In the Shadow of Banks: Wealth Management Products and Issuing Banks' Risk in China*

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Abstract

Chinese banks issue wealth management products (WMPs) to circumvent regulations for onbalance sheet activities, attract funding, and increase profits. To support the government's stimulus plan in response to the global financial crisis, the "Big Four" state-owned banks substantially increased their loan supply and grew more aggressive in the deposit markets. Small- and medium-sized banks more exposed to competition from the Big Four banks, especially the fastest expanding large bank, issued more WMPs after 2008. The growth of WMPs imposes rollover risks for the issuers, as reflected by higher yields on new WMPs and banks' behavior in the interbank market.

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I. Introduction

Since the 2007/08 financial crisis, an extensive strand of literature studies how a shadow banking sector arises in the financial system as a result of regulatory arbitrage by financial institutions.¹ Much of this literature focuses on developed economies, with little research studying shadow banking in emerging markets, including what many believe to be a large sector in China.² Facing tight regulations for on-balance sheet activities, Chinese banks issue wealth management products (WMPs)—off-balance sheet investment products and possible substitutes for deposits, to circumvent regulations and increase profits. Interest rates on WMPs are much less regulated than deposit rates, and the funds raised from selling these products are invested in projects without affecting on-balance sheet assets. The size of this segment began to take off at the end of 2011 (Figure 1), and this rapid growth continues to the present day.

What triggered the rise of WMPs in China? What types of risks do these products impose on the issuing banks and the overall financial system? Are the regulators and investors aware of these risks? We address these questions in this paper. In particular, we link the growth of this sector to the RMB 4 trillion stimulus plan initiated by the Chinese government in response to the global financial crisis in 2007/08, and examine how the stimulus, along with bank competition, affects bank behavior both on- and off-balance sheets. Our results extend the literature by showing that the rapid growth of China's shadow banking seems to have been triggered by the stimulus and the associated credit boom, and that it has contributed to the greater fragility of the financial system.

We first show that, consistent with regulatory arbitrage, banks facing a shortfall in deposits issue more WMPs to attract funding, and banks issue more WMPs when the gap between the regulated deposit rates and the market lending rates is greater. We next show that competition for deposits among banks intensified following the massive stimulus plan in 2008. To support and implement the stimulus, the largest four state-owned banks ("Big Four" banks) issued a large volume of new loans into the economy.³ Banks face on-balance-sheet lending restrictions, including a limit on the loan-to-deposit ratio (LDR)—loans *cannot* exceed 75% of total deposits. As a result, the Big Four banks competed more aggressively for deposits to stay below

¹ See, e.g., Acharya and Oncu (2013), for a review of this literature.

² The *Financial Times* estimates that the scale of China's shadow banking, in terms of lending, is half that of total bank lending, and that China's shadow banking system provided much of the leveraged capital that eventually went into the stock market (FT 06/25/2015, article by Gabriel Wildau).

³ The "Big Four" banks refer to the Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Bank of China (BOC), and Agricultural Bank of China (ABC).

the LDR limit. The differing extent of balance sheet expansion across these four banks and the resulting increase in competition created a plausibly exogenous shock in the local deposit market to small and medium-sized banks (SMBs). We find that SMBs that are more exposed to the competition from the Big Four banks, especially the most aggressively expanding big bank, had higher LDRs, and issued more WMPs after 2008. These SMBs also established fewer branches in cities with more competition from the Big Four banks.

Issuer banks take on substantial rollover risks: when a large amount of WMPs mature, SMBs offer significantly higher yields on the *new* WMPs, while the Big Four banks and the next ten large banks are willing to borrow at higher interest rates in the interbank market, in order to raise sufficient funds to meet redemption. As the total amount of WMPs rises sharply, the aggregate risk also increases as banks need to roll over greater amounts. When the cost of interbank funds unexpectedly rises, stock prices drop more for banks with more WMPs maturing, indicating that the market is concerned with the extent of banks' rollover risks.

Our dataset covers all WMPs issued by the largest 25 banks in China for 2008-2014, with matched data on the issuing banks. We separate the banks into two categories: the Big Four banks and the remaining 21 banks. The Big Four banks are among the largest financial institutions in the world, and are under direct control of the central government. They had extensive networks of branches before many other banks were established. They are also predominant players in China's financial system, including the interbank markets. The remaining 21 banks in our sample are much smaller, and many of these SMBs concentrate their business in certain regions.

During our sample period, China's central bank—the People's Bank of China (PBC)—set ceilings on bank deposit rates, which changed over time, but were almost always *below* the market rates (Shanghai Inter-bank Offered Rate, or SHIBOR). In addition to capital ratio regulations, banks must comply with the LDR requirement as discussed above. They in turn pursue less regulated, off-balance-sheet activities, most notably in the form of WMPs. By offering higher rates than regulated deposit rates, WMPs help banks attract more savings, including from bank depositors. Moreover, *principal-floating* products can move loan assets off the balance sheet.

Hence, the issuance of WMPs ought to be greater when the LDR rises, especially when the market lending rate rises considerably above the regulated deposit rate. For example, as the gap between SHIBOR and the deposit ceiling widens to 2%, the WMP issuance as a percentage of the bank's equity increases by 43% within a single quarter, with one standard deviation increase (7.6%) in the LDR.

Next, we study how the stimulus and bank competition led to the liftoff of WMPs, especially those issued by the SMBs. The Chinese economy was booming before the stimulus plan was announced in 2008. Thus, the government initiated the stimulus due to *external* pressure—in particular, the expeditious drop in exports resulted from weakened demand in developed economies, and *not* due to internal economic problems, including conditions in the banking system. The stimulus was implemented mostly through the Big Four banks' large volume of new loans to various sectors of the economy during 2009-2010. Consequently, these banks also raised deposits to fulfill the LDR requirement and stay below the 75% limit.

Interestingly, the extent of support for the stimulus differed across the four banks, with Bank of China (BOC) becoming the most aggressive big bank in expanding both new loans and new deposits. While all four banks have branches throughout the country, the concentration of their branches differs by region. Therefore, the SMBs, with their business concentrated in regions with more intensive branching of Big Four banks, especially BOC branches, would face more competition in attracting and securing deposits following the stimulus. With information on branch openings and closings of all the banks at the city level (including those *not* in our WMP sample), we construct four sets of bank-level competition metrics, measuring each of the twenty-one SMBs' geographical exposure to branch competition, in all regions of the country, from the Big Four banks. These competition measures are relatively steady overtime (hence bank fixed effects are not included in regressions), while the differential pace of expansion in support of the stimulus created an exogenous shock to local SMBs facing different degrees of competition from the big banks. Our identification strategy is thus to track the issuance of WMPs by SMBs confronting various degrees of competition from the Big Four banks, and we expect the BOC competition measures to have a positive and significant impact on SMBs' issuance of WMPs *following* the stimulus plan.⁴

Consistent with our hypothesis, we find that both the LDR and the amount of WMP issuance were greater for SMBs with more exposure to regional competition from the local branches of the BOC, and the effects of BOC on SMBs became significant only after the implementation of the stimulus. During 2011-2012, for example, a one-standard deviation increase in the geographic exposure to the BOC leads to an increase of an SMB's LDR by 0.48

⁴ Acharya and Kulkarni (2018) use a similar variation in competition from state-owned banks to document crowding out of private sector banks by state-owned banks in India.

standard deviation (or 3.1%), and an increase in its WMP issuance over equity by 0.22 standard deviation (or by 39.2% over equity). By contrast, the impact of the other three big banks—which increased the scale of their lending and deposits at slower paces than the BOC—on SMBs' LDRs and WMP issuance is much weaker.

Our analysis of WMP issuance is performed at the bank level, while a bank's issuance decisions might be driven by certain factors (e.g., investment opportunities) that correlate with the degree of its BOC exposure after the stimulus. To rule out this alternative hypothesis, we explore *within*-bank variations, and find that the same bank chose to establish fewer branches in cities with more presence of BOC branches, and this pattern only holds for the post-stimulus period. This result reinforces that deposit competition at the branch level is the force that prompted SMBs to issue more WMPs.

The Big Four banks' issuance of WMPs also rose during the second half of the sample period. We can interpret this as their response to the WMP issuance by SMBs. We also hypothesize that Big Four banks issue WMPs to refinance the long-term projects originally funded by the stimulus credit. A large fraction of the stimulus credit went to real estate and infrastructure projects, leading to rising leverage and risks in these sectors. The PBC began tightening the bank credit supply to these sectors in 2010. Facing restrictions on extending new loans and to help avoid defaults in these long-term projects, many owned by local governments, the Big Four banks issued WMPs, especially principal-floating products, to refinance these projects and rolled over old loans. Consistent with our hypothesis, we find a positive relationship between the estimated (abnormal) loan increase due to the stimulus and the WMP balance in later years (when earlier loans matured) for the Big Four banks.

In our final set of tests, we analyze the rollover risk of WMPs for the issuing banks. When WMPs mature, investors often put the funds they redeem back in their deposit accounts (for a short period) with the issuing bank, which helps the bank to temporarily boost deposit levels and lower its LDR. WMPs typically mature in three months or less, and many products mature immediately before the end of a quarter, when banks' LDRs are calculated and monitored by the China Banking Regulatory Commission (CBRC). Some investment projects financed by WMPs, such as those in real estate and infrastructure, however, pay off in much longer horizons. Thus, banks may need to issue new WMPs to meet the redemption of mature products and to refinance assets.

When there are more WMPs due in a quarter, SMBs offer significantly higher yields on the *new* products. WMPs also affect banks' behavior in the interbank market. The ask quotes show that the Big Four banks and the next ten large banks are willing to borrow at higher interest rates when they have more WMPs due for redemption. At the aggregate level, the one-week SHIBOR rises during the second half of the sample period, closely tracking the aggregate amount of maturing WMPs issued by the Big Four banks. This result also indicates that the rollover risk grows with the total amount of outstanding WMPs, as the amount to rollover also increases. We also look at the stock market response during episodes of 'credit crunch,' when the cost of interbank funds unexpectedly rises. Stock prices drop more for banks with more WMPs maturing in the short-run, indicating that investors and the market are concerned about the extent of banks' rollover risks.

Our study contributes to and extends the literature on the formation and risk of shadow banking. There are at least two important differences between the U.S. shadow banking sector and its counterpart in China. First, the process of moving debt obligations from institutions' balance sheets and packing and re-packaging them into structured products makes these products complicated and opaque in the U.S. By contrast, most WMPs offered by Chinese banks during our sample period are simple, short-term fixed income products.⁵ Second, after institutions sell the loans and other (unpackaged) debt to the underwriters, there remains some connection between the structured products and the originating institutions in the U.S. The WMPs and their issuing banks in China, in terms of the on- and off-balance sheet activities and banks' overall risks, however, are all closely tied, as our results show. The growth of WMPs in China more closely resembles the growth of the money market in the U.S. due to Regulation Q, and, more recently, the growth and collapse in the issuance of asset-backed commercial paper market due to regulatory arbitrage (Acharya, Schnabl, and Suarez, 2013).

There are a few recent studies on China's shadow banking sector. Dang, Wang, and Yao (2014) provide a theoretical model to explain the differences between the U.S. and Chinese shadow banking. Allen, Qian, Tu, and Yu (2018) and Chen, Ren, and Zha (2018) study another large component of the shadow banking sector—entrusted loans, which non-bank financial institutions and firms offer. Hachem and Song (2015) provide a theoretical analysis of the interactions between large and small banks in both the on- and off-balance sheet markets and demonstrate how a shadow banking sector with off-balance sheet products can arise from bank

⁵ Some of the funds raised from selling WMPs *do* go into risky and speculative areas, mostly through trust companies such as leveraged trading in the stock market, but banks often retain the most senior tranches.

competition.⁶ Unlike these studies, we use a large set of product-level data to examine the relationship between WMP issuance and issuing bank characteristics. Our empirical strategy—tracking how SMBs respond to competition from the Big Four banks expanding their lending and deposits at different paces—allows us to establish a direct link between the implementation of the stimulus along with bank competition, and the growth of shadow banking. Our results also indicate that the swift rise of WMPs increased the banking system's fragility.

In Section II, we describe China's banking sector and the regulatory framework. In Section III, we present our sample of WMPs and their issuing banks, assess the effects of the capital ratio and LDR on WMP issuance, and link the rise of WMPs to the 4-trillion stimulus plan and bank competition. In Section IV, we study the rollover risk of WMPs. We conclude in Section V. The appendix contains the explanations of the variables.

II. Institutional Background, Banking Regulation, and Shadow Banking

There are four categories of banks in China. The first category is the aforementioned Big Four banks, including the ABC, BOC, CCB, and ICBC. They are listed in both the domestic A-share market and the stock market in Hong Kong, with the central government as the controlling shareholder. The State Council, the highest branch of the government, directly appoints presidents of these banks.⁷ These banks are the dominant players in China's commercial loan, deposit, and interbank markets. As market-oriented institutions, they also carry out certain policy goals—typically through lending, as all state-owned enterprises do. The second category is state-owned *policy* banks, whose goal is to carry out certain government policies through lending. This category includes the China Export-Import Bank, China Development Bank, and the Agricultural Development Bank of China.

The third category is joint-equity commercial banks (there were 12 of these as of 2017). The average size of these banks is about 10% of that of the Big Four banks. They are also market oriented, with most being publicly listed companies. The fourth category is urban and rural commercial banks, which are typically founded and majority-owned by provincial or city governments. They are typically much smaller than joint-equity commercial banks. Unlike the other three types of banks, they concentrate their business in a limited number of cities.

⁶ In a setting resembling the US financial markets, Hanson, Shleifer, Stein and Vishny (2015) show that while traditional banks and "shadow banks" (e.g., intermediaries involving money market funds) both create safe, "money-like" claims, they differ in their investment portfolios of assets to support these claims.

⁷ The Bank of Communications is the fifth largest bank in China. However, its size is still much smaller than that of the Big Four banks, and we thus classify it as an SMB in the tests.

The PBC and CBRC supervise and monitor commercial banks. Standard regulations such as capital ratio requirements, in conjunction with the Basel III Accords, are in place. Banks' reserve ratios have been high—21.5% in June 2011 and 17.5% for big banks at the end of 2015—in part to help sterilize the large amount of foreign currency reserves accumulated over the previous years.⁸

China tightly regulated interest rates. As part of its macroeconomic policy tools, the PBC set base interest rates along with upper and lower bounds that fluctuated over business cycles. Both the upper and lower bounds on lending rates and the lower bound on deposit rates were not binding most of the time, and were liberalized gradually. The upper bound on deposit rates, however, was usually binding and not lifted until 2015. These interest rate policies were also part of China's investment-driven growth model—transferring capital from savers/depositors to borrowers such as large industrial enterprises (e.g., Song, Storesletten, and Zilibotti, 2011).

The gap between the regulated deposit rate and market lending rate gives banks an incentive to engage in excessive lending. In response, the CBRC monitors and sets limits on total bank lending through tools including capital ratio requirements and the LDR. The limit on the LDR prohibits banks from lending more than 75% of their total deposits, and this upper bound on lending was binding during our sample period, especially for SMBs.⁹

These regulations give rise to the shadow banking sector in China. First, to fulfill capital ratio requirements, banks can raise capital by issuing new equity and bonds. They can also conduct off-balance sheet investments, which do not increase on-balance sheet assets. Second, to ensure that the LDR stays below the 75% threshold, banks can attract more deposits and/or cut on-balance sheet lending. WMPs can help banks satisfy both requirements and increase profits. On the asset side, banks often invest the funds raised from WMPs in loan assets originated by themselves and/or packaged by other financial institutions. Hence, loans are supplied without increasing on-balance sheet assets. On the liability side, WMPs are "deposit-like" products banks sell to investors. There was no default on WMPs issued by our sample banks during the sample period, and investors regard these products as similar to deposits. As interest rates on these products are not regulated, WMPs can help banks attract funds. The principal of WMPs can be either guaranteed or floating. Principal-guaranteed WMPs are often

⁸ For a comprehensive description of the banking sector and its relationship with other parts of the financial system and overall economy, see Allen, Qian, Zhang, and Zhao (2012) and Qian, Strahan, and Yang (2015).

⁹ The restrictions on deposit rates as well as the LDR were lifted at the end of 2015. However, Chinese banks still face high reserve ratios and their lending remains capped by the PBC through "window guidance." Hence, banks' incentives for shadow banking activities, including the issuance of WMPs, remain.

included on the balance sheet as deposits, as the CBRC requires. Principal-floating WMPs are treated as off-balance sheet liabilities, but the structure of their maturities can be chosen to boost the banks' deposit balance when LDR is calculated.

A broad definition of "shadow banking" refers to all investment products in the market that are not on the banks' balance sheets, including loans issued by non-bank financial institutions and non-financial firms (entrusted loans). A popular product is *Yu'e'Bao*, offered by *Alibaba* along with a money market fund. Another important component of China's shadow banking sector is the loans offered by trust companies (e.g., Allen, Gu, Qian, and Qian, 2018).¹⁰

With the rise of shadow banking, there is a dual-track system of intermediation in China's financial system (e.g., Wang et al., 2015). While interest rates on deposits are capped and onbalance sheet lending is regulated by the capital ratio and LDR, the shadow banking sector, including banks' off-balance sheet activities, is not subject to on-balance sheet requirements. However, regulators (PBC and CBRC) are aware of both the scale and nature of WMPs issued by banks, and a cat and mouse game between the CBRC and banks has been evolving along with the expansion of the shadow banking sector.

Early waves of WMPs were issued through coordination between banks and trust companies. In July 2009, the CBRC prohibited banks from investing funds raised from WMPs in their own (loan) assets. Banks sidestepped this policy by selling their loan assets to trust companies to form a trust plan, while asking other banks to issue WMPs and invest the proceeds into the plan. In August 2010, the CBRC further stipulated that trust companies cannot invest more than 30% of all proceeds from bank-trust WMPs in loan assets. Banks circumvented the new policy by inviting investment banks to the circle: trust companies first extend loans to borrowers and packaged the loan assets into a trust plan; banks then issue WMPs and delegate the management of the funds to investment banks. Through contractual agreements, the banks require the investment banks to invest the WMP proceeds in the trust plan.

In March 2013, the CBRC announced yet another new policy: total WMP investment in *non-standard* financial assets cannot exceed 35% of all WMPs or 4% of bank assets. Non-standard financial assets include not only trust assets, but also all financial products *not* traded on the interbank or securities markets. To circumvent this policy, banks needed to find certain types of standard financial assets to facilitate lending to firms/projects *and* pay riskless returns

¹⁰ Offered by *Alipay* (the payment arm of Alibaba) and *Tianhong Fund Management Co., Yu'e'Bao* grew very quickly, with its net assets growing from RMB 200 million in May 2013 to over RMB 700 billion in April 2015. For more information, including its promised returns, see <u>https://bao.alipay.com/yeb/index.htm</u>.

above the deposit rates to WMP investors. Accordingly, banks and trust companies developed a new business model involving even more steps and participants.¹¹

Figure 2 shows the WMP balances sorted by the four main investment categories according to information disclosed in the WMP prospectus, starting from December 2011. The balance of WMPs funding loan assets peaked in March 2013, when the CBRC implemented the new policy regarding non-standard assets, and has since stayed at a high level. WMPs targeting deposits increased sharply at the end of 2014, possibly when banks developed the new business model with multiple participants and steps as discussed above. WMPs going to the money market also increased over time, as banks can lend the WMP's proceeds to other banks, which can then purchase non-standard financial assets like trust plans. CBRC regulations never fully achieved their intended goals because financial institutions can devise new products with contractual agreements involving more parties to transfer funds.

There are at least two types of risks involved in the shadow banking sector. The first is the rollover risk of WMP issuing banks. Some of the assets financed by WMPs pay off in the medium to long-term, but many investors prefer liquid assets, as do the other participating banks and institutions. The issuing banks prefer short maturities because they can transfer the WMP's funds at maturity to the deposit accounts (even for only a few days), which can help lower their LDRs. This maturity mismatch leads to rollover risk. Large banks can tap into the inter-bank market for liquidity needs, and all banks can issue new WMPs to refinance long-term loans and meet the redemption of mature WMPs. However, during credit crunches, as was the situation in June 2013, banks with large amounts of WMPs due would face tremendous pressure. The second type of risk is "contagion risk," in which the rollover risk of an individual bank can spread to other banks and possibly the entire banking system, because the multiple channels of WMPs link various types of financial institutions and firms and the fast-growing interbank market also makes financial institutions more interconnected than before.

III. Data and Determinants of WMP Issuance

¹¹ For example, Bank A places WMP funds with Bank B in the form of "contracted (interbank) deposits"—a form of standard asset. Bank B then invests its own funds (*not* the WMP funds) or delegates an investment bank to invest its own funds in certain trust plans packaged by trust companies. The contracted deposits are then pledged as guarantees for the trust plans, and in return, can be swapped with the returns on the trust plans. Through this scheme, Bank A invests the WMP funds in standard assets (interbank deposits); Bank B uses its own funds to invest in non-standard financial assets, and increases its deposit balance (with the interbank deposits) with no increase in its loan balance; WMP investors receive a risk-free (guaranteed by Bank A) return above the deposit rate (from the trust plans); and the borrower receives funding.

We focus on the 25 largest banks in China, including the Big Four banks, the 13 (national) joint-equity commercial banks (including the Bank of Communications), and the 8 largest urban commercial banks (Table 1, Panel B). We consider the 21 non-Big Four banks as SMBs. Our data come from multiple sources. First, we collect bank financial and WMP information from public datasets and surveys. Listed banks and banks that issued publicly traded bonds disclose their financial information (on a semi-annual or quarterly basis). For the remaining unlisted banks, we conduct a survey of each bank to inquire about their financial information. We also gather reports from the CBRC and PBC. The final data set obtained from public sources and surveys covers the period of 2008-2014, and includes bank equity, total loan and deposit balances, the capital ratio, LDR, and aggregate WMP quantity information for each bank in each quarter.

Second, bank branch information is available from the CBRC. Each individual branch of all financial institutions requires a license from the CBRC to open and operate. Starting from November 2007, CBRC has been publishing information on bank branch licenses, including the opening date, the closing date (if applicable), operation location, and affiliation of each branch. Third, we collect individual WMP information from WIND, which covers a large fraction of bank WMPs. We collect yield and maturity information for all WMPs issued by the 25 banks, including those available from WIND, during the sample period. Finally, we download the SHIBOR quotes and each bank's submitted quotes from the SHIBOR web site.

III.1 Summary Statistics

Table 1 reports the summary statistics of bank and WMP characteristics (see Appendix A for definitions of all variables). The Big Four banks are typically 10 times the size of SMBs in terms of equity, total deposit balance, and total loan balance (Panel A). These two groups of banks have similar capital ratios.¹² The average LDR of SMBs is higher than that of the Big Four banks. During our sample period, 75 of the 700 bank-quarter observations have bank LDRs exceeding the 75% upper bound, and only one such observation belongs to a Big Four bank. When the LDR exceeds 75%, a bank will receive a warning from the CBRC, and it must lower the LDR to below 75% or face fines and suspensions of normal activities.

¹² According to the Basel Accord, banks' capital ratios cannot be lower than 8%. Most banks in the sample fulfill this requirement, except for the ABC, which had lower capital ratios before 2009, reached the required level in 2009 Q4 after receiving a capital injection. Starting from 2013, a new approach to calculate the capital ratio was adopted, but the previous approach is still in use. For consistency, we use the capital ratio calculated with the previous approach. The results using the updated capital ratios stay largely the same.

All Big Four banks participate in the SHIBOR bid and ask processes, but only ten SMBs submit quotes. We calculate each bank's SHIBOR quoted rates minus the SHIBOR for different maturities, but report only the overnight rates to save space. SMBs seem to ask for higher rates than the Big Four banks do, a pattern consistent with the fact that SMBs typically face more liquidity pressure.

Table 1, Panel C reports the summary statistics of WMPs. While the Big Four banks issue much more WMPs in total amounts, SMBs are more aggressive in issuing WMPs if we scale total WMP issuance by the bank's equity. Both groups of banks issue more principal-floating WMPs than principal-guaranteed WMPs. As stated above, principal-guaranteed WMPs are recorded on the balance sheet according to CBRC regulations, while principal-floating WMPs are not. Panel C also shows that principal-floating WMPs have higher annualized expected yields than principal-guaranteed WMPs do. WMPs issued by SMBs generally have higher expected yields than those issued by the Big Four banks, especially principal-floating WMPs.

Figure 3 shows the evolution of (the weighted average) WMP yields as well as the SHIBOR and deposit rate ceilings over the sample period. The yields of WMPs closely track the 3-month SHIBOR rates. Except for the first half of 2009, when the SHIBOR dropped dramatically, perhaps due to the substantial liquidity injection by the PBC in response to the global financial crisis, the SHIBOR and WMP yields are above the deposit rate ceiling. This means that the regulatory constraint on deposit rates was binding for most of our sample period.

Table 1, Panel D shows a decreasing trend in WMP maturities for both groups of banks, which may reflect banks' responses to the LDR regulation. As discussed above, when WMPs mature, the funds can be transferred to investors' deposit accounts, thus (temporarily) boosting its deposit level. Before 2009, the CBRC monitored LDRs at year end; in late 2009, the CBRC switched to end-of-quarter monitoring, and we observe newly issued WMPs with shorter maturities. In short, the increasing scale and decreasing maturities reflect banks' dependence on WMP financing, and a greater maturity mismatch and rollover risks in these products.

III.2 Determinants of WMP Issuance

In this subsection, we first examine the effects of the LDR and capital ratio on WMP issuance, and then link the rise of WMPs to the 4-trillion stimulus and bank competition.

A. LDR, Capital Ratio, and Regulatory Arbitrage

We hypothesize that the rise of WMPs is a result of profit-seeking banks' regulatory arbitrage to circumvent on-balance sheet regulations. First, during our sample period, banks' deposit rates were capped. As Figure 3 shows, the ceiling on the deposit rate was binding: the SHIBOR was strictly higher than the deposit rate for most of the period. Second, banks also face on-balance sheet lending restrictions in the form of capital ratio requirements and limits on the LDR. By issuing WMPs, banks can attract more deposits by offering higher returns than the (capped) deposit rates and get around the on-balance sheet lending restrictions by moving loan assets off the balance sheet.

Based on the discussion above, both the capital ratio and LDR can be factors in the issuance of WMPs. Capital ratio requirements target the asset side and aim to control the total size of the bank relative to its capital. To maintain a certain capital ratio, a bank can conduct more off-balance sheet activities or move on-balance sheet assets off the balance sheet. WMPs, especially principal-floating ones, fulfill this role.

Alternatively, LDR requirements target *both* sides of the balance sheet, with the goal of controlling the bank's loan balance relative to its deposit balance. To stay below the LDR threshold, banks can either increase deposits or decrease on-balance sheet loans. Again, WMPs can accomplish both tasks. The higher yields on WMPs relative to deposit rates can attract more investors. Principal-guaranteed WMPs are regarded as deposits. Principal-floating WMPs are off the balance sheet, but by setting the maturity date right before the end of a quarter, when the CBRC monitors the LDR, these products can increase deposits on and shortly after the maturity dates too. In addition, loans financed by principal-floating WMPs are off-balance sheet and do not increase banks' on-balance sheet loan balances.

We estimate the following model of WMP issuance:

$$issue_{e_{it}} = \beta_1 Cap_{i,t-1}(or \ LDR_{i,t-1}) + \beta_2 spread_t + \beta_3 spread_t$$
(1)

$$\times \ Cap_{i,t-1}(or \ LDR_{i,t-1}) + bank_i + quarter_t + e_{it}$$

The dependent variable in Eq. (1) is the total amount of WMPs issued in quarter t divided by lagged bank equity (at the end of quarter t-1). For the key explanatory variable, capital ratio or LDR, we also use its lagged value as a control. We define the variable *spread* as the difference between the 3-month SHIBOR rate and the associated deposit rate ceiling. We use 3-month rates because they match the maturity structure of the WMPs; the market rates ought to be driven by market conditions for loans while shorter-term rates are primarily driven by interbank market liquidity. More specifically, a greater spread between the market rate (SHIBOR) and the regulated deposit rate gives a stronger incentive for banks to issue WMPs.

According to our discussion above, β_2 is positive and β_3 is negative when Spread interacts

with capital ratio; that is, banks with lower capital ratios will issue more WMPs, especially when the spread is greater. These effects should be more pronounced for principal-floating WMPs as these represent off-balance activities. β_3 is positive when Spread interacts with LDR: when the gap between the market rate and the deposit rate ceiling rises, banks with higher LDRs will issue more WMPs. Additionally, these effects should hold for both principal-guaranteed and principal-floating WMPs, as both can help attract savings. Finally, given the differences between Big Four banks and SMBs—Table 1 shows that the two groups are similar in capital ratio but different in LDR, we also estimate the models for each group of banks separately.

The results in Table 2 indicate that the LDR matters more for WMP issuance than the capital ratio does. In Panel A, as predicted, the coefficient of the interaction between *spread* and capital ratio is significant for principal-floating WMPs and insignificant for principal-guaranteed WMPs, and this pattern holds for both groups of banks. However, the interaction term is only significant at the 10% level. In Panel B, we find that while the LDR does not affect WMP issuance for the Big Four banks, it has a significant effect for SMBs. In Column (4), the estimated coefficient of the interaction term is 3.449, significant at the 1% level, and remains significant for both principal-floating WMPs and principal-guaranteed WMPs.

The economic significance of the effect of LDR on WMP issuance is also greater. For SMBs, the standard deviation of capital ratio is 0.03 and of LDR is 0.08. If we use the estimated coefficients, then a one-standard deviation decrease in the capital ratio will increase WMP issuance over bank equity by $(0.254 \times spread - 0.247)$, while a one-standard deviation increase in the LDR will increase WMP issuance over bank equity by $(0.276 \times spread - 0.097)$.

The different degrees of impact of capital ratio and LDR on WMP issuance may reflect the relative difficulty in raising capital vs. raising deposits. By issuing equity and (junior) debt, banks can raise capital and improve their capital ratios; in fact, the average capital ratio for both the Big Four banks and SMBs is 12% (Table 1, Panel A), well above the regulatory floor. By contrast, it is much more difficult to attract deposits for SMBs than it is for the Big Four banks. SMBs have far fewer branches, and their businesses, including lending and deposits, are usually concentrated in certain regions. As Table 1, Panel A shows, SMBs have higher LDRs than Big Four banks do, and thus face a more binding constraint from the LDR regulation.

Given the greater impact of the LDR on WMPs in Table 2, we include LDR as the main regulatory variable in subsequent tests; all results are robust to the inclusion of the capital ratio. We next explore the factors that contributed to the sudden and dramatic increase in WMP issuance, especially for SMBs, after 2008 (Figure 1). Is this increase connected to the stimulus plan in response to the global financial crisis?

B. The Stimulus Plan and Differing Implementation Process by the Big Four Banks

While China's financial system was largely closed to global markets, the economy was impacted by the global financial crisis through trade, among other channels. Total exports fell from US \$136.7 billion in September 2008 to \$64.86 billion in February 2009; the GDP growth rate fell from 13.9% in 2007 Q4 to 6.2% in 2009 Q1, an unprecedented slowdown since China's entry to the WTO in 2001. The Chinese government responded by introducing the RMB 4-trillion Stimulus Plan.

The implementation of the stimulus plan involved multiple parties. First, the central government invested RMB 1.18 trillion from fiscal revenues and other sources of incomes. According to the National Development and Reform Commission, the investment projects from 2008 Q4 to 2010 Q4 include infrastructure, such as reconstruction following the *Wenchuan* earthquake (in Sichuan Province), housing, public health and education, energy and environmental protection, and so on. One stated purpose of the stimulus was to increase domestic demand and improve public services. Second, local governments, through state-owned City Infrastructure Investment Corporations (CIICs), also made investments. These CIICs raise funds from bank loans and issuing bonds against local government land properties.

Third, banks, especially the Big Four banks, played a crucial role in the implementation process by providing the lion's share of the funds for the investment projects associated with the stimulus, both by issuing bank loans and purchasing CIIC bonds. This led to a large credit expansion in the economy. Figure 4.1 shows total loan balance during the sample period for the Big Four banks and SMBs (data for SMBs only became available from 2010). Many investment projects, such as infrastructure projects, were medium and long-term in nature and thus financed by medium and long-term loans. From Figure 4.1, we can see that from January 2009 to December 2010, Big Four banks' medium and long-term loan balances increased by RMB 5.80 trillion (a 66% increase), while their short-term loan balances increased by RMB 1.26 trillion (a 31% increase). In contrast, both the short- and medium/long-term loan balances of the SMBs remained relatively stable: from January 2009 to December 2010, their medium and long-term loan balances increased by RMB sincreased by 0.82 trillion RMB (18%). These results confirm that the Big Four banks were definitely the major lenders during the stimulus plan.

While all four banks announced large-scale credit expansion in support of the stimulus,

the speed of the expansion was different. Figure 4.2 shows total loan balances of the Big Four banks. For comparison, we scale each bank's current loan balance by its loan balance at the end of 2008, the beginning of the stimulus plan. From 2006 Q4 to 2008 Q4, except ABC, the other three banks exhibited similar growth rates in loans.¹³ The paths of the loan balances began to diverge in 2009. The BOC illustrated a much steeper growth path than the other three banks did: from 2009 Q1 to 2010 Q4, the BOC's total loan balance increased by 77%, compared to an increase of 60% by ABC, and 48% by both the CCB and ICBC.

We can see the same patterns for the LDR. From Figure 4.3, none of these banks' LDRs exceeded 65% at the end of 2008 Q4, well below the limit of 75%. Starting from 2009, however, the BOC's LDR jumped due to aggressive credit expansion and approached the 75% threshold by the end of 2009, while the LDR of the other three banks dropped in the same year. Finally, rising loan balances and LDRs would put pressure on the deposit side. Increasing and maintaining higher deposit levels can help banks stay below the LDR threshold.

Figure 4.4 presents the evolution of the total deposits of the Big Four banks. Similar to Figure 4.2, we scale each bank's total deposits by its deposit balance at the end of 2008. From 2006 Q4 to 2008 Q4, all four banks were on similar growth paths for deposits. Starting in 2009, the growth rates of all the banks spiked compared to the earlier period. Since the BOC had the highest LDR among the four banks, it also became the most aggressive in raising total deposits. From 2009 Q1 to 2010 Q4, the BOC's total deposit increased by 58%, compared to increases of 47%, 43%, and 35% for the ABC, CCB, and ICBC, respectively. Given the average deposit balance of RMB 9660.8 billion, the magnitude of the growth rates in deposits for these large banks (within two years) is substantial, and dramatically changed the landscape of the deposit market in many regions in China.

What can explain the differences in how the Big Four banks supported the stimulus plan through credit expansion? One possibility is related to bank executives' career concerns. The central government controls the Big Four banks, with top executives appointed by the Organization Department of the Central Committee of the Communist Party of China. Bank presidents hold the rank of vice-minister within the hierarchy of government branches. The President of the BOC at the time was Mr. Xiao Gang, who worked in PBC before joining BOC. He directed the bank to actively support the stimulus plan through credit expansion. In 2013,

¹³ ABC went public in July 2010 (the last IPO of the Big Four banks). To prepare for the IPO, capital was injected and non-performing loans were removed from its balance sheet (see Allen et al., 2012, for more details). As in Figure 4.2, its loan balance exhibits two jumps leading up to the IPO.

Mr. Xiao was promoted to Chairman of the China Securities Regulatory Commission, a ministerial position. In contrast, the long-time President of the ICBC, Mr. Jiang Jianqing, widely regarded as one of the best banking executives in the world, was more cautious in extending credit following the announcement of the stimulus plan, as the statistics above indicate. Despite the consistently strong performance of the ICBC relative to the other large banks, Mr. Jiang retired in May 2016 without any further promotion.¹⁴

C. Bank Competition and the Rise of WMPs: Empirical Strategies and Results

As discussed earlier, the Big Four banks enjoy a much stronger status in the deposit market over all other smaller banks due to their extensive branches across all parts of the country. Thus, SMBs typically have higher LDRs, as in Table 1. Following the credit expansion as part of the stimulus implementation, the Big Four banks' LDRs rose to higher levels, forcing them to increase deposit levels to stay below the LDR limit. This put even greater pressure on SMBs to preserve deposits. To circumvent the regulatory ceiling on deposit rates and to attract depositors, banks employed tactics such as offering gifts, including cash, to depositors when the account balance is sufficiently high on days close to the CBRC's LDR monitoring.¹⁵

With increasing pressure on the deposit side and facing LDR regulations, SMBs turned to WMPs, especially the off-balance sheet principal-floating products. Since there was no restriction on the interest rate for WMPs, and WMPs issued by our sample banks during the sample period typically mature in 6 months or less with almost no default risk, WMPs were "deposit-like" instruments without interest rate control. The CBRC and other regulators also regarded off-balance-sheet WMPs as a compliment to banks' on-balance-sheet assets and activities (e.g., Wang et al., 2015), and thus allowed the co-existence of a dual-track intermediation system. With SMBs' need to attract deposits, the issuance of WMPs took off.

We hypothesize that competition in local deposit markets, along with LDR regulations, drove SMBs to issue WMPs. Our point of departure is that competition for deposits occurs in local markets among branches of different banks. The Big Four banks have extensive branch networks across all regions in China, but with various degrees of intensity (see the four branch "heat" maps in Figure 5). Since most SMBs concentrate their branches in certain regions, they

¹⁴ During an interview with *McKinsey Quarterly* in March 2009, Mr. Jiang said, "the government's recent decision to boost domestic demand provides opportunities for banks, but ICBC is a commercial bank, and we should consider these opportunities from a commercial standpoint." See Allen, Qian, Shan, and Zhao (2014) for more details on the ICBC, and Deng, Morck, Wu, and Yeung (2015) for bank executives' career concerns.

¹⁵ Concerned about the effectiveness of the interest rate policy, the CBRC forbade banks from giving gifts of any kind to depositors. See a collection of news reports here: http://finance.qq.com/zt2010/banklc/.

have different degrees of geographical exposure to competition from the Big Four banks.

We measure SMBs' exposure to Big Four bank competition in two steps. First, we calculate the market share of each of the Big Four banks in a given city. Denote $n_{i,j,t}$ as the number of bank *i*'s branches in city *j* at the beginning of quarter *t*, then define the market share of Big Bank *b* in city *j* at the beginning of quarter *t* as:

$$MarSha_{b,j,t} = \frac{n_{b,j,t}}{\sum_{i} n_{i,j,t}}$$
(2)

The denominator in Eq. (2) is the sum of all bank branches in city j at the beginning of quarter t. Second, we calculate the bank-level exposure of SMB i at the beginning of quarter t to Big Bank b as follows:

$$banknm_{i,t} = \frac{\sum_{j} n_{i,j,t} \times MarSha_{b,j,t}}{\sum_{j} n_{i,j,t}}$$
(3)

The variable $banknm_{i,t}$, in Eq. (3) measures the degree of SMB *i*'s branches overlapping with those of Big Bank *b*. We can also interpret this variable as the weighted average of large bank *b*'s market share ($MarSha_{b,j,t}$) across all cities, with the weights being the number of branches of SMB *i* in these cities. Since there are four Big Banks (subscript *b* in (2) and (3) denotes the Big Four banks), we define four sets of competition variables based on Eq. (3): BOC_{it} , ABC_{it} , $ICBC_{it}$, and CCB_{it} , which measure the degree of competition that SMB *i* faces from the BOC, ABC, ICBC, and CCB during *t*, respectively.

There are at least two sources of variations in the bank-level competition measures of $banknm_{i,t}$ for the SMBs: the branch network strategies of both the SMB and the Big Four banks. In particular, if all SMBs proportionally allocate their branches across all cities, or if the Big Four banks equally allocate their branches across cities; that is, $MarSha_{b,j,t}$ in Eq. (2) does not vary with *j*, then there is no variation in $banknm_{i,t}$. The first concern is not a problem because most SMBs concentrate their branches in certain regions. Among the 21 SMBs in our sample, the 8 urban commercial banks are regional, meaning they can only operate in one region. For example, the Bank of Chongqing operates in only four provinces (Chongqing—provincial level municipality, Ningxia, Sichuan, and Guizhou), and Huishang Bank operates in only two provinces (Jiangsu and Anhui). For the other thirteen SMBs, most concentrate their business in their region of founding. For instance, the Guangdong Development Bank locates about 60% of its branches in Guangdong Province as of the end of 2012, its founding province.

The second concern is not a problem either. Again, from Figure 5 (branches as of the end of 2012), while all four banks have branches in all provinces, their network intensities vary. For example, the ABC has most of its branches in the western areas, the ICBC concentrates on the northern and southern regions, the CCB focuses on central China, and the BOC concentrates on the coastal and northern parts of the country. If we aggregate the four banks, they have much stronger presence in less developed areas compared to the SMBs. Table 3 presents the summary statistics of these competition measures and their correlations.

We attribute the spike in SMBs' WMP issuance post-stimulus to increased competition from the Big Four banks in local deposit markets. Our identification strategy stems from the differential pace of credit expansion among the Big Four banks following the announcement of the stimulus. As Figure 4 documents, the BOC was the most aggressive in its expansion in the credit and deposit markets. These differences created a plausibly exogenous shock to SMBs competing against the big banks in local deposit markets. Accordingly, the exposure to BOC competition ought to have a greater impact on the SMBs' LDRs and WMP issuance relative to other big banks' expansion during the post-stimulus period.¹⁶

To test our hypothesis, we first look at whether the four sets of competition measures have a positive effect on SMBs' LDR. We run the following regression:

$$DR_{it} = \alpha_1 BOC_{it} + \alpha_2 ABC_{it} + \alpha_3 ICBC_{it} + \alpha_4 CCB_{it} + banktype_i + quarter_i + \varepsilon_{it}$$
(4)

From Eq. (4), we expect α_1 , the coefficient on SMBs' exposure to BOC competition, to be positive and greater than α_2 , α_3 , and α_4 , the coefficients on SMBs' exposure to the competition of the other three large banks, only during the post-stimulus period. We cluster standard errors by bank. We do not employ bank fixed effects because the bank-level competition measures are quite stable over time. We do control for bank type (urban or jointequity commercial banks) in all models, and include bank controls (size and return on assets, ROA) in the regressions to ensure that the effects on SMBs' LDRs come from the various degrees of competition from the large banks.

We then introduce the competition measure into the WMP issuance regression. Given an SMB's LDR at the beginning of the period and competition from the Big Four banks during the current period, the SMB determines the volume of WMP issuance.

$$issue_{e_{it}} = \beta_1 LDR_{i,t-1} + \beta_2 spread_t + \beta_3 spread_t \times LDR_{i,t-1} +$$
(5)

¹⁶ In untabulated results, we also find that the BOC had the same business model, loan portfolio, and asset structure as the other three banks, and was thus different only in the dimension of its reaction to the stimulus.

$$\gamma_1 BOC_{it} + \gamma_2 ABC_{it} + \gamma_3 ICBC_{it} + \gamma_4 CCB_{it} + banktype_i + quarter_t + \varepsilon_{it}$$

Similarly, we expect γ_1 to be positive and greater in magnitude than γ_2 , γ_3 , and γ_4 . Again, we do not include bank fixed effects; we include a set of bank controls, and cluster standard errors by bank.

Table 4, Panel A reports the estimation results for the baseline model of Eq. (4). In Column (1), we run regressions for all twenty-one SMBs over the entire sample period of 2007-2014. Among the four competition variables, only *BOC*, which measures SMBs' geographical exposure to the BOC, has a positive and significant effect on SMBs' LDR. In Columns (2)-(5), we repeat the regressions in two-year intervals for both the pre- and post-stimulus periods. We can see that the positive relationship between the BOC and LDR holds only after 2010. In 2009 and 2010, when the stimulus plan just came into effect, competition from the BOC had a positive but statistically insignificant effect on SMBs' LDRs (Column 3), perhaps because the central bank provided much liquidity to support the plan.

The effect of BOC competition became positive and statistically significant starting in 2011 (Columns 4 and 5).¹⁷ During 2011-2012 (Column 4), a one-standard deviation increase in the geographic exposure to the BOC increases an SMB's LDR by 0.48 standard deviations or 3.1%. In Panel B of Table 4, we added more bank control variables (size and ROA) to the regressions, and the effects of BOC competition on SMBs' LDRs remain qualitatively the same in both the entire period and in the sub-periods; both the magnitude and statistical significance of the effects drop only slightly.

Table 5 reports the estimation results for SMBs' WMP issuance based on Eq. (5). Similar to the results in Table 4, we find that BOC competition has a positive and significant impact on SMBs' WMP issuance even after controlling for banks' LDRs, and this relation holds starting only from 2009. Panel A reports the results from the baseline regressions: a one-standard deviation increase in BOC competition will increase banks' WMP issuance over equity by 0.27 standard deviations or by 9.0% (of bank equity) in 2009-2010 (Column 2), 0.22 standard deviations or by 39.2% in 2011-2012 (Column 3), and 0.52 standard deviations or by 122.7% in 2013-2014 (Column 4). By contrast, none of the competition measures from the other three big banks (ICBC, CCB, or ABC) has a consistently positive and significant effect on banks' WMP issuance during the post-stimulus period.

¹⁷ SUR tests of the estimated coefficients of the BOC variable show that the coefficients for 2011-12 and 2013-14 are significantly different from those for 2007-08 and 2008-09 (all significant at the 1% level).

We learned from Table 4 that BOC competition affects SMBs' LDRs. Therefore, banklevel measure of geographical exposure to competition from the BOC branches not only affects smaller banks' WMP issuance directly, but also indirectly through LDR—in particular, SMBs facing a tighter LDR constraint have a stronger incentive to issue WMPs to help them stay below the threshold. To see the total effects of BOC competition on SMBs, we repeat the estimation without LDR. Columns (5)-(8) in Panel A show that all results continue to hold in these specifications, except that the magnitude of the coefficients on *BOC* becomes greater. According to the estimation, a one-standard deviation increase in BOC exposure will increase banks' WMP issuance over equity by 0.33 standard deviations in 2009-2010, and 0.33 standard deviations in 2011-2012, and 0.56 standard deviations in 2013-2014.

Since the four sets of competition metrics are correlated (see Table 3), to obtain a clearer picture of how each individual large bank affects SMBs' WMP issuance, we include only one large bank's competition variable in the regressions, and report the results in Table 5, Panel B. For brevity, we report only the coefficients on the competition measures; thus, we obtain each coefficient from one regression. From Panel B, we can see that only geographic exposure to the BOC has a positive and significant effect on the SMBs' WMP issuance during the entire post-stimulus period. ICBC exposure has a much smaller effect, while that of the two other banks is mostly positive but statistically insignificant. In Panel C, we again add bank size and ROA as additional controls (with and without LDR as a control) and the main results are robust to this specification.¹⁸

To summarize, Tables 4 and 5 provide support for our hypothesis that the 4-trillion stimulus, especially different paces in Big Four banks' credit expansion, created a plausibly exogenous shock to SMBs, and those facing more competition in local deposit markets from the fastest expanding big bank—the BOC—issued more WMPs.

Although we provide evidence that the effect of big bank competition on SMBs' WMP issuance exists only after the stimulus period and only for the most aggressive big bank BOC, one concern may be that there is an omitted variable that happens to be correlated with BOC's presence in the post-stimulus period and drives the WMP issuance of SMBs. For example, as BOC's branching network is more concentrated in the coastal areas and these areas generally experience faster economic growth, SMBs with more branches in the coastal areas will be

¹⁸ We also look at the effects of monetary policy tightening on WMP issuance. We introduced the 3-month SHIBOR as an additional control and compared this rate with the BOC competition variable to find that the interaction term has a positive and significant effect on SMBs' WMP issuance (results available upon request).

exposed to more BOC competition and also face have more investment opportunities which can drive their funding raising activities through WMPs. Ideally, if branches of the same bank face the same investment opportunities through its internal financial market, we can conduct a within-bank estimation strategy, that is, to control for bank fixed effect and explore variations in WMP issuance and Big Four competition across branches. Since WMP issuance decisions are made at the headquarter of SMBs (and *not* at branch-level), a branch-level analysis on WMP issuance is not feasible.¹⁹

Instead, we provide a different within-bank analysis that can further confirm the deposit competition channel. Banks can compete for funding not only through issuing WMPs but also by establishing new branches. To avoid competition from BOC branches, they ought to prefer establishing branches in cities with less BOC presence. So, after controlling for bank fixed effect, we should expect to see less branch establishment in cities with more BOC competition. However, if more presence of BOC branches represents more investment opportunities in that city, we should expect to see more (if any) branch establishment to capture these opportunities.

To empirically test the hypothesis, we consider branch establishment decisions in cities where the banks already operate. For all the commercial banks, we construct bank-city pairs such that the bank operates at least one branch in that city on December 31, 2008 (so as to avoid new branch establishments possibly affecting the competition measures). Then for any year after 2008, we construct a binary variable *Establish* which equals 1 if the bank established any new branches in that city from 2009 up to that year, and 0 otherwise. We then regress *Establish* on the Big Four competition measures (as of December 31, 2008), as follows:

$$Establish'_{ict} = \gamma_{1t}BOC_c + \gamma_{2t}ABC_c + \gamma_{3t}ICBC_c + \gamma_{4t}CCB_c + \beta_tCitBraNum_c + bank_{it} + province_c + \varepsilon_{ict}$$
(6)

We assume $Establish_{ict} = 1(Establish'_{ict} > 0)$. In Eq. (6), *c* represents city and *i* represents bank. We include both the bank and province fixed effects, as well as the number of branches in a city as a control variable. We run Logit estimation of the model for each year from 2009 to 2016, and cluster the standard errors at the city level.

Table 6 reports the results. BOC competition has a negative and significant effect on new branch establishment of SMBs. For example, in 2011 (Column 3), moving from the 10th percentile of the BOC competition measure to the 90th percentile would reduce the probability

¹⁹ In our conversation with executives of Big Four banks and SMBs, we learned that a few large branches of the large banks do have authority to issue WMPs. However, our focus here is to understand how deposit-competition led to SMBs' issuance of WMPs, and not WMP issuance of the large banks.

of establishing a new branch (of an SMB) in that city from 59% to 52%. The effect of competition from the other three large banks is much weaker (the ICBC competition measure has a marginally *positive* effect in some years). Because we control for the bank fixed effect, the variation is only driven by city-specific factors. As we discuss above, the investment opportunity hypothesis would predict either a zero or positive effect of BOC competition, while the deposit competition hypothesis is consistent with the negative estimates. In fact, the negative and significant effect of BOC competition begins to emerge in 2011, which is also consistent with heightened deposit competition in the post-stimulus period.

In the next subsection, we argue and show that the rise of Big Four's WMP issuance can also be attributed to the RMB 4-trillion stimulus.

D. Big Four Banks' WMP Issuance and the Stimulus Plan

Recall from Figure 1 that the Big Four banks also increased WMP issuance (relative to assets) during the post-stimulus period, although the extent of the increase is more subdued compared to that of the SMBs. As we discussed in Section III.2B, a significant amount of new bank loans went to CIICs, which are owned by the local governments. At the end of 2008, the total bank loan balance to CIICs was RMB 4.33 trillion; the total balance shot up to RMB 7.66 trillion in June 2009 and then to RMB 9.20 trillion at the end of 2012. Some of the extra credit supply resulting from the stimulus also went to the real estate sector and pushed up housing prices substantially (see, e.g., Deng et al., 2015).²⁰

The sharp increase in CIICs' debt levels, as well as an overheated real estate sector, posed a threat to the overall financial system. On June 10, 2010, the State Council passed a new regulation on CIICs and their debt: commercial banks must tighten their credit supply to CIICs and reduce their existing debt levels. The central government, along with the PBC, also placed restrictions on new bank loans going to the real estate sector. Consequently, the total amount of bank loans for real estate shrank from RMB 2.02 trillion in 2009 and 2010 to 1.38 trillion in 2011 and 2012.

These regulatory changes and tightening of bank credit to CIICs and the real estate sector led to a sharp increase in shadow banking activities. Long-term investment in infrastructure and real estate will take years before cash inflows can cover the initial costs. Thus, when the original bank loans extended during the stimulus mature, these loans need to be rolled over or

²⁰ The total income of local governments in 2010, as a main source of funds to repay the debt, was about RMB 11.51 trillion, while total CIIC debt balance was over 7.8 trillion. It is estimated that RMB 1.84 billion of bank loans for CIICs was due in 2012 alone (see the Chinese Financial Statistics Yearbooks 2010-2012).

they may face default. Since banks were restricted to extend new loans, credit originating in the shadow banking sector emerged as a substitute. Banks could refinance these loans with principal-floating WMPs, which are off their balance sheet, or work with non-bank institutions, such as trust companies, to extend new credit.²¹

We do not have information on the individual loans extended during the stimulus; instead, we look at the changes in loan balances, most of which are medium and long-term, over time, and link these changes to the issuance of WMPs for the Big Four banks. Figure 7.1 shows that the fraction of medium (1-5 years) and long-term (longer than 5 years) loans among all loans rose sharply from 56% and 68% in 2008 to 63% and 73% in 2010 for all Big Four banks, before falling gradually in later years. The drop in the percentages of these loans is consistent with banks cutting new loans to CIICs and the real estate sector.

To test our hypothesis that banks issue WMPs to refinance maturing bank loans, for each big bank, we first estimate the linear trend of total loan balances using quarterly observations from 2006 Q4 to 2008 Q4 and calculate the predicted loan balance in 2010 Q4. We then calculate the difference between the actual and predicted loan balances in 2010 Q4 and use it as a proxy for loan increase due to the stimulus. We scale this proxy and the WMP balance by banks' total loan balances at the end of 2008.

Figure 7.2 shows a positive relationship between a large bank's WMP balance at the end of 2013 and the estimated loan increase. In Table 7, we regress banks' WMP balance each year on our proxy of loan increase due to the stimulus. For principal-floating WMP balance (top panel), the positive relationship grew stronger during the post-stimulus period, when more medium- and loan-term loans matured and the need for debt rollover increased. For principal-guaranteed WMPs, however, there is no such relationship, since these WMPs cannot move loans and assets off the balance sheet.

Combining the results of this section, we conclude that there are at least two mechanisms through which the 4-trillion stimulus triggered the rise in China's shadowing banking sector in the form of bank WMPs. For SMBs, the local deposit markets became more competitive because of the Big Four banks, especially the BOC's, massive credit support for the stimulus and need to raise deposits (to satisfy the LDR requirement). The heightened competition in the local deposit markets resulting from the stimulus and large banks' credit expansion had a causal impact on SMBs, leading them to issue much more WMPs to attract more savings. For the Big

²¹ See, for example, Chen, He, and Liu (2018) on the debt rollover of CIICs, and Allen, Gu, Qian, and Qian (2018) on the use of trust products to refinance real estate projects.

Four banks, when the large amount of "stimulus" loans to CIICs and the real estate sector matured, and regulators tightened the credit supply to these sectors, they issued off-balance sheet, principal-floating WMPs to refinance these long-term projects.

As the Big Four banks and SMBs issued more WMPs, the total amount of outstanding, off-balance sheet products rose substantially, and this put pressure on the banking system as the amount required to pay off or roll over also increased sharply. In Table 5 (all 3 panels), the coefficient on BOC competition increases significantly during 2011-12 and 2013-14 compared to 2009-10. The BOC competition variable, which measures SMBs' geographical exposure to BOC branches, is relatively stable over time, while the amount of new issuance (by SMBs) is tied to the total amount they need to roll over, which is increasing for both the Big Four banks and SMBs.

Hence, the rising magnitude of the coefficients of the BOC variable in Table 5 captures a "compounding" effect of bank competition on WMP issuance. In Table 8, we use the amount of net issuance (the difference between total issuance and WMP due in the quarter) as the dependent variable, and regress it on the same set of controls as in Table 5, Panel A. We still observe that the coefficient on BOC competition becomes larger after the stimulus, but the BOC coefficient for 2011-2012 is not statistically different from that for 2013-14. These results confirm that new WMP issuance is indeed tied to the total amount that the bank needs to roll over. These results and interpretations also highlight the importance of rollover risk, which we examine next.

IV. Rollover Risk of WMPs

In the previous section, we established a causal relation between bank competition, which was "shocked" by the 4-trillion stimulus, and the sharp increase in the issuance of WMPs by SMBs during the post-stimulus period. We also examine the reasons behind the increase in WMP issuance by the Big Four banks. In this section, we study the outcome of the fast rise in WMP issuance—the substantial rollover risk of the issuing banks—and whether the stock market and investors are aware of this risk.

IV.1 Maturity Mismatch of WMPs and Yield on New Products

Recall from Table 1, Panel C that many WMPs are short-term products with an average maturity of 3-4 months. We examine the distribution of the maturity *dates* of WMPs within a

quarter. We collect information on individual WMPs from the WIND database and count the number of WMPs that mature on each day within a quarter. Figure 8.1 shows that many WMPs issued by the Big Four banks mature on the final few days within a quarter. For SMBs, the most striking pattern is that an abnormally high proportion of WMPs mature on the last day of each month, and especially on the last day of the quarter (Figure 8.2). For principal-floating WMPs, a large proportion of products issued by both the Big Four banks and SMBs mature at month end, and again, many products mature on the last day of the quarter (Figure 8.3). For principal-guaranteed products, which issuing banks do include on their balance sheets, the distribution is more even across the days of a quarter (Figure 8.4).

The above patterns support the notion that banks use off-balance sheet principal-floating WMPs to help manage LDR regulations. When this type of WMPs mature on the last day of a quarter, investors, many of whom have a deposit account at the issuing bank, let funds flow back to their deposit account (at least temporarily), thus boosting the bank's overall deposit level on that day. Since the CBRC monitors the LDR on the last day of a quarter, this temporary boost in banks' deposit levels helps them stay below the LDR limit of 75%.

The above regulatory arbitrage behavior introduces rollover risk for the banks, in that when a large amount of WMPs mature on a particular day, if a fraction of the invested (long-term) assets does not yield sufficient cash flows, banks will need to refinance these loans and satisfy the redemption of funds by issuing new WMPs and/or raising funds from other institutions and the interbank market.

To examine the rollover risk around WMP maturity dates, we construct a variable *WMPdue*, which is the amount of WMPs due in a quarter over bank equity at the end of the previous quarter, and study its impact on the issuing bank's behavior. We first study its effect on the yield of *newly* issued WMPs by estimating the following model:

$$WMPreturn_{d_{it}} = \beta_1 WMPdue_{it} + \beta_2 Shibor_{d_t} + bank_i + e_{it}$$
(7)

The dependent variable is the difference between the annualized yield on a new WMP and the bank's deposit rate ceiling. The variable *SHIBOR_dt* measures the difference between the SHIBOR and banks' deposit rate ceiling. We choose the SHIBOR and the deposit rate that have the same (or closest) maturity as the WMP and obtain the rates on the day of the WMP issuance. Note that in Eq. (7), we do not include the quarter fixed effect due to the presence of the variable *SHIBOR_dt*, but we do include the issuing bank fixed effect.

The key independent variable is WMPdue. For principal-floating (guaranteed) WMPs, we

use only the total amount of all such products that mature in the same quarter over bank equity. If one purpose of issuing new WMPs is to raise funds to refinance long-term assets and meet the redemption of maturing products, then the issuing bank should offer a higher yield on the new WMPs. Therefore, we expect β_1 in Eq. (7) to be positive.

Table 9 presents the results. Consistent with our hypothesis, *WMPdue* has a positive and significant impact on the yields of new WMPs by the SMBs, but no such relationship exists for the large banks. These results make sense, as different banks have different financing needs and channels when WMPs come due. On one hand, the Big Four banks can raise funds from the interbank market; moreover, they are not as aggressive as SMBs in issuing WMPs, so the amount of WMPs maturing in each quarter does not require large-scale fundraising through the issuance of new products. On the other hand, SMBs face greater liquidity shortages and offer considerably higher yields on the new WMPs to attract capital. The effect of *WMPdue* on new the WMP's yield is positive and significant for both principal-floating and principal-guaranteed products issued by SMBs (Columns 3 and 4; significant at the 1% level). A one-standard deviation increase in *WMPdue* increases the annual yield of WMPs by 0.23% for principal-floating products and 0.38% for principal-guaranteed products. These results indicate a large economic effect of maturing WMPs on the issuance of new products, and confirm that SMBs face substantial rollover risk when a large amount of WMPs mature.

IV.2 Rollover Risk and the Interbank Market

As we discussed above, besides raising funds via new WMPs, banks can tap the interbank market for liquidity. With more maturing WMPs, issuing banks ought to be more willing to offer higher rates when borrowing funds; in other words, banks should submit higher quotes when they have more maturing WMPs and when the aggregate demand for liquidity is greater. To see whether the Big Four banks or SMBs' amount of maturing WMPs plays a greater role in determining the interbank market rate, we include both the average amount of maturing WMPs for the Big Four banks (*WMPdue_BIG4*) and the average amount of maturing WMPs for SMBs (*WMPdue_SMB*) in the regressions. We also include the WMPs due for each individual bank (*WMPdue*). We run the following regression model:

$$Ask_{it} = \alpha + \beta_1 WMPdue_{it} + \beta_2 WMPdue_SMB_t + \beta_3 WMPdue_BIG4_t$$

$$+ \beta_4 Cap_{i,t-1} + \beta_5 LDR_{i,t-1} + e_{it}$$
(8)

The dependent variable is a participating bank's average ask quote within quarter t. We do not

include the bank fixed effect because we are interested in *cross-sectional* variation—how the variation in *WMPdue* across banks affects the submission of ask quotes. We do not include the quarter fixed effect either because we are interested in the relative importance of *WMPdue*, which varies both across banks and over quarters, and *WMPdue_SMB* and *WMPdue_BIG4*, which vary over time, on the ask quotes.

We use quarterly observations of banks that participate in the SHIBOR bid and ask process from 2008 Q1 to 2014 Q4 and estimate the model in Eq. (8) for the Big Four banks and SMBs separately. We standardize the four variables—ask rate, *WMPdue*, *WMPdue_BIG4*, and *WMPdue_SMB*—by scaling them by their standard deviations. There are only fourteen banks in the regression sample; clustering standard errors by bank would dramatically reduce the statistical significance of the coefficients. We do cluster standard errors by quarter.

Table 10 reports the results. The effect of the (average) maturing WMPs for the Big Four banks on the borrowing rates is much stronger than that of WMPs for the SMBs. The coefficient on *WMPdue_SMB* is statistically insignificant in all models, while the coefficient on *WMPdue_BIG4* is positive and significant for both the Big Four banks and SMBs. A one-standard-deviation increase in *WMPdue_BIG4* leads to an increase in a large bank's ask for the overnight SHIBOR by 0.805 standard deviations (Column 1), and a participating SMB's ask for the overnight SHIBOR by 0.728 standard deviations (Column 7). The amount of a large bank's maturing WMPs does not affect its own quotes, while the amount of an SMB's maturing WMPs increases their ask quotes, especially for long-term SHIBOR bidding (Columns 7-12).

These results confirm that the Big Four banks are the dominant players and usually the main liquidity providers in the interbank market, while SMBs are typically net borrowers. When large banks have more maturing WMPs, SMBs are forced to submit higher ask quotes. Further, to analyze how WMPs affect the interbank market as a whole, we look at the relationship between the aggregate amount of maturing WMPs and the one-week SHIBOR. In Figure 9, we calculate the aggregate amount of maturing WMPs over M2 in the Big Four banks and for all SMBs, and plot them against the one-week SHIBOR. We can see a clear rising trend in the one-week SHIBOR over our sample period, and it closely tracks the total amount of maturing WMPs of the Big Four banks (Figure 9.1). By contrast, the amount of WMP due from the SMBs steadily increases over time, but has no clear relationship with the SHIBOR. These patterns indicate that the Big Four banks' activities—the amount of maturing WMPs as one factor—play an important role in determining the SHIBOR.

IV.3 Rollover Risk and the Stock Market's Response

As a final set of tests on the impact of rollover risk, we look at the stock market's response to 17 (publicly listed) banks when their funding cost jumps to higher levels. We calculate the daily change in the overnight and 1-week SHIBOR and regard the changes as unexpected if changes in both the overnight and one-week rates are high. On each business day, the SHIBOR is announced at 11:30am (9:30am starting from 08/01/2014); if the announced rates in the current day are much higher than those on the previous day, then stock prices ought to reflect this adverse change before trading ends. Specifically, we estimate the following model:

$$return_{it} = \alpha + \beta WMPdue_{it} + \varepsilon_{it} \tag{9}$$

The independent variable *WMPdue*_{it} is the amount of WMPs that mature in the current *month* t scaled by the issuing bank's equity at the end of the previous quarter; the dependent variable *return*_{it} is the stock return of the issuing bank from the previous trading day to the current day. We choose days on which the changes in both the overnight and one-week SHIBOR are above a certain threshold. The coefficient β is expected to be negative for sufficiently large changes.

Table 11 reports the results. We choose four different thresholds, with the highest c = 1%. During our sample period, we have 9 trading days in which both the overnight and one-week SHIBOR jumped by 1% or more. The second, third, and fourth thresholds are 0.8%, 0.6%, 0.4% with 16, 25, and 48 trading days, respectively. The first row in Table 10 reports the raw returns on the banks' stocks. We find that the coefficient on *WMPdue* is negative and statistically significant when the threshold is greater than or equal to 0.6%. Figure 10 presents the scatter plot of raw returns against *WMPdue* with c = 1%; clearly, we find a negative relationship between bank stock prices and *WMPdue*.

We also use three risk-adjusted stock returns as the dependent variable in Table 10: raw daily return minus the market return (second row), the residual (from the current day) from a linear projection of raw daily returns on market returns for the past 60 trading days (third row), and the residual from a CAPM model (with the 3-month SHIBOR as the risk-free rate) using observations for the past 60 trading days (fourth row). We continue to find a negative relationship between the amount of WMPs due and the bank's returns on days when the SHIBOR rises sharply. The economic magnitude of the effect is also very large: a one-standard deviation increase in *WMPdue* (68% of issuing bank's equity) leads to a drop in raw returns by 0.64% during the trading days when the SHIBOR spiked by 1% or higher.

The results from Figure 10 and Table 11 suggest that the stock market and investors appear

to be aware of the rollover risk—as measured by maturing WMPs—that the issuing banks face. To conclude, the results in this section show that the rollover risks of WMPs put pressure on banks' liquidity management and increase their funding cost, and the amount of maturing WMPs of the Big Four banks is a determinant of the SHIBOR in the interbank market. As the Big Four banks and SMBs all issue more WMPs, the scale and rollover risks rise the amount to roll over increases, which poses a threat to the stability of the entire financial system.

V. Conclusion

Much attention has been paid to the rise of shadow banking as a result of "regulatory arbitrage" by financial institutions and its impact on the stability of the overall financial system. However, there is little academic research on how shadow banking arises in emerging markets. In this study, we examine one of the largest components of China's shadow banking sector—WMPs issued by banks. We link the rapid rise in the scale of WMPs after 2009 to banking regulations, especially on-balance sheet regulations, and the RMB 4-trillion stimulus. We also study the rollover risk of the WMPs by looking at issuing banks' behavior when these products mature and in the context of the interbank market.

While WMPs existed long before 2009, their scale, especially off-balance sheet, principalfloating products, took off after the stimulus was implemented. We first provide evidence showing that regulatory arbitrage is indeed behind the issuance of WMPs: the scale of WMP issuance is greater for banks that are more constrained by on-balance sheet lending restrictions, in particular the LDR (loan-to-deposit ratio) requirement for SMBs, and when the gap between the market lending rates and the regulated deposit rate ceiling is high.

Second, we attribute the swift rise of SMBs' issuance of WMPs during the post-stimulus period to heightened competition with large banks triggered by the massive credit expansion during the implementation of the stimulus. The Big Four banks were the primary source that pumped stimulus credit into the economy. After a rapid increase in loan balances, these large banks, especially the BOC, grew much more aggressive in deposit markets to ensure that their LDRs stay below the regulatory limit. Increased competition in the local deposit markets then forced SMBs, especially those with high geographical exposure to BOC competition, to issue off-balance sheet WMPs to attract savings and satisfy on-balance sheet lending requirements. When the regulators tightened the credit supply to local governments and the real estate sector, the Big Four banks issued principal-floating WMPs to refinance the long-term projects in these

sectors, while moving the new loans off their balance sheets. Hence, this is another channel through which the stimulus triggered the growth of WMPs.

Third, as the amount of WMPs rises over time, they impose increasingly greater rollover risks for the issuing banks, the inter-bank market, and the entire financial system. When more WMPs mature, SMBs offer higher yields on new WMPs, while more maturing WMPs in the Big Four banks is associated with higher short-term rates (SHIBOR) in the interbank market. Finally, (listed) issuing banks' stock prices drop more during credit crunches when they have more WMPs come due. Overall, our tests and results shed light on how the stimulus and bank competition triggered the rapid rise of shadow banking—in the form of WMPs—in China, and contributed to the greater fragility of the financial system.

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Table 1 Summary Statistics

The sample includes quarterly observations of the largest 25 Chinese banks from 2008 Q1 to 2014 Q4 (names listed in Panel B). Panel A reports bank characteristics at the end of each quarter. For the variable SHIBOR ask quotes, Panel A reports the quarterly average values for quotes submitted by the Big Four and participating SMBs. Panel C reports total WMP issuance and amount due for each group of banks every quarter and the annualized expected yield of WMPs issued by the banks during the sample period. Panel D reports the average maturity of WMPs issued by the Big Four banks and SMBs each year. See Appendix A for definitions of all variables.

Variables	Banks	Max	Min	Mean	Std. Dev.
Equity	Big 4 Banks	1507.3	148.0	737.5	281.58
(Billion RMB)	SMBs	463.7	2.4	69.9	81.67
Deposit Balance	Big 4 Banks	15591.3	3965.6	9660.8	2793.38
(Billion RMB)	SMBs	4719.5	27.4	860.0	926.25
Loan Balance	Big 4 Banks	10441.7	2638.5	6053.4	1839.74
(Billion RMB)	SMBs	3473.4	21.3	610.3	673.45
Capital Ratio	Big 4 Banks	0.15	0.00	0.12	0.047
	SMBs	0.26	0.06	0.12	0.022
Bank ROA	Big 4 Banks	.015	.002	.008	.003
	SMBs	.017	.003	.007	.003
LDR	Big 4 Banks	0.76	0.51	0.63	0.061
	SMBs	0.93	0.44	0.68	0.076
Overnight SHIBOR Ask	Big 4 Banks	4.02	0.81	2.45	0.85
Rate (%)	SMBs	3.97	0.82	2.45	0.84

Panel A: Summ	ary Statistics:	Bank	Characteristics
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Panel B: List of banks

Big 4 Banks	Joint-equity Commercial Banks
Agricultural Bank of China	Bank of Communications
Industrial and Commercial Bank of China	Bohai Bank
China Construction Bank	China Zheshang Bank
Bank of China	Hua Xia Bank
Urban Commercial Banks	China CITIC Bank
Shengjing Bank	Shanghai Pudong Development Bank
Bank of Beijing	China Everbright Bank
Bank of Nanjing	Guangdong Development Bank
Harbin Bank	Evergrowing Bank
Bank of Chongqing	China Merchants Bank
Bank of Shanghai	China Minsheng Bank
Bank of Ningbo	Ping An Bank
Huishang Bank	Industrial Bank

Variables	Banks	Max	Min	Mean	Std. Dev.
Issuance	Big 4 Banks	3022.3	1.0	1002.2	771.16
(billions of RMB)	SMBs	4249.5	0.0	206.8	506.10
Issuance/Equity	Big 4 Banks	4.41	0.00	1.22	0.83
	SMBs	10.53	0.00	1.55	2.03
Principal-guaranteed WMP	Big 4 Banks	3.74	0.00	0.41	0.54
Issuance/Equity	SMBs	6.57	0.00	0.54	0.94
Principal-floating WMP	Big 4 Banks	1.83	0.00	0.82	0.54
Issuance/Equity	SMBs	10.05	0.00	1.01	1.45
WMP Due/Equity	Big 4 Banks	4.21	0.00	1.19	0.84
1 5	SMBs	11.72	0.00	1.41	1.98
Principal-guaranteed WMP	Big 4 Banks	3.34	0.00	0.40	0.55
Due/Equity	SMBs	6.70	0.00	0.50	0.90
Principal-floating WMP	Big 4 Banks	1.73	0.00	0.78	0.52
Due/Equity	SMBs	11.72	0.00	0.91	1.44
WMP annualized return (%)	Big 4 Banks	30.00	0.36	4.50	1.00
	SMBs	30.00	0.36	4.70	1.15
Principal-guaranteed	Big 4 Banks	15.95	0.36	4.11	0.97
WMP return (%)	SMBs	30.00	0.36	4.19	1.24
Principal-floating	Big 4 Banks	30.00	1.45	4.68	0.96
WMP return (%)	SMBs	30.00	0.80	4.89	1.06

Panel C: Summary Statistics: WMPs

Panel D: Average Maturity (in days) of WMPs

Banks Big 4 Banks		Banks	SMBs			
Yield	Туре	Floating	Guarantee	Floating	Guarantee	
Year	2007	326	282	377	278	
	2008	203	207	165	90	
	2009	219	38	162	91	
	2010	117	38	129	87	
	2011	107	72	90	70	
	2012	123	78	116	94	
	2013	127	83	125	97	
	2014	139	76	118	100	

Table 2 Determinants of WMP Issuance

The sample includes quarterly observations of the 25 banks from 2008 Q1 to 2014 Q4. Both the capital ratio and *LDR* are measured at the end of the previous quarter. "Floating" refers to principal-floating and "Guarantee" refers to principal-guaranteed WMPs. Panels A and B examine whether the capital ratio and *LDR* affect the issuance of WMPs, respectively. Standard errors are clustered by bank. Robust *t*-statistics are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Bank		Big 4			SMBs	
Yield Type	All	Floating	Guarantee	All	Floating	Guarantee
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)	(5)	(6)
Capital Ratio	5.040	5.696	-0.861	8.247*	6.619*	1.625
	(0.663)	(2.123)	(-0.167)	(1.811)	(1.760)	(0.446)
Spread	3.835***	2.772***	1.086**	8.316***	5.575***	2.757***
	(11.18)	(6.581)	(4.784)	(6.551)	(5.496)	(3.992)
Capital Ratio*Spread	-5.571	-5.108*	-0.440	-8.469*	-6.141*	-2.378
	(-1.329)	(-2.632)	(-0.174)	(-2.039)	(-1.928)	(-0.839)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112	112	112	588	588	588
R-squared	0.830	0.787	0.481	0.697	0.605	0.606

Panel A: Effect of the Capital Ratio on Banks' WMP Issuance

Panel B: Effect of LDR on Banks' WMP Issuance

Bank		Big 4			SMBs	
Yield Type	All	Floating	Guarantee	All	Floating	Guarantee
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)	(5)	(6)
LDR	-3.822	-3.489	-0.537	-1.215	-2.541	1.336
	(-1.419)	(-1.469)	(-0.360)	(-0.326)	(-0.971)	(0.576)
Spread	2.488*	2.598***	-0.113	5.222***	3.355***	1.867***
	(2.731)	(7.013)	(-0.0953)	(3.921)	(3.195)	(2.873)
LDR*Spread	1.073	-0.259	1.376	3.449***	2.204**	1.263*
	(0.847)	(-1.018)	(1.351)	(2.902)	(2.443)	(1.948)
Bank fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	112	112	112	588	588	588
R-squared	0.836	0.807	0.498	0.707	0.608	0.629

Table 3 Summary Statistics: Bank Competition Measure

The variable BOC measures each of the 21 SMBs' exposure to geographic competition from the BOC. We obtain quarterly observations from 2007 Q1 to 2014 Q4 for the 21 SMBs in our sample. The variables ICBC, CCB, and ABC are similarly defined. The first table reports the summary statistics of these four variables and the second table reports the correlations between each pair.

Variable	Obs.	Mean	Std. Dev.	Min	Max
BOC	672	0.077	0.013	0.039	0.128
ICBC	672	0.129	0.024	0.069	0.207
CCB	672	0.107	0.018	0.056	0.167
ABC	672	0.134	0.025	0.035	0.233

Correlations between the Competition Measures

	BOC	ICBC	CCB	ABC
BOC	1.000			
ICBC	0.632	1.000		
CCB	0.676	0.866	1.000	
ABC	0.707	0.544	0.609	1.000

Table 4 The Effects of the Big Four's Competition on SMBs' LDRs

The dependent variable is SMBs' LDRs, and the sample includes quarterly observations of 21 SMBs from 2007 Q1 to 2014 Q4. Standard errors are clustered by bank. Robust *t*-statistics are shown in the parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Year	07-14	07-08	09-10	11-12	13-14
Dep Var: LDR	(1)	(2)	(3)	(4)	(5)
BOC	2.379***	0.790	1.177	3.274**	5.300**
	(3.700)	(0.774)	(1.226)	(2.720)	(2.209)
ICBC	0.276	0.336	-0.566	0.970	3.505
	(0.404)	(0.707)	(-0.440)	(0.580)	(1.614)
CCB	-1.698*	-1.179**	-0.411	-3.475	-5.783**
	(-1.782)	(-2.466)	(-0.300)	(-1.629)	(-2.395)
ABC	-0.395	0.394	-0.697	-0.823	-2.120
	(-0.637)	(1.074)	(-0.802)	(-0.504)	(-1.222)
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes
Bank type fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	672	168	168	168	168
R-squared	0.467	0.633	0.554	0.499	0.451

Panel A: Basic Regressions

Year	07-14	07-08	09-10	11-12	13-14
Dep Var: LDR	(1)	(2)	(3)	(4)	(5)
BOC	1.973***	0.664	0.678	2.395*	5.297**
	(3.505)	(0.829)	(0.783)	(2.083)	(2.124)
ICBC	-0.381	0.514	-1.380	-0.167	2.317
	(-0.518)	(1.067)	(-1.462)	(-0.107)	(1.115)
CCB	-1.224	-1.314**	0.230	-2.707	-5.410**
	(-1.215)	(-2.502)	(0.213)	(-1.327)	(-2.292)
ABC	-0.208	0.392	-0.448	-0.681	-2.063
	(-0.329)	(1.194)	(-0.523)	(-0.482)	(-1.669)
Bank size	0.0192***	-0.0131*	0.0267***	0.0390**	0.0504*
	(2.922)	(-1.843)	(2.909)	(2.678)	(1.729)
Bank ROA	-5.438*	-2.600	-5.893	-1.451	14.84
	(-1.748)	(-1.220)	(-1.585)	(-0.325)	(1.678)
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes
Bank type fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	664	162	166	168	168
R-squared	0.492	0.677	0.624	0.615	0.644

Table 5 Effects of the Big Four's Competition on SMBs' WMP Issuance

The dependent variable is an SMB's issuance (in a quarter) scaled by bank equity, and the sample includes quarterly observations of 21 SMBs from 2008 Q1 to 2014 Q4. As competition from BOC also affects WMP issuance through the LDR, we conduct the tests with and without SMBs' LDRs. Panel B repeats Regressions (5)-(8) in Panel A with only one bank's competition measure in the regression at a time. Panel C adds two more bank control variables (size and ROA). Standard errors are clustered by bank. Robust t-statistics are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1.

Year	08	09-10	11-12	13-14	08	09-10	11-12	13-14
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BOC	6.061	7.246***	40.45*	146.4***	4.916	8.669***	60.79***	159.4***
	(1.319)	(3.167)	(2.056)	(2.847)	(0.985)	(3.760)	(3.814)	(4.011)
ICBC	3.077	2.174	44.10**	54.60	3.087	2.155	50.48*	62.40
	(0.948)	(1.167)	(2.242)	(0.855)	(0.948)	(0.866)	(1.876)	(1.012)
CCB	-6.079	-1.414	-52.97*	-93.99	-4.072	-3.020	-77.16**	-107.4
	(-1.370)	(-0.480)	(-1.792)	(-1.248)	(-0.946)	(-0.965)	(-2.214)	(-1.530)
ABC	0.756	-3.797**	18.87	15.21	0.312	-3.665**	15.02	9.900
	(0.522)	(-2.314)	(1.295)	(0.347)	(0.195)	(-2.154)	(0.785)	(0.237)
LDR	-4.985*	0.502	8.228	2.649	_	_	_	_
	(-1.809)	(0.729)	(0.845)	(0.535)	_	_	-	-
Spread	-1.807	-0.880*	-1.277	3.089**	0.0374	0.136**	-1.554***	3.031***
-	(-1.254)	(-1.896)	(-0.467)	(2.275)	(0.105)	(2.447)	(-4.934)	(3.071)
LDR*Spread	2.638	1.488**	-0.602	-0.150	_	_	-	-
*	(1.346)	(2.136)	(-0.142)	(-0.130)	-	_	_	-
Bank type fixed effect	Yes	Yes						
Quarter fixed effect	Yes	Yes						
Observations	84	168	168	168	84	168	168	168
R-squared	0.214	0.431	0.348	0.515	0.179	0.394	0.318	0.511

Panel A: Basic Regressions with All Big Four Bank Competition Measures

Panel B: Effects of Bank Competition on SMBs' WMP Issuance: One Competition Measure at a time

In the table below, we repeat Regressions (5)-(8) in Panel A with only one competition measure in the regression at a time. To save space we report only the key coefficients on the particular competition measure.

Year	08	09-10	11-12	13-14
BOC	6.071	5.366***	56.37***	125.7***
	(1.548)	(3.097)	(2.940)	(3.401)
ICBC	2.398	2.327*	20.89*	42.85*
	(1.081)	(2.061)	(2.039)	(1.979)
CCB	0.950	1.815	15.02	34.59
	(0.390)	(1.254)	(1.172)	(1.223)
ABC	1.880	-0.720	13.57	17.14
	(1.146)	(-0.484)	(0.736)	(0.400)

Panel C: Regressions with More Bank Control Variables

Year	08	09-10	11-12	13-14	08	09-10	11-12	13-14
Dep Var:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Issuance/Equity								
BOC	3.465	5.936**	41.21	151.2***	2.738	6.552**	47.64*	113.5***
	(0.796)	(2.194)	(1.695)	(3.198)	(0.679)	(2.279)	(1.897)	(2.895)
ICBC	3.899*	0.510	38.73*	17.53	3.665*	0.210	38.86	2.948
	(1.770)	(0.225)	(1.783)	(0.284)	(1.805)	(0.0919)	(1.666)	(0.0477)
CCB	-7.985**	-0.630	-62.94**	-96.81	-6.395**	-1.551	-71.54**	-60.10
	(-2.256)	(-0.253)	(-2.672)	(-1.409)	(-2.335)	(-0.612)	(-2.260)	(-0.866)
ABC	0.996	-2.962*	17.45	-5.960	0.669	-2.617	16.17	9.626
	(0.697)	(-1.873)	(1.009)	(-0.149)	(0.493)	(-1.621)	(0.879)	(0.262)
Bank size	0.0587	0.0774	0.552	2.041***	0.0644	0.0943*	0.656*	1.685***
	(1.269)	(1.534)	(1.291)	(4.492)	(1.451)	(2.041)	(1.809)	(3.548)
Bank ROA	88.45**	7.169	109.7	-57.00	87.46**	7.620	111.6	-144.2
	(2.179)	(0.478)	(0.632)	(-0.198)	(2.168)	(0.512)	(0.640)	(-0.490)
LDR	Yes	Yes	Yes	Yes	No	No	No	No
Spread	Yes							
LDR*Spread	Yes	Yes	Yes	Yes	No	No	No	No
Bank type FE	Yes							
Quarter FE	Yes							
Observations	81	166	168	168	81	166	168	168
R-squared	0.416	0.470	0.388	0.666	0.395	0.451	0.384	0.643

Table 6 Within-Bank Estimation of New Branch Establishment

This table examines whether an SMB's decision to establish new branches in a city is affected by deposit competition (from the Big Four banks) in that city. The sample includes all commercial banks in China. Each observation is a bank-city pair such that the bank had branches in that city on Dec. 31, 2008. The dependent variable equals 1 if the bank established new branches in the city since 2009 to the current year, and 0 otherwise. CitBraNum is the total number of branches in that city. All the explanatory variables take their values on Dec. 31, 2008. Logit model is used. Standard errors are clustered by city. Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

From 2009 to	2009	2010	2011	2012	2013	2014	2015	2016
Dep Var: Establish	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BOC	2.567	-3.358	-5.317**	-6.146*	-7.024**	-8.128**	-8.997***	-9.416***
	(0.722)	(-1.115)	(-1.970)	(-1.916)	(-2.181)	(-2.447)	(-2.690)	(-2.808)
ICBC	1.873	4.442*	3.487*	3.352	3.860*	4.249*	3.837	3.643
	(0.568)	(1.784)	(1.685)	(1.389)	(1.686)	(1.783)	(1.630)	(1.542)
CCB	3.673	3.118	2.581	0.744	2.212	3.617	1.715	2.196
	(1.037)	(1.112)	(0.931)	(0.239)	(0.779)	(1.256)	(0.589)	(0.747)
ABC	-1.929	-1.527	-1.469	-0.250	-1.017	-1.506	-1.654	-1.388
	(-1.267)	(-1.395)	(-1.518)	(-0.242)	(-1.013)	(-1.490)	(-1.637)	(-1.352)
CitBraNum	0.00145***	0.00135***	0.00146***	0.00152***	0.00225***	0.00218***	0.00221***	0.00226***
	(6.949)	(7.316)	(8.189)	(4.945)	(8.384)	(7.605)	(7.542)	(7.523)
Bank F.E.	Yes							
Province F.E.	Yes							
Cluster	city							
Observations	2,486	2,455	2,436	2,418	2,415	2,330	2,260	2,260

Table 7 The RMB 4-trillion Stimulus and Banks' WMP Issuance

This table reports whether the estimated loan increase due to the stimulus plan during 2009-2010 can predict later WMP balances. We first estimate the linear trend of loan balances for each bank using quarterly observations from 2006 Q4 to 2008 Q4 and use the difference between the actual loan balances and the predicted loan balances in 2010 Q4 as the estimated loan increase during the stimulus plan. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Year t	2010	2011	2012	2013	2014
Yield type	floating	floating	floating	floating	floating
Dep Var: (WMP Balance in year t)/(Loan Balance in 2008)	(1)	(2)	(3)	(4)	(5)
Estimated loan increase/Loan balance in 2008	0.0237	-0.000119	1.227***	1.364***	2.093***
	(0.354)	(-0.00240)	(5.547)	(5.174)	(3.068)
Constant	0.0463	0.0865***	-0.116	-0.0959	-0.0997
	(1.637)	(3.287)	(-1.022)	(-0.744)	(-0.383)
Observations	25	25	25	25	25
R-squared	0.006	0.000	0.448	0.485	0.391
Year t	2010	2011	2012	2013	2014
Yield type	guarantee	guarantee	guarantee	guarantee	guarantee
Dep Var: (WMP Balance in year t)/(Loan Balance in 2008)	(1)	(2)	(3)	(4)	(5)
Estimated loan increase/Loan balance in 2008	-0.00646	0.00559	0.252	0.398	0.202
	(-0.708)	(0.149)	(1.233)	(1.166)	(0.558)
Constant	0.0149**	0.0316*	0.0230	0.0227	0.234
	(2.322)	(1.950)	(0.280)	(0.173)	(1.570)
Observations	25	25	25	25	25
R-squared	0.004	0.001	0.161	0.150	0.029

Table 8 Re-examining the BOC's Effect on WMP Issuance

We repeat the regressions from Table 5, Panel A (Columns 1-4) and examine the effects of BOC competition on WMP issuance. Here, we use the amount of net issuance of each SMB (the difference between total WMP issuance and the amount due in the quarter) scaled by bank equity as the dependent variable. Panel B reports the SUR test results compared to the coefficients on the BOC variable from Panel A. Standard errors are clustered by bank. Robust t-statistics are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Year	08	09-10	11-12	13-14
Dep Var: Net Issuance/Equity	(1)	(2)	(3)	(4)
BOC	-1.647	0.282	6.024**	12.51***
	(-1.292)	(0.277)	(2.575)	(3.050)
ICBC	0.129	-0.442	2.023	-2.444
	(0.185)	(-0.687)	(1.152)	(-0.859)
CCB	-0.179	1.829**	-7.605**	-2.352
	(-0.241)	(2.178)	(-2.728)	(-0.639)
ABC	0.465	-1.028*	0.124	4.618**
	(0.893)	(-1.746)	(0.0701)	(2.249)
LDR	-5.437**	0.159	-2.101**	3.278*
	(-2.364)	(0.771)	(-2.136)	(2.083)
Spread	-3.223**	-0.409*	-0.485	0.864
	(-2.224)	(-1.885)	(-1.530)	(1.561)
LDR*Spread	5.407**	0.701**	0.593	-1.614**
	(2.451)	(2.179)	(1.385)	(-2.141)
Bank type fixed effect	Yes	Yes	Yes	Yes
Quarter fixed effect	Yes	Yes	Yes	Yes
Observations	82	167	168	168
R-squared	0.332	0.157	0.458	0.279

Panel A: WMP Issuance using SMBs' Net Issuance of WMPs

Panel B: SUR test of estimated coefficients (1)-(4)

Comparison Periods	08 vs 09-10	09-10 vs 11-12	11-12 vs 13-14
BOC	1.2	7.12	2.68
	0.2733	0.0076	0.1013
	2		

Each cell in the top row reports Chi² and p values in the bottom row.

Table 9 Rollover Risk and WMPs' Expected Yield

The sample includes all WMPs issued by the 25 banks from 2008 to 2014. The dependent variable WMPReturn_d is the difference between the WMP's annualized yield and bank deposit rate ceiling; SHIBOR_d is the difference between the SHIBOR and bank deposit rate ceiling. "Floating" refers to principal-floating WMPs and "Guarantee" refers to principal-guaranteed WMPs. For regressions on principal-floating (guaranteed) WMPs, WMPdue is total amount of principal-floating (guaranteed) WMPs due in the same quarter over bank equity (measured at the end of last quarter). Standard errors are clustered by quarter. Robust t-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Bank type	Big	Four	SN	/IBs
Yield type	Floating	Guarantee	Floating	Guarantee
Dep Var: WMPReturn_d	(1)	(2)	(3)	(4)
SHIBOR_d	0.629***	0.676***	0.621***	0.630***
	(13.64)	(12.42)	(13.8)	(14.66)
WMPdue	0.18	0.07	0.132***	0.225***
	(1.275)	(0.806)	(4.37)	(4.784)
Bank fixed effect	Yes	Yes	Yes	Yes
Quarter fixed effect	No	No	No	No
Observations	29,589	14,073	64,322	23,839
R-squared	0.660	0.717	0.671	0.659

Table 10 WMP Rollover Risk and SHIBOR Quoted Rate

The sample includes quarterly observations for banks participating in the SHIBOR bidding processes from 2008 Q1 to 2014 Q4. See the appendix for definitions of variables. Both capital ratio and LDR take values at the end of the last quarter while WMPdue takes the value in the current period. We standardize WMPdue by dividing it over its standard deviation. Standard errors are clustered by quarter. Robust t-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Bank			Bi	g 4					SN	í Bs		
Term	o/n	1-w	2-w	1-m	3-m	6-m	o/n	1-w	2-w	1-m	3-m	6-m
Dep Var: Ask Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
WMPdue	-0.0270	-0.0127	-0.0138	-0.0195	-0.0527	-0.0263	0.0330*	0.0301*	0.0304**	0.0297*	0.0492**	0.0689***
	(-1.155)	(-0.475)	(-0.496)	(-0.693)	(-1.488)	(-0.625)	(1.968)	(1.923)	(2.096)	(1.838)	(2.313)	(3.090)
WMPdue_BIG4	0.805***	0.787***	0.800***	0.851***	0.771***	0.675***	0.728***	0.725***	0.740***	0.794***	0.638***	0.569**
	(3.971)	(3.866)	(3.970)	(4.115)	(3.434)	(3.050)	(3.696)	(3.610)	(3.706)	(3.857)	(2.794)	(2.489)
WMPdue_SMB	0.0271	0.0544	0.0460	-0.00455	0.0379	0.113	0.0121	0.0379	0.0357	-0.0154	0.0346	0.0704
	(0.143)	(0.318)	(0.278)	(-0.0271)	(0.234)	(0.764)	(0.0638)	(0.220)	(0.214)	(-0.0903)	(0.213)	(0.452)
Capital Ratio	-4.073***	-4.526***	-4.278***	-3.814***	-5.562***	-6.075***	-0.869	-0.974	-0.930	-0.725	-0.563	0.0788
	(-2.834)	(-2.959)	(-2.903)	(-2.866)	(-3.486)	(-3.737)	(-0.646)	(-0.752)	(-0.741)	(-0.589)	(-0.410)	(0.0540)
LDR	1.134*	1.290*	1.479**	1.445**	1.683**	1.419*	-1.345***	-1.288**	-1.230**	-0.898	-1.301*	-1.430*
	(1.805)	(1.915)	(2.256)	(2.390)	(2.304)	(1.808)	(-3.057)	(-2.633)	(-2.382)	(-1.657)	(-1.799)	(-1.920)
Bank fixed effect	No	No	No	No	No	No						
Quarter fixed effect	No	No	No	No	No	No						
Constant	1.335***	1.331***	1.063***	0.895**	1.203***	1.720***	2.721***	2.730***	2.537***	2.145***	2.751***	3.070***
	(3.543)	(3.310)	(2.788)	(2.578)	(2.966)	(3.833)	(5.450)	(4.937)	(4.417)	(3.758)	(3.566)	(3.707)
Observations	112	112	112	112	112	112	271	271	271	271	271	271
R-squared	0.610	0.636	0.653	0.664	0.537	0.513	0.591	0.616	0.636	0.649	0.502	0.473

Table 11 WMP Rollover Risk and Stock Market Response

The sample includes daily stock return observations from 2009 to 2014 for the 17 listed banks. We choose the (trading) days during which the change in the one-week and overnight SHIBOR are both above a specified threshold c. For these days, we regress the individual stock return on WMPdue in the current month. The first row uses raw data and the second row uses stock returns minus market returns. In the third row, we apply a linear projection of raw daily returns on market returns for the past 60 days and use the estimated residual today as the dependent variable. In the fourth row, we estimate CAPM using observations for the past 60 trading days and use the estimated residual today as the dependent variable. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Threshold	c=1%	c=0.8%	c=0.6%	c=0.4%
Raw	-0.950***	-0.754***	-0.683***	-0.0690
	(-3.806)	(-4.204)	(-5.285)	(-0.755)
Deduct market	-0.296**	-0.201*	-0.264***	-0.0345
	(-1.986)	(-1.790)	(-2.746)	(-0.478)
Projection	-0.246**	-0.157*	-0.281***	-0.0801
	(-2.043)	(-1.653)	(-3.309)	(-1.122)
CAPM	-0.246**	-0.157	-0.281***	-0.0800
	(-2.039)	(-1.650)	(-3.306)	(-1.120)
Observations	159	253	397	765

Figure 1 WMP Issuance over Time

Figure 1.1 reports the average (WMP balance/bank asset) and (deposit/bank asset) over time for Big Four banks and SMBs, respectively. Figure 1.2 divides WMPs according to their yield type and reports (WMP balance/bank asset) over time for Big Four banks and SMBs, respectively.



Figure 1.1: (WMP Balance/Bank asset) across time



Figure 1.2: (WMP Balance/Bank asset) across time by yield type

Figure 2 WMP Balance Sorted by Investment Target

Banks can channel money raised through WMPs into 4 main investment targets: money market, bank deposits at other banks, loan assets, and equity assets. This graph shows the average WMP balances for each type of target at the end of each month from December 2011 to December 2014.



Figure 3 Deposit and SHIBOR Rates and Average WMP Yields over Time

This figure reports the 3-month SHIBOR rate, 3-month deposit rate ceiling, and average WMP expected yield in each month across the sample period. We collect the yield information for all WMPs (not only those issued by the 25 banks) from WIND.



Figure 4 Banks' Activities during the RMB 4-trillion Stimulus Plan

Figure 4.1 shows total loan balance (both short- and medium-/long-term) of all national SMBs and the Big Four banks, respectively. Data for SMBs is only available from 2010. Figure 4.2 presents the total loan balance of the Big Four banks only. For comparison, we scale each by the bank's loan balance at the end of 2008, the beginning of the Stimulus plan. Figure 4.3 focuses on the Big Four's LDRs, while Figure 4.4 exhibits their total deposit balance.





Figure 4.2: Total Loan Balance of the Big Four Banks





Figure 4.3: LDR of the Big Four Banks

Figure 5 Province-level Market Share of the Big Four Banks

The following four figures present the province-level market share (branch intensity) of the Big Four Banks, ABC, BOC, CCB, and ICBC, respectively.





Figure 6 Average Exposure of SMBs to Big Four Bank Competition over Time

This figure plots the average exposure of the 21 SMBs to competition from the Big Four banks over the period 2007 Q1 to 2015 Q1.



Figure 7 Bank Loans and WMP Balance during the Stimulus Plan

We regress banks' WMP balance each year on our proxy of loan increase. Figure 7.1 plots the percentage change in medium- and long-term bank loans during the stimulus plan. Figure 7.2 tracks the relationship between bank's WMP balance at the end of 2013 and the estimated loan increase.



Figure 7.2: Relation between WMP Balance in 2013 and Estimated Loan Increase



Figure 8 Distribution of WMP Maturity Dates (within a quarter)

All individual WMP information is collected from WIND. We label the last day of each quarter as the 90th day and then label other days backwards. Figures 8.1 and 8.2 show the total number of WMPs issued by the Big Four banks and SMBs, respectively. Figures 8.3 and 8.4 show the total number of principal-floating and principal-guaranteed WMPs maturing on each day of a quarter, respectively.



Figure 8.1: Number of WMPs Issued by the Big Four Banks Due on Each Day Within a Quarter



Figure 8.2: Number of WMPs Issued by SMBs Due on Each Day Within a Quarter







Figure 8.4: Number of Principal-guaranteed WMPs Due on Each Day Within a Quarter

Figure 9 Relationship between Aggregate WMPdue and 1-week SHIBOR

The figure shows the relation between the aggregate *WMPdue* and SHIBOR. For each month, we calculate the aggregate *WMPdue* of for the Big Four banks and SMBs and divide it by M2 at the end of the month. We also calculate the average daily 1-week SHIBOR within each month.







Figure 9.2: Average WMPdue of SMBs and 1-week SHIBOR

Figure 10 Rollover Risk and Stock Market Response

This figure shows the stock returns versus *WMPdue* on days in which both the overnight and 1-week SHIBOR increase by more than 1% compared to the previous day. Stock returns are calculated as (today's closing price / yesterday's closing price) -1. The explanatory variable *WMPdue* is total the WMP due in that month over bank equity at the end of the last month.



Variable	Definition
Issuance/Equity	Total WMPs issued in the current quarter divided by bank equity at the end of the previous quarter (scaled by bank equity)
Net Issuance/Equity	The difference between total amount of WMP issued and amount due in the quarter (scaled by bank equity)
Capital Ratio	Commercial bank's capital adequacy ratio calculated according to the "Commercial Bank Capital Adequacy Ratio Management Method" modified by the CBRC on December 28, 2006. Starting from January 1, 2013, a new requirement for the capital ratio took effect, but for consistency, we maintain the old method. Some banks had extreme capital ratios in the early stage of the sample period, so we winsorize it at 1%
LDR	Loan-to-deposit ratio, calculated as the bank's loan balance over deposit balance. The values for the loan and deposit balances are adjusted according to the risk to different deposits and loan assets.
Spread	Difference between the market rate and regulatory rate calculated using the 3-month SHIBOR minus the 3-month bank deposit rate ceiling and taking the average across days within the same quarter.
Size WMPReturn_d	Logarithm of total bank asset at the end of the previous quarter. WMP initial expected annualized yield minus the bank deposit rate ceiling with the same maturity on the issuing date.
SHIBOR_d	SHIBOR of the same maturity as the WMP minus the bank deposit rate ceiling with the same maturity on the issuing date.
WMPdue	Total amount of WMPs due in the current quarter (in the current month in Table 11) over the bank's equity at the end of the previous quarter.
WMPdue_BIG4	The average WMPdue of the Big Four banks in each quarter.
WMPdue_SMB	The average WMPdue of the 21 SMBs in each quarter.
Ask Rate	The banks' average SHIBOR ask rate within the same quarter. All Big Four banks participate in the SHIBOR bid and ask process, but only 9 or 10 SMBs do. Winsorized at both sides by 1%.
BOC	Exposure of an individual bank to competition from the BOC measured by the weighted average of city-level market share of the BOC using the bank's number of branches in that city as the weight. Similar for ABC, CCB, ICBC, and SMB.

Appendix A: Definitions of Variables Used in Empirical Tests