	7.3	14.3	26.4	20.7	19.5	9.9
2010Q3	330	4.5	11.5	20.6	28.8	15.2	15.5	3.9
2010Q4	1053	1.7	8.5	14.4	29.4	20.3	16.3	9.2
2011Q1	253	0.8	3.6	16.2	32.0	27.3	13.8	6.3
2011Q2	1138	1.5	6.3	13.1	27.1	19.8	20.2	12.0
2011Q3	179	1.1	14.0	19.6	26.8	21.2	11.7	5.6
2011Q4	953	0.4	5.5	10.8	27.8	22.1	21.9	11.4
Full sample	11873	1.0	9.0	15.6	30.6	18.7	17.6	7.5

Table A4. What Kinds of Banks Make Loans in the Sample

Time	Total loans	Big 4 banks	Joint-venture banks	Foreign banks	Rural credit union	City banks	Private credit firms	Other financial firms	Development banks	Others
Prior to 2007	265	87.2	8.3	0	1.1	1.1	0.02	1.1	1.1	0
2007	1116	75.4	13.5	0.2	3.0	4.5	0.02	0.1	2.3	0.9
2008	1571	77.0	9.4	0.4	2.6	3.9	0.02	0.6	5.3	0.6
2009	3592	67.0	15.5	1.2	2.8	5.6	0.02	2.4	4.6	0.7
2010	2806	63.2	17.9	0.6	2.9	7.1	0.02	1.8	5.5	1.0
2011	2518	57.7	20.7	0.8	3.1	6.6	0.02	1.8	7.9	1.3
Full sample	11868	66.7	16.0	0.7	2.8	5.7	0.02	1.6	5.3	0.9

Table A5. Loan Maturity and Firm Size

Sample	Number of loans	Loan maturity less than 1 year	Loan maturity between 1 year and 2 year	Loan maturity between 2 years and 3 years	Loan maturity between 3 years and 5 years	Loan maturity between 5 years and 10 years	Loan maturity larger than 10 years
Full sample	11873	4.3%	23.5%	17.1%	28.9%	17.5%	8.7%
	Number of observations	Firms' total assets less than 100 million RMB	Firms' total assets between 0.1 and 1 billion RMB	Firms' total assets between 1 and 5 billion RMB	Firms' total assets between 5 and 10 billion RMB	Firms' total assets between 10 and 100 billion RMB	Firms' total assets larger than 100 billion RMB
Full sample	11873	0.04%	15.2%	48.4%	15.3%	15.0%	6.1%

Table A6. Summary of Statistics

Name of variables	Mean	St. dev.	Min	Max	Obs
Loan rate (%)	6.15	0.98	4.73	9.83	11873
Loan size (million rmb)	72.6	140.9	0.003	3200	11873
Benchmark deposit rate (%)	2.78	0.66	1.98	4.14	11873
Benchmark lending rate (%)	6.08	0.76	4.86	7.83	11873
RRR (%)	16.3	2.82	6.0	21.0	11873
7-day Repo rate (%)	2.84	1.86	0.87	10.1	11873
Overnight Repo rate (%)	2.30	1.48	0.81	8.83	11869
Maturity (year)	3.90	3.89	0.20	25	11873
Bank type (1-9)	2.03	2.01	1	9	11862
Collateral (0-1)	0.76	0.42	0	1	11873
Fixed asset investment growth (%)	27.0	4.18	19.8	62.6	11873
Loan growth year-on-year (%)	20.0	6.87	12.7	34.0	11873
Inflation (%)	2.95	2.82	-1.53	8.1	11873
FX purchase position (trillion rmb)	19.1	4.21	2.09	25.4	11873
Return of equity (%)	6.45	25.1	-744.4	151.8	11164
Total liquid asset (billion rmb)	3.14	8.33	0.004	249.8	11201
Total asset (billion RMB)	6.72	12.88	0.004	261	11212
Debt-to-asset ratio (%)	57.9	17.6	4.36	196.8	11201
Equity-to-debt ratio (%)	3.13	19.4	0.04	1282.3	11161
Profit margin(%)	14.4	21.5	-405	248	11204
Total employment (person)	4496	10294	18	183317	11640