# Shadow Banking and the Bank Lending Channel of Monetary Policy in China *

Xiaoqiang Cheng† Yabin Wang‡

August 2019

**Abstract**

The dramatic increase in shadow banking activities in China in recent decade has channeled a large amount of credit to borrowers outside of the normal regulatory framework, potentially affecting the bank lending channel of monetary policy in China. Using a novel database of 33 listed banks' shadow banking involvement and a battery of monetary policy indicators from 2011 to 2018, we find strong evidence that shadow banking dampens the effectiveness of monetary policy, especially for medium-sized banks that are the most aggressive in expanding shadow activities. We further explore the underlying mechanism using a rich dataset on bank-issued negotiable certificates of deposit, and find that shadow banking increases banks' credit ratings and lowers the sensitivity of banks' funding cost to monetary policy. These findings are consistent with a model where the bank lending channel depends on banks' balance sheet health (as in Disyatat (2011)) and banks use shadow banking to shift riskier assets off balance-sheet.

**Keywords: Shadow Banking, Monetary Policy, Wealth Management Products, Bank Lending Channel in China**

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†Hong Kong Monetary Authority *axcheng@hkma.gov.hk*

‡Hong Kong Monetary Authority *yabin.wang.econ@gmail.com*

# 1 Introduction

Shadow banking in China has grown rapidly in the past decade, from less than 5% of total GDP in 2007 to nearly 25% of GDP at the end of 2018.[1] According to conservative estimates, bank-related shadow activities are 22 trillion RMB at the end of 2018.[2] As banks have moved on-balance sheet lending and credit intermediation off their balance sheets, a large amount of credit has been channelled to borrowers outside of normal regulatory framework, contributing to the rapid decline in the share of traditional loans as a percentage of total social financing in China since 2009 (Figure 1).

These changes in China's banking system raise concerns not only about financial stability but also about the effectiveness of standard monetary policy tools: shadow banking may have changed the way banks grant traditional loans, thus affecting the bank lending channel (BLC) of monetary policy. Several pioneering studies suggest that the emergence of shadow banking in China was an unintended consequence of monetary and banking policy (Hachem and Song (2017), Gu and Yun (2019),Chen et al. (2017b), Acharya et al. (2019), Chen et al. (2018)). Yet very few studies have looked at whether and how shadow banking activities feed back into the effectiveness of monetary policy on traditional banking. Using bank-level data, in this paper we show that higher involvement in shadow banking activities weakens the BLC of monetary policy. We further provide evidence about a potential mechanism: banks move riskier loans off the balance sheet, thus lowering the interest-sensitivity of their market-based funding cost.

To formulate our research hypotheses, we develop a tractable theoretical model of the bank lending channel with shadow banking based on Disyatat (2011). In this framework, the BLC arises because monetary policy affects banks lending by changing banks' market-based funding cost. Banks have to offer higher yield for market-based funding in light of a policy tightening in order to match a higher return creditors could get from an alternative investment opportunity. In turn, banks optimally charge higher rates on loans to firms and this reduces loan demand. While the original model of Disyatat (2011) focuses on the role of bank capital in reducing the interest-sensitivity of funding costs, we adopt this framework to study the role of banks' involvement in

[1]Shadow banking is defined as credit creation and maturity transformation that fall outside the realm of traditional regulated banking. While in the US shadow banking activities are more prominent among non-bank financial companies, as we discuss in later sections China's shadow banking is "bank-centric."

[2]This is equivalent to 12% of M2 or15% of bank loans in 2018.

shadow banking. Shadow banking activities provide banks a venue to move risky loans off their balance sheets. By doing so, banks are able to improve upon their risk profile (credit rating) as they no longer bear the risks from off-balance sheet shadow activities. This reduces the interest-sensitivity of bank's funding cost and, in turn, of the bank's lending rates. As a result, the bank lending channel is weaker for banks that engage more in shadow-banking.

To test these theoretical predictions, we first quantify the extent to which banks engage in shadow banking. We manually construct a shadow banking involvement indicator at the bank level by going through various years of listed banks' financial reports. We use the year-end balance of the off-balance sheet wealth management product (WMP) over the bank's total liability as a proxy for bank's involvement in the shadow banking activities. We show that the off-balance sheet WMP is a very good approximation of the total shadow lending extended by banks. Data on WMP is available for 33 listed banks from 2011 to 2018. Using this sample, we establish several stylized facts about the cross-sectional and longitudinal distribution of WMP. For instance, we show that non-state medium and small banks (such as joint stock commercial banks and city commercial banks) are more aggressive in shadow banking involvement as well as more risk-taking (offering much higher yields on their issuance of WMP) compared to state-owned big banks (the big four banks in China).

We then test how WMP and other banks' characteristics affect the responsiveness of loans to monetary policy. Our empirical specification uses a battery of price and quantity monetary policy indicators as proxies for monetary policy. Our empirical results from different policy variables on different types of banks suggest that banks with larger balance sheet (large asset), better capitalization, and higher liquidity tend to be less responsive to monetary policy, consistent with results from previous literature (Gambacorta and Marques-Ibanez (2011)). Our novel finding is that banks' involvement in off-balance sheet WMP issuance is consistently found to dampen the effectiveness of monetary policy. This dampening effect is stronger and more statistically significant for joint-stock commercial banks.

To validate the mechanism hypothesized in our BLC model, we then examine whether funding costs in wholesale (i.e. non-deposit) markets and their responsiveness to monetary policy are affected by banks' involvement in issuance of off-balance sheet WMP. In particular we focus on yields on negotiable certificates of deposit (NCD) issued by banks. We find evidence of a link between banks' shadow banking involvement and their funding cost, which is particularly strong

for small and medium banks, i.e. joint-stock, city and rural commercial banks. In this subsample, the funding cost of banks with larger WMP balances are less responsive to monetary policy. Our results on the funding costs and bank loans are consistent with the view that shadow banking affects the credit channel of monetary policy by altering the riskiness of the pool of loans on the bank's balance sheet (Disyatat (2011)). Indeed, we show that NCDs issued by banks with with larger WMP balances have better credit ratings. Finally, our collected data also include the bank-level balance of principal-guaranteed on-balance-sheet WMP, which provides a natural falsification test of our main hypothesis. Because banks bear the risk of principal-guaranteed WMP, this liabilities should not affect the bank lending channel. Consistent with this prediction of the model, we find that the amount of principal-guaranteed WMP is uncorrelated with the responsiveness of a bank's loans and funding costs to monetary policy.

Our paper contributes to the large literature on the transmission of monetary policy to the real economy. Since the seminal contribution of Bernanke and Blinder (1988) and Bernanke and Blinder (1992), many studies have shown that bank lending to firms is an important transmission mechanism of monetary policy. In the original framework of Bernanke and Blinder (1988), monetary policy induces quantitative changes in the deposit market, thus affecting deposit taking and loans. An alternative view, proposed by Bernanke et al. (2007) and Disyatat (2011) in recent years, emphasizes the increasing importance of market-based funding of banks and maintains that the BLC works through the impact of monetary policy on banks' external finance premium, which is determined by their perceived balance sheet strength and risk perception. While much of the empirical research on the BLC reviewed below has been premised very loosely on the traditional theory, our paper suggests market-based funding indeed plays an integral part in the monetary policy transmission mechanism.

The BLC has been empirically investigated using data from the US (see for example Kashyap and Stein (2000) and Kishan and Opiela (2006) among others), the Eurozone (e.g. Altunbaş et al. (2002), Gambacorta (2005), Halvorsen and Jacobsen (2016)) and in more recent years using data on emerging markets (e.g. Perera et al. (2014), Abuka et al. (2019)). Within this literature, two papers that have examined the role of banks' off-balance sheet activities are particularly relevant for our study. Using data on European banks, Altunbas et al. (2009) find securitization mitigates the BLC of monetary policy. Similarly, Perera et al. (2014) find that off-balance-sheet activities dampen monetary policy effectiveness using bank-level data from four southeast Asian

economies. The findings of these papers are consistent with the mechanism we uncover in our analysis: securitization and other off-balance sheet activities change the composition of the asset side of the bank's balance sheet, resulting in an improved risk-profile and a less interest-sensitive funding cost. Our paper adds to this line of the literature by providing direct evidence about this mechanism.

Our paper also contributes to the growing studies on the monetary policy transmission in China. As the monetary policy transmission channels in China have moved closer to those of Western market economies (Fernald et al. (2014)), bank lending has played an increasingly prominent role in China as well. Previous studies (such as Fungáčová et al. (2016), Yang and Shao (2016), Chen et al. (2017a), Chen et al. (2019), and Xiong (2013)) have tested whether monetary policy by the People's Bank of China (PBoC) affects bank lending, but the evidence is mixed. For example, Fungáčová et al. (2016) find the required reserve ratio (RRR) is an effective monetary policy instrument in China, but they did not find evidence that RRR affects loan growth through the BLC.

Finally, our paper is related to the recent literature on the interaction between monetary policy and shadow-banking in China. Several pioneering studies suggest that the emergence of shadow banking in China was an unintended consequence of stricter liquidity standards (Hachem and Song (2017), Gu and Yun (2019)), the large-scale stimulus plan in 2008 (Chen et al. (2017b), Acharya et al. (2019)) and contractionary monetary policy (Chen et al. (2018)). As remarked earlier, there is little discussion of whether and how shadow-banking has in turn affected the effectiveness of monetary policy. Chen et al. (2018) show that contractionary monetary policy during 2009-2015 caused shadow banking loans to rise rapidly, offsetting the expected decline of traditional bank loans and hampering the effectiveness of monetary policy on total bank credit. Our paper differs from Chen et al. (2018) in a number of ways, most importantly in the main research question. While their paper examines the endogenous response of shadow-banking to monetary policy, we study how shadow-banking affects the responsiveness of traditional (on-balance-sheet) lending to monetary policy. Another difference is that while Chen et al. (2018) focuses on loans with "shadow banking" features - namely on balance sheet account-receivable investments - we study the interaction of monetary policy and shadow banking as measured by banks' off-balance-sheet wealth management products.

The remaining of the paper is as follows. Section 2 outlines recent developments in shadow

banking in China with a special focus on the bank-issued wealth management products. This background provides a broad picture of the relevance and representativeness of our shadow banking measure thus the subsequent findings. Section 3 sketches a theoretical model in which WMPs affect the monetary policy transmission on bank loans and derives testable predictions. Section 4 describes various data sources descriptive statistics. Section 5 introduces econometric specifications and presents empirical evidence from bank lending and bank funding cost. Section 6 performs some robustness checks. Finally section 7 draws conclusions.

# 2 Wealth management products and shadow banking in China

This section briefly describes shadow banking in China, its scope and connection to WMP issued by commercial banks. We then document some stylized facts of bank-issued WMPs using manually-collected data from various years of banks' financial reports and product-level WMP data.

China's shadow banking has been growing rapidly since 2009 with an annual growth rate of 22%. The total growth has peaked around 2016, and currently stands at 22 trillion RMB as the end of 2018. Commercial banks have been playing an active leading role in this wave of shadow banking expansion, in the forms of bank-trust cooperation, bank-securities cooperation, bank-insurer cooperation as well as inter-bank transactions in more recent years. Figure 3 shows the trend using different measures of shadow banking. Because of the scopes of different measures vary, the numbers we obtain are also different, and one clear message is commercial banks are at the center of shadow banking activities.[3]

To get a more precise measure, we quantify the total shadow banking size from the source of funds and the use of funds. In particular, we focus on bank-related activities that channel credits from the source to the use of funds. As shown in Table 2, bank-issued wealth management products is the main source of fund. WMPs can be described as asset-backed deposits, which typically offer higher yield to depositors or investors than the deposit rates (deposits rates are

[3]Shadow banking in China is bank-centric and China's banks involvement in shadow banking activities takes the lion's share, whereas non-bank financial institutions are only a minor party of the financial system and do not account for the bulk of shadow banking activities ("China's Bank-Centric Shadow Banking System" (PIIE, 2 May 2013)).

capped with a ceiling, which was officially removed only recently in 2015). WMP funds are then channelled to non-bank financial institutions (asset management companies, trust companies and securities companies) that invest them in a range of assets including bonds, stocks, CDs (Municipal Corporate Bonds (MCB), interbank negotiable certificate of deposits) or purchase trust products and other banks' WMPs. The ultimate recipients of the funds are arguably some real estate and infrastructure projects, or other high risky projects that normally have limited access to the formal bank loans.[4]

# 3 A model of monetary policy effectiveness with shadow banking

In this section we present a model to explain how shadowing can affect monetary policy effectiveness through the BLC. Our model is based on Disyatat (2011) and formalizes the idea that "banks that rely more heavily on securitization may be less responsive to monetary policy because they are more likely to shift risky assets off balance-sheet (e.g., through SIVs), resulting in a less interest-sensitive asset portfolio" (Disyatat (2011), p. 731). [5] In order to illustrate the main mechanism and derive clear predictions, we focus on the interaction between the bank's assets and the market for funding, while abstracting from other aspects of banking, such as equity and deposits.

In our framework, banks earn profits by raising fundings from the wholesale markets at a gross rate $R_f$ and lending to firms at a gross rate $R_l$. On banks' funding side, banks pay back the funds they borrowed with a probability $p(\theta)$, i.e. the bank's solvency probability. It can also be interpreted as the credit rating of the bank's liabilities, which depends on the states of $\theta$: traditional banking ($\theta = TB$) and shadow banking ($\theta = SB$). The only difference between these two types of banks is that under shadow banking riskier loans are shifted off the bank's balance sheet.

Assume that there is no remaining net worth that lenders can claim in case of a bank default and that lenders of the funds have an alternative and risk-free investment strategy that lends to the money market at a rate $R_m$. Given no arbitrage condition, we can derive that the sensitivity

[4] WMPs are often used to fund Local Government Financing Vehicles (LGFVs), which are established to finance public real estate and infrastructure projects.

[5] SIVs represent structured investment vehicles, which are non-bank financial institutions established to earn a credit spread between the long-term assets held in their portfolio and the short-term liabilities they issued. They are often established as offshore companies and kept off the balance-sheet of the banks that set them up.

of the funding cost to money market conditions is *inversely* related to the bank's credit rating:

$$R_f = \frac{R_m}{p(\theta)} \tag{1}$$

On banks' lending side, they are faced with two firms differentiated with default probabilities: safe firm repays its loans with probability $\overline{p}$ and the risky one with probability $\underline{p}$, and $\overline{p} > \underline{p}$. Loan demand of each firm is described by the same function of the lending rate, $L(R_l)$. [6] If the firm repays the loan, the bank obtains $R_l$ and pays $R_f$ on the amount equal to the bank lending to the firm. If the firm defaults, the bank loses the amount of funds loaned to that firm but can in turn default on its own interest payments on those funds.

To determine the equilibrium in the loan market, we assume the bank has market power and chooses the lending rates to maximize its expected profits. [7] We consider two cases:

*Case 1*: Under traditional banking, the bank hold loans to both safe and risky firm on the balance sheet and the total bank loans are equal to $2 \times L(R_l)$ and are allocated to the two firms in equal shares. Thus, bank's expected profits are:

$$\pi(\theta = TB) = p(TB) \cdot (R_l - R_f) \cdot 2L(R_l)$$

where $p$ is the probability that the bank's average asset will pay off and is given by:

$$p(\theta = TB) = \frac{\overline{p} + \underline{p}}{2}$$

*Case 2*: Under shadow banking, the bank moves its riskier loans off the balance sheet and receives a revenue $x$ from the trust company that holds the riskier loans. [8] Thus, the bank's expected profit is:

$$\pi(\theta = SB) = p(SB) \cdot (R_l - R_f) \cdot L(R_l) + x$$

Given that under shadow banking, only loans to safe firm with high repayment probability are left on the bank's balance sheet and therefore the probability that the bank's average asset will pay

[6] We denote the first and second derivative of the loan demand function by $L'(R_l)$ and $L''(R_l)$ respectively. At the end of this section we discuss the assumption that the two firms have the same demand function.

[7] As mentioned before we assume there is no equity for simplicity.

[8] Risky loans are shifted to the lightly regulated shadow banking institutions mainly trust companies, brokerages and insurance companies, which have become a vital source of credit, allowing banks to arrange off-balance-sheet refinancing for risky loans. Trust companies sell WMP to raise funds so they can purchase loans that banks want off their books. MWPs are then marketed through bank branches as a higher-yielding alternative to traditional bank deposits. "In China, off-balance-sheet lending risks lurk in the shadows" (Reuters, April 8, 2013)

off is simply:

$$p(\theta = SB) = \overline{p}$$

For both $\theta \in \{TB, SB\}$ profit maximization implies the optimal lending rates depend on the funding cost according to the first-order condition (F.O.C.):

$$L(R_l) + (R_l - R_f)L'(R_l) = 0 \tag{2}$$

The BLC arises because monetary policy affects money market rates, money market rates affect the bank's funding cost, which in turn affects lending rates and thus loan demand. Given that $R_m$ can be used as a broad measure of monetary policy, we can denote the derivative $\left|\frac{\partial L}{\partial R_m}\right|$ as the strength of the bank lending channel, as it measures the responsiveness of loans to money market conditions. The strength of the BLC is thus given by:

$$\underbrace{\frac{\partial L}{\partial R_m}}_{\text{strength of the BLC}} = \underbrace{\frac{\partial L}{\partial R_l}}_{\text{(A)}} \underbrace{\frac{\partial R_l}{\partial R_f}}_{\text{(B)}} \underbrace{\frac{\partial R_f}{\partial R_m}}_{\text{(C)}} \tag{3}$$

Equation (3) shows the strength of the BLC depends on (A) the responsiveness of loan demand to the lending rate, (B) the sensitivity of lending rates to funding costs, and (C) the sensitivity of funding costs to money market conditions.

We can derive expressions for the last two terms on the right-hand side of equation (3) using equation (2) and equation (1) respectively. We can then rewrite the BLC strength equation (3) as:

$$\frac{\partial L}{\partial R_m} = L'(R_l)\frac{L'(R_l)}{2L'(R_l) + (R_l - R_f)L''(R_l)}\frac{1}{p(\theta)}$$

To derive clearer results, we adopt a linear specification of the loan demand function:

$$L(R_l) = \alpha - \beta R_l$$

so that $L'(R_l) = -\beta$ and $L''(R_l) = 0$. Then the strength of the BLC is:

$$\left|\frac{\partial L}{\partial R_m}\right| = \frac{\beta}{2}\frac{1}{p(\theta)}$$

This equation shows that the strength of the BLC is inversely related to the bank's solvency probability.

At this stage, we are ready to derive predictions about the effect of shadow banking. By moving the riskier asset off the balance sheet, the bank now obtains a higher credit rating:

$$p(\theta = SB) = \overline{p} > \frac{\overline{p} + \underline{p}}{2} = p(\theta = TB) \qquad \textit{Hypothesis 3}$$

Because the sensitivity of the funding cost to money market conditions is inversely related to the bank's credit rating (see equation (1)), shadow banking lowers the sensitivity of the funding cost to money market conditions, as follows:

$$\frac{\partial R_f(\theta = SB)}{\partial R_m} = \frac{1}{p(SB)} < \frac{1}{p(TB)} = \frac{\partial R_f(\theta = TB)}{\partial R_m} \qquad \textit{Hypothesis 2}$$

It also follows that shadow banking weakens the BLC:

$$\left|\frac{\partial L(\theta = SB)}{\partial R_m}\right| = \frac{\beta}{2p(SB)} < \frac{\beta}{2p(TB)} = \left|\frac{\partial L(\theta = TB)}{\partial R_m}\right| \qquad \textit{Hypothesis 1}$$

Note that we derive the last prediction (corresponding to the Hypothesis 1 below) conditional on the assumption of an identical and linear loan demand function for safe and risky firms. The prediction may fail under different functional forms. Rather than deriving more general conditions under which this prediction would hold, we treat it as a hypothesis to be empirically tested. To sum up, the effects of shadow banking can be summarized in the following three hypotheses:

**Hypothesis 1.** *Shadow banking weakens the bank lending channel.*

**Hypothesis 2.** *Shadow banking lowers the sensitivity of the funding cost to money market conditions.*

**Hypothesis 3.** *Shadow banking increases the bank's credit rating.*

In the empirical section, we will test the model predictions and the underlying mechanism.

# 4 Data

## 4.1 Monetary policy data

The monetary policy framework in China consists of price-based and quantity-based monetary policy tools. The quantity-based tool refers to the required reserve ratio. While this ratio mostly fixed in the US, in China the required reserve ratio is used much more frequently, and serves as an important monetary policy tool to affect bank lending and liquidity. We thus choose the RRR as one of our proxies of monetary policy (Figure 5). The price-based monetary tools include the rate of Standing Lending Facility (SLF), which is comparable to the US discount window rate, the interest rate paid on excess reserve, and the interest rate paid on required reserve. Unlike

the discount rate, the other two rates are rarely changed in China. The PBoC exercises its rate control on the banking sector by setting the benchmark lending rate and benchmark deposit rate. However because interest rates are not fully liberalized in China, these two benchmark rates do not necessarily reflect the true market liquidity. In recent years, the PBoC started to emphasize the role of money market rates as intermediate policy targets, especially the 7-day interbank repo rate for depository institutions (DR007), which would be a perfect candidate for policy rate but is only available from 31 May 2017. We choose instead the money market rate 7-day interbank repo rate for all financial institutions (R007) as one of our proxies for policy rate. It is the 7-day repurchase rate pledged on interest rate bonds by deposit-taking institutions and other financial institutions on China's interbank market. There are two series of R007, fixing rate and weighted average rate. The fixing R007 (FR007) is a bit lower than the weighted average and less volatile. We compute the average of daily R007 within each quarter and this makes the two series nearly identical. Another important money market rate that we use in our analysis is the Shanghai Interbank Offered Rate (SHIBOR). The SHIBOR and the R007 rate differ in several ways. First, the SHIBOR is submission-based and thus does not reflect actual transaction prices. Moreover, R007 is the repo rate for banks using policy bonds and treasury bills as pledge and therefore does not include credit risk. On the contrary, SHIBOR may also price credit risk. Finally, we use a measure of monetary policy based on lending rates. Instead of using the benchmark lending rate set by PBoC which is adjusted infrequently, we use the weighted average lending rate of RMB loans issued by financial institutions, as it is more accurately reflecting the true borrowing cost.[9] Figure 4 shows the quarterly hange of price-based monetary policy indicators (together with a narrative policy stance taken from Sun (2013)).

## 4.2 Bank loan growth and bank-specific data

The Chinese banking system is composed by banks differentiated in type of ownership and size among many other dimensions. Our sample covers the majority of listed banks, among which there are 4 state-owned banks, 10 joint-stock commercial banks, 15 city commercial banks and

[9]The PBoC introduced prime loan lending rate based on 6 member banks as part of the financial liberalization process. However this series is new, and include only 6 member banks. Based on data published by the PBoC,as of the end of September 2018, 13.64% of total loans from financial institutions are priced the same as the benchmark lending rate 34.05% of total loans are priced 30% higher than the benchmark lending rate (Liu et al. (2019)).

3 rural commercial banks. Bank-specific data are obtained from the WIND Financial Terminal with other key variables taken directly from banks' financial reports at a quarterly frequency. For each bank, we compute the following time-varying variables. Bank size is constructed as the log of banks' total asset, capital ratio is measured by the ratio of the bank's capital to asset, and liquidity denotes the share of liquid asset in total asset. In particular, banks' liquid assets denote the sum of cash and due from banks, due from central banks, due from other credit institutions, lending to banks and other financial institutions, and financial asset at fair value. For some of the smaller banks whose financial reports are only available at a half-yearly frequency (especially in early sample years of 2012 and 2013), we use linear interpolation for the missing variables.

### 4.3 Banks' shadow banking involvement data

As mentioned in section 2, there are various ways to measure the size of shadow banking in China - from the use of the fund side and from the source of fund side. We collect data on bank-issued wealth management products (WMP) as they are the source of fund for shadow activities. This variable provides us with an accurate measure of shadow banking involvement at the bank level.

We construct a bank's exposure to shadow banking as its year-end outstanding balance of principal-floating WMPs as a percentage of the bank's total liability. Since the WMP's principal is not guaranteed by the bank, the related risks are not borne by the bank and therefore the total amount of outstanding WMP does not have to be reported as a liability item on the bank's balance sheet (similarly the use of WMP and its investment asset class are not reported in the asset side of banks' balance sheets). Nonetheless, following the regulatory rules set out by the CBRC in XX, banks are required to list the outstanding amount of principal-floating WMP in their annual financial report under the item of "Involvement with Unconsolidated Structured Entities". The term "unconsolidated structure entities sponsored by the bank group" means that the bank group does not consolidate and does not have an interest in it during the reporting year. The nature and purpose of these structured entities are to generate fees from managing assets on behalf of investors, and are financed through the issuance of units to investors. Non-principal-guaranteed WMPs is one major type of such unconsolidated structured entities sponsored by the bank group.[10] We

[10]Under this item, banks report the aggregated amount of the non-principal guaranteed wealth management products sponsored and issued by the bank group after 1 January but matured before 31 December of the year, as well as the total outstanding amount of assets held by the unconsolidated non-principal-guaranteed WMPs, which

manually collect this variable from various years of banks' annual reports. Since most banks only report the outstanding non-principal-guaranteed WMPs in their annual report starting in 2011 (except for a few state-owned banks reporting on a half-yearly basis), we use yearly frequency for the WMPs and our sample spans from 2011 to 2018.

Figure 3 provides the trend of bank-issued non-principal guaranteed WMP for different type of banks over 2011-2018. To make it comparable, we scale it using the bank's total liability. Two key observations emerge. First, the growth of WMPs over liability ratio took off since 2011 and peaked by the end of 2016. Second, small and medium-sized banks are much more aggressive in issuing WMPs given their size. While big state banks total exposure is less than 10%, joint-stock commercial banks' outstanding WMPs have reached over 25% of their total liabilities, though in recent year the scale has cooled down to 20%. Smaller banks such as city and rural commercial banks' total exposure to WMPs are ranked in the middle.

## 4.4 Banks' funding cost data

Banks can tap into the deposit market or non-deposit wholesale markets for funds. In China, the Negotiable Certificates of Deposit (NCD) issued by banks are a major funding source for banks in the wholesale market. They are certificates of fixed-term deposit issued by depository institutions in the interbank market. The interbank NCD market has experienced dramatic growth since its official inception in December 2013 and reached 9.8 trillion RMB at the end of 2018. It has a relatively high credit quality, as guaranteed by issuing banks, high secondary market liquidity and reasonable premium over the risk-free benchmark offered by government bonds. The typical issuers of NCDs are smaller joint-stock commercial banks, while the buyers are large state-owned banks (Amstad and He (2019)). The product-level NCD data can be obtained from the WIND Financial Terminal. Banks' funding cost is constructed as the NCD spread, that is the at-issue yield minus the yield of 6-month treasury bills.

## 4.5 Summary statistics

Our sample consists of observations at a quarterly frequency from 2011 to 2018 using mainly listed banks. As of end-2018, there are 45 listed banks in China, but only 35 of them provide data on principal-floating WMPs. Banks with abnormally large or small loan growth rate (capped at the

are sponsored by the bank group.

top and bottom 1 percentile) or extreme high volatility in loan growth (top 99th percentile) have been dropped. This leaves us with 33 banks including the big 4 state-owned banks, 10 joint-stock commercial banks, 19 city and rural commercial banks. Table 1 gives a brief description of the sample banks (see Table 3 for bank list summary).

Chinese banks are well capitalized and liquid, with an average regulatory capital ratio of 7% and average liquid-to-total deposits ratio of 21%. The typical bank funds its assets with the following mix of sources: 69% through deposits, 7% through shareholders' equity, 4% through market funding (primarily domestic interbank funding), and 22% through other sources. The average bank holds 44% of its assets in loans. The average bank's actual reserve ratio (required reserves+cash+excess reserves at the central bank) is 19%.

# 5 Empirical strategy and results

## 5.1 Shadow banking and bank lending channel

We start by first plotting the loan growth response curve by parting banks into high WMP and low WMP holding groups (top vs. bottom 15th percentile). Figure 6 shows that a higher degree of shadow banking involvement is associated with a flattening of the loan growth response curve to monetary policy change (RRR in this case), i.e. bank's loan growth is less sensitive to policy rate change if its current balance of WMP is high. Yet this graphical evidence cannot be directly interpreted as an application to our theory, as it may potentially mix both cross-sectional and within-bank variations. To construct the figure, we treat each bank-quarter observation as an individual independent observation and pool all the observations together, so it is possible that banks that have issued more WMP are fundamentally different from banks that have issued less WMP (e.g. a medium-sized joint-stock bank and a small rural commercial bank may face different lending opportunities), thereby the difference embedded in the bank type may explain their responsiveness to monetary policy change even without the shadow banking channel we proposed. Thus, to establish a direct test of our theory of shadow banking involvement on monetary policy effectiveness, we need to strip the cross-sectional variation out of the evidence and focus on the within-bank variation.

### 5.1.1 Estimation strategy

To do so, we implement our within-bank estimation strategy to control for differential changes in banks' lending opportunities by including bank fixed effects ($\lambda_i$). Any unobserved time-invariant bank heterogeneity is therefore captured by bank fixed effects. To account for shifts in credit demand, we control for unobserved time-varying demand shocks that are common to all firms by including year fixed effects. [11] Our baseline specification is therefore the following panel regression:

$$\text{Loan growth}_{i,t} = \alpha \Delta mp_t + \boldsymbol{\beta} X_{i,t-1} + \boldsymbol{\delta} X_{i,t-1} \Delta mp_t + \lambda_i + \text{Year FE} + \varepsilon_{i,t} \tag{4}$$

Because most of our variables have a quarterly frequency, the time index $t$ represents quarter $q$ in year $y$. The dependent variable, Loan growth$_{i,t}$, is calculated as the log change in bank $i$'s loans between quarter $q$ in year $y-1$ and quarter $q$ in year $y$. We use year-over-year changes to mitigate seasonality effects. $\Delta mp_t$ is the contemporaneous change in a monetary policy measure. We will run a different regression for each of the monetary policy measures introduced above. In each of these regression, the coefficient $\alpha$ captures the average sensitivity of bank loan growth to changes in monetary policy.

The regression controls for a set of observable time-varying bank characteristics $X_{i,t-1}$. This includes balance sheet variables, such as bank's size, capital ratio and liquidity that are traditionally used in studies on the bank lending channel (for example Kashyap and Stein (2000), Kishan and Opiela (2006), Ehrmann 2001, 2003, Fungáčová et al. (2016)). These variables are constructed using banks' quarterly financial reports. Our study extends this standard framework by including in $X_{i,t-1}$ also a bank's off-balance sheet exposure to shadow banking activities, proxied by off-balance sheet WMPs over total liabilities. Because we only observe this variable with a yearly frequency, observations from different quarters within the same year have the same WMP value (for a given bank). Bank characteristics are lagged one quarter relative to the quarter of the policy change and are normalized with respect to their sample means. By normalizing or centering the bank-specific variables, we make the results more meaningful and easy to interpret without changing the model prediction. For example, the main effect of bank size can be interpreted as the effect of bank size on a bank who has average liquidity, capitalization and shadow banking involvement. [12]

[11] Similar results could be obtained by substituting the year fixed effects with macroeconomic variables such as the GDP growth rate and the CPI changes (Kashyap, Stein and Wilcox, 1993, Bernanke and Gertler 1989).

[12] The coefficients of the interaction terms are therefore directly interpretable as the effect of monetary policy on

The coefficients in $\boldsymbol{\beta}$ measure the effect of bank characteristics on loan growth. The key estimate is however the coefficient vector $\boldsymbol{\delta}$ as this captures how different bank-specific characteristics change the sensitivity of bank loan growth to monetary policy. In particular, assuming monetary policy has a negative effect on loan growth ($\alpha < 0$), a positive (negative) $\delta_{wmp}$ coefficient would indicate a mitigating (intensifying) effect of banks' exposure to shadow banking on monetary policy. Note that in our fixed-effect estimation framework, we are comparing the same bank in different periods and estimating whether more involvement in shadow banking activities in some period causes the bank to respond more or less to policy changes.

Finally the standard errors are clustered at the bank-year level to take into account that unobserved error terms are correlated within the same bank, as well as that observed common macroeconomic factors may affect all banks in the same year. We run the same regression specification using both quantity-based and price-based measures of monetary policy, and for different types of banks as well.

### 5.1.2 Results

Table 4 shows that most of monetary policy measures we tested have a significant effect on bank loans growth. With the exception of the change in 7-day repo rate, other measures have negative coefficients, statistically significant at the 1-5% level. Larger banks (in terms of larger total asset size) and banks with larger WMP balances tend to have higher loan growth rates. Moreover, larger banks are less responsive to monetary policy ($\delta_{size} > 0$). This empirical finding is consistent with the evidence from US bank data (e.g. Kashyap and Stein (2000), Kishan and Opiela (2006)). A larger size gives banks more flexibility in responding to monetary policy either because of better diversification or because bank asset size is a good proxy for an implicit too-big-to-fail guarantee. More importantly, the $\delta_{wmp}$ coefficients are positive and significant in three of our regressions. This indicates that banks holding higher balance of outstanding WMP experience a weaker bank lending channel, as predicted by our model.

To examine if the results from our baseline regression hide heterogeneity across different types of banks, we rerun regression (4) for each of the following three subsamples: state-owned banks, joint-stock commercial banks and a subsample including city and rural commercial banks. Tables 5, 6 and 7 report the results. The RRR is found to be most effective for smaller banks such as city

bank loan supply for banks with average size, capitalization, liquidity and shadow banking exposure.

and rural commercial banks. This suggests that smaller banks are potentially more constrained by liquidity therefore respond more to the change of reserve requirement. The change of 7-day repo rate and 7-day SHIBOR are both effective in affecting loan growth, and the results are more prominent for joint-stock commercial banks. In general, results from different policy variables on different type of banks suggest that banks with larger balance sheets, more capital, and higher liquidity tend to be less responsive to the change of the selected policy variables, though some of these results are significant only for certain types of banks. As regards the effect of banks' involvement in off-balance sheet WMP issuance, we find that our earlier result is driven by joint-stock commercial banks: only in this subsample WMP issuance dampens the effectiveness of monetary policy (at significance levels between 1% and 5%).

## 5.2 Shadow banking and bank's funding cost

One key finding from the baseline model is that joint-stock commercial banks that engage in more shadow banking activities are less responsive to monetary policy changes. To further explain the finding, we turn to the funding side of banks.

### 5.2.1 Estimation strategy

To test for the hypothesized channel, we now examine the relationship between off-balance sheet WMP, the credit rating of banks' NCD and the responsiveness of NCD yields to monetary policy. First, we directly study whether the sensitivity of a bank's funding cost to monetary policy is affected by the bank's WMP balance by running the following regression:

$$\begin{aligned}\text{Spread}_{i,t} =& \gamma_1 \text{MP}_t + \gamma_2 \text{WMP}_{i,t-1} + \gamma_3 log(\text{Issue amount})_{i,t} + \gamma_4 \text{Banksize growth}_{i,t} \\ &+ \gamma_5 \text{Maturity}_{i,t} + \theta \text{MP}_t \text{WMP}_{i,t-1} + \text{Year FE} + \varepsilon_{i,t}\end{aligned} \tag{5}$$

The variable $\text{Spread}_{i,t}$ is the difference between the NCD at-issue yield and the yield on 6-month Treasury bills. As above, $\text{MP}_t$ and $\text{WMP}_{i,t-1}$ are monetary policy measure and the lagged percentage WMP balance. We add other explanatory variables that contribute to the determination of NCD yields, namely the NCD issue amount, the growth in the size of the issuing bank and the NCD maturity. We expect higher monetary policy rate increase the NCD spread, that is $\gamma_1 > 0$. Our main parameter of interest is $\theta$: a negative $\theta$ implies that higher involvement in off-balance sheet WMP issuance reduces the influence of policy rate on banks' funding cost.

To further test whether our findings are consistent with the mechanism hypothesized in our model, we also adopt an alternative method, consisting of two steps. In the first step, we test whether a better NCD credit rating lowers the NCD yield and weakens its responsiveness to monetary policy. In the second step, we test whether indeed a higher exposure to shadow banking activities on the part of the issuing bank is associated with a better NCD credit rating. Thus our first-step regression is:

$$\begin{aligned}\text{Spread}_{i,t} =&\alpha_1 \text{Credit rating}_{i,t} + \alpha_2 \text{Maturity}_{i,t} + \alpha_3 log(\text{Issue amount})_{i,t} \\ &+ \alpha_4 \text{Banksize growth}_{i,t} + \text{Year FE} + \varepsilon_{i,t}\end{aligned} \tag{6}$$

and our second-step regression is:

$$\begin{aligned}\text{Credit rating}_{i,t} =&\beta_1 \text{WMP}_{i,t-1} + \beta_2 \text{Banksize growth}_{i,t} + \beta_3 \text{CAR}_{i,t} + \beta_4 \text{ROA}_{i,t} \\ &+ \beta_5 \text{LDR}_{i,t} + \beta_5 \text{banksize}_{i,t} + \text{NPL ratio}_{i,t} + \text{Year FE} + \varepsilon_{i,t}\end{aligned} \tag{7}$$

### 5.2.2 Results

Results from the first approach are summarized in Tables 8, 9 and 10. Table 8 shows results from a regression with RRR as monetary policy indicator, while Table 9 reports the results for the specifications using SHIBOR and the repo rate as monetary policy variables. Finally, Table 10 shows results from different subsamples. As shown by Table 8 and 9, contractionary monetary policy increases NCD spreads (positive significant coefficient on all $\gamma_1$), regardless of whether the policy indicator is a more volatile money market rate or a less frequently deployed RRR. The outstanding WMP amount increases the NCD's at-issue spread, which may reflect banks' in need of liquidity in general. We find that the estimated coefficient $\theta$ on the interaction term is negative and significant: the funding cost for banks with higher involvement in non-principal-guaranteed WMP is less sensitive to monetary policy change. Further subsample analysis in Table 10 suggests that the dampening effects are stronger among small and medium-sized banks, i.e. joint-stock banks, who face a relatively lower funding cost in case of a drop in deposits following a monetary tightening. This echoes our earlier findings for joint-stock banks displaying strong mitigating effect of monetary policy with shadow banking.

Results from the second approach are summarized in Table 11 and 12. Table 11 presents the results on determinants of the interbank NCD pricing. Column (1), (2) and (3) report results from the full sample, while column (4), (5) and (6) report results from state-owned banks, joint-stock

commercial banks, and city/rural commercial banks respectively. We find that bank risks are reflected in the initial pricing of interbank NCDs, i.e. rating scores negatively affect NCD's yield spread in both the full sample and all the sub-samples. Longer maturities and larger issuance amount tend to increase the at-issue yield spread, although the effect of issuance amount is more significant for joint-stock commercial banks. Adding monetary policy rate into the determinants of NCD's spread (column (2)) shows that the interbank NCD pricing positively moves with monetary policy rate, proxied by 7-day shibor, without changing other findings. In column (3) banks' zscore is added. Zscore is a proxy usually used as a measure for bankruptcy likelihood, the higher the zscore, the less likely to default. Similar to the findings on credit rating, zscore also negatively affect NCD's initial pricing, although with only marginal significant level.

Table 12 shows results from our second-step regression. After controlling for bank-specific variables that may affect the bank's credit rating, such as capital adequacy ratio, return on asset, loan-to-deposit ratio, non-performing loan ratios and bank size, we find that there is a positive interaction between banks' holding of WMP and the credit rating of the NCD issued by the bank. This relationship is significant for small and medium-sized banks, i.e. joint-stock, city and rural commercial banks, which suggests that banks (especially SMB) with higher involvement in non-principal-guaranteed WMP may be perceived as less riskier by the market. Taken together with the first step results, these estimates strongly suggest there is a clear link between banks' shadow banking involvement, banks' credit rating and their funding cost thus the ability to rely on alternative funding source. In particular, the evidence from such a link is stronger for small and medium banks, i.e. joint-stock, city and rural commercial banks.

Our results on the funding costs are consistent with the view that shadow banking affects the credit channel of monetary policy in part by altering the riskiness of bank loans (Disyatat). First, by issuing WMP banks can add riskier projects or remove some of their riskier projects. Second, given that the WMP is off-balance sheet and that bank lenders believe that banks do not bear the risk for it. (Bank may also use it to finance some of the riskier loans that were previously on balance sheet). That is, banks move the most risky loans off the balance sheet. As a result, the average loan on the balance sheet of the bank is now less risky. It then follows that more WMP decreases average riskiness of the bank and thus will dampen the credit channel on bank loans. The fact that dampening effects are observed along both the asset side (loans) and liability side of the bank is circumstantial evidence that the shadow banking credit channel is operative.

# 6 Robustness

## 6.1 Falsification test using on balance sheet WMP

Our key findings of the shadow banking credit channel works only if the WMP are not guaranteed by the bank and the bank's creditors in the wholesale market believe that the bank does not bear the risk of its off-balance-sheet WMP. To test this mechanism, we exploit a special feature of the current banking system. Besides offering principal-floating products, banks currently also provide principal-guaranteed WMP to their clients as a means of shoring up funding sources. As its name suggests, banks offer explicit guarantees on these products. As principal-guaranteed WMP are issued and guaranteed by banks, they are on banks' balance sheet. Thus, even if banks reallocate the funding of riskier loans from regular deposits to principal-guaranteed WMP, the overall risk does not change and is still reflected by banks' balance sheet total exposure. Whether the WMP is on the balance sheet or off-balance sheet should have very different implications: on-balance-sheet WMP should not weaken the bank lending channel.

To test this counterfactual prediction, we collected data on banks' issuance of principal-guaranteed WMP. [13] We then replace principal-floating WMP with the principal-guaranteed WMP in a regression that is otherwise identical to the baseline specification (4). Results are collected in Table 13 and Table 14. Table 13 presents the results for the full sample using different measures of monetary policy changes. Table 14 shows results for joint-stock commercial banks only. The key finding in these tables is that principal-guaranteed WMP does not weaken the bank lending channel, contrary to our earlier finding on off-balance-sheet WMP.

# 7 Conclusion

The fast development of shadow banking in China is part of the post-GFC global trend, as over-lending and risk-taking behavior of banks globally are fueled by prolonged easing monetary policy environment. Although China had arguably successfully prevented an immediate economic slow-down at the time by employing a large-scale economic stimulus, "the 4 Trillion RMB stimulus plan," initiated by the State Council in 2008, many unintended effects have arisen in the years

[13] Although the principal-guaranteed WMP are no longer allowed as banks' on-balance sheet business under the new rule set out in mid-2018 by the regulators (http://m.safe.gov.cn/safe/2018/0427/8876.html), the transition period is until the end of 2020, and banks take time to change their business models.

after. The burgeoning shadow banking sector is one of the these ripple effects. The ability of commercial banks to move credit intermediation off the balance sheet affects their lending decisions and thus it is important to understand how it interacts with monetary policy.

We provide evidence using a novel dataset on banks' shadow banking involvement and banks' market-based funding and draw two main substantive conclusions. First, shadow banking activities led mostly by commercial banks have altered the model of how financial system works, and hamper the effect of monetary policy. Second, banks alter their balance sheet strength and risk perception by engaging in shadow activities, thus affecting the interest-sensitivity of their funding cost. These findings support the view that the bank lending channel of monetary policy works through banks' reliance on the market-based funding in nowadays banking system.

Figure 1: Share of bank loans to total social financing (%)

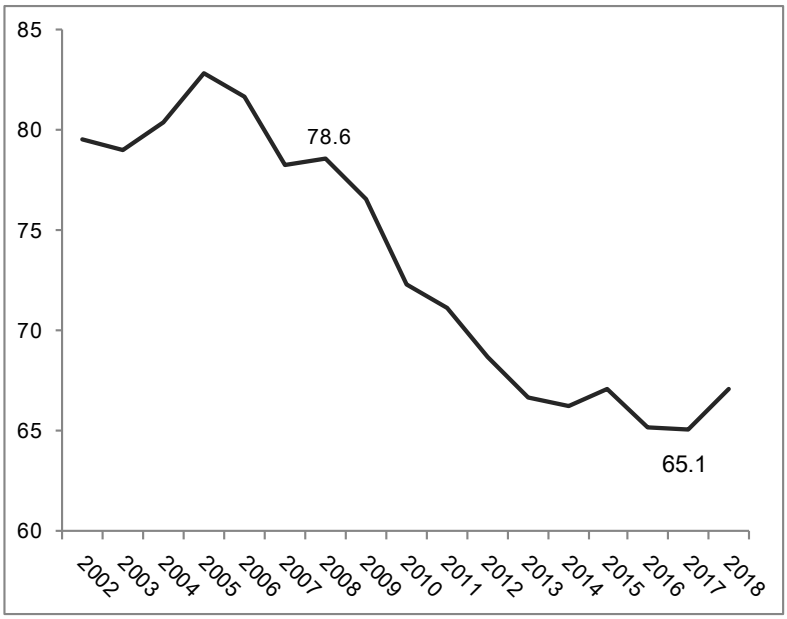


Figure 2: Shadow banking size by different measures

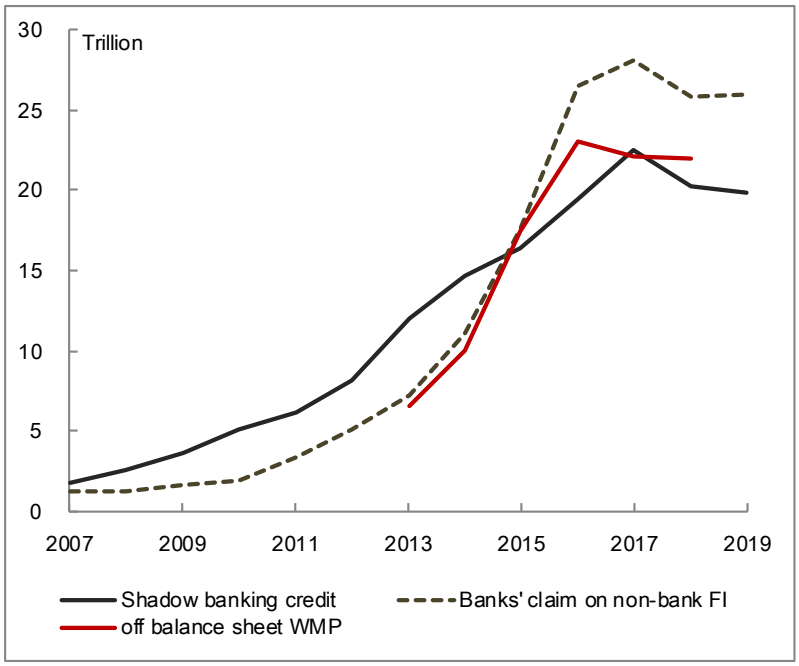

Figure 3: Bank-level off-balance-sheet WMP: by bank type

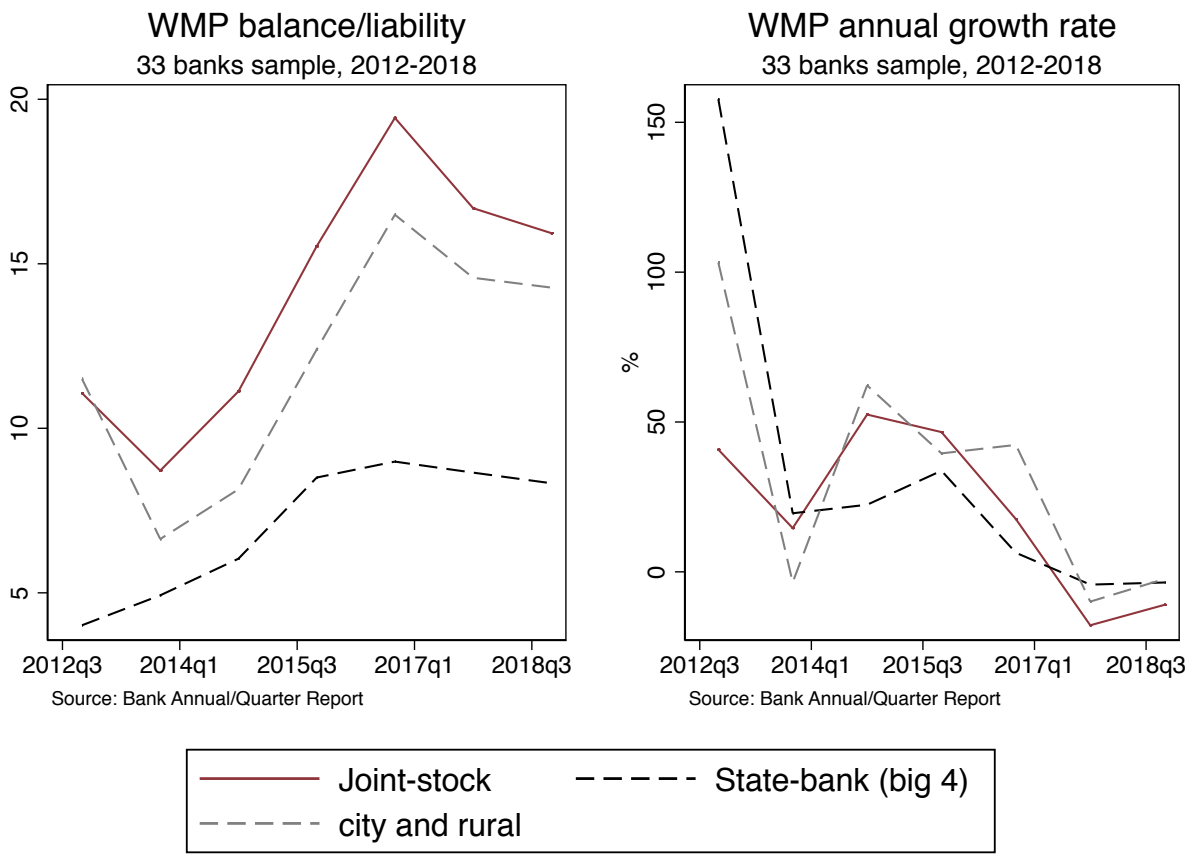

Figure 4: Price-based monetary policy indicators

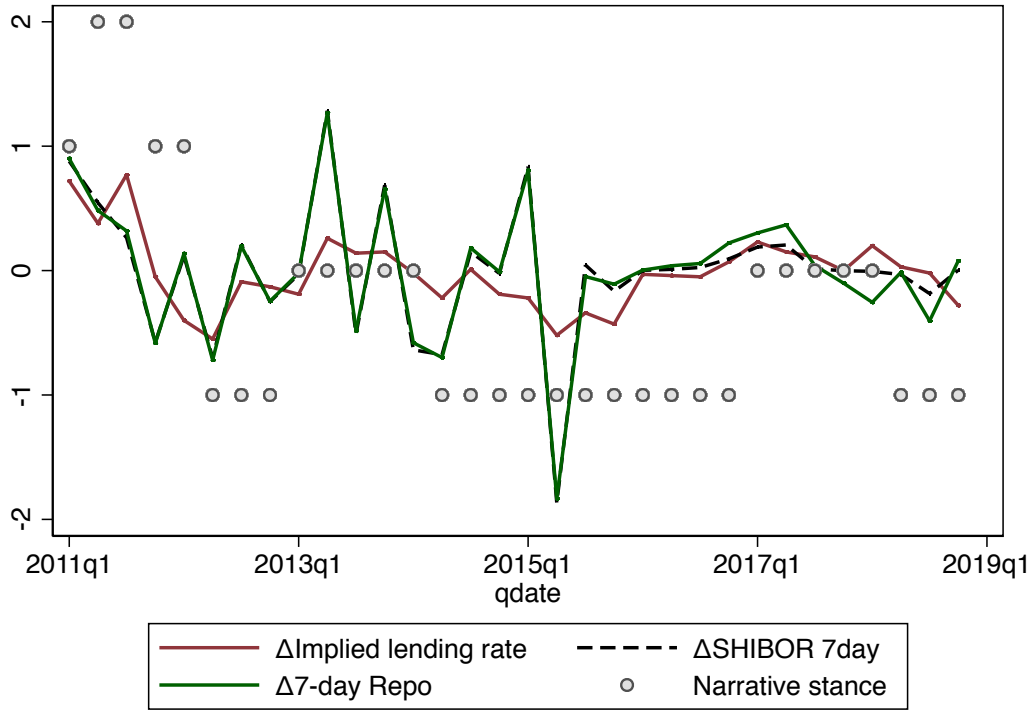


Figure 5: Quantity-based monetary policy change - required reserve ratio

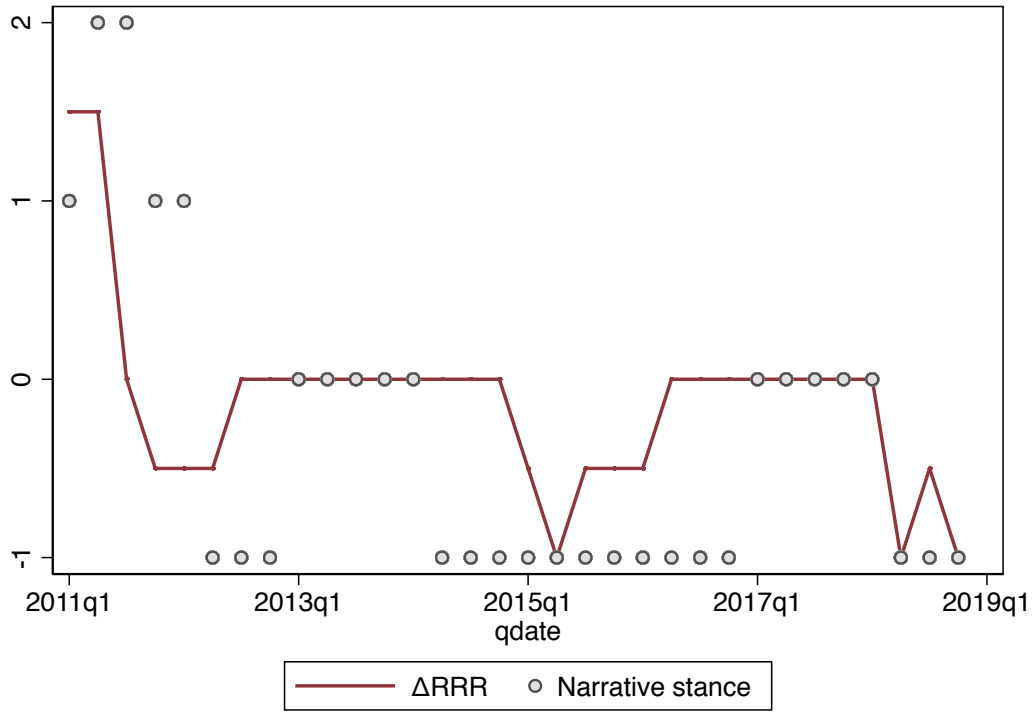

Figure 6: Loan growth sensitivity to monetary policy: by level of WMP

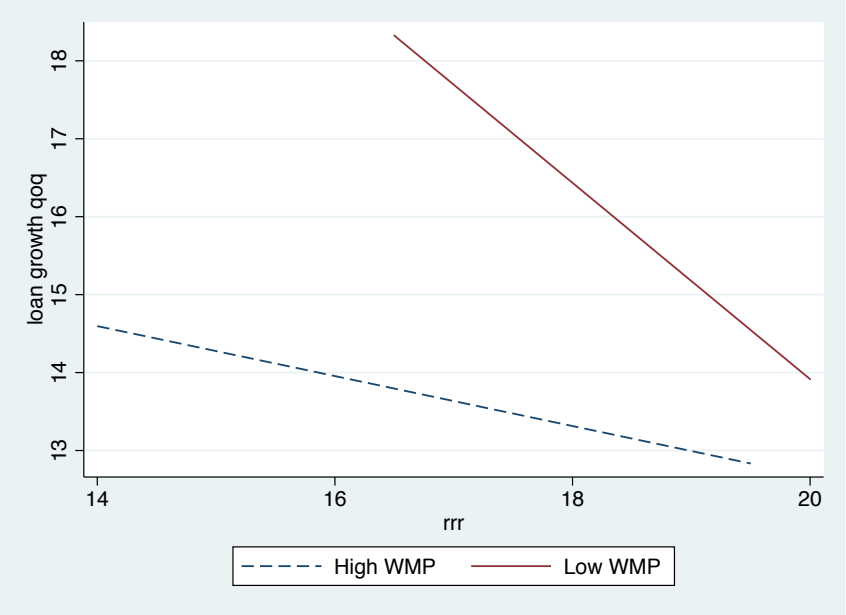


Table 1: Summary statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| deposit_share | 1106 | 0.69 | 0.10 | 0.43 | 0.93 |
| equity_share | 1106 | 0.07 | 0.01 | 0.02 | 0.10 |
| interbank_share | 1060 | 0.02 | 0.01 | 0 | 0.09 |
| others_share | 1060 | 0.22 | 0.10 | .013 | 0.48 |
| pfbal_liab | 852 | 13.7 | 8.53 | 0.09 | 45.43 |
| pgbal_liab | 792 | 3.9 | 4.78 | 0 | 52.52 |
| loan_asset | 1103 | 44.18 | 8.07 | 22.62 | 61.86 |
| loanqoq | 1035 | 15.27 | 5.91 | 1.5 | 53.92 |
| arr | 1106 | 19.37 | 3.69 | 11.14 | 38.15 |
| capratio | 1106 | 6.57 | 1.09 | 2.53 | 10.92 |
| liq | 1106 | 21.02 | 6.16 | 8.60 | 46.10 |
| ldr | 1103 | 64.95 | 12.31 | 28.10 | 106.21 |
| log_issamt | 23767 | 6.50 | 1.29 | 2.30 | 10.78 |
| rating_score | 23819 | 9.84 | 0.41 | 5 | 10 |
| banksize_growth | 23819 | 1.01 | 0.01 | 0.99 | 1.03 |
| zscore | 23819 | 50.12 | 23.53 | 16.57 | 151.11 |
| NPL_ratio | 23713 | 1.40 | 0.34 | 0.42 | 2.41 |
| offering_spread | 23819 | 1.17 | 0.40 | -0.46 | 2.84 |
| maturity_year | 23819 | 0.49 | 0.37 | 0.08 | 3.00 |

Table 2: A snapshot of shadow banking size by key components

| **Use of fund** | | **Source of fund** | |
|---|---|---|---|
| 2018 (Trillion RMB) | | Deposit-like | Other channels |
| Loan-like shadow activities | 38.7 | | |
| **Originated by banks** | **33.1** | | |
| Bank-trust cooperation loans | 5.3 | off balance sheet WMP of banks | |
| Bank-securities cooperation loans | 14.1 | off balance sheet WMP of banks | |
| Entrusted loans | 12.4 | | enterprise deposits in banks |
| Bridge loans by small loan FIs | 1.4 | | paid-in capital of small loans FIs |
| **Not directly related to banks** | **5.6** | | |
| Trust loans by trust company | 2.6 | collective or single trust program | |
| Other loans by small loan FIs | 1.4 | | paid-in capital of small loans FIs |
| MMF invested to debt instruments | 0.4 | WMPs issued by securities and banks | |
| Private lending | 1.2 | | mostly individual lenders |

Source: PBoC, CSRC, CIRC, CCDC, NAFMII, Securities Association of China (SAC), WIND, p2p001.com

Table 3: A summary of bank sample:
unbalanced panel with 33 banks 2012-2018

| Bank name and type | First obs date | WMP > 1 trillion RMB | WMP > 100 billion RMB |
|---|---|---|---|
| *State-owned (4)* | | | |
| Agricultural Bank of China | 2012 | Y | |
| Bank of China | 2013 | Y | |
| China Construction Bank | 2012 | Y | |
| Industrial and Commercial Bank of China | 2013 | Y | |
| *Joint-state commercial bank (10)* | | | |
| Bank of Communications | 2014 | | |
| China CITIC Bank | 2014 | | |
| China Everbright Bank | 2012 | | |
| China Merchant Bank | 2012 | | |
| China Minsheng Bank | 2014 | | |
| Huaxia Bank | 2013 | | |
| Ping An Bank | 2013 | | |
| Postal Savings Bank of China | 2016 | | |
| Shanghai Pudong Development Bank | 2013 | | |
| Xingye Bank | 2014 | | |
| *City and rural commercial bank (19)* | | | |
| Beijing Bank | 2012 | | Y |
| Chongqing Bank | 2014 | | |
| Guiyang Bank | 2016 | | |
| Haerbin Bank | 2013 | | |
| Hangzhou Bank | 2016 | | Y |
| Huishang Bank | 2014 | | |
| Jiangsu Bank | 2016 | | Y |
| Ningbo Bank | 2013 | | Y |
| Qingdao Bank | 2015 | | |
| Shanghai Bank | 2016 | | Y |
| Shengjing Bank | 2014 | | |
| Tianjin Bank | 2015 | | |
| Zhengzhou Bank | 2015 | | |
| Zhongyuan Bank | 2017 | | |
| Changshu Bank | 2016 | | |
| Chongqing Nongshang Bank | 2016 | | |
| Guangzhou Nongshang Bank | 2015 | | |
| Wujiang Bank | 2016 | | |
| Wuxi Bank | 2016 | | |

Table 4:
Baseline Results - Bank Lending Channel

| | Quantity-based | Price-based | | |
|---|---|---|---|---|
| loan growth rate | RRR | Repo rate | Shibor7d | Lending rate |
| | (1) | (2) | (3) | (4) |
| $\Delta mp$ | -1.788*** | -0.320 | -0.420** | -3.676*** |
| | (0.558) | (0.220) | (0.201) | (1.053) |
| size | 7.251*** | 7.606*** | 7.562*** | 8.572*** |
| | (2.149) | (2.333) | (2.354) | (2.242) |
| capital ratio | 0.911 | 0.690 | 0.661 | 0.691 |
| | (0.553) | (0.553) | (0.557) | (0.561) |
| liquidity | 0.0538 | 0.0289 | 0.0315 | 0.0155 |
| | (0.0614) | (0.0581) | (0.0582) | (0.0577) |
| wmp | 0.116** | 0.0944* | 0.100* | 0.104* |
| | (0.0532) | (0.0570) | (0.0575) | (0.0577) |
| size#$\Delta mp$ | 1.096*** | 0.507*** | 0.466*** | 2.118*** |
| | (0.251) | (0.141) | (0.139) | (0.445) |
| capital ratio#$\Delta mp$ | 0.604 | 0.0648 | -0.116 | 0.369 |
| | (0.484) | (0.273) | (0.266) | (0.863) |
| liquidity#$\Delta mp$ | 0.130 | 0.0774 | 0.0805 | 0.0422 |
| | (0.114) | (0.0553) | (0.0554) | (0.168) |
| wmp #$\Delta mp$ | 0.113** | 0.105** | 0.0796* | 0.141 |
| | (0.0555) | (0.0471) | (0.0451) | (0.119) |
| Observations | 633 | 633 | 633 | 633 |
| R-squared | 0.579 | 0.562 | 0.559 | 0.574 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5:
Bank Lending Channel by Bank Type
quantity-based policy RRR

| loan growth rate | State-owned bank (1) | Joint-stock commercial bank (2) | City and rural commercial bank (3) |
|---|---|---|---|
| $\Delta RRR$ | 8.254 | -2.891 | -1.880** |
| | (12.37) | (2.642) | (0.740) |
| size | -2.640 | 5.520 | 7.947* |
| | (3.437) | (5.094) | (4.481) |
| capital ratio | -1.205* | -0.970 | 1.180 |
| | (0.600) | (0.687) | (0.739) |
| liquidity | -0.130 | 0.239 | 0.0103 |
| | (0.155) | (0.144) | (0.0703) |
| wmp | 0.0392 | -0.0139 | 0.177 |
| | (0.121) | (0.0755) | (0.145) |
| size#$\Delta RRR$ | -3.728 | 2.230 | 0.332 |
| | (3.705) | (1.496) | (1.188) |
| capital ratio#$\Delta RRR$ | 2.079*** | -0.566 | 0.589 |
| | (0.656) | (0.758) | (0.945) |
| liquidity#$\Delta RRR$ | 0.0162 | 0.655*** | 0.0220 |
| | (0.196) | (0.224) | (0.135) |
| wmp#$\Delta RRR$ | -0.186 | 0.259** | -0.00892 |
| | (0.403) | (0.0993) | (0.108) |
| Observations | 104 | 220 | 309 |
| R-squared | 0.810 | 0.547 | 0.495 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6:
Bank Lending Channel by Bank Type
7-day Repo rate

| loan growth rate | State-owned bank (1) | Joint-stock commercial bank (2) | City and rural commercial bank (3) |
|---|---|---|---|
| $\Delta R007$ | -1.318 | -3.825** | -0.717 |
| | (5.756) | (1.868) | (0.545) |
| size | -1.543 | 5.658 | 7.172* |
| | (3.451) | (5.224) | (4.278) |
| capital ratio | -1.449** | -0.732 | 1.015 |
| | (0.687) | (0.745) | (0.698) |
| liquidity | -0.142 | 0.0605 | 0.0194 |
| | (0.174) | (0.138) | (0.0706) |
| wmp | 0.123 | -0.0689 | 0.163 |
| | (0.147) | (0.0749) | (0.143) |
| size#$\Delta R007$ | 0.0215 | 3.283** | -0.136 |
| | (1.532) | (1.392) | (0.498) |
| capital ratio#$\Delta R007$ | 0.617 | -1.043 | -0.157 |
| | (0.481) | (0.892) | (0.379) |
| liquidity#$\Delta R007$ | -0.0184 | 0.270* | 0.0409 |
| | (0.108) | (0.161) | (0.0529) |
| wmp#$\Delta R007$ | -0.159 | 0.191*** | -0.00746 |
| | (0.236) | (0.0715) | (0.0528) |
| Observations | 104 | 220 | 309 |
| R-squared | 0.786 | 0.543 | 0.486 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7:
Bank Lending Channel by Bank Type
7-day shibor

| loan growth rate | State-owned bank (1) | Joint-stock commercial bank (2) | City and rural commercial bank (3) |
|---|---|---|---|
| $\Delta Shibor7d$ | -3.475 | -4.620* | -0.821 |
| | (5.423) | (2.308) | (0.544) |
| size | -1.471 | 5.766 | 6.981 |
| | (3.441) | (5.262) | (4.260) |
| capital ratio | -1.405* | -0.822 | 0.994 |
| | (0.687) | (0.737) | (0.704) |
| liquidity | -0.137 | 0.0712 | 0.0215 |
| | (0.176) | (0.145) | (0.0707) |
| wmp | 0.113 | -0.0661 | 0.162 |
| | (0.150) | (0.0761) | (0.142) |
| size#$\Delta Shibor7d$ | 0.401 | 3.819** | 0.00743 |
| | (1.432) | (1.745) | (0.495) |
| capital ratio#$\Delta Shibor7d$ | 0.808* | -1.557 | -0.458 |
| | (0.471) | (1.126) | (0.284) |
| liquidity #$\Delta Shibor7d$ | 0.0445 | 0.270 | 0.0694 |
| | (0.101) | (0.167) | (0.0558) |
| wmp #$\Delta Shibor7d$ | -0.288 | 0.177** | -0.0175 |
| | (0.226) | (0.0754) | (0.0539) |
| Observations | 104 | 220 | 309 |
| R-squared | 0.786 | 0.535 | 0.489 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8:
Bank's Exposure to Off-Balance Sheet WMP and its Funding Cost

| NCD's | Quantity-based monetary policy | | | |
|---|---|---|---|---|
| | RRR | | RRRsize | |
| At-issue yield spread | (1) | (2) | (3) | (4) |
| RRR | 0.333*** | 0.365*** | | |
| | (0.0413) | (0.0435) | | |
| RRR # wmp1 | -0.00338* | -0.00456** | | |
| | (0.00194) | (0.00224) | | |
| RRRsize | | | 0.331*** | 0.365*** |
| | | | (0.0405) | (0.0422) |
| RRRsize # wmp1 | | | -0.00328* | -0.00453** |
| | | | (0.00186) | (0.00214) |
| wmp1 | 0.0591* | 0.0771** | 0.0525* | 0.0698** |
| | (0.0320) | (0.0374) | (0.0279) | (0.0324) |
| log_issamt | 0.0120*** | 0.0125*** | 0.0119*** | 0.0124*** |
| | (0.00335) | (0.00344) | (0.00335) | (0.00344) |
| banksize | 0.101 | -0.140 | 0.0944 | -0.147 |
| | (0.104) | (0.111) | (0.105) | (0.111) |
| maturity_year | 0.238*** | 0.236*** | 0.238*** | 0.236*** |
| | (0.0201) | (0.0201) | (0.0201) | (0.0201) |
| rating_score | -0.182*** | | -0.181*** | |
| | (0.0337) | | (0.0340) | |
| Observations | 23,704 | 23,704 | 23,704 | 23,704 |
| R-squared | 0.478 | 0.466 | 0.478 | 0.466 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9:
Bank's Exposure to Off-Balance Sheet WMP and its Funding Cost

| | Price-based monetary policy | | | |
|---|---|---|---|---|
| NCD's | SHIBOR | | Interbank Repo Rate | |
| At-issue yield spread | (1) | (2) | (3) | (4) |
| shibor7d | 0.437*** | 0.440*** | | |
| | (0.0425) | (0.0358) | | |
| shibor7d # wmp1 | -0.00566* | -0.00486* | | |
| | (0.00291) | (0.00264) | | |
| R007 | | | 0.394*** | 0.398*** |
| | | | (0.0376) | (0.0347) |
| R007 # wmp1 | | | -0.00503** | -0.00442* |
| | | | (0.00220) | (0.00218) |
| wmp1 | 0.0193** | 0.0153** | 0.0193*** | 0.0157** |
| | (0.00793) | (0.00726) | (0.00664) | (0.00677) |
| log(issue vol) | 0.0141*** | 0.0146*** | 0.0145*** | 0.0150*** |
| | (0.00330) | (0.00335) | (0.00323) | (0.00329) |
| banksize | 0.145 | -0.114 | 0.170 | -0.0964 |
| | (0.112) | (0.119) | (0.113) | (0.116) |
| maturity | 0.231*** | 0.229*** | 0.228*** | 0.226*** |
| | (0.0204) | (0.0202) | (0.0204) | (0.0204) |
| rating score | -0.193*** | | -0.198*** | |
| | (0.0292) | | (0.0291) | |
| Observations | 23,704 | 23,704 | 23,704 | 23,704 |
| R-squared | 0.497 | 0.484 | 0.494 | 0.480 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10:
Bank's Exposure to Off-Balance Sheet WMP and its Funding Cost

| | State-owned | | Joint-stock | | City+rural | |
|---|---|---|---|---|---|---|
| | shibor | repo rate | shibor | repo rate | shibor | repo rate |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| NCD's at-issue yield spread | | | | | | |
| shibor7d | 0.581 | | 0.552*** | | 0.315*** | |
| | (0.265) | | (0.0694) | | (0.0525) | |
| shibor7d# wmp1 | -0.0411 | | -0.0106* | | -0.00377 | |
| | (0.0568) | | (0.00528) | | (0.00378) | |
| R007 | | 0.542 | | 0.532*** | | 0.265*** |
| | | (0.256) | | (0.0545) | | (0.0545) |
| R007#wmp1 | | -0.0315 | | -0.0109** | | -0.00203 |
| | | (0.0505) | | (0.00372) | | (0.00369) |
| wmp1 | 0.0588 | 0.0423 | 0.0311* | 0.0354** | 0.0273** | 0.0237** |
| | (0.147) | (0.144) | (0.0145) | (0.0114) | (0.0113) | (0.0113) |
| log(issue vol) | 0.0238 | 0.0242 | 0.0237*** | 0.0239*** | -0.00105 | -0.000428 |
| | (0.0123) | (0.0139) | (0.00194) | (0.00192) | (0.00413) | (0.00399) |
| banksize | -0.0293 | 0.103 | -0.0480 | -0.0942 | 0.283 | 0.310 |
| | (0.883) | (1.031) | (0.160) | (0.203) | (0.193) | (0.197) |
| maturity | 0.564*** | 0.569*** | 0.216*** | 0.215*** | 0.231*** | 0.227*** |
| | (0.0896) | (0.0946) | (0.0178) | (0.0173) | (0.0358) | (0.0360) |
| rating score | -0.0611** | -0.0682** | -0.0135 | -0.0370 | -0.261*** | -0.265*** |
| | (0.0136) | (0.0142) | (0.0803) | (0.0776) | (0.0409) | (0.0408) |
| Observations | 809 | 809 | 11,907 | 11,907 | 10,988 | 10,988 |
| R-squared | 0.372 | 0.378 | 0.483 | 0.479 | 0.479 | 0.480 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: NCD yield spread and NCD rating score

| At-issue yield spread | full sample | full sample | full sample | state-owned | joint-stock | city+rural |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| rating score | -0.225*** | -0.184*** | -0.222*** | -0.0704** | -0.423*** | -0.254*** |
| | (0.0449) | (0.0292) | (0.0454) | (0.0218) | (0.106) | (0.0527) |
| maturity | 0.245*** | 0.232*** | 0.245*** | 0.566** | 0.236*** | 0.240*** |
| | (0.0208) | (0.0201) | (0.0204) | (0.105) | (0.0244) | (0.0337) |
| log(issue vol) | 0.00823** | 0.0139*** | 0.00826** | 0.0232 | 0.0167*** | -0.00602 |
| | (0.00344) | (0.00329) | (0.00340) | (0.0122) | (0.00328) | (0.00493) |
| banksize growth | -3.115 | -2.110 | -3.843 | -30.24 | -3.729 | -3.185 |
| | (2.290) | (2.187) | (2.291) | (29.51) | (2.680) | (3.657) |
| banksize | 0.222* | 0.166* | 0.139 | -1.059 | 0.394 | 0.127 |
| | (0.118) | (0.0966) | (0.123) | (3.300) | (0.234) | (0.241) |
| shibor7d | | 0.361*** | | | | |
| | | (0.0157) | | | | |
| zscore | | | -0.00427* | | | |
| | | | (0.00258) | | | |
| Observations | 23,767 | 23,767 | 23,767 | 809 | 11,970 | 10,988 |
| R-squared | 0.422 | 0.495 | 0.423 | 0.332 | 0.352 | 0.446 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12:
NCD rating score and WMP

| NCD's rating score | full sample (1) | state-owned (2) | joint-stock (3) | city+rural (4) |
|---|---|---|---|---|
| wmp1 | 0.0117 | -0.0598 | 0.00159** | 0.0633*** |
| | (0.00724) | (0.0508) | (0.000702) | (0.0142) |
| banksize growth | -0.355 | 273.6 | -0.338 | 5.198 |
| | (5.868) | (205.9) | (1.912) | (6.462) |
| CAR | 7.654 | 33.80 | 0.0651 | 9.246 |
| | (6.056) | (116.7) | (0.841) | (6.066) |
| ROA | -113.0** | 2,891* | 16.96* | -115.4* |
| | (46.08) | (942.2) | (8.086) | (61.12) |
| LDR | -1.263** | 29.17 | -0.0366 | -1.669* |
| | (0.510) | (14.52) | (0.0462) | (0.886) |
| banksize | 0.881** | 21.52* | 0.491*** | 1.122* |
| | (0.430) | (8.272) | (0.0530) | (0.573) |
| NPL ratio | -0.0924 | 0.897*** | 0.0134 | 0.0134 |
| | (0.141) | (0.0723) | (0.0365) | (0.124) |
| Observations | 23,650 | 810 | 11,929 | 10,911 |
| R-squared | 0.643 | 0.349 | 0.241 | 0.698 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Falsification - Bank's Exposure to principal-guaranteed WMP and the Effectiveness on Bank's Loan Growth

| | Quantity-based | Price-based | | |
|---|---|---|---|---|
| loan growth rate | RRR | Repo rate | Shibor | Lending rate |
| | (1) | (2) | (3) | (4) |
| $\Delta mp$ | -2.173*** | -0.494** | -0.567*** | -4.287*** |
| | (0.551) | (0.202) | (0.190) | (1.122) |
| size # $\Delta mp$ | 1.264*** | 0.486*** | 0.459*** | 2.290*** |
| | (0.266) | (0.131) | (0.124) | (0.494) |
| capital ratio # $\Delta mp$ | 0.481 | 0.0229 | -0.148 | -0.117 |
| | (0.486) | (0.259) | (0.253) | (0.939) |
| liquidity #$\Delta mp$ | 0.0702 | -0.0171 | 0.00702 | -0.103 |
| | (0.0970) | (0.0477) | (0.0455) | (0.134) |
| $wmp_{pg}$#$\Delta mp$ | 0.213 | 0.0341 | 0.0311 | 0.264 |
| | (0.192) | (0.0599) | (0.0652) | (0.222) |
| size | 7.162*** | 7.437*** | 7.497*** | 9.051*** |
| | (2.501) | (2.725) | (2.750) | (2.657) |
| capital ratio | 0.958* | 0.876 | 0.870 | 0.860 |
| | (0.542) | (0.558) | (0.563) | (0.573) |
| liquidity | 0.0174 | 0.0186 | 0.0212 | -0.00843 |
| | (0.0584) | (0.0561) | (0.0564) | (0.0544) |
| $wmp_{pg}$ | -0.0878 | -0.120 | -0.119 | -0.0944 |
| | (0.149) | (0.193) | (0.193) | (0.190) |
| Observations | 605 | 605 | 605 | 605 |
| R-squared | 0.566 | 0.543 | 0.542 | 0.560 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14:
Falsification - Bank's Exposure to principal-guaranteed WMP and the Effectiveness on Bank's Loan Growth: Joint-stock commercial bank

| | Quantity-based | Price-based | | |
|---|---|---|---|---|
| loan growth rate | RRR | Repo rate | Shibor | Lending rate |
| | (1) | (2) | (3) | (4) |
| $\Delta mp$ | 0.613 | -1.048 | -1.442 | -3.194 |
| | (2.647) | (1.618) | (2.018) | (3.642) |
| Bank's Lending Channel | | | | |
| size#$\Delta mp$ | 0.841 | 1.348 | 1.490 | 3.074 |
| | (1.432) | (1.112) | (1.414) | (2.626) |
| capital ratio #$\Delta mp$ | 1.250* | 0.420 | 0.0212 | 1.631 |
| | (0.705) | (0.808) | (1.020) | (1.561) |
| liquidity #$\Delta mp$ | 0.428** | 0.0596 | 0.0693 | 0.212 |
| | (0.182) | (0.0983) | (0.0941) | (0.226) |
| $wmp_{pg}$ #$\Delta mp$ | -0.429*** | -0.206* | -0.180* | -0.777** |
| | (0.155) | (0.103) | (0.0977) | (0.339) |
| size | 5.267 | 4.282 | 4.289 | 5.178 |
| | (5.054) | (5.100) | (5.158) | (5.583) |
| capital ratio | -0.819 | -1.025 | -1.064 | -0.927 |
| | (0.676) | (0.763) | (0.760) | (0.753) |
| liquidity | 0.241* | 0.0901 | 0.0926 | 0.109 |
| | (0.138) | (0.142) | (0.145) | (0.160) |
| $wmp_{pg}$ | 0.0833 | 0.220 | 0.226 | 0.213 |
| | (0.156) | (0.153) | (0.152) | (0.152) |
| Observations | 220 | 220 | 220 | 220 |
| R-squared | 0.558 | 0.541 | 0.537 | 0.548 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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