

DISCUSSION PAPER SERIES

DP14957

**IN THE SHADOW OF BANKS: WEALTH
MANAGEMENT PRODUCTS AND
ISSUING BANKS' RISKS IN CHINA**

Viral V Acharya, Jun Qian, Yang Su and Zhishu Yang

FINANCIAL ECONOMICS



IN THE SHADOW OF BANKS: WEALTH MANAGEMENT PRODUCTS AND ISSUING BANKS' RISKS IN CHINA

Viral V Acharya, Jun Qian, Yang Su and Zhishu Yang

Discussion Paper DP14957

Published 28 June 2020

Submitted 23 June 2020

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

This Discussion Paper is issued under the auspices of the Centre's research programmes:

- Financial Economics

Any opinions expressed here are those of the author(s) and not those of the Centre for Economic Policy Research. Research disseminated by CEPR may include views on policy, but the Centre itself takes no institutional policy positions.

The Centre for Economic Policy Research was established in 1983 as an educational charity, to promote independent analysis and public discussion of open economies and the relations among them. It is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions.

These Discussion Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

Copyright: Viral V Acharya, Jun Qian, Yang Su and Zhishu Yang

IN THE SHADOW OF BANKS: WEALTH MANAGEMENT PRODUCTS AND ISSUING BANKS' RISKS IN CHINA

Abstract

We study the rise and risks in bank issuance of Wealth Management Products (WMPs), which are off-balance-sheet substitutes for deposits without the regulatory interest rate ceilings and constitute the largest shadow banking segment in China. We show that competition for deposits has a causal effect on the WMP issuance of small and medium sized banks (SMBs), where we instrument deposit competition by SMBs' geographical exposure to the large (Big Four) banks. The Big Four banks substantially increased their loan supply to support the RMB 4 trillion stimulus initiated in response to the global financial crisis, and thereafter grew more aggressive in the deposit markets in order to stay below the regulatory ceiling on the loan-to-deposit ratio. In response, SMBs issued more WMPs and more frequently, besides also establishing fewer branches in cities with greater competition from the Big Four banks. We find that this growth of WMPs imposed rollover risks for all the bank issuers, as reflected in higher yields on new WMPs, higher borrowing rates in the inter-bank market, and adverse stock market performance of WMP-issuing banks on days with heightened rollover risks.

JEL Classification: G2, E4, L2

Keywords: shadow banking, regulatory arbitrage, Rollover Risk, financial fragility, deposit competition

Viral V Acharya - vacharya@stern.nyu.edu
Stern School of Business, NYU and CEPR

Jun Qian - qianj@fudan.edu.cn
Fudan University

Yang Su - ysu4@chicagobooth.edu
Booth School of Business, University of Chicago

Zhishu Yang - yangzhsh@sem.tsinghua.edu.cn
Tsinghua University

Acknowledgements

We are grateful for helpful comments from Zhuo Chen, Kinda Hachem, Zhiguo He, Nirupama Kulkarni, Robert Marquez, Yiming Qian, Hong Ru, Tianyue Ruan, Vineet Srivastava, Hao Wang, Hao Zhou, and seminar/session participants at the Central Univ. of Finance & Economics, Fudan University, Korea University, NYU Stern, Shanghai Univ. of Finance & Economics, Tsinghua PBC

School, University of Nottingham, Ningbo, Asian Econometric Meetings (Hong Kong), China International Conference in Finance (Xiamen), China Financial Research Conference, NBER China Working Group Meeting (Cambridge, MA), Princeton China Conference, Summer Institute of Finance, and the Western Finance Association meetings (Whistler, Canada). We gratefully acknowledge research assistance from Vanya Petrova, Yang Zhao, and financial support from Fudan University, NYU, and Tsinghua University; Qian and Yang also acknowledge financial support from the National Science Foundation of China (Grant #71972051 for Qian, and Grant #71272024 for Yang). The authors are responsible for all remaining errors.

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

Viral V. Acharya

Stern School of Business
New York University
vacharya@stern.nyu.edu

Jun “QJ” Qian

Fanhai International School of Finance
Fudan University
qianj@fudan.edu.cn

Yang Su

Booth School of Business
University of Chicago
ysu4@chicagobooth.edu

Zhishu Yang

School of Economics and Management
Tsinghua University
yangzhsh@sem.tsinghua.edu.cn

Last Revised: June 8, 2020

Abstract

We study the rise and risks in bank issuance of Wealth Management Products (WMPs), which are off-balance-sheet substitutes for deposits without the regulatory interest rate ceilings and constitute the largest shadow banking segment in China. We show that competition for deposits has a causal effect on the WMP issuance of small and medium sized banks (SMBs), where we instrument deposit competition by SMBs' geographical exposure to the large (Big Four) banks. The Big Four banks substantially increased their loan supply to support the RMB 4 trillion stimulus initiated in response to the global financial crisis, and thereafter grew more aggressive in the deposit markets in order to stay below the regulatory ceiling on the loan-to-deposit ratio. In response, SMBs issued more WMPs and more frequently, besides also establishing fewer branches in cities with greater competition from the Big Four banks. We find that this growth of WMPs imposed rollover risks for all the bank issuers, as reflected in higher yields on new WMPs, higher borrowing rates in the inter-bank market, and adverse stock market performance of WMP-issuing banks on days with heightened rollover risks.

JEL Classifications: G2, E4, L2.

Keywords: Shadow banking, regulatory arbitrage, rollover risk, financial fragility, deposit competition

* We are grateful for helpful comments from Zhuo Chen, Kinda Hachem, Zhiguo He, Nirupama Kulkarni, Robert Marquez, Yiming Qian, Hong Ru, Tianyue Ruan, Vineet Srivastava, Hao Wang, Hao Zhou, and seminar/session participants at the Central Univ. of Finance & Economics, Fudan University, Korea University, NYU Stern, Shanghai Univ. of Finance & Economics, Tsinghua PBC School, University of Nottingham, Ningbo, Asian Econometric Meetings (Hong Kong), China International Conference in Finance (Xiamen), China Financial Research Conference, NBER China Working Group Meeting (Cambridge, MA), Princeton China Conference, Summer Institute of Finance, and the Western Finance Association meetings (Whistler, Canada). We gratefully acknowledge research assistance from Vanya Petrova, Yang Zhao, and financial support from Fudan University, NYU, and Tsinghua University; Qian and Yang also acknowledge financial support from the National Science Foundation of China (Grant #71972051 for Qian, and Grant #71272024 for Yang). The authors are responsible for all remaining errors.

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 relatively 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. 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 1.1), and this rapid growth continues to the present day.

What triggered the rise of WMPs in the shadow banking sector of China? What types of risks do these products impose on the issuing banks and the overall financial system? We address these questions in this paper and provide a novel result that bank deposit competition, intensified after the global financial crisis, had a causal impact on the growth of this form of shadow banking. In particular, we show that the rise of WMPs issued by small and medium sized banks (SMBs) is caused by increased competition for deposits from large (Big Four³) banks, which aggressively raised deposits to maintain their loan-to-deposit ratios after supporting the RMB 4 trillion stimulus plan initiated by the Chinese government in 2008. Having established the origins of this form of shadow banking, we then show that the short maturities and frequent rollovers of large volumes of WMPs have contributed to the greater fragility of the Chinese banking system. In other words, bank regulation, bank competition and regulatory arbitrage interacted in a complex manner in China following the global financial crisis to engender financial fragility.

We first show that, consistent with regulatory arbitrage, banks facing a shortfall in deposits issue more WMPs to attract funding because deposit rates are capped while the WMP returns are not. We instrument the deposit shortfall of SMBs with their exposure to competition from the local branches of the Big Four banks. In 2008, China initiated an RMB 4 trillion stimulus plan in response to the global financial crisis. To support and implement the stimulus, the Big

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).

Four banks injected a large volume of new loans into the economy. Due to the restrictions on the loan-to-deposit ratio (LDR)—loans *cannot* exceed 75% of total deposits, these banks had to compete more aggressively for deposits in order to stay below 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 markets to SMBs. SMBs that are more exposed to the competition from the Big Four banks, especially the most aggressively expanding big bank, had lower deposit-to-asset ratios and issued more WMPs after 2010. These SMBs also established fewer branches in cities with more competition from the Big Four banks.

The WMPs typically have short maturities, and issuer banks take on substantial rollover risks: when a large amount of WMPs mature, SMBs offer significantly higher yields on the *new* WMPs, and the Big Four banks and the other ten large banks that submit SHIBOR (Shanghai Inter-bank Offered Rate) quote rates 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 of short-term funding. When the cost of interbank funds unexpectedly rises, stock prices drop more for banks with more WMPs maturing, indicating that the market is concerned about the extent of WMP-issuing banks' rollover risks.

Our dataset covers all the WMPs issued by the largest 25 banks in China, as well as these issuing banks' characteristics for 2008-2014. We separate the banks into two categories: 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. In addition to capital ratio regulations, banks must comply with the LDR requirement. 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, investment projects financed by *principal-floating* WMPs are recorded off the balance-sheet.

A central question is why the liftoff of WMPs, especially those issued by the SMBs,

followed the stimulus. The Chinese economy was booming and there were no imminent problems within the banking sector before 2008. The initiation of the stimulus was due to *external* pressure—in particular, the expeditious drop in exports resulting from weakened demand in developed economies. The stimulus was implemented mostly through the Big Four banks' large volumes of new loans to various sectors of the economy during 2009-2010. Consequently, these banks also competed more aggressively for deposits to keep their LDRs staying below the 75% limit.

Interestingly, the extent of support for the stimulus differed across the four banks, with Bank of China (BOC) being the most aggressive one in expanding both new loans and new deposits. While all four banks have branches throughout the country, the distribution of their branches differs across regions. Therefore, the SMBs whose business concentrated in regions with more intensive branching of Big Four banks, especially BOC, would face more competition in 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 the degrees of each of the twenty-one SMBs' branch overlapping with each of the Big Four banks. Our identification strategy is thus to compare banks with differential exposure to the competition from the Big Four banks, especially BOC, after the stimulus period, and analyze their deposit availability and WMP issuance.⁴

We find that the BOC competition variable had a significantly negative effect on SMBs' *deposit-to-asset* ratios, and this effect existed only after the stimulus period.⁵ No such patterns were found for the other three large banks, indicating that the level of competition from these large banks is indistinguishable from other smaller banks. We then regress SMBs' WMP balance (scaled by assets) on their deposit-to-asset ratio, and use the geographical exposure to Big Four banks' competition as the instrument variables (IVs) for the deposit-to-asset ratios. The exclusion restriction for the IVs should hold, i.e., Big Four banks' competition only affects SMBs' WMP issuance through the *deposit* channel, as there were no such effects before 2010, and we found no effect of these competition variables on SMBs' *lending* during the post-stimulus period. One concern is that as BOC has more presence in the coastal areas, and thus the greater overlap between the SMB and BOC branches may pick up certain regional effects

⁴ Acharya et al. (2020) use a similar variation in competition from state-owned banks to document crowding out of private sector banks by state-owned banks in India.

⁵ These results not only hold for the 21 SMBs in our WMP sample, but also for a larger sample of all the SMBs for which we can collect data on bank characteristics including deposits.

(e.g., investment opportunities) post stimulus. Therefore, we include time-varying area fixed effects in all the regressions along with bank characteristics.

Consistent with our hypothesis, we find a causal and negative relationship between the level of SMBs' deposits and their WMP balances, and this relationship became statistically significant during the post-stimulus period of 2011-2014. During 2011-2012, an SMB raised 13.6 cents through WMP issuance for every one dollar loss of deposits. During 2013-2014, as the WMP balances built up, the bank was able to raise 74.1 cents through WMP issuance for the loss of one dollar in deposits. These results suggest that the substitution effect between less regulated WMPs and tightly regulated deposits was economically significant. In fact, during 2013-2014, the average deposit-to-asset ratio of the 21 SMBs decreased by 2.8%, leading to an increase of 2.1% of the WMP balance-to-asset ratio according to our estimates. As the average WMP balance-to-asset ratio of the 21 SMBs increased by 6.0% during the same period, the deposit competition channel accounted for 35% of the total increase of WMP issuance.

The issuance of WMPs can be driven by both a shortfall in deposits and more investment opportunities. To provide further evidence that more WMP issuance by banks with more branch overlap with BOC is due to deposit competition rather than more investment opportunities, we explore *within*-bank variations, and find that the same bank chose to establish fewer branches in cities with more presence of BOC branches. Again, this pattern only holds for the post-stimulus period. These results reinforce that branch overlap with BOC is disadvantageous (greater deposit competition) for SMBs rather than the opposite (a proxy for better investment opportunities).⁶

The Big Four banks' issuance of WMPs also rose during the second half of the sample period. This could be 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

⁶ It is important to note that our identification strategy relies on the fact that BOC competed more aggressive in deposit markets than the other large banks, and this difference generated variations in the levels of competition exposure across SMBs. While we also provide evidence that enhanced BOC competition was related to its aggressive credit expansion to carry out the stimulus plan, we do not necessarily need the assumption that the stimulus was the sole factor that caused the heightened competition among banks, or the stimulus increased the level of competition only through BOC.

and rolled over old loans. Accordingly, we find a positive relationship between the estimated loan increase due to the stimulus and the WMP balance in later years (when the stimulus loans matured) for the Big Four banks. These results confirm the findings in Chen et al. (2020), who study local governments' financing channels before and after the stimulus.

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.

We show that 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 Big Four banks and the other ten large banks that submit SHIBOR quote rates are willing to borrow or lend 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 indicates that the rollover risk grows with the total amount of outstanding WMPs as the amount to rollover 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 risks 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.⁷ Second, after institutions sell the loans and other (unpackaged) debt to the underwriters, there remains some

⁷ Some of the funds raised from selling WMPs *do* go in risky and speculative areas such as leveraged trading in the stock market, but banks often retain the most senior tranches.

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 the growth and collapse in the issuance of asset-backed commercial paper market due to regulatory arbitrage (Acharya et al., 2013b; Borst, 2013).

There are a few recent studies on China's shadow banking sector. Allen et al. (2019a) and Chen et al. (2018) study another large component of the shadow banking sector, i.e., entrusted loans extended by non-bank financial institutions and firms to other firms. Hachem and Song (2017) 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 competition. Ehlers et al. (2018) provides a comprehensive description of the backgrounds and evolution of shadow banking in China.

Other papers also make some linkage between the rise of shadow banking products and the stimulus. For example, Chen et al. (2020) show that local governments financed investment projects through stimulus bank loans in 2009, and then switched to nonbank, "shadow banking" debt financing after 2012, when faced with rollover pressure from bank loans coming due. Allen et al. (2019b) show that the scale of trust products issued by trust companies began to take off in 2010, with the majority of capital raised going to real estate sectors and local government debt. In addition, Cong et al. (2019) show that, during 2009-2010, stimulus bank credit disproportionately favored SOEs, which were less productive than private firms.

In contrast to these papers, we focus on the substitution between deposits and WMPs and WMPs' rollover risks. We also linked the growth of WMPs to the stimulus and credit expansions by the Big Four banks, which heightened deposit competition between large and small banks. To the best of our knowledge, we are the first to adopt an identification strategy that tracks how SMBs respond to the unexpectedly increasing competition from the Big Four banks expanding their lending and deposits at different paces. This strategy allows us to link the growth in WMPs and deposit competition to the implementation of the stimulus. 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, and in Sections IV and V we link the rise of WMPs to the 4-trillion stimulus plan and bank competition. In Section VI, we study the rollover risk of WMPs. We conclude in Section VII. The appendix contains the explanations of the variables and classification of the banks.

II. Institutional Background, Banking Regulation, and Shadow Banking

II.1 Banking System and Regulations

There are four categories of banks in China. The first is the aforementioned Big Four banks, including the ABC, BOC, CCB, and ICBC. They are listed in both the domestic and Hong Kong stock market, with the central government as the controlling shareholder. The State Council, the highest branch of the government, directly appoints presidents of these banks. They are the dominant players in China's commercial loan, deposit, and interbank markets. Market oriented as they are, these banks also serve certain policy goals—typically through lending. The second category is state-owned *policy* banks, including the Export-Import Bank of China, China Development Bank, and the Agricultural Development Bank of China. The third category is joint-equity commercial banks, which include 13 members. The largest one, Bank of Communications, is also regarded as a big bank, but its size is only half of the Big Four banks, and so we regard it as an SMB in the paper. The average size of these banks is about 10% of that of the Big Four banks. They are also market oriented and most of them are listed. The fourth category is urban and rural commercial banks, which are typically founded and majority-owned or controlled 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.

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—it gradually increased to the maximum value of 21.5% in June 2011 and then slowly decreased—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 lifted gradually. The upper bound on deposit rates, however, was usually binding and not lifted until the end of 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 et al., 2011).

The gap between the regulated deposit rates and market lending rates gives banks an

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

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 capital ratios of almost all commercial banks are well above the lower bound. The limit on the LDR prohibits banks from lending more than 75% of their total deposits, and this upper bound on lending was often binding for many SMBs.⁹

II.2 The Rise of Shadow Banking

Similar to the case of the U.S., the shadow banking sector in China rises as a result of regulatory arbitrage. On the asset side, shadow banking activities, such as the issuance of principal-floating WMPs, are recorded off the balance-sheet, and hence can help banks avoid on-balance-sheet regulations such as LDR. Banks can invest the funds raised from WMPs in loan assets originated by themselves and/or packaged by other financial institutions. Hence, credit is supplied without increasing on-balance-sheet loan balance. On the liability side, as interest rates of WMPs are not regulated as deposits, banks can offer higher rates to attract funds. The principal of WMPs can be either guaranteed or floating. Principal-guaranteed WMPs are often included on the balance-sheet as deposits, following CBRC requirements. Principal-floating WMPs are treated as off-balance-sheet liabilities, but the structure of their maturities can be chosen to boost the issuing banks' deposit balances when their LDRs are monitored. From the perspective of investors, WMPs are "deposit-like" products. While realized returns fluctuate for some products, banks will pay the principal in full, no matter whether they are principal-guaranteed or principal-floating products.

A broad definition of "shadow banking" refers to all investment products in the markets that are not on the banks' balance-sheets, including loans issued by non-bank financial institutions and non-financial firms. Examples include entrusted loans and the loans offered by trust companies (Allen et al., 2019a; Allen et al., 2019b), both of which are important components of China's shadow banking sector. With the rise of shadow banking, there is a dual-track system of intermediation in China's financial system (Wang et al., 2019; Chen and Lin, 2019). While interest rates on deposits are capped and on-balance-sheet lending is regulated by the capital ratio and LDR, the shadow banking sector is not subject to on-balance-sheet requirements. However, regulators are aware of both the scale and nature of WMPs issued

⁹ Although the PBC scrapped the official ceiling for deposit rates in October 2015, the rates are still largely constrained by its window guidance and the market interest rate pricing self-discipline mechanism. On April 12, 2018, members of the mechanism held a meeting to discuss the possibility of completely lift the constraint. See <https://www.reuters.com/article/us-china-cenbank-deposits/chinas-central-bank-to-relax-commercial-banks-deposit-rate-ceiling-sources-idUSKBN1HK0T3> .

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 cooperation 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 chain: first, trust companies extend loans to borrowers and package the loan assets into a trust plan; second, banks issue WMPs and delegate the management of the funds to investment banks; finally, through contractual agreements, the banks require the investment banks to invest the WMP proceeds in the trust plan.

In March 2013, the CBRC announced 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 exchanges. To circumvent this policy, banks needed to find some standard financial assets to facilitate lending to firms/projects *and* pay riskless returns above the deposit rates to WMP investors. Accordingly, banks and trust companies developed a new business model involving even more steps and participants.¹⁰

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 stable level. WMPs targeting deposits increased sharply at the end of 2014, possibly because banks came up with the strategy to sidestep the new regulation through contracted (interbank) deposits. 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

¹⁰ For example, Bank A invests WMP funds in the form of “contracted (interbank) deposits,” a form of standard asset, in Bank B. 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, their returns are 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.

new products with contractual agreements involving more parties to channel funds.

The development of WMPs not only makes financial institutions more inter-collected and easier for banks to hide the true risks of their assets, but also leads to greater rollover risks. A sizeable fraction of assets financed by WMPs pays off in the medium to long-term, but many investors prefer short-term investment products, so do the other participating banks and institutions. The issuing banks also prefer short maturities because they can transfer the WMP funds at maturity to the investors' deposit accounts (even for only a few days), which can help boost deposit balance and lower their LDRs. This maturity mismatch leads to frequent rollovers of WMPs. Banks can tap into the inter-bank market or issue new WMPs to meet the redemption of mature WMPs. However, during credit crunches, as was the situation in June 2013, banks with large amounts of WMPs maturing would face tremendous pressure.

III. Data

III.1 Data Sources

We focus on the 25 largest commercial banks in China, including the Big Four banks, the 13 joint-equity commercial banks, and the 8 largest urban commercial banks (Table 1, Panel A). We classify all the 21 non-Big Four banks as SMBs. Our data comes 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 periods with no available information and for the other banks, we conduct a survey of each bank to ask for the Wealth Management Activity Statements of Commercial Banks and the financial statements that they submit to CBRC. The final data set covers all the 25 banks on a quarterly basis and includes their financial information from 2006Q4 to 2014Q4 and their WMP summary information from 2008Q1 to 2014Q4.

Second, we collect bank branching information from the CBRC website. Each individual branch of all the financial institutions is required to acquire a license from the CBRC before operating. Starting from November 2007, CBRC has been publishing information of bank branch licenses, including the opening date, the closing date (if applicable), address, and affiliation.

Third, we collect information of individual WMPs issued by the 25 banks during 2008-2014 from WIND. WIND covers not all but quite a large fraction of the WMP population. The product-level information includes issuing date, expected yield, yield type, maturity, issuing

bank, target investors, and so on. Finally, we download the SHIBOR quotes and each bank's submitted quotes from the SHIBOR web site.

III.2 Summary Statistics

Table 1 reports the summary statistics of bank financial and WMP information. In Panel B, the Big Four banks are typically 10 times the size of SMBs in terms of either total deposit balance or total loan balance. The two groups of banks have similar capital ratios.¹¹ 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 certain business activities. The average deposit-to-asset ratio (henceforth DAR) of SMBs is lower than that of the Big Four banks. The nationwide network provides Big Four banks a significant advantage in attracting deposits.

All Big Four banks submit the bid and ask rates for SHIBOR, but only 10 SMBs submit quotes. We calculate each bank's SHIBOR quoted rates minus the SHIBOR for different maturities, but report only the overnight rates. SMBs ask for higher rates than the Big Four banks do, a pattern consistent with the fact that SMBs typically face more liquidity pressure.

The amount of WMP issuance of each of the 25 banks during the sample period comes from surveys. To evaluate the quality of the data, we compare this portion of the data set to publicly available aggregate-level data. We obtain the aggregate balance of WMPs issued by all urban commercial banks, so we can calculate the total balance of WMPs issued by all the large, joint-equity and urban-commercial banks at the end of each quarter. In Figure 1.2, we compare this time series with the total balance of WMPs issued by *all* commercial banks as reported by CBRC. These two closely track each other. The gap reflects WMPs issued by rural commercial banks and foreign banks, which is quite small.

Table 1, Panel C reports the summary statistics of WMPs. Both Big Four banks and SMBs issue much more principal-floating WMPs than principal-guaranteed WMPs. While the Big Four banks issue much more WMPs than an average SMB, SMBs' WMP balance as a share of total assets is larger than that of Big Four banks. Interestingly, the average WMP amount due

¹¹ According to the Basel Accord, banks' capital ratios cannot be lower than 8%. Most banks in the sample fulfill this requirement, except for ABC, which had lower capital ratios before 2009 and reached the required level in 2009Q4 after receiving a capital injection. Starting from 2013, a new approach to calculate the capital ratio was adopted, but the previous approach was 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.

in each quarter is larger than the WMP balance for both Big Four banks and SMBs. This reflects the short maturity of WMPs as shown in Panel D. In terms of yield, principal-floating WMPs have higher annualized expected yields than principal-guaranteed WMPs. WMPs issued by SMBs generally have higher expected yields than those issued by the Big Four banks, especially principal-floating WMPs.

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. When WMPs mature, the funds can be transferred to investors' deposit accounts, thus temporarily boosting the bank's deposit balance. Before 2009, the CBRC monitored LDRs annually at year end; in late 2009, the CBRC switched to end-of-quarter monitoring, and with more frequent monitoring of LDRs, we observe newly issued WMPs with shorter maturities. This leads to greater maturity mismatch and rollover risks as we analyze below.

IV. The Stimulus Plan, Deposit Competition, and the Growth of WMPs

IV.1 The Growth of WMPs

In Figure 1.1, the WMP balance is about 2% the issuing bank's total assets for both Big Four banks and SMBs before 2012. Since 2012, while the Big Four banks' WMP balance grew slowly, SMBs' WMP balance took off. At the end of 2014, the average WMP balance-to-asset ratio is about 16% for SMBs, as compared to 8% for Big Four banks. During the same period, the deposit-to-asset ratio (DAR) of SMBs declined steadily from about 75% to below 65%, while the Big Four banks' DARs remained stable and above 80% for most of the time.

The time series dynamics supports the idea that WMPs and deposits are substitutes for SMBs. Due to the increasing difficulty to raise deposits, SMBs shifted to WMP funding. As described above, banks can channel the funds raised from WMPs to loan assets originated by themselves. On the contrary, Big Four banks had more sufficient and stable deposit funding, and their WMP growth was more subdued than that of SMBs.

The substitution effect between WMPs and deposits can also be shown in the cross section. Figure 3 plots the quarterly WMP balance-to-asset ratio against the DARs for the 21 SMBs during 2008-2010 and 2011-2014, respectively. Before 2011, there was virtually no correlation between the levels of WMP balance and deposits. After 2011, however, there was a clear negative correlation between these two ratios across the 21 SMBs. This relationship also holds if we plot these graphs for each quarter end separately.

WMPs arise as a substitute for deposits mainly because there is no regulatory ceiling on their interest rates, and banks can attract investors by offering WMPs with return rates higher than the deposit rate ceiling. Figure 4 shows the evolution of the weighted average WMP yields and the deposit rate ceiling, as well as SHIBOR, over the sample period. First, except for the first half of 2009 when there was substantial liquidity injection by the PBC in response to the global financial crisis, the WMP yields were well above the deposit rate ceiling. This means the upper bound on deposit rates was indeed binding for banks. Second, since the interbank market is an alternative source for funding for SMBs, the yields of WMPs closely track the 3-month SHIBOR rates.

Three questions arise from the patterns described above. First, despite the negative correlation of WMP and deposit balances both in the time series and in the cross section, is there a causal relationship? Second, if the shortage of deposits was the driving factor for the rise of WMPs for SMBs, what caused the decline of deposits in the first place? Third, since the DAR remains stable for the Big Four banks, what could explain the growth of their WMP issuance? In the rest of this section, we will try to answer the first two questions, and in the next section, we will examine the last question.

IV.2 The Stimulus Plan and Deposit Competition

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 into 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 incomes, among other sources. According to the National Development and Reform Commission, the investment projects from 2008Q4 to 2010Q4 included infrastructure, such as reconstruction following the *Wenchuan* earthquake in May 2008, 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 governments' land assets (Bai et al., 2016).

Third, banks, especially the Big Four banks, played a crucial role by providing the lion's

share of the funds for the investment projects associated with the stimulus, by both issuing bank loans and purchasing CIIC bonds. This led to a large credit expansion in the economy. Figure 5.1 shows total loan balance during the sample period for the Big Four banks and SMBs (data for SMBs is only available from 2010). Many investment projects, such as infrastructure projects, were medium and long-term and thus financed by medium and long-term loans. From Figure 5.1, 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 1.27 trillion RMB (25%) and short-term loan balances increased by 0.82 trillion RMB (18%). These results confirm that the Big Four banks were definitely the major lenders during the stimulus period.

While all four banks announced large credit expansion in support of the stimulus, the scale and speed of the expansion were different. Figure 5.2 shows the total loan balances of the Big Four banks separately. To ease comparison, we scale each bank's loan balance by its loan balance at the end of 2008, the beginning of the stimulus plan. From 2006Q4 to 2008Q4, except for ABC, the other three banks exhibited similar growth rates in loans.¹² The paths of the loan balances began to diverge in 2009. BOC exhibited a much steeper growth path than the other three banks: from 2009Q1 to 2010Q4, BOC's total loan balance increased by 77%, compared to an increase of 60% by ABC, and 48% by both the CCB and ICBC.

The large-scale expansion of credit led to a spike in LDR for BOC. From Figure 5.3, none of these banks' LDRs exceeded 65% at the end of 2008Q4, well below the limit of 75%. Starting from 2009, however, BOC's LDR jumped due to aggressive credit expansion and touched the 75% threshold by the end of 2009, while the LDR of the other three banks dropped in the same year.

The rapid increase in LDR put pressure on the deposit side for BOC. Figure 5.4 presents the evolution of total deposits of the Big Four banks. Similar to Figure 5.2, we scale each bank's total deposits by its deposit balance at the end of 2008. From 2006Q4 to 2008Q4, all four banks were on similar growth paths for deposits. Starting in 2009, the growth rates of all the banks rose as compared to the earlier period. Since BOC had the highest LDR among the four banks, it became the most aggressive bank in attracting deposits. From 2009Q1 to 2010Q4, BOC's

¹² 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 5.2, its loan balance exhibits two jumps leading up to the IPO.

total deposits increased by 58%, compared to increases of 47%, 43%, and 35% for ABC, CCB, and ICBC, respectively. Given the average deposit balance of RMB 9,660.8 billion, the magnitude of deposit growth for these large banks (within two years), especially BOC, was substantial, and dramatically altered the landscape of the local deposit market in many regions.

In Figure 5.5, we plot the average interest rates on deposits of the Big Four banks over time. Before 2010, all four banks offered similar deposit rates. After 2010, BOC started to offer much higher deposit rates (but still below the deposit ceiling) than the other three banks, in order to attract more savings. These patterns lend further support that the large credit expansion and deposit growth of BOC were not due to alternative factors such as an increase in the demand for its services or its better access to funding.

What could explain BOC's greater support for the stimulus plan compared to the other big banks? One possible explanation is related to the bank executives' career concerns. On one hand, top bank executives are appointed by the Organization Department of the Central Committee of the Chinese Communist Party, and their promotions along the political hierarchy must also be approved by the committee. It is therefore an open secret that answering the calls of the central government helps (political) career advancement. On the other hand, the Big Four banks are market-oriented, and should pursue profits as any commercial bank. As a result, bank executives need to balance between political career concerns and the banks' commercial goals.

The President of BOC at the time was Mr. Xiao Gang, who worked in PBC for 22 years before joining BOC. It is perhaps due to his experiences and strong political preference that he was the most supportive for PBC's call to increase credit supply. In 2013, Mr. Xiao was promoted to Chairman of the China Securities Regulatory Commission, a minister level position. In contrast, the long-time President of 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 ICBC relative to the other large banks, Mr. Jiang retired in May 2016 without any further promotion.¹³

The Big Four banks enjoy a much stronger status in the deposit market than all other smaller banks due to their extensive branches across the country. Therefore, when they start to compete for funding, SMBs are likely to suffer from deposit losses. To circumvent the

¹³ 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 et al. (2014) for more details on the ICBC, and Deng et al. (2015) for bank executives' career concerns.

regulatory ceiling on deposit rates and to attract deposits, banks employed tactics such as offering gifts, including cash and gold, to depositors, but such behavior was soon prohibited by CBRC.¹⁴ SMBs then turned to WMPs, which are deposit-like instruments without the interest rate controls. 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., 2019), and thus allowed the co-existence of a dual-track banking system. With SMBs' need to attract funding, the issuance of WMPs took off.

IV.3 Deposit Competition and WMP Issuance

A. Measure of Big Four Competition

The analysis on the impact of the stimulus plan serves two purposes. First, it links the heightened deposit competition to the stimulus plan. That is, the Big Four banks, especially BOC, started to compete for deposits after pumping large volumes of loans into the economy, so as to stay below the LDR ceiling. Second, we will use deposit competition from Big Four banks as instrument variables for the deposit shortage of SMBs and try to establish a causal effect of deposit shortage on WMP issuance. To this end, we need to construct a measure of exposure to Big Four banks' competition for each SMB.

This measure is based on the overlap of bank branches. People usually deposit money in the local bank branches, and thereby more branch overlap implies more direct competition for deposits. We construct the measure 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 , and then define the market share of big bank b in city j at the beginning of quarter t as its share of branches:

$$MarSha_{b,j,t} = \frac{n_{b,j,t}}{\sum_i n_{i,j,t}} \quad (1)$$

Second, we calculate the bank-level exposure of SMB i at the beginning of quarter t to big bank b as follows:

$$banknm_{i,t} = \frac{\sum_j n_{i,j,t} \times MarSha_{b,j,t}}{\sum_j n_{i,j,t}} \quad (2)$$

The variable $banknm_{i,t}$ in Eq. (2) measures the degree to which the SMB i 's branches overlap

¹⁴ 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/>.

with those of big bank b . It is the weighted average of the big bank b 's market share ($MarSha_{b,j,t}$) across all cities, using the number of branches of SMB i in these cities as weights. Since there are four large banks (subscript b in (1) and (2) above denotes the Big Four banks), we define four sets of competition variables based on Eq. (2): BOC_{it} , ABC_{it} , $ICBC_{it}$, and CCB_{it} , which measure the degree of competition that SMB i faces from BOC, ABC, ICBC, and CCB during quarter t , respectively.

Table 2 presents the summary statistics of these competition measures and their correlations. In the cross section, the variations of $banknm_{i,t}$ come from the branching networks of both the SMBs and the Big Four banks. Specifically, if all SMBs proportionally allocate their branches across all cities, or if the Big Four banks equally allocate their branches across cities, i.e., $MarSha_{b,j,t}$ in Eq. (2) does not vary with j , then there will be no variation in $banknm_{i,t}$ for different SMBs. First, 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, 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, at the end of 2012, the Guangdong Development Bank locates about 60% of its branches in Guangdong Province, where the bank was founded. Second, while the Big Four banks have branches in all provinces, their network intensities vary. In Figure 6, ABC has most of its branches in the western areas, ICBC concentrates in the northern and southern regions, CCB focuses on central China, while BOC has its most presence in the coastal and northern parts of the country.

In the time series, Figure 7 shows a steady decline in all four measures over time. This decline is the result of SMBs' expansion. From 2007Q1 to 2014Q4, the total number of branches affiliated with the Big Four banks increased by 14.2% (from 57,868 to 66,092). Meanwhile, the number of SMBs increased by 56% (from 787 to 1,228) and the total number of SMB branches increased by 100% (from 53,439 to 106,979).

There are two takeaways from these facts. First, since the declining trend of the competition measures is mostly driven by the expansion of SMBs, the time series variations of these measures do not necessarily capture the changes of the Big Four banks' competition. Therefore, we include a quarter fixed effect in the regressions and focus on cross-sectional variations. Second, the cross-sectional variations of the competition measures may pick up regional fixed effects. For example, as Figure 6 shows, BOC has its strongest presence in the

most developed provinces (Beijing, Shanghai, Jiangsu, Zhejiang and Guangdong), so SMBs more concentrated in these areas will naturally face more BOC competition. As we only have 21 SMBs in the sample, to capture regional fixed effects *and* maintain sufficient variations in the cross section, we classify the 21 SMBs into *three* groups based on the provinces where they have most branches. Provinces within the same group will share similar levels of economic and financial development. The first group is Shanghai and Beijing, the two financial and economic centers of China; the second group is Jiangsu, Zhejiang, and Guangdong, the three coastal and most (economically) developed provinces in China; the third group includes all the other provinces. See Appendix B for detailed classifications.

B. Big Four Competition and the Extent of SMBs' Deposits Shortfall

The goal of the first set of regressions is to establish the causal effects of Big Four banks' competition on the supply of SMBs' deposits. We measure the deposit availability of an SMB with its deposit-to-asset ratio (DAR), i.e., how much the bank is able to finance its assets with deposits.¹⁵ Specifically, we run the following regression model:

$$\begin{aligned}
 DAR_{it} = & \alpha_1 BOC_{it} + \alpha_2 ICBC_{it} + \alpha_3 CCB_{it} + \alpha_4 ABC_{it} \\
 & + \beta size_{it} + Quarter \times Area_{it} + banktype_i + \varepsilon_{it}
 \end{aligned} \tag{3}$$

The dependent variable is measured at the end of quarter t while the explanatory variables are measured at the beginning of quarter t . As discussed above, with quarter-by-area fixed effects, only the variations across SMBs in the same area and in the same quarter are used for identification. If the correlation between branch overlap with Big Four banks and DAR picks up the effect of some local economic conditions even after controlling for the time-varying area fixed effect, we would expect the α estimates to be similar both *before* and after the stimulus period, since such economic conditions tend to be persistent. However, if the effect reflects the changing nature of deposit competition from the big banks following the stimulus, the α estimates ought to be significantly different from zero only after the stimulus period. Furthermore, since BOC is the most aggressive big bank in credit expansion and deposit competition, we expect α_1 , the coefficient of BOC competition, to be negative, and its magnitude to be greater than that of α_2 , α_3 , and α_4 , the coefficients of competition from the

¹⁵ In previous versions of the paper, we used LDR to measure SMBs' need to raise deposits and examined its impact on these banks' WMP issuance. There are two problems with this measure. First, as Figure 8 shows, during the stimulus period, LDR was binding for most SMBs and the little variation of LDR across banks was not indicative of different degrees of deposit shortage. Second, for every dollar of WMP issuance, issuing banks can move one dollar of loans off their balance-sheet, and hence LDR fell subsequently as WMP balances rose and the 75% ceiling became non-binding, as is shown in Figure 8.

other three big banks. In Eq. (3), we also control for bank type (urban or joint-equity commercial banks) and bank size, and standard errors are clustered by banks.

Table 3 reports the OLS regression results. In Panel A, consistent with our prediction, the BOC competition variable has a negative and significant effect on SMBs' DARs, and this effect exists only after the stimulus period (2011-12 and 2013-14). The area fixed effect will pick up the level of economic development that may affect both the exposure to BOC competition and DAR. One may still be concerned about possible heterogeneities across provinces within the same area, but this type of heterogeneity is often persistent, and we do not observe a significant coefficient for the years before and during the stimulus period.

Consistent with the fact that BOC was more aggressive in credit and deposit expansion than the other three big banks, only the BOC competition variable has a negative and significant effect in the post-stimulus period. One question is, since the other three big banks also increased credit supply during the stimulus period, should we also expect a negative, though smaller in magnitude, effect of their competition on the SMB's deposits? First, note that in Figures 5.3 and 5.4, the growth rates of deposits for these three banks kept up with their credit expansion, and their LDRs actually fell during the stimulus period. Hence, they did not have to compete as aggressively during the post-stimulus period. Second, as our competition measures are based on branch overlap, the coefficient α essentially picks up how much more aggressively a big bank competes for deposits than the other SMBs do. Deposit competition from these big banks, especially BOC, is likely to be followed by similar actions of other banks, and as the general level of deposit competition ratchets up, the intensity of competition from these three big banks could become indistinguishable from that of other banks.

Deposits measured at the end of quarters are likely to be manipulated because the CBRC's monitoring of LDRs is conducted at the quarter end. One approach of manipulation is to set the maturity date of WMPs right at the end of each quarter, so that when WMPs mature, funds will be transferred from the investors' WMP accounts to their deposit accounts with the issuing bank, boosting the bank's quarter-end deposit balance (see Figure 10; also see Garcia-Herrero et al., 2019). This type of "window dressing" behavior can help some banks meet their LDR requirement, which is examined by CBRC based on quarter-end balances. Accordingly, we estimate the amount of 'manipulated deposits' by taking the difference between the WMP amount due in the last month of a quarter and the average WMP amount due in the first two months of the same quarter. We then subtract the estimated amount of manipulated deposits from the deposit balance and obtain the adjusted DAR. In Table 3, Panel B, we report the estimation results using adjusted DARs. All the main results are robust to this specification.

To further address the concern that the area fixed effect is not sufficient to absorb the effects of local economic conditions, we expand the bank sample to including *all* SMBs for which we can obtain their financial information disclosed publicly when they issue bonds. Table 4 reports the results on this expanded sample (number of banks ranged from 80 in 2008 to 121 in 2014 and 2015). We control for the bank headquarter province fixed effect in all the models, since now we have many more observations. From Table 4, we can see that the BOC competition variable still has a negative and significant effect on SMBs' DARs after 2011. In contrast, the ICBC competition variable had a negative and significant effect on SMBs' DARs in 2011 and 2012 only, while the other two sets of competition measures have no such effect on SMBs' DARs.

The analysis so far establishes the causal effect of BOC competition on the SMBs' DARs. As Figure 1.1 shows, the average DARs for the 21 SMBs decreased by about 10% from 2007Q4 to 2014Q4. According to the estimates in Column (4) of Table 3, Panel A, a one standard-deviation increase in the BOC competition variable reduces an SMB's DAR by 10.7% (from 65.6% to 54.9%), an economically significant impact.¹⁶

C. Competition for Deposits and WMP Issuance

We now use the geographical exposure to Big Four banks' competition as IVs for the amount of available deposits for an SMB, and study the causal effect of deposit competition on SMBs' WMP issuance. Results from Tables 3 and 4 clearly establish the relevance condition for the IV. The exclusion restriction should also hold, that is, the Big Four competition variables only affect SMBs' WMP issuance through the deposit channel. Besides the deposit markets, banks in the same region also interact in the loan markets. One may be concerned that the credit expansion of the Big Four banks may also change the loan investment opportunities for local SMBs. This is not likely to be the case. First, as discussed above, the intention of the credit expansion of the Big Four banks was not meant to take away investment opportunities from other banks, but rather to supply credit to meet new demand (e.g., in infrastructure projects) created by the stimulus plan. Second, we run regressions similar to Eq. (3) using loan-to-asset ratio as the dependent variable. Appendix C reports the results. In contrast to results in Tables 3 and 4, the BOC competition variable has no impact on the loan-to-asset ratios of SMBs either

¹⁶ We should be cautious in interpreting this as the total effect of BOC competition, however, as we do not account for the general equilibrium effects in our estimation models. Note also that heightened competition by large banks for deposits may result in more aggressive competition by other banks in an equilibrium model of bank competition; our competition measure is based on branching overlaps, and in fact we show later that small and medium sized banks *reduced* their branch openings in cities with greater competition from big banks.

before or after the stimulus period.

To estimate the impact of adjusted DARs on SMBs' WMP balance, using Big Four banks' competition measures as IVs for DARs, we run the following regression:

$$\frac{WMPBalance_{it}}{Asset_{it-1}} = \gamma Adj_DAR_{i,t} + \theta size_{it-1} + Quarter \times Area_{it} + banktype_i + \epsilon_{it} \quad (4)$$

Similar to Eq. (3), we include area-by-quarter and bank type fixed effects as well as bank size as controls. We expect γ in Eq. (4) to be negative; since the IVs only work after the stimulus period, the γ estimate should be negative and significant during the post-stimulus period.

Table 5 reports the results from both 2SLS (IV, Columns 1-3) and OLS (Columns 4-6) regressions. As expected, there is a significantly negative relationship between the supply of deposits and WMP balance, and this relationship only holds after the stimulus period. In terms of magnitude, during 2011-2012, an SMB was able to raise 13.6 cents (Column 2) through WMP issuance for every dollar's loss of deposits. During 2013-2014, as the issuance of WMPs built up, the bank was able to raise as much as 74.1 cents (Column 3) through WMP issuance for the loss of one dollar in deposits. It is not surprising that the "substitution" effect of WMP issuance on deposits rose over time, as it takes time for the bankers, investors and the market to familiarize with the new WMPs, and for the investors to accept them as a new form of investment. However, WMP issuance cannot fully compensate for the shortfall in deposits, since WMP financing is more costly than deposit financing, for reasons beyond the fact that WMP yields are higher than the controlled deposit rates.

Based on the IV regression estimates, we can also calculate how much the channel of WMP issuance compensating for the loss of deposits contributed to the rise of WMP balance. For example, from 2012Q4 to 2014Q4 (Column 3 of Table 5), the average deposit-to-asset ratio of the 21 SMBs decreased by 2.8%, which would lead to an increase of 2.1% ($= 2.8\% \times 0.741$) of the WMP balance-to-asset ratio. The average WMP balance-to-asset ratio of the 21 SMBs increased by 6.0% during the same period. Therefore, the deposits shortfall-WMP issuance mechanism contributed to about 35% of the total increase of WMP issuance in this period.

From Table 5, we can also see that the OLS coefficient estimates are smaller in magnitude as compared to those from the 2SLS regressions, implying a positive bias of the OLS estimates. This bias can be caused by an omitted variable that is positively correlated with both the WMP and deposit balances. One such omitted variable, and possibly the most important one, is the bank's ability to attract funds from its customers: banks with better services or a wider customer pool tend to have higher levels of both deposits *and* WMP balances.

IV.4 Deposit Competition and SMBs' New Branch Establishment

In the previous subsection, we tie WMP issuance to SMBs' geographical exposure to the Big Four banks and competition in the deposit market. We argue and show that the relationship is *not* due to variations in local economic conditions with three pieces of evidence. First, we include time-varying area fixed effect so that banks within each area share similar levels of economic development. Second, the observed effect did not exist prior to the stimulus period. Third, we expand the SMB sample to all the SMBs for which we can obtain financial information, and include the headquarter province fixed effect in the regressions, and still obtained similar results.

Ideally, to rule out local economic conditions as an alternative hypothesis for WMP issuance, we should conduct *within*-bank estimates comparing branches of the same bank facing similar investment opportunities. That is, we should include bank fixed effect and explore variations in WMP balances and exposure to Big Four competition across branches. However, for SMBs, WMP issuance decisions are made at the headquarter level instead of the branch-level, and thus a branch-level analysis on WMPs is not feasible.¹⁷

Instead, we provide a different within-bank analysis that can help confirm the deposit competition channel as the main driver of our results. Banks can compete for funding not only through issuing WMPs but also by establishing new branches. We hypothesize that, to avoid direct competition from BOC branches, SMBs ought to prefer to establish new branches in cities with less BOC presence. So, after controlling for bank fixed effect, we should expect to see less branch establishments in cities with more BOC competition. However, if more presence of BOC branches in a city represents more investment opportunities in that city, we should expect to see more branch establishments by SMBs so as 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. Then for any year t after 2008, we construct a binary variable $Establish_{ijt}$, which equals 1 if bank i established any new branches in city j from 2009 up to year t , and 0 otherwise. We then regress this variable on the market shares of the Big Four banks as follows:

$$Establish'_{ijt} = \sum_{b \in \{BOC, ICBC, CCB, ABC\}} \gamma_{b,t} MarSha_{b,j,08} + bank_{it} + CityControls_{j,08}$$

¹⁷ 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.

$$+province_{jt} + \varepsilon_{ijt} \quad (5)$$

We assume $Establish_{ijt} = 1(Establish'_{ijt} > 0)$. We use the market share values evaluated at the end of year 2008, right before the stimulus plan, since new branch establishments will affect future market shares of the Big Four. Most importantly, we include the bank fixed effect so that we can explore the within-bank variations across branches. We include a set of city-level controls evaluated in 2008, including GDP per capita, log (population), log (fixed investment), and log (number of branches), as well as the province fixed effect. We run Logit estimations for each year from 2009 to 2016, and cluster standard errors at the city level.

Table 6 reports the results for all SMBs (including the 21 sample SMBs). The market share of BOC has a significantly negative effect on new branch establishment of SMBs, and this effect only exists starting in 2011, after the stimulus plan became effective. The magnitude of the effect is economically significant. For example, in 2016 (Column 8), moving from the 10th percentile of the BOC market share to the 90th percentile would reduce the probability of establishing any new branches by an SMB in the city from 82% to 73%. The coefficient estimates of the market shares of the other three large banks are mostly insignificant. Because we control for the bank fixed effect, the variations are driven by city-specific factors. As we discussed above, the investment opportunity hypothesis would predict either a zero or positive effect of BOC competition on branch establishment, while the deposit competition hypothesis is consistent with the negative estimates in Table 6 during the post-stimulus period.

V. 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 was more subdued compared to that of the SMBs. As we discussed in Section IV.2, a significant amount of new (stimulus) 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).

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 these investment corporations must reduce their debt levels.¹⁸ 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 (Chen et al., 2020). 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 granted during the stimulus period mature, these loans need to be rolled over or the borrowers may default. Since banks were restricted to extend new loans to these sectors, credit supply in the shadow banking sectors emerged as a solution. In particular, banks could refinance these loans with principal-floating WMPs, which are off their balance-sheets, or work with non-bank institutions, such as trust companies, to extend new credit.¹⁹

We do not have information on the individual loans extended during the stimulus period; instead, we look at the changes in loan balances over time, and link these changes to the issuance of WMPs for the Big Four banks. Figure 9.1 shows that for these banks, the fraction of medium- (1-5 years) and long-term (longer than 5 years) loans rose sharply from 68% in 2008 to 73% in 2010, 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 bank, we first estimate a linear trend of total loan balances using quarterly observations from 2006Q4 to 2008Q4 and calculate the predicted loan balance in 2010Q4. We then calculate the difference between the actual and predicted loan balances in 2010Q4 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 9.2 shows a positive correlation between a bank's WMP balance at the end of 2013 and the estimated loan increase. In Table 7, we regress banks' WMP balance on our proxy of loan increase due to the stimulus year-by-year. 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

¹⁸ 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).

¹⁹ See, for example, Chen et al. (2020) on the debt rollover of CIICs and changes in the forms of financing, and Allen et al. (2019b) on the use of trust products to refinance real estate projects.

WMPs, however, we do not observe such a relationship, since with principal-guaranteed WMPs, issuing banks cannot move loans off their balance-sheets.

Combining results from this section with those in the previous section, we conclude that there are at least two mechanisms through which the four-trillion stimulus triggered the rise in China's shadowing banking sector in the form of bank WMPs. First, the local deposit markets became more competitive because of the Big Four banks', especially the BOC's, massive credit support for the stimulus and the pressure to raise deposits so as to satisfy the LDR requirement. The heightened competition in the local deposit markets had a causal impact on SMBs' deposit shortage, leading them to issue more WMPs to attract more savings. In some sense, as deposit rates are capped, the flexible returns of WMPs improve the allocation efficiency of savings across banks. Second, when the large amount of "stimulus" loans to CIICs and the real estate sector matured, and regulators tightened the credit supply to these sectors, banks issued off-balance-sheet, principal-floating WMPs to refinance these long-term projects.

VI. Rollover Risks of WMPs

In the previous section, we examined reasons behind the sharp increase of the issuance of WMPs by SMBs and the Big Four banks during the post-stimulus period. In this section, we study possible outcome(s) of the fast rise in WMP issuance—in particular, rollover risks of the issuing banks—and whether the stock market and investors are aware of this risk.

VI.1 Maturity Mismatches of WMPs and Yields on New Products

At least part of the assets financed by the WMPs are long-term, but WMPs are usually very short-term. Recall from Table 1, Panel D, the WMPs have an average maturity of 3-4 months. One reason for the short maturities of WMPs may be tied to investors' preferences for short-term investment products. Another reason is to boost issuing banks' deposit balances in order to meet the LDR requirement, with the monitoring conducted at the end of each quarter.

We examine the distributions 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. Figures 10.1 and 10.2 show the total number of WMPs issued by the Big Four banks and SMBs, respectively. Both groups of banks tend to set the maturity dates near the end of the quarter, but SMBs have a higher incentive to do this type of window dressing since they face more pressure from the binding LDR requirements. Figures 10.3 and 10.4 distinguish between principal-floating and principal-guaranteed WMPs. For

principal-floating WMPs, a large portion of products issued by both the Big Four banks and SMBs mature on exactly the last day of the quarter. For principal-guaranteed products, which issuing banks are required to include on their balance-sheets, the distribution is more even across the days of a quarter. These patterns support the notion that banks use off-balance-sheet, principal-floating WMPs to help manage LDR regulations.

This type of regulatory arbitrage behavior leads to a short maturity of WMPs and introduces rollover risk for the issuing banks, in that when a large amount of WMPs mature on a particular day, banks will need to refinance these loans and satisfy the redemption of funds by issuing new WMPs and/or raising funds from other institutions in the interbank market.

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

$$WMPreturn_d_{ikt} = \beta_1 WMPdue_{it} + month_t + bank_i + e_{ikt} \quad (6)$$

The dependent variable is the difference between the annualized yield on a new WMP k and the ceiling on bank deposit rate. The key independent variable is $WMPdue$. For principal-floating (guaranteed) WMP k , we use only the total amount of principal-floating (guaranteed) products that mature in the quarter, when the product k is offered, divided by the bank asset at the end of the previous quarter. We expect that the issuing bank should offer a higher yield on the new WMPs if there are more WMPs approaching maturity; hence, β_1 in Eq. (6) is expected to be positive.

Table 8 presents the results. Consistent with our hypothesis, $WMPdue$ has a positive and significant impact on the yields of new WMPs for the SMBs, but such relationship does not exist for the Big Four banks. These large 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. In contrast, SMBs face greater liquidity shortages and offer considerably higher yields on the new WMPs to attract capital. The effect of $WMPdue$ on the new WMP's yield is positive and significant for both principal-floating and principal-guaranteed products issued by SMBs. The magnitude of the effect is also economically significant. For SMBs, a one-standard deviation increase in $WMPdue$ increases the annual yield of WMPs by 20 basis points for principal-floating products and 31 basis points 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.

VI.2 Rollover Risk and the Interbank Market

Besides raising funds via new WMPs, banks can tap the interbank market for liquidity. With more maturing WMPs, issuing banks ought to be willing to offer higher rates when borrowing funds (and ask for higher rates when lending funds); in other words, banks should submit higher quotes when they have more maturing WMPs. To examine how the rollover of WMPs affect the SHIBOR, an indicator for interbank market liquidity, we estimate the following model:

$$\begin{aligned} Ask_{it} = & \alpha + \beta_1 WMPdue_{it} + \beta_2 WMPdue_{SMB_t} + \beta_3 WMPdue_{BIG4_t} \\ & + \beta_4 Cap_{i,t-1} + \beta_5 LDR_{i,t-1} + e_{it} \end{aligned} \quad (7)$$

In Equation (7), the dependent variable is a SHIBOR-participating bank's average ask quotes within quarter t . The variable $WMPdue_{it}$ captures the bank's own liquidity condition due to the rollover of WMPs. We also include the average WMPdue for the Big Four banks ($WMPdue_{BIG4}$) and the average WMPdue for SMBs ($WMPdue_{SMB}$) in the regressions to capture the overall market liquidity due to the rollover of WMPs by the Big Four banks and all the SMBs, respectively. We do not include bank fixed effect because we are interested in *cross-sectional* variations—how the variation in $WMPdue$ across banks affects the submission of ask quotes. We do not include quarter fixed effect either, because we are interested in the relative importance of $WMPdue_{SMB}$ 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 2008Q1 to 2014Q4 and estimate the model in Eq. (7) for the Big Four banks and SMBs separately. We standardize the three variables— $WMPdue$, $WMPdue_{BIG4}$, and $WMPdue_{SMB}$ —by scaling them with their standard deviations. There are only fourteen banks in the regression sample, and clustering standard errors by bank would dramatically reduce the statistical significance of the coefficients. Hence, we only cluster standard errors by quarter.

Table 9 reports the results. The liquidity condition of the Big Four banks is a much more important determinant on the market liquidity than that of the SMBs. The coefficient on $WMPdue_{SMB}$ is statistically insignificant in all the 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 rates for the overnight SHIBOR by 81 basis points (Column 1), and an increase in a participating SMB's ask rates for the overnight SHIBOR by 73 basis points (Column 7). The effects on

different rates are similar, but they seem to be the largest for the 1-month SHIBOR. The amount of a big bank's maturing WMPs does not affect its own quotes, while a one standard deviation increase in the amount of an SMB's maturing WMPs increases their ask quotes by around 3-7 basis points.

The asymmetric effects of the liquidity condition between the Big Four banks and the SMBs are in line with the fact that the Big Four banks are the main liquidity providers and the price setters in the interbank market, while SMBs are typically net borrowers and price takers. When big banks have more maturing WMPs, SMBs are forced to submit higher ask quotes.

Further, to see 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 11, we calculate the aggregate amount of maturing WMPs issued by the Big Four banks and the 21 SMBs (in the sample) over M2 (aggregate money supply), 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 issued by the Big Four banks (Figure 11.1). In contrast, the amount of WMP due for the SMBs increases steadily over time, but has no clear relationship with the SHIBOR. These patterns also indicate that the Big Four banks' activities—the amount of maturing WMPs as one factor—play an important role in determining the SHIBOR.

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

As a final set of tests on the impact of rollover risks, we look at the stock market's response to an unexpected change of funding costs for the 17 listed banks during 2009-2014. Since banks tap the interbank market for liquidity when their WMPs mature, a sudden increase in SHIBOR would increase their funding cost, especially when they have a large amount of WMPs to roll over. This should be reflected in their stock price if investors are aware of their rollover risk.

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. A high increase in SHIBOR should be unexpected, because otherwise, banks could arbitrage by borrowing one day in advance and lending on the same day. On each business day, the SHIBOR is announced at 11:30am (9:30am starting from 08/01/2014); if the announced rates on 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:

$$return_{it} = \alpha + \beta WMPdue_{it} + \varepsilon_{it} \quad (8)$$

The dependent variable $return_{it}$ is the end-of-day 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 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. In the analysis of the previous subsection, we use the amount of WMPs maturing in a quarter as the key variable, but what is more relevant here is the amount of WMPs needed to be rolled over within a short time window around the date when SHIBOR increases unexpectedly, as the SHIBOR event only affects funding cost temporally. Therefore, we use the amount of WMPs maturing in the current month. We scale WMP amount due by (book) equity instead of total assets because the dependent variable in the current model is the (market) return on equity. The coefficient β is expected to be negative for dates with sufficiently large changes in the overnight and one-week SHIBORs.

Table 10 reports the results. We choose four different thresholds, with the largest change (in SHIBOR) $c = 1\%$. During our sample period, there were 9 trading days on which both the overnight and one-week SHIBOR jumped by 1% or more. The second, third, and fourth thresholds are 0.8%, 0.6%, and 0.4% with 16, 25, and 48 trading days, respectively. The first row in Table 10 reports estimation results using 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 12 presents the scatter plot of raw returns against $WMPdue$ with $c = 1\%$; a negative relationship between bank stock prices and $WMPdue$ emerges.

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 banks' stock returns on days when the SHIBOR rises sharply. The economic magnitude of the effect is also large: a one-standard deviation increase in $WMPdue$ 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 Table 10 and Figure 12 suggest that the stock market and investors appear to be aware of the rollover risks—as measured by maturing WMPs—that the issuing banks face. To summarize, 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 an important determinant of the interbank market liquidity. As the Big Four banks and SMBs all issue more WMPs, the amount to roll over increases, so does the scale and rollover risks, which poses a threat to the stability of the entire financial system.

VII. 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 studying issuing banks’ behavior when these products mature and in the context of the interbank market.

While WMPs existed long before 2009, their scale took off after the stimulus was implemented. We attribute the swift rise of SMBs’ issuance of WMPs during the post-stimulus period to heightened competition in the local deposit markets attributed to the Big Four banks. These four banks, especially the BOC, were the primary institutions that pumped stimulus credit into the economy, and subsequently grew much more aggressive in deposit markets to ensure that their LDRs stay below the regulatory ceiling. Increased competition in the local deposit markets then forced SMBs, especially those with high geographical exposure to BOC competition, to issue WMPs to attract savings. For the Big Four banks, when the regulators tightened the credit supply to local governments and the real estate sector, they issued principal-floating WMPs to refinance the long-term projects in these sectors. Hence, this is another channel through which the stimulus triggered the growth of WMPs.

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, we find issuing banks’ stock prices drop more during credit crunches when they have more WMPs coming due.

Overall, our tests and results shed light on how the largest segment of China’s shadow banking, namely the WMP sector, rose as regulatory arbitrage in response to heightened deposit competition for funding the fiscal stimulus following the global financial crisis and contributed to the greater fragility of the financial system.

References:

1. Acharya, Viral, Abhiman Das, Nirupama Kulkarni, Prachi Mishra, and N.R. Prabhala, 2020, "Government Guarantees and Bank Vulnerability during a crisis: Evidence from an Emerging Market," Working paper, NYU Stern School of Business.
2. Acharya, Viral, and Sabri Oncu, 2013, "A Proposal for the Resolution of Systemically Important Assets and Liabilities: The Case of the Repo Market," *International Journal of Central Banking* 9 (1), 291-350.
3. Acharya, Viral, Philipp Schnabl and Gustavo Suarez, 2013b, "Securitization without Risk Transfer", *Journal of Financial Economics* 107, 515-536.
4. Allen, Franklin, Jun Qian, Chenyu Shan, and Mengxin Zhao, 2014. "The IPO of Industrial and Commercial Bank of China and the 'Chinese Model' of Privatizing Large Financial Institutions," *European Journal of Finance* 20, 599-624.
5. Allen, Franklin, Jun Qian, Chenying Zhang, and Mengxin Zhao, 2012. "China's Financial System: Opportunities and Challenges," Chapter 2 in *Capitalizing China*, Joseph Fan and Randall Morck, eds. University of Chicago Press.
6. Allen, Franklin, Yiming Qian, Guoqian Tu, and Frank Yu, 2019a. "Entrusted Loans: A Close Look at China's Shadow Banking System," *Journal of Financial Economics* 133, 18-41.
7. Allen, Franklin, Xian Gu, Wei Li, Jun Qian, and Yiming Qian, 2019b. "Implicit Guarantees and the Rise of Shadow Banking: The Case of Trust Products in China," working paper, Imperial College London and Fudan University.
8. Bai, Chong-En, Chang-Tai Hsieh, and Zheng Michael Song, 2016. "The Long Shadow of A Fiscal Expansion," *Brookings Papers on Economic Activity*, Fall 2016.
9. Borst, Nicholas, 2013. "Shadow Deposits as a Source of Financial Instability: Lessons from the American Experience for China," *Policy Brief Peterson Institute for International Economics* 13.
10. Chen, Kaiji, Jue Ren, and Tao Zha, 2018. "The Nexus of Monetary Policy and Shadow Banking in China," *American Economic Review* 108, 3891-3936.
11. Chen, Zhuo, Zhiguo He, and Chun Liu, 2020. "The Financing of Local Government in China: Stimulus Loan Wanes and Shadow Banking Waxes," *Journal of Financial Economics* 137, 42-71.
12. Chen, Shiyi, and Bin Lin, 2019. "Dual-track Interest Rates and Capital Misallocation," *China Economic Review* 57, 301-338.

13. Cong, Lin William, Haoyu Gao, Jacopo Ponticelli, and Xiaoguang Yang, 2019. "Credit Allocation under Economic Stimulus: Evidence from China," *Review of Financial Studies* 32, 3412-3460.
14. Deng, Yongheng, Randall Morck, Jing Wu, and Bernard Yeung, 2015. "China's Pseudo-monetary Policy," *Review of Finance* 19, 55-93.
15. Ehlers, Torsten, Steven Kong, and Feng Zhu, 2018. "Mapping Shadow Banking in China: Structure and Dynamics," BIS Working Paper No. 701.
16. Garcia-Herrero, Alicia, Jinghan Cai, Fengyun Li, and Le Xia, 2019. "Regulatory Arbitrage and Window-dressing in Shadow Banking: The Example of Chinese Wealth Management," *Available at SSRN 3420552*.
17. Hachem, Kinda, and Zheng Song, 2017. "Liquidity Regulation and Unintended Financial Transformation in China," Working Paper, Chinese University of Hong Kong.
18. Qian, Jun, Phil Strahan, and Zhishu Yang, 2015, "The Impact of Incentives and Communication Costs on Information Production and Use: Evidence from Bank Lending," *Journal of Finance* 70, 1457-1493.
19. Song, Michael, Jetil Storesletten, and Fabrizio Zilibotti, 2011. "Growing like China," *American Economic Review* 101, 196-233.
20. Wang, Hao, Honglin Wang, Lisheng Wang, and Hao Zhou, 2019. "Shadow Banking: China's Dual-track Interest Rate Liberalization," *Available at SSRN 2606081*.

Table 1 Summary Statistics

The sample includes quarterly observations of the largest 25 Chinese banks, as reported in Panel A, from 2007Q1 to 2014Q4. Panel B reports bank characteristics at the end of each quarter. Panel C reports total WMP balance, WMP amount due, and their share of total asset for both Big 4 banks and the SMBs, as well as the annualized expected yields of WMPs issued by the two types of banks during the sample period. Panel D reports the average maturity of WMPs issued by the Big Four banks and the SMBs in each year. See Appendix A for definitions of all the variables.

Panel A: List of banks

Big 4 Banks	Joint-equity Commercial Banks
Agricultural Bank of China (ABC)	Bank of Communications
Industrial and Commercial Bank of China (ICBC)	Bohai Bank
China Construction Bank (CCB)	China Zheshang Bank
Bank of China (BOC)	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

Panel B: Summary Statistics: Bank Characteristics

Variables		Mean	Sd.	Min	Max
Deposit Balance (Billion RMB)	Big 4 Banks	9089.96	3042.83	3549.61	15591.33
	SMBs	796.36	893.15	11.67	4719.54
Loan Balance (Billion RMB)	Big 4 Banks	5694.05	1977.13	2197.30	10441.73
	SMBs	566.09	647.78	11.81	3473.44
Capital Ratio	Big 4 Banks	0.11	0.07	0.00	0.15
	SMBs	0.12	0.03	0.00	0.48
LDR	Big 4 Banks	0.63	0.06	0.51	0.76
	SMBs	0.69	0.08	0.44	1.06
DAR	Big 4 Banks	0.82	0.04	0.72	0.89
	SMBs	0.71	0.08	0.46	0.93
Overnight SHIBOR Quoted Rate - SHIBOR (%)	Big 4 Banks	-0.0005	0.0219	-0.1719	0.0983
	SMBs	0.0037	0.0103	-0.0302	0.0497

Panel C: Summary Statistics of WMPs
(WMP balance and due data are from 2008 to 2014)

Variables		Mean	Sd.	Min	Max
Principal guaranteed WMP Balance (billion RMB)	Big 4 Banks	183.6	203.25	0.0	837.4
	SMBs	36.1	78.28	0.0	703.2
Principal floating WMP Balance (billion RMB)	Big 4 Banks	354.23	334.67	1.14	1487.30
	SMBs	72.63	121.58	0.00	729.22
Total WMP Balance (billion RMB)	Big 4 Banks	537.86	465.93	3.72	2038.43
	SMBs	108.74	183.24	0.00	1055.45
Total WMP Balance/Asset	Big 4 Banks	0.04	0.03	0.00	0.11
	SMBs	0.06	0.06	0.00	0.31
Total WMP due (billion RMB)	Big 4 Banks	969.38	755.12	0.00	2877.87
	SMBs	198.59	494.13	0.00	4276.19
Total WMP due/Asset	Big 4 Banks	0.07	0.05	0.00	0.25
	SMBs	0.08	0.12	0.00	0.70
WMP annualized return (%)	Big 4 Banks	4.50	1.00	0.36	30.00
	SMBs	4.70	1.15	0.36	30.00
Principal-guaranteed WMP return (%)	Big 4 Banks	4.11	0.97	0.36	15.95
	SMBs	4.19	1.24	0.36	30.00
Principal-floating WMP return (%)	Big 4 Banks	4.68	0.96	1.45	30.00
	SMBs	4.89	1.06	0.80	30.00

Panel D: Average Maturity (in days) of WMPs

Banks	Big 4 Banks		SMBs		
	Yield Type	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 Summary Statistics: Bank Competition Measures

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

Panel A: Summary Statistics

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

Panel B: 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 3 The Effects of the Big Four Banks' Competition on 21 SMBs' Deposits

These tables show how the BOC competition measure affects SMBs' deposit-to-asset ratio around the stimulus period. The sample includes quarterly observations of 21 SMBs from 2007Q1 to 2014Q4. Panel A reports results using each bank's deposits, measured at the end of each quarter, over its assets as the dependent variable. In Panel B, we take into account of possible window dressing of deposit balance by subtracting the difference between WMP amount due in the last month of the quarter and the average WMP amount due in the first two months of the same quarter from the quarter-end deposit balance. Standard errors are clustered by bank. Robust *t*-statistics are shown in the parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Panel A: Basic OLS Regressions

Year	07-08	09-10	11-12	13-14
Dep Var: Deposit/Asset	(1)	(2)	(3)	(4)
BOC	-0.769 (-0.493)	0.719 (0.348)	-5.941* (-1.995)	-7.256* (-2.017)
ICBC	0.321 (0.387)	2.851* (1.734)	3.181 (1.186)	2.454 (0.777)
CCB	-1.857 (-1.199)	-3.487** (-2.320)	-2.932 (-0.865)	-0.386 (-0.135)
ABC	0.488 (1.190)	-0.182 (-0.363)	2.396* (1.789)	0.386 (0.255)
Size	-0.00817 (-0.457)	-0.0181 (-0.910)	0.0198 (0.940)	0.0159 (1.035)
Quarter×Area FE	Yes	Yes	Yes	Yes
Bank Type FE	Yes	Yes	Yes	Yes
Observations	168	168	168	168
R-squared	0.294	0.266	0.429	0.353

Panel B: OLS Regressions with Adjusted Deposit Balance

Year	09-10	11-12	13-14
Dep Var: Adjusted Deposit/Asset	(1)	(2)	(3)
BOC	0.921 (0.468)	-5.794* (-2.007)	-7.719** (-2.207)
ICBC	2.887* (1.810)	2.832 (1.123)	2.736 (0.869)
CCB	-3.503** (-2.430)	-2.375 (-0.737)	-0.529 (-0.180)
ABC	-0.149 (-0.301)	2.099 (1.675)	0.396 (0.274)
Size	-0.0157 (-0.823)	0.0186 (0.917)	0.00954 (0.613)
Quarter×Area FE	Yes	Yes	Yes
Bank Type FE	Yes	Yes	Yes
Observations	168	168	168
R-squared	0.267	0.420	0.356

Table 4 The Effects of the Big Four Banks' Competition on *all* SMBs' Deposits

This table shows how the BOC competition measure affects an extended sample of SMBs' deposit-to-asset ratios from 2008 to 2015. Data for SMBs other than the 21 banks in our WMP sample are from their financial statements disclosed when issuing bonds. Robust *t*-statistics are shown in the parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Year	2008	2009	2010	2011	2012	2013	2014	2015
Dep Var: Deposit/Asset	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BOC	0.424 (0.900)	0.224 (0.461)	-0.485 (-0.956)	-0.695 (-1.383)	-1.270* (-1.894)	-2.024* (-1.982)	-2.257* (-1.983)	-3.030** (-2.442)
ICBC	-0.302 (-0.656)	-0.109 (-0.215)	-0.580 (-0.981)	-1.624** (-2.452)	-1.492** (-2.155)	-1.288 (-1.455)	-0.558 (-0.585)	-0.286 (-0.244)
CCB	0.0882 (0.253)	-0.0818 (-0.158)	0.229 (0.402)	1.654** (2.360)	1.378* (1.715)	1.782* (1.794)	1.479 (1.243)	1.885 (1.374)
ABC	0.181 (1.092)	-0.117 (-0.539)	0.846** (2.161)	0.554 (1.614)	0.578* (1.947)	-0.0646 (-0.211)	-0.0735 (-0.220)	0.235 (0.751)
Size	-0.0340*** (-3.132)	-0.0239* (-1.710)	-0.0203 (-1.453)	-0.0179 (-1.268)	-0.0309** (-2.106)	-0.0309** (-2.315)	-0.0455*** (-3.468)	-0.0366*** (-2.911)
Bank Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Headquarter Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	80	91	104	111	114	119	121	121
R-squared	0.586	0.508	0.467	0.564	0.585	0.528	0.518	0.458

Table 5 The Effects of Deposits Shortfall on WMP Balance for SMBs: 2SLS vs. OLS

This table shows how SMBs' deposit availability measured as the deposit-to-asset ratio affects their WMP issuance. The sample includes quarterly observations for 21 SMBs from 2009 to 2014. The first three columns report results from a 2SLS estimation procedure, using the Big Four banks' competition measures as IVs for adjusted deposit/asset ratio, while the last three columns report results from OLS regressions. Standard errors are clustered by bank. Robust *t*-statistics are shown in the parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Regression Method	2SLS			OLS		
	09-10	11-12	13-14	09-10	11-12	13-14
Year						
Dep Var: WMP Balance/Assets	(1)	(2)	(3)	(4)	(5)	(6)
Adjusted Deposits/Assets	0.0279 (0.358)	-0.136* (-1.698)	-0.741** (-2.313)	0.0217 (0.620)	-0.0981** (-2.438)	-0.191 (-1.474)
Size	0.0120*** (4.243)	0.0106*** (2.941)	0.0191 (1.278)	0.0120*** (3.844)	0.0102** (2.338)	0.0153 (1.093)
Quarter × Area FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Type FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	168	168	168	168	168	168
R-squared	0.466	0.668	0.072	0.466	0.673	0.431

Table 6 *Within-Bank Logit Estimation of SMBs' New Branch Establishment*

This table examines whether an SMB's decision to establish new branches in a city is affected by the presence of 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 between 2009 to the current year, and 0 otherwise. BranchNum is the total number of branches in a given city. All the explanatory variables are measured 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.

Year	2009	2010	2011	2012	2013	2014	2015	2016
Dep Var: Establish	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MarSha_BOC	1.902 (0.460)	-4.096 (-1.099)	-5.890* (-1.700)	-7.032* (-1.691)	-9.377** (-2.090)	-10.18** (-2.278)	-11.11** (-2.504)	-11.69*** (-2.578)
MarSha_ICBC	3.638 (0.919)	4.707 (1.373)	3.767 (1.289)	4.596 (1.368)	4.498 (1.366)	4.555 (1.280)	3.587 (1.030)	3.530 (0.992)
MarSha_CCB	-0.0214 (-0.00509)	-0.0302 (-0.00776)	-1.628 (-0.438)	-5.933 (-1.403)	-2.412 (-0.617)	0.0529 (0.0133)	-1.389 (-0.361)	-0.415 (-0.104)
MarSha_ABC	-1.255 (-0.639)	-0.162 (-0.0949)	0.193 (0.125)	1.400 (0.897)	-0.483 (-0.316)	-2.103 (-1.367)	-2.557* (-1.727)	-2.768* (-1.856)
GDP Per Capita	0.0307 (0.313)	0.0427 (0.477)	-0.00603 (-0.0683)	0.0831 (0.903)	0.129 (1.270)	0.205* (1.911)	0.172 (1.630)	0.176 (1.590)
log(population)	0.149 (0.334)	0.154 (0.410)	-0.325 (-0.934)	0.0279 (0.0919)	-0.0170 (-0.0512)	0.0973 (0.276)	0.0498 (0.153)	0.0546 (0.165)
log(fixed investment)	0.438 (1.638)	0.451** (1.998)	0.577** (2.519)	0.773*** (3.493)	0.782*** (3.223)	0.612** (2.337)	0.705*** (2.804)	0.700*** (2.740)
log(BranchNum)	0.425 (0.906)	0.316 (0.784)	0.571 (1.517)	0.223 (0.762)	0.410 (1.140)	0.343 (0.935)	0.301 (0.908)	0.300 (0.901)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	city	city	city	city	city	city	city	city
Observations	2,209	2,178	2,154	2,134	2,133	2,053	1,989	1,989

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

This table reports whether the estimated loan increase due to the stimulus plan during 2009-2010 can predict a bank's subsequent WMP balances. We first estimate the linear trend of loan balances for each of the 25 banks (in our WMP sample) using quarterly observations from 2006Q4 to 2008Q4 and use the difference between the actual loan balances and the predicted loan balances in 2010Q4 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 (0.354)	-0.000119 (-0.00240)	1.227*** (5.547)	1.364*** (5.174)	2.093*** (3.068)
Constant	0.0463 (1.637)	0.0865*** (3.287)	-0.116 (-1.022)	-0.0959 (-0.744)	-0.0997 (-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 (-0.708)	0.00559 (0.149)	0.252 (1.233)	0.398 (1.166)	0.202 (0.558)
Constant	0.0149** (2.322)	0.0316* (1.950)	0.0230 (0.280)	0.0227 (0.173)	0.234 (1.570)
Observations	25	25	25	25	25
R-squared	0.004	0.001	0.161	0.150	0.029

Table 8 Rollover Risk and WMPs' Expected Yields

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

Bank type Yield type Dep Var: WMPReturn_d	Big Four		SMBs	
	Floating	Guarantee	Floating	Guarantee
	(1)	(2)	(3)	(4)
WMPdue	1.340 (0.886)	-0.0491 (-0.0232)	1.794*** (4.036)	2.597*** (4.386)
Bank fixed effect	Yes	Yes	Yes	Yes
Quarter fixed effect	Yes	Yes	Yes	Yes
Observations	29,589	14,073	64,322	23,839
R-squared	0.660	0.717	0.671	0.659

Table 9 WMP Rollover Risk and SHIBOR Quoted Rates

The sample includes quarterly observations for banks that submit SHIBOR quotes from 2008Q1 to 2014Q4. See Appendix A 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, $WMPdue_{BIG4}$, and $WMPdue_{SMB}$ by dividing them over their standard deviations. Standard errors are clustered by quarter. Robust t-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Bank Term	Big Four Banks						SMBs					
	o/n	1wk	2wks	1mth	3mths	6mths	o/n	1wk	2wks	1mth	3mths	6mths
Dep Var: Ask Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
WMPdue	-0.0270 (-1.155)	-0.0127 (-0.475)	-0.0138 (-0.496)	-0.0195 (-0.693)	-0.0527 (-1.488)	-0.0263 (-0.625)	0.0330* (1.968)	0.0301* (1.923)	0.0304** (2.096)	0.0297* (1.838)	0.0492** (2.313)	0.0689*** (3.090)
$WMPdue_{BIG4}$	0.805*** (3.971)	0.787*** (3.866)	0.800*** (3.970)	0.851*** (4.115)	0.771*** (3.434)	0.675*** (3.050)	0.728*** (3.696)	0.725*** (3.610)	0.740*** (3.706)	0.794*** (3.857)	0.638*** (2.794)	0.569** (2.489)
$WMPdue_{SMB}$	0.0271 (0.143)	0.0544 (0.318)	0.0460 (0.278)	-0.00455 (-0.0271)	0.0379 (0.234)	0.113 (0.764)	0.0121 (0.0638)	0.0379 (0.220)	0.0357 (0.214)	-0.0154 (-0.0903)	0.0346 (0.213)	0.0704 (0.452)
Capital Ratio	-4.073*** (-2.834)	-4.526*** (-2.959)	-4.278*** (-2.903)	-3.814*** (-2.866)	-5.562*** (-3.486)	-6.075*** (-3.737)	-0.869 (-0.646)	-0.974 (-0.752)	-0.930 (-0.741)	-0.725 (-0.589)	-0.563 (-0.410)	0.0788 (0.0540)
LDR	1.134* (1.805)	1.290* (1.915)	1.479** (2.256)	1.445** (2.390)	1.683** (2.304)	1.419* (1.808)	-1.345*** (-3.057)	-1.288** (-2.633)	-1.230** (-2.382)	-0.898 (-1.657)	-1.301* (-1.799)	-1.430* (-1.920)
Bank FE	No	No	No	No	No	No	No	No	No	No	No	No
Quarter FE	No	No	No	No	No	No	No	No	No	No	No	No
Constant	1.335*** (3.543)	1.331*** (3.310)	1.063*** (2.788)	0.895** (2.578)	1.203*** (2.966)	1.720*** (3.833)	2.721*** (5.450)	2.730*** (4.937)	2.537*** (4.417)	2.145*** (3.758)	2.751*** (3.566)	3.070*** (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 10 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 changes in the one-week and overnight SHIBOR are both above a specified threshold c . For these days, we regress the individual stock return on WMP amount due in the current month over its (book) equity and report the coefficient in each cell in the table. The first row uses raw returns 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*** (-3.806)	-0.754*** (-4.204)	-0.683*** (-5.285)	-0.0690 (-0.755)
Deduct market	-0.296** (-1.986)	-0.201* (-1.790)	-0.264*** (-2.746)	-0.0345 (-0.478)
Projection	-0.246** (-2.043)	-0.157* (-1.653)	-0.281*** (-3.309)	-0.0801 (-1.122)
CAPM	-0.246** (-2.039)	-0.157 (-1.650)	-0.281*** (-3.306)	-0.0800 (-1.120)
Observations	159	253	397	765

Figure 1 WMP vs Deposit Balances over Time

Figure 1.1 reports the average (WMP balance/bank asset) and (deposit/bank asset) over time for Big Four banks and the SMBs, respectively. Figure 1.2 compares the total balance of WMP issued by the Big Four, joint-equity and urban commercial banks in our sample with the balances of WMPs issued by all the banks reported in the news.

Figure 1.1: Banks' WMP Balances/Assets vs Deposits/Assets across time

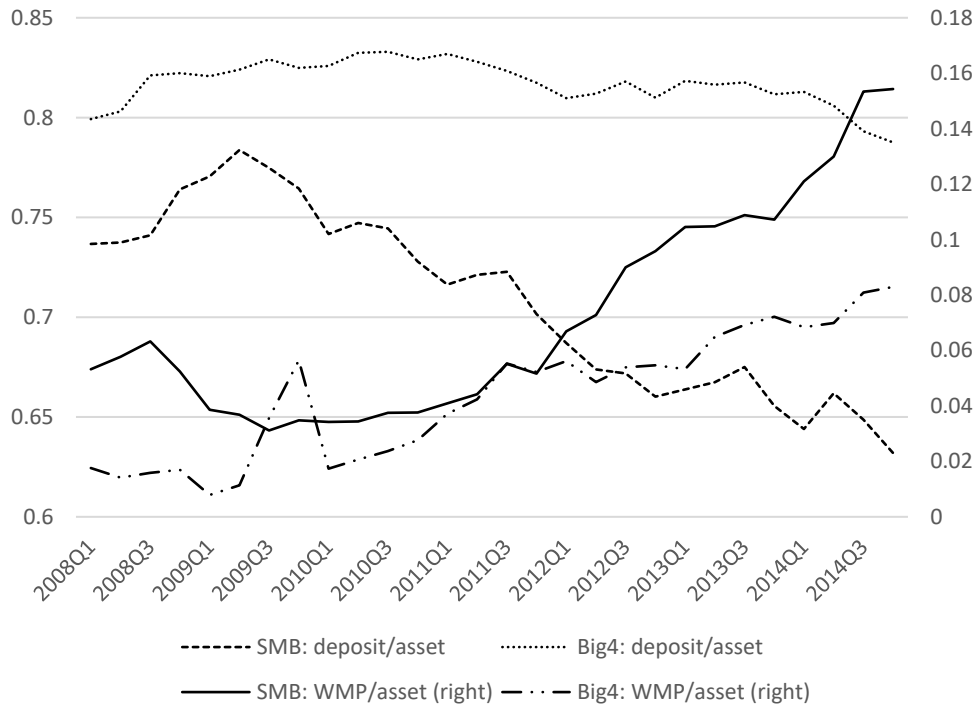


Figure 1.2: Sample WMP Balances vs All WMP Balances (publicly disclosed)

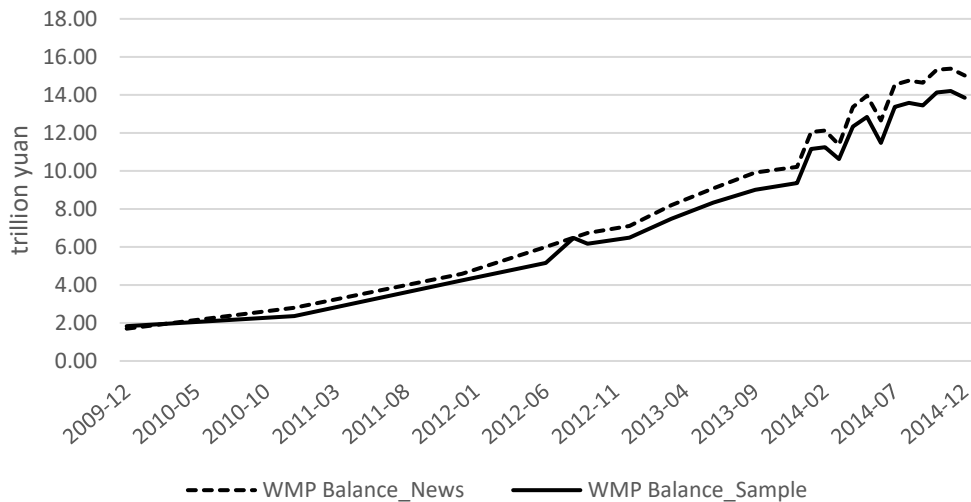


Figure 2 WMP Balances Sorted by Investment Targets

Banks can invest capital raised through WMPs into four types of targets: money market, bank deposits, loan assets, and equity assets. This graph shows the average WMP balances for each type of investment targets at the end of each month from December 2011 to December 2014.

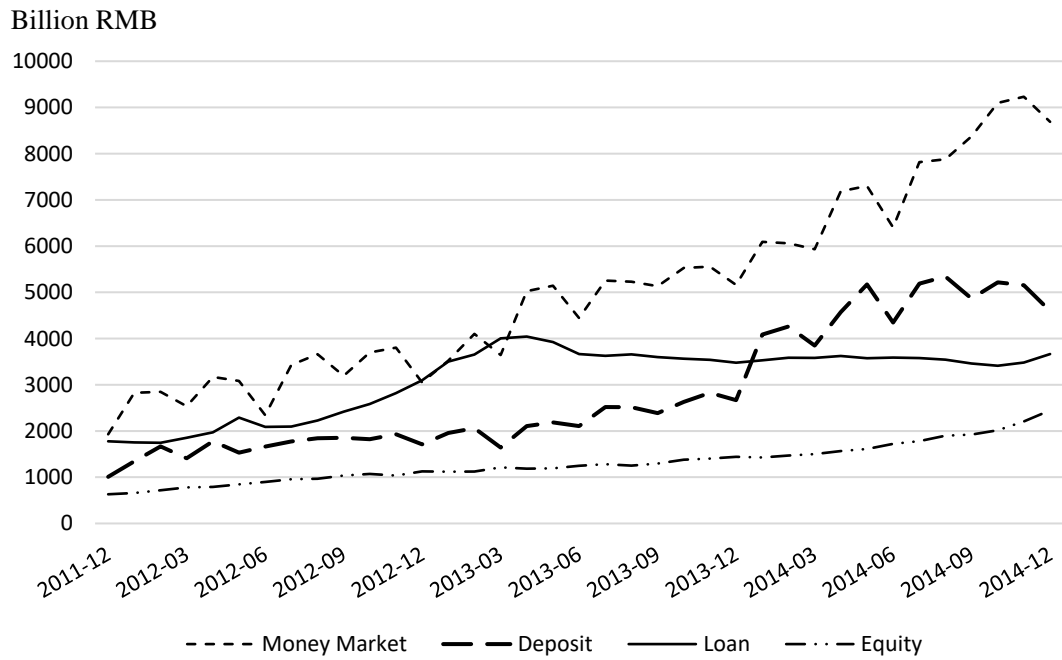


Figure 3 SMBs' WMP vs Deposit Balances in the Cross Sections

These figures plot the SMBs' WMP balances against deposit balances, both scaled by the bank's total asset, at the end of each year from 2008 to 2013.

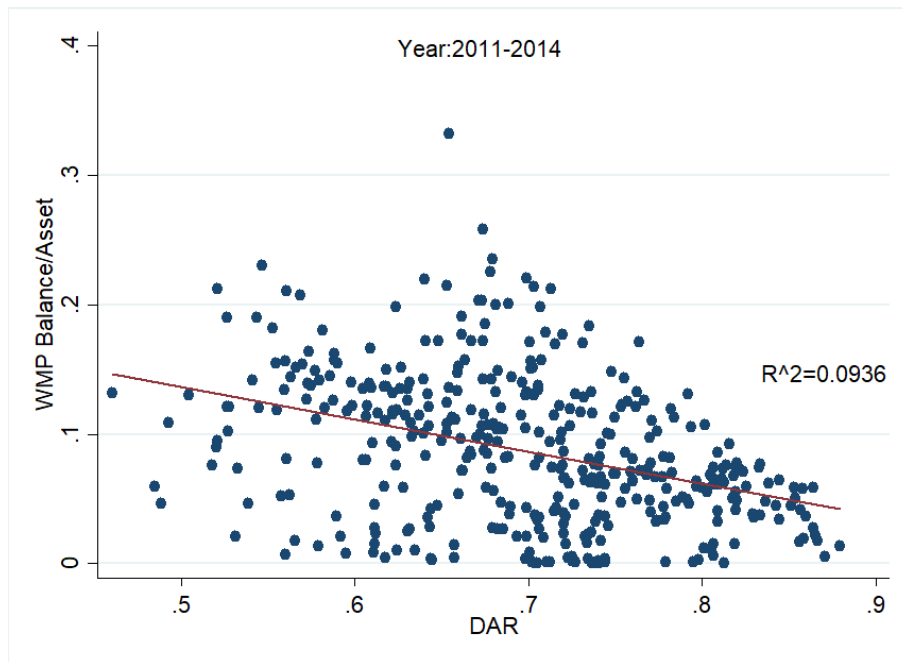
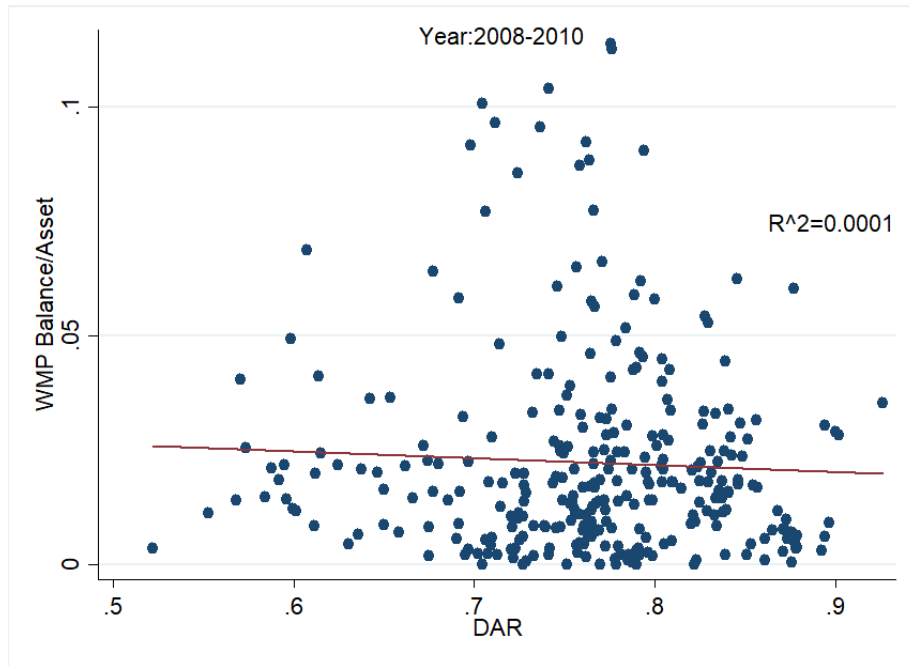


Figure 4 Deposit Rates, SHIBORs, and Average WMP Yields over Time

This figure plots the 3-month SHIBOR, 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.

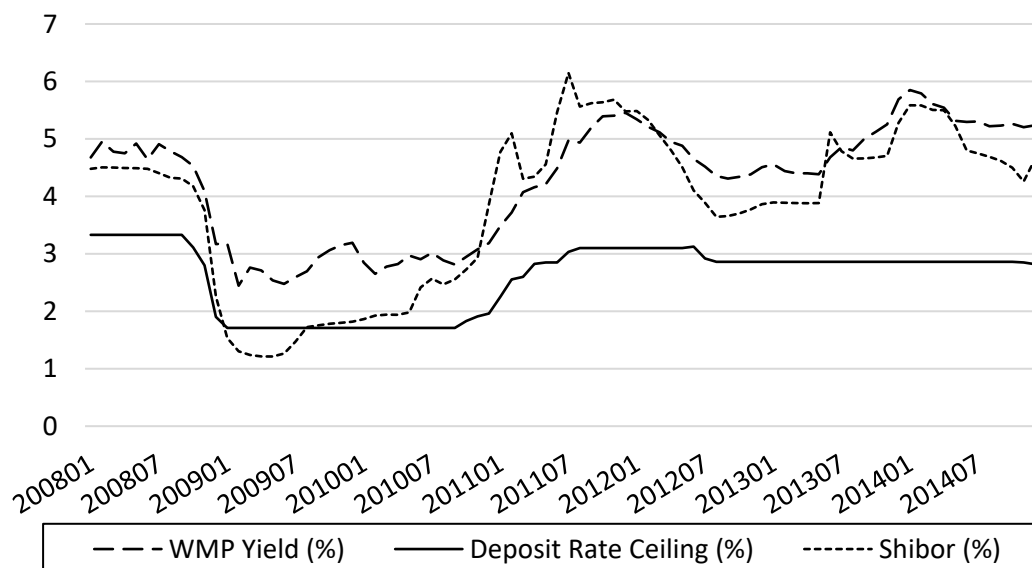


Figure 5 Banks' Activities around the RMB 4-trillion Stimulus Plan

Figure 5.1 shows total loan balances (both short- and medium and long-term) of all SMBs and the Big Four banks, respectively. Data for SMBs is only available from 2010. Figure 5.2 presents the total loan balances of the Big Four banks. For comparison, we scale loan balances by the bank's loan balance at the end of 2008, the beginning of the stimulus. Figure 5.3 plots the Big Four's LDRs, and Figure 5.4 exhibits their total deposit balances (scaled by the initial value in 2008). Figure 5.5 shows their average deposit rates calculated using annual deposit interest expenses divided by the average deposit balance.

Figure 5.1: Total Loan Balances of all National Banks

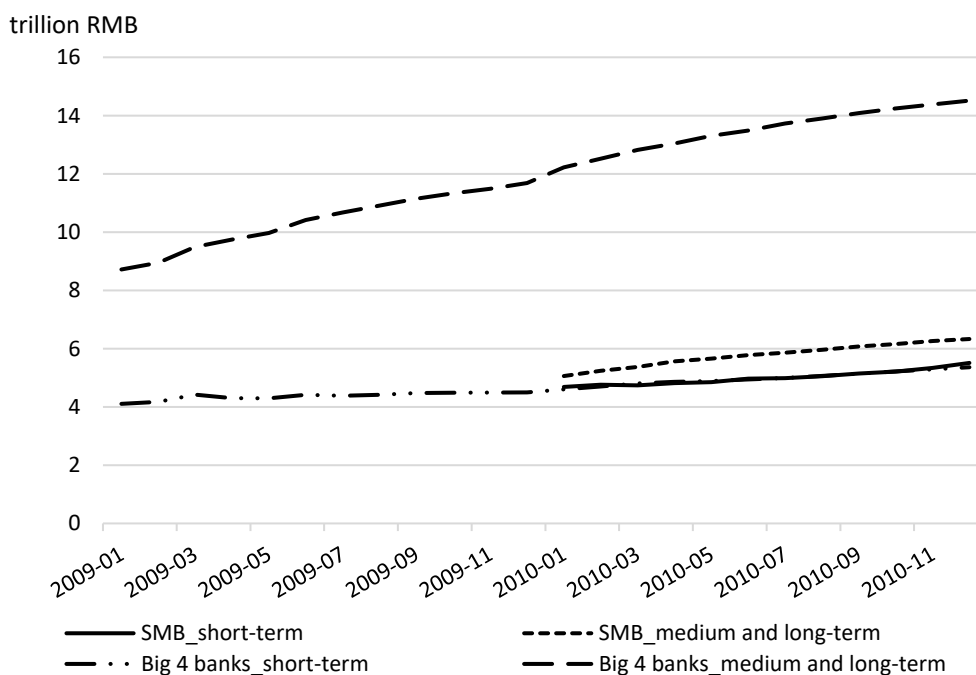


Figure 5.2: Total Loan Balances of the Big Four Banks

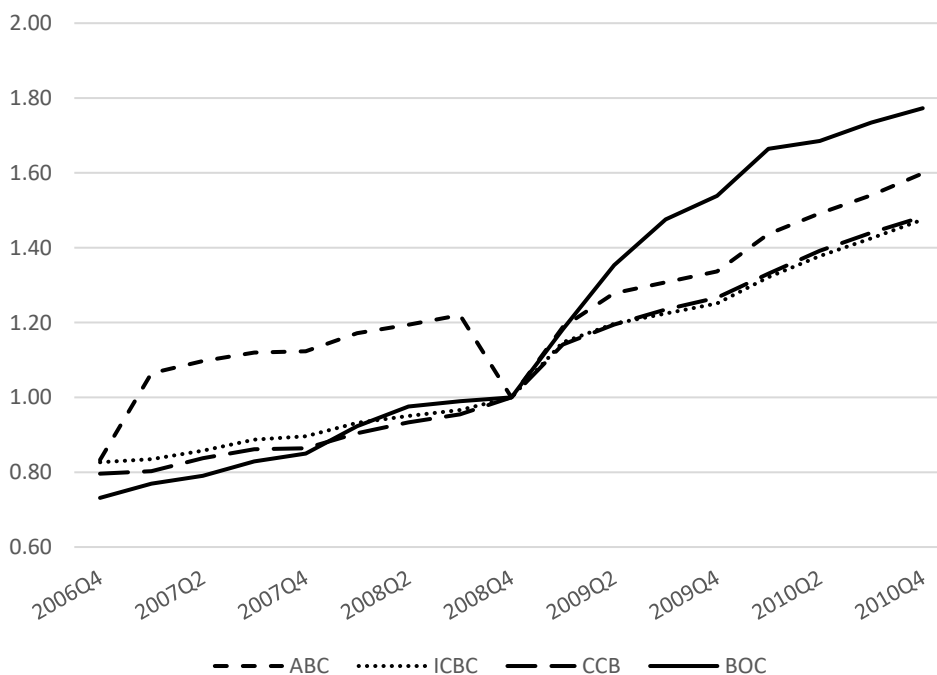


Figure 5.3: LDRs of the Big Four Banks



Figure 5.4: Total Deposit Balances of the Big Four Banks

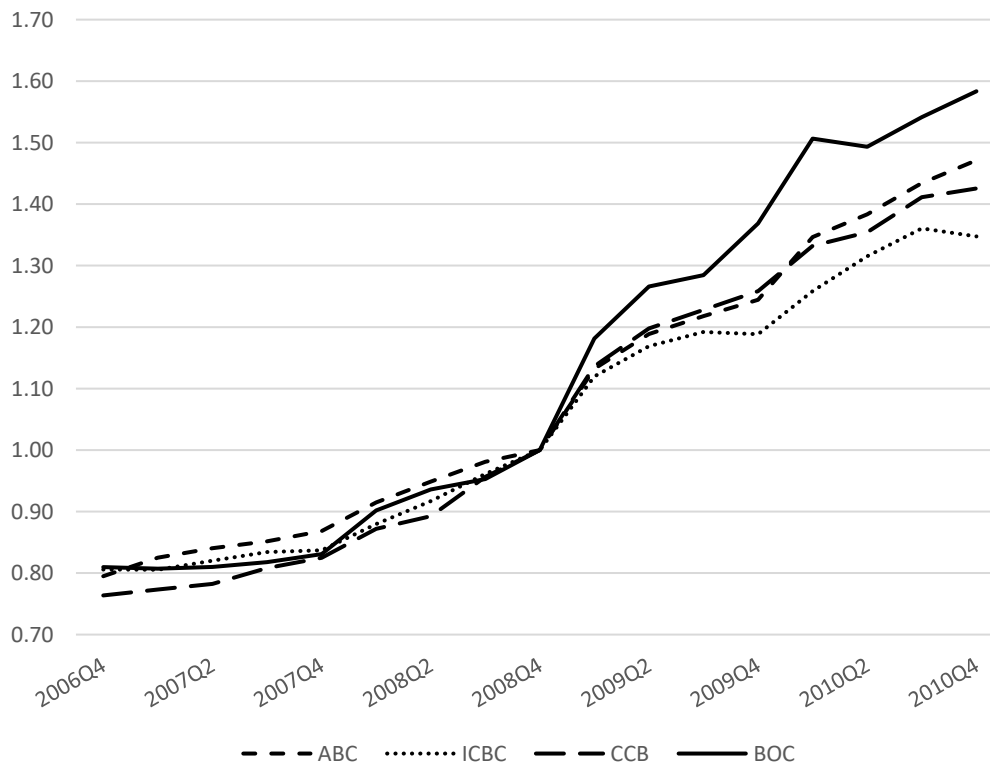


Figure 5.5: Average Deposit Rates (%) of the Big Four Banks

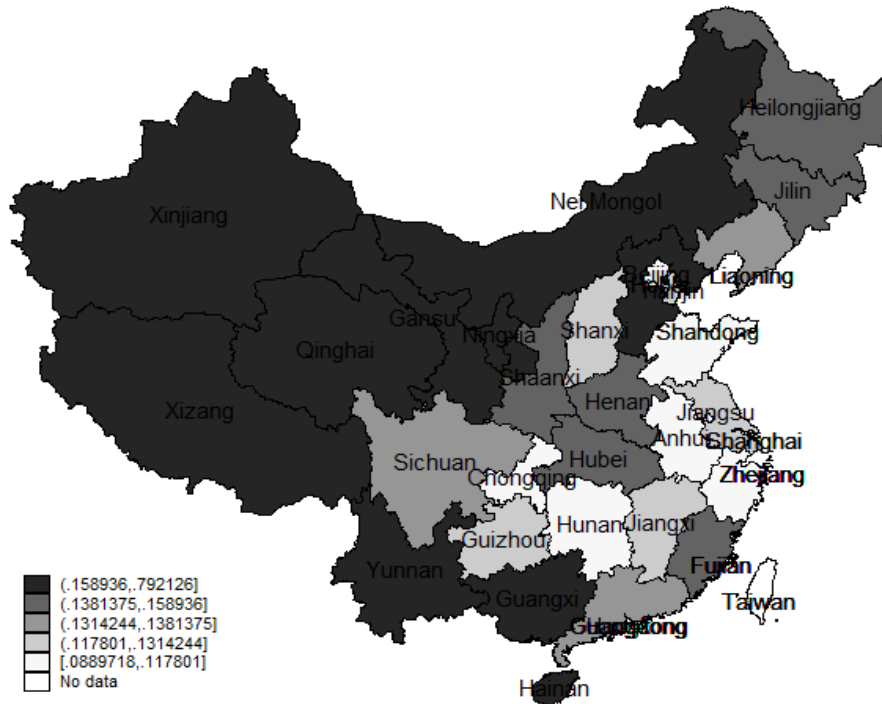


Figure 6 Province-level Market Shares of the Big Four Banks

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

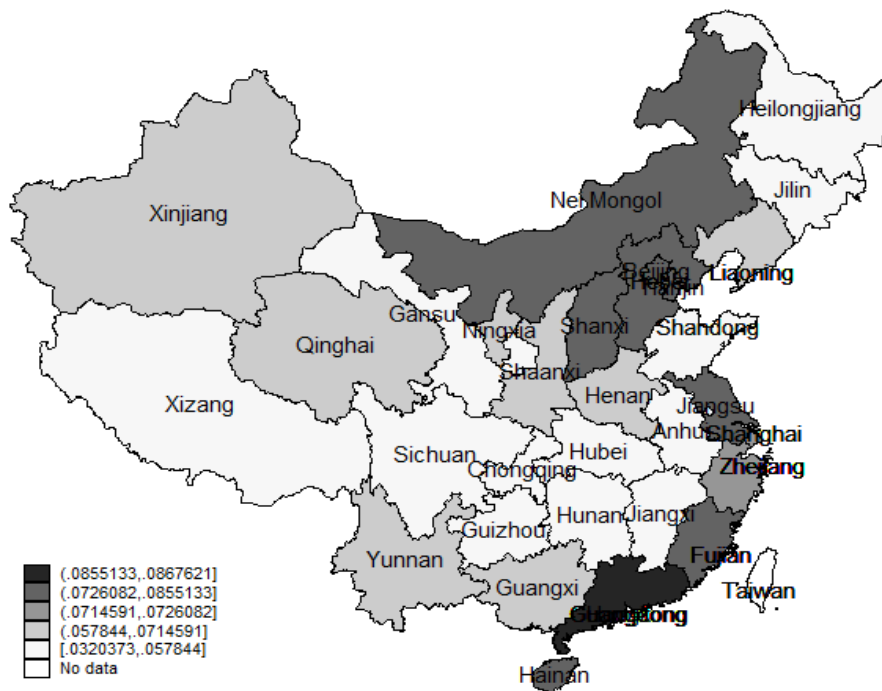
Province-level Market Share of ABC

As on 2012/12/31

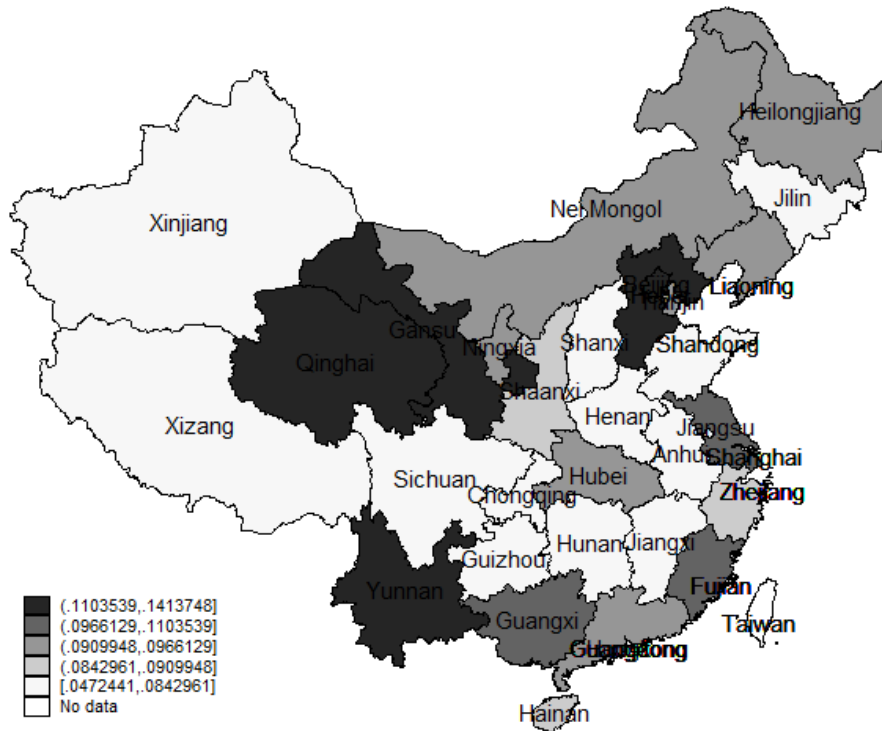


Province-level Market Share of BOC

As on 2012/12/31



Province-level Market Share of CCB As on 2012/12/31



Province-level Market Share of ICBC As on 2012/12/31

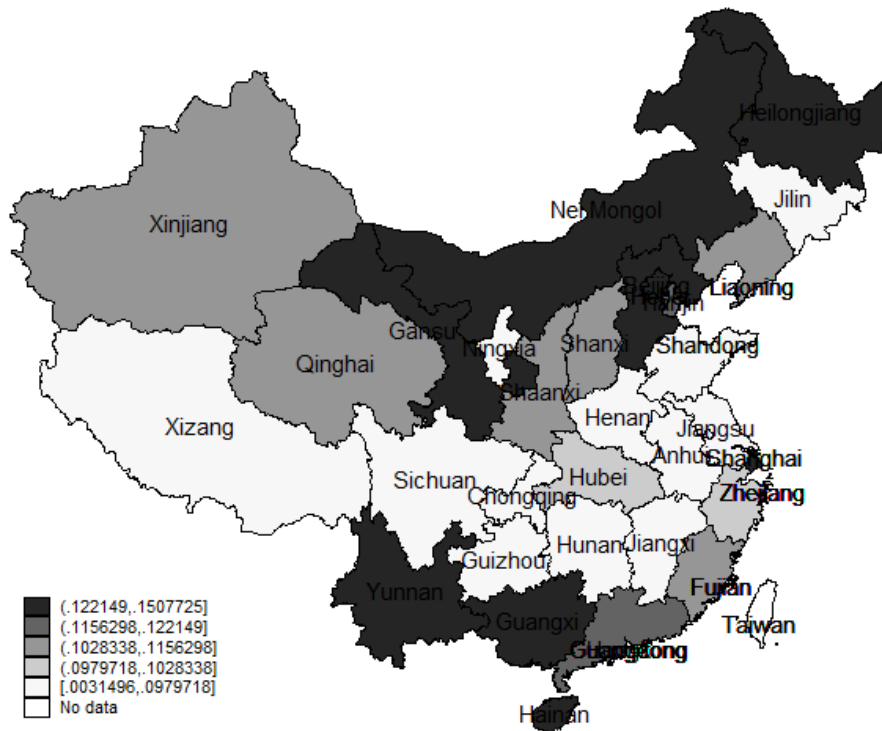


Figure 7 Average Exposure of SMBs to Big Four Banks' Competition over Time

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

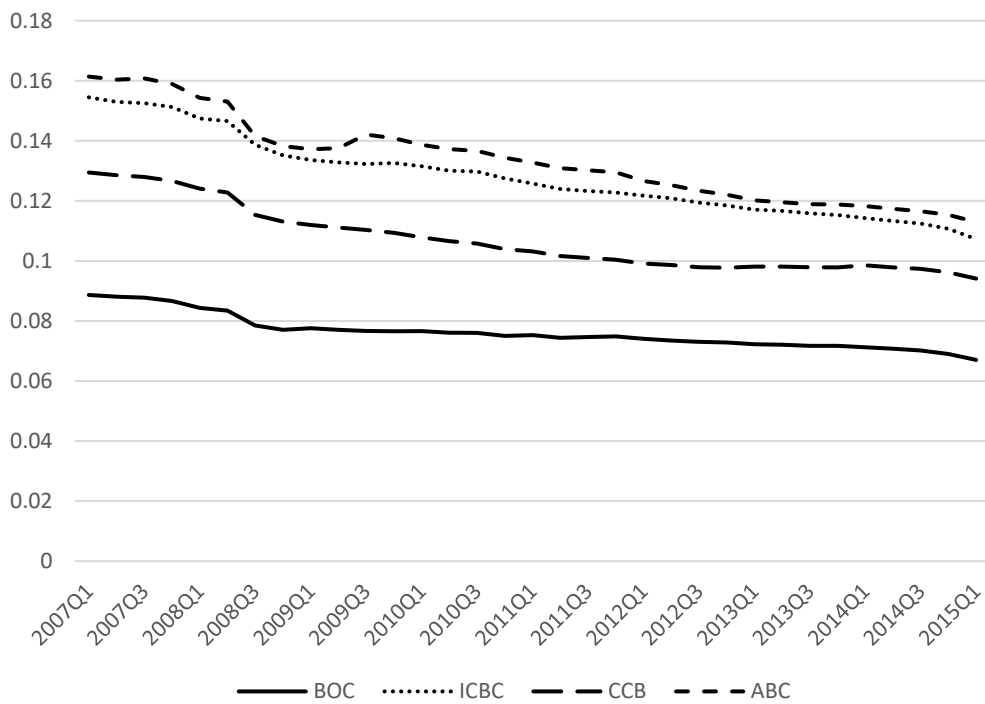


Figure 8 SMBs' Capital Ratios and LDRs over time

The graph shows the average capital ratio and loan-to-deposit ratio of the 21 sample SMBs from 2008 to 2014.

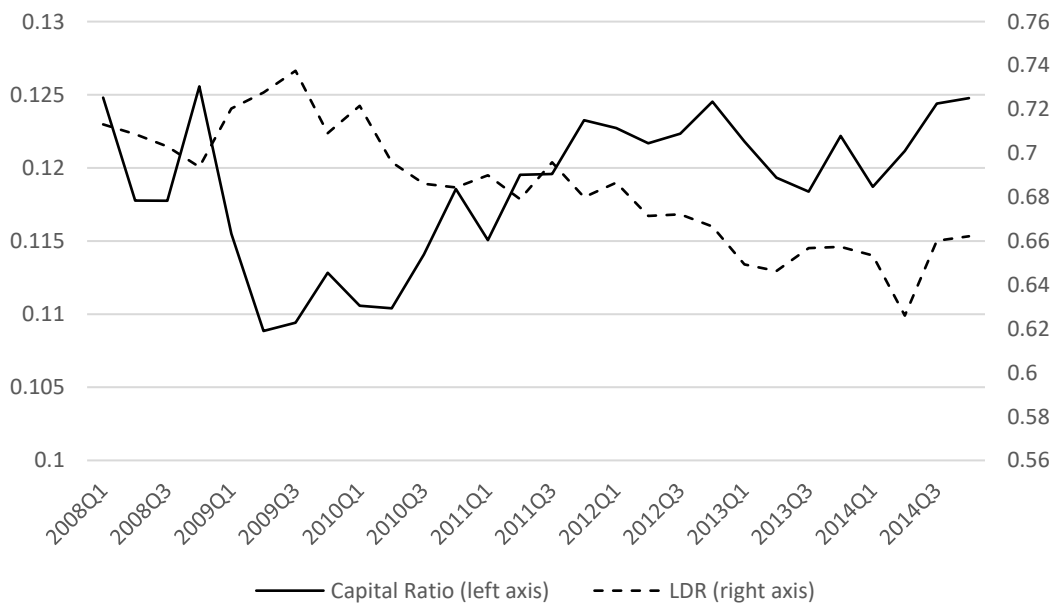


Figure 9 Bank Loans and WMP Balances during the Stimulus Plan

Figure 9.1 plots the percentage of medium and long-term bank loans from 2009 to 2014 for all banks and for Big Four banks only. Figure 9.2 tracks the relationship between a bank’s WMP balance at the end of 2013 and its estimated loan increase, both scaled by the loan balance at the end of 2008.

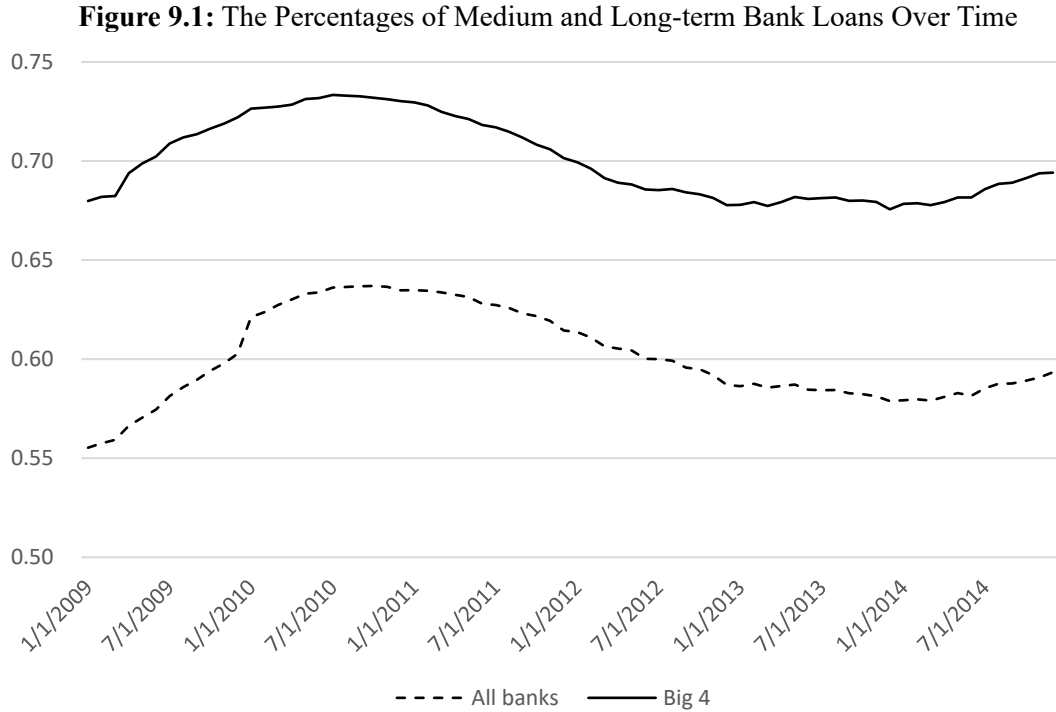


Figure 9.2: Relation between WMP Balances in 2013 and Estimated Loan Increases

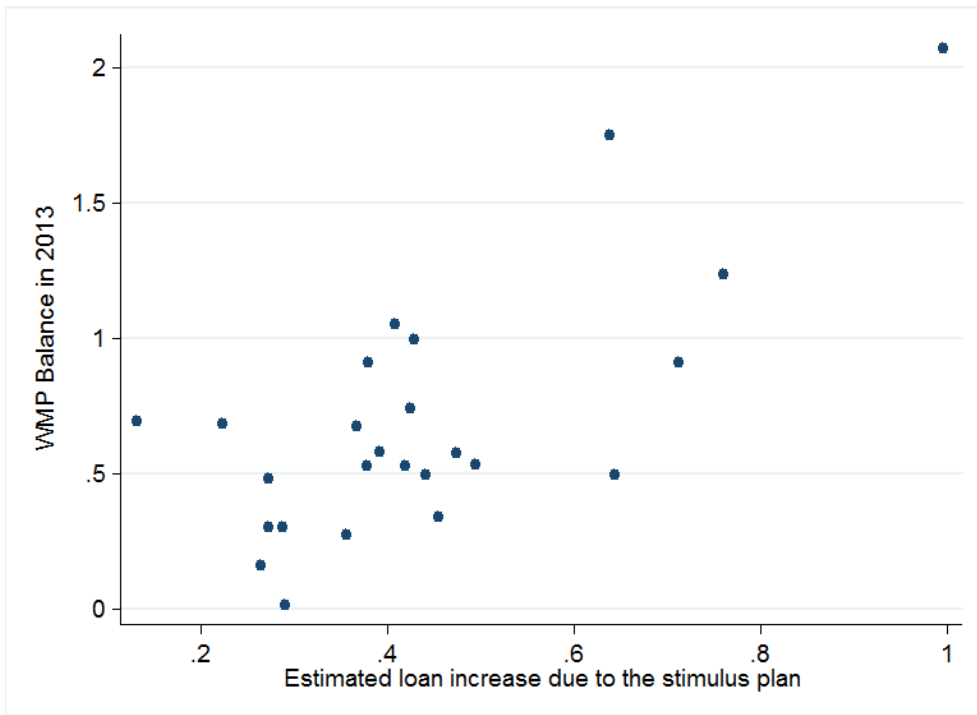


Figure 10 Distributions of WMP Maturity Dates (within a quarter)

All individual WMP information is collected from WIND. We label the last day of each quarter as the 90th day and label other days backwards. Figures 10.1 and 10.2 show the total number of WMPs issued by the Big Four banks and SMBs maturing on each day of a quarter, respectively. Figures 10.3 and 10.4 show the total number of principal-floating and principal-guaranteed WMPs maturing on each day of a quarter, respectively.

Figure 10.1: Number of WMPs Issued by the Big Four Banks Due on Each Day Within a Quarter

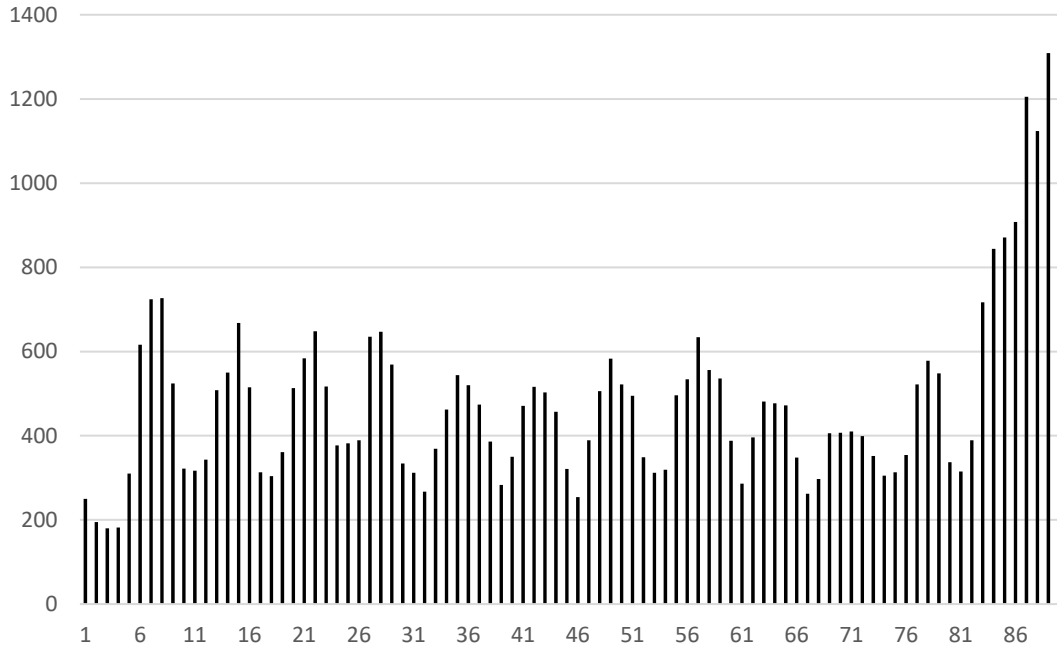


Figure 10.2: Number of WMPs Issued by SMBs Due on Each Day Within a Quarter

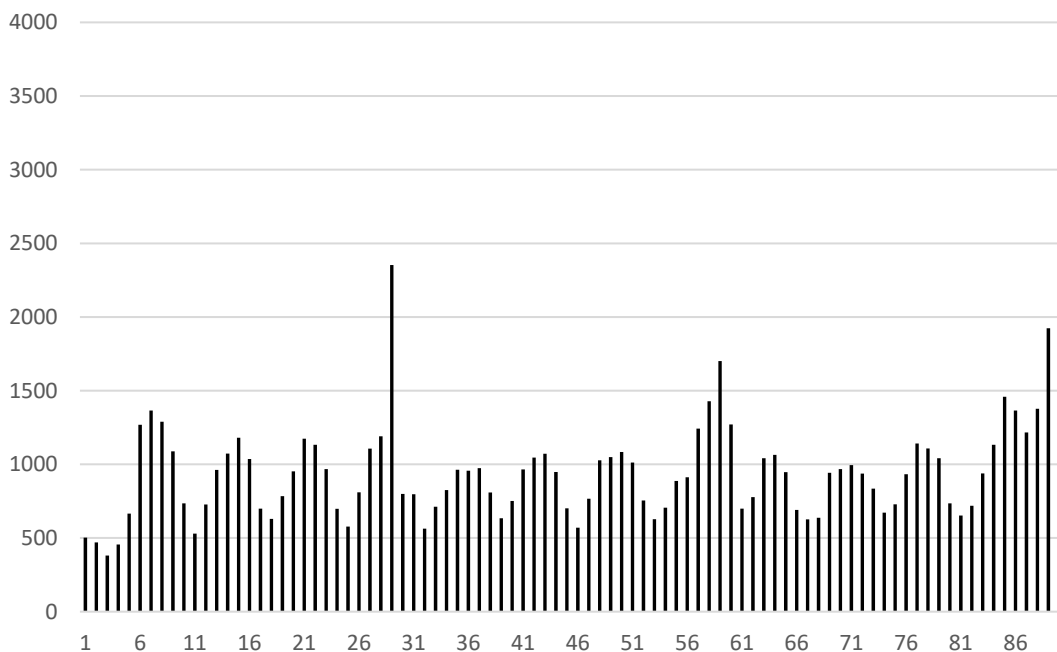


Figure 10.3: Number of Principal-*floating* WMPs Due on Each Day Within a Quarter

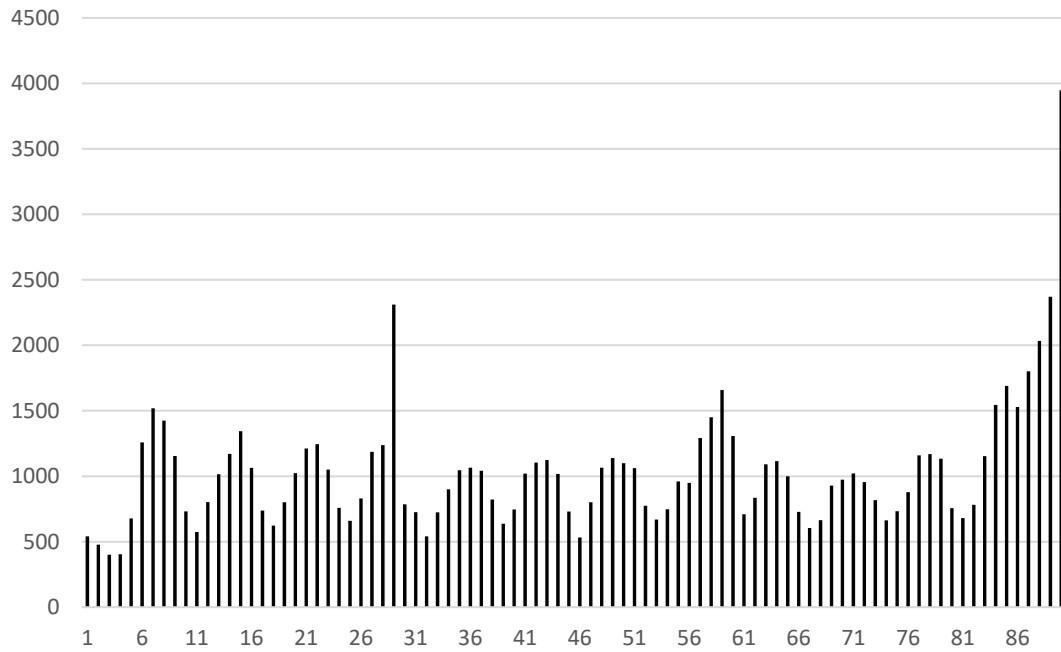


Figure 10.4: Number of Principal-*guaranteed* WMPs Due on Each Day Within a Quarter

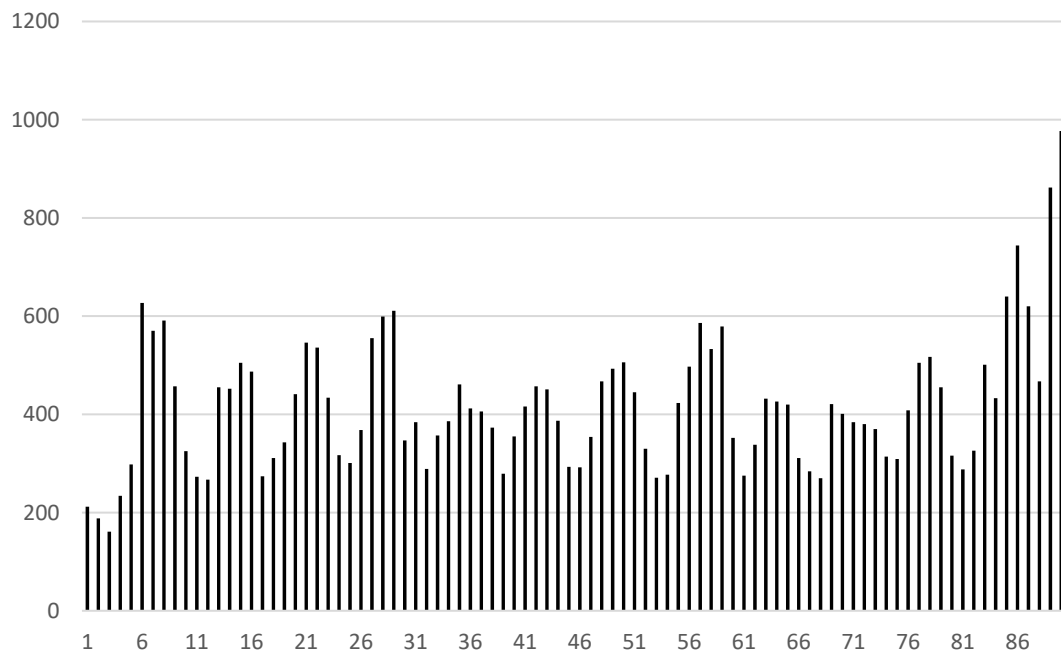


Figure 11 WMP Amount Due/M2 and the One-week SHIBOR over time

The figure shows the relation between the aggregate WMP amount due/M2 and SHIBOR over time. For each month, we calculate the aggregate maturing amount of WMPs issued by the Big Four banks (and by the 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 11.1: Aggregate WMP Amount due/M2 of the Big Four Banks and 1-week SHIBOR

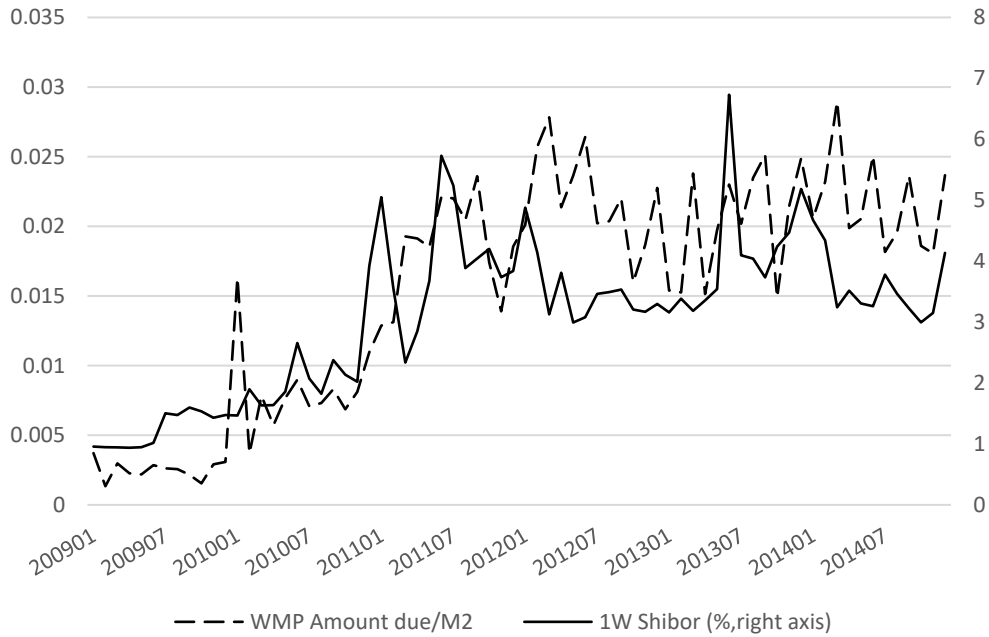


Figure 11.2: Average WMP Amount due/M2 of SMBs and 1-week SHIBOR

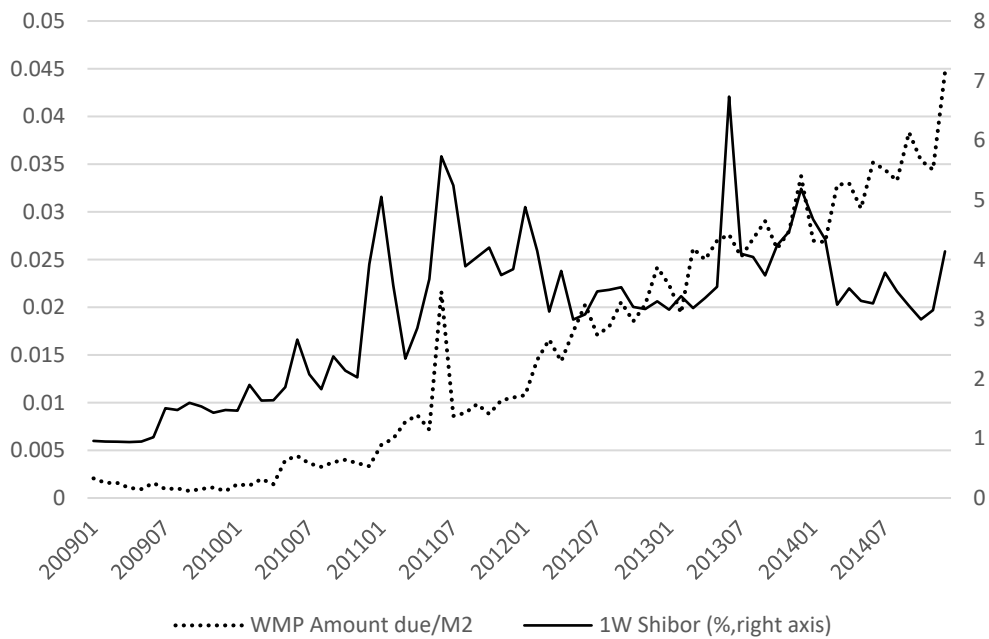
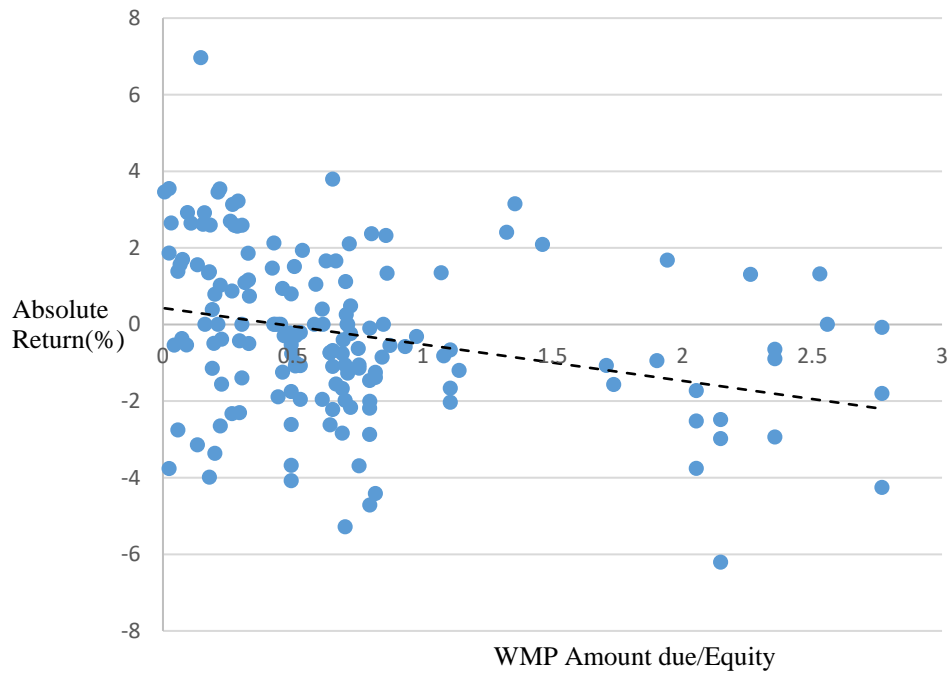


Figure 12 Rollover Risk and Stock Market Response

This figure shows the stock returns versus WMP amount due/Equity on days when both the overnight and 1-week SHIBOR increase by more than 1% compared to the previous day during 2009-2014. Stock returns are calculated as (today's closing price / yesterday's closing price) minus 1. The explanatory variable is total the WMP due in that month over bank equity at the end of the last month.



Appendix A: Definitions of Variables

Variable	Definition
Capital Ratio	Commercial bank's Capital Adequacy Ratio, calculated according to "Commercial Bank Capital Adequacy Ratio Management Method" modified by China Banking Regulatory Commission on Dec 28th, 2006. Starting from Jan 1st, 2013, new requirement for Capital Ratio was carried out, but for consistency we stick to 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 bank's loan balance over deposit balance.
DAR	Deposit-to-asset ratio, calculated as the bank's deposit balance over total asset at the end of each quarter.
DAR_ad	Adjusted deposit-to-asset ratio, where adjusted deposit=deposit balance - (WMP amount due in the last month of the quarter - average WMP amount due in the first two months of the same quarter).
Size	logarithm of total bank asset at the end of last quarter.
WMPReturn_d	WMP initial expected annualized yield minus bank deposit rate ceiling with the same maturity on the issuing date.
WMPdue	Total amount of WMP due in this quarter (month in Table 8) over bank's asset at the end of last 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 B: Bank Area Classifications

The following classification is based on in which provinces a bank has most branches in operation at the end of 2008.

Shanghai/Peking	Jiangsu/Zhejiang/Guangdong	Others
Bank of Shanghai	China Minsheng Bank	Bohai Bank
Shanghai Pudong Development Bank	China Everbright Bank	Huishang Bank
Bank of Beijing	Guangdong Development Bank	Evergrowing Bank
Hua Xia Bank	Ping An Bank	Industrial Bank
	China Merchants Bank	Harbin Bank
	Bank of Communications	Shengjing Bank
	China CITIC Bank	Bank of Chongqing
	Bank of Nanjing	
	Bank of Ningbo	
	China Zheshang Bank	

Appendix C: The Effects of Big Four Banks' Competition on SMBs' *Loan-to-Asset Ratios*

This table shows how the BOC competition affects SMBs' loan-to-asset ratio around the stimulus plan period. Other variables are similar to those used in Table 3. The sample includes quarterly observations of 21 SMBs from 2007Q1 to 2014Q4. 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	07-08	09-10	11-12	13-14
Dep Var: Loan/Asset	(1)	(2)	(3)	(4)
BOC	0.269 (0.270)	0.609 (0.436)	-3.190 (-1.310)	-4.597 (-1.452)
ICBC	0.519 (0.907)	1.468 (1.539)	2.537 (1.465)	3.382 (1.241)
CCB	-2.142** (-2.622)	-2.666** (-2.609)	-4.411* (-1.740)	-3.785 (-1.230)
ABC	0.500* (1.948)	-0.321 (-0.548)	1.560 (1.391)	-0.378 (-0.318)
size	-0.00727 (-0.597)	0.00298 (0.245)	0.0356** (2.381)	0.0430*** (2.963)
Quarter×Area FE	Yes	Yes	Yes	Yes
Bank Type FE	Yes	Yes	Yes	Yes
Observations	168	168	168	168
R-squared	0.570	0.518	0.567	0.591