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

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Abstract

Following China's massive stimulus plan in response to the global financial crisis in 2008, large state-owned banks pumped large volume of newly issued loans into the economy and also raised deposits. The pace of issuing new loans was different across the 'Big Four' banks, creating a plausibly exogenous shock to small- and medium-sized banks facing differential competition from the large banks. We find that small- and medium-sized banks significantly increased off-balance sheet activities, most notably by issuing wealth management products (WMPs), the scale of issuance being greater for banks that are more constrained by on-balance-sheet lending and have greater pressure to maintain deposits from being poached away by local branches of the most rapidly expanding big bank. The WMPs impose a substantial rollover risk for issuers when they mature, as reflected by the yields on new products, the issuers' behavior in the inter-bank market, and the adverse effects on stock prices following a credit crunch. Overall, the swift rise of shadow banking in China seems to have been triggered by the stimulus plan and has contributed to the greater fragility of the banking system.

JEL Classifications: G2, E4, L2.

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I. Introduction

Since the 2007-2009 financial crisis, an extensive strand of literature focuses on how a shadow-banking sector arises in the financial system as a result of 'regulatory arbitrage'—by banks in the form of off-balance sheet activities or by non-banking entities that are entirely unregulated or lightly regulated compared to banks. Due to the opaqueness and complexity of this sector, shadow banking is more difficult to monitor and often deemed to increase the overall fragility and risk of the financial system.[1] Much of this literature focuses on developed economies. There is little research studying shadow banking in emerging markets, including what many believe to be a large sector in China, the second largest economy in the world.[2] Recent turbulence in China's stock market has been attributed to be a source of greater risk of the global financial system, with the shadow-banking sector reportedly providing much leveraged capital fueling the market bubble during the first half of 2015.[3]

In this paper, we examine a major component of China's shadow-banking sector—wealth management products (WMPs) issued by banks, and link the growth of this segment to the RMB 4 trillion stimulus initiated by the Chinese government in response to the global financial crisis in 2008. Following the announcement of the stimulus plan, the largest four state-owned banks ('Big Four' banks) issued large volume of new loans, and also raised deposits so as to fulfill requirements for on-balance-sheet lending.[4] However, the pace of adding new loans was different across the Big Four banks, creating a plausibly exogenous shock to small- and medium-sized banks facing differential competition from the large banks.

We find that small- and medium-sized banks significantly increased the issuance of WMPs, and the scale is greater for banks that are more constrained by on-balance-sheet lending and have greater likelihood of losing deposits to local branches of the fastest expanding big bank. These banks take on substantial rollover risk when issuing WMPs, especially on maturing dates, as shown by the yields set on new products, their behavior in the inter-bank market, and the adverse effects on stock prices following a credit crunch. Overall, our results extend the literature by showing that the swift rise of China's shadow banking seems to have been triggered by the massive stimulus plan, and it has

[1] See, e.g., Acharya and Oncu (2013) for a review of this literature.
[2] At the end of 2014, according to World Bank, China has overtaken the U.S. and become the largest economy in the world as measured in Purchasing Power Parity (PPP) terms.
[3] *Financial Times* estimates that the scale of China's shadow banking, in terms of lending, is half of that of total bank lending, and that China's shadow banking provides much of the leveraged capital that eventually went into the stock market (*FT* 06/25/2015, article by Gabriel Wildau).
[4] They are the Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Bank of China (BOC), Agricultural Bank of China (ABC), and Bank of Communications (BComm).

contributed to the greater fragility of the banking system.

Our data set covers all the WMPs issued by the largest 25 banks in China over the period 2008-2014, with matched data on the issuing banks. While all the sample banks are ultimately owned by the government, we separate them into two categories: Big Four banks and small and medium-sized banks (SMBs). The Big Four banks are among the largest institutions in the world, and are directly controlled by the central government. They are dominant players in the financial system including the deposit and the loan market and the interbank market. The SMBs are much smaller in size and many concentrate their lending in certain regions, with local governments as the largest shareholder.

During our sample period, China's central bank—People's Bank of China (PBOC) set ceilings on bank deposit rates which changed over time but were almost always *below* the market rates (SHIBOR). Banks face on-balance-sheet lending restrictions including capital ratio requirement and loan-to-deposit ratio (LDR) requirement—loans *cannot* exceed 75% of total deposits. Facing these tight regulations, profit-seeking banks pursue off-balance activities, most notably in the form of WMPs. By offering higher interest rates than deposits, these products help banks attract more depositors, and principal-floating products can move loan assets off the balance sheet. Hence, banks' incentive to issue WMPs ought to be affected by regulations of on-balance-sheet lending and the spread between regulated deposit rates and market rates. With disadvantages in both lending and deposits relative to large banks, SMBs should have a stronger incentive to issue WMPs.

We find that the issuance of WMPs spiked upward following the massive stimulus plan announced in 2008. The implementation of the plan was mostly through the injection of large volume of newly issued loans by the Big Four banks into the economy. These banks also raised deposit levels so as to stay below the LDR threshold. Interestingly, Bank of China (BOC), led by Mr. Xiao, Gang, became the most rapidly expanding bank in terms of both newly issued loans and new deposits during 2009-2010, among the four banks. While all four banks have branches throughout the country, the intensity of their branching across various regions is different. The differential pace of adding new loans and deposits following the stimulus plan, and geographic branching strategies among the four banks, created an exogenous shock to SMBs facing differential competition from the large banks.

Our identification strategy is therefore tracking the issuance of WMPs by SMBs facing differential degrees of competition from the large banks. With information on branch openings and closings at city level of all the banks, we find that SMBs increased their issuance of WMPs in response to Big Four banks' expansion (in lending and deposits) in

regions where they operate, and the effects are most pronounced for banks that face direct competition from local branches of BOC. Consistent with our hypotheses, we also find that the scale of issuance is larger for banks that are more constrained by on-balance-sheet lending (higher LDRs) and when the spread between the deposit rate and SHIBOR.

In addition, Big Four banks' issuance of WMPs also rose during the second half of the sample period. This can be regarded as their response to the large volume of WMPs issued by SMBs. We argue that another reason is related to the implementation and 'outcome' of the stimulus plan. A large fraction of the new bank credit, created during the implementation of the stimulus plan, went to real estate and infrastructure projects, leading to rising leverage and risk in these sectors. PBOC began tightening credit supply to these sectors in 2010. With restrictions on making new loans and to avoid defaults on these long-term projects—many are owned by local governments, large banks issued WMPs to refinance these loans. We find a robust, positive relationship between the estimated loan increase due to the stimulus plan and WMP balance in later years (when loans matured) for the Big Four banks, consistent with our hypothesis.

Next, we analyze the rollover risk of WMPs for the issuing banks: WMPs typically mature in three months or less, while investment projects, such as those in real estate and infrastructure mentioned above, pay off in much longer horizons. Many WMPs mature near the end of a quarter, when LDRs are also monitored and calculated by the regulators, and hence banks may need to issue new WMPs to meet redemption of matured products (a portion of the funds will be put back in deposit accounts, helping the banks to stay below the LDR threshold) and refinance loan assets. When there are more WMPs mature, SMBs offer significantly higher yields on the new WMPs, in order to raise more capital and manage liquidity needs.

Large banks, on the other hand, can tap into the interbank market as a source for funds. For Big Four banks, when there is a greater amount of WMPs mature, they are willing to pay higher interest rates (as shown by the quotes submitted to the interbank market) to borrow short-term funds. The effect seems not to exist among SMBs since SMBs are passive price takers in the inter-bank market. At the aggregate level, the one-week SHIBOR closely tracks the aggregate amount of maturing WMPs issued by the Big Four banks during the sample period. In the final part of our empirical analysis, we look at the stock market response when there is a jump in SHIBOR (of 1% or higher). As cost of funds rise, we find that stock prices drop more for banks with more WMP maturing in the short-run. This indicates that investors and the market seem to be aware of the rollover risk of WMP-issuing banks.

Our paper contributes to and extends the literature on the formation and risk of shadow banking. There are at least two important differences between the U.S. shadow banking sector and its counterpart in China. First, the process of moving debt obligations from institutions' balance sheets and packing and re-packaging them into structured products make these products complicated and opaque in the U.S. By contrast, most of the WMPs offered by Chinese banks are simple, short-term fixed income products.[5] Second, after institutions sell the loans and other (unpackaged) debt to the underwriters, there is little or no connection between the structured products and the originating institutions in the US. But in China, as we document, there remains a tight link between the WMPs and their issuing banks. Overall, the growth of the WMPs in China resembles more closely the growth of money market in the US as a result of Regulation Q, and, more recently, the growth and collapse in the issuance of asset-backed commercial paper (Acharya, Schnabl and Suarez, 2013).

There are a few recent studies on China's shadow banking. Dang, Wang and Yao (2014) provide a theoretical model to explain the differences between the US and Chinese shadow banking as described above. Allen, Qian, Tu and Yu (2015) and Chen, Ren and Zha (2016) study another large component of the shadow banking—entrusted loans, which are extended by non-bank companies or institutions. Hachem and Song (2015) provides theoretical analysis on the interactions between large and small banks both in on- and off-balance sheet markets. Unlike these papers, we use a large, product-level data to empirically examine the relationship between WMP characteristics and issuing banks. Our evidence supports the prediction in Hachem and Song (2015) that competition among banks is a driving force behind the issuance of WMPs. However, our empirical strategy—tracking how SMBs respond to differential competition from the large banks expanding their lending and deposits at different paces, allows us to establish a direct link between the implementation of the massive stimulus plan and the growth of shadow banking. Our results also indicate that the swift rise of WMPs, especially those issued by SMBs, has contributed to the greater fragility of the banking system.

The rest of the paper proceeds as follows. In Section II we describe China's banking sector and the regulatory framework. In Section III, we describe our sample of WMPs and their issuing banks. In Section IV, we assess the effect of Capital Ratio and LDR on WMP issuance. In Section V, we link the rising of WMPs to the 4-trillision stimulus plan and show how it is triggered by the stimulus plan for both SMBs and big 4 banks. In Section VI, we

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

study the rollover risk of WMPs. We conclude in Section VII. The Appendix contains the explanations of all the variables used in the paper.

II. Institutional Environment and Shadow Banking

There are a total of four types of banks in China. The first is state-owned *policy* banks, whose only goal is to carry out a particular type (or types) of policy lending. This category includes China EXIM Bank, China Development Bank and Agriculture Development Bank of China. The second category is the Big Four banks, including Agriculture Bank of China (ABC), Bank of China (BOC), China Construction Bank (CCB) and Industrial and Commercial Bank of China (ICBC). They are all listed in both the domestic A-share market and in the Hong Kong Stock Exchange. They are the predominant players in China's commercial lending market and deposit market. They are mostly market-oriented but also carry out some policy lending especially during extreme periods. Presidents of these banks are directly appointed by the State Council. The third is national joint-equity commercial banks. There are 12 of them. The average bank asset is about 10% of that of Big 4 banks. Bank of Communications was in this category, and is regarded by PBOC as the fifth big bank now. But its size is way below the other big 4 banks, so in the paper we still consider it to be a SMB. The fourth is urban and rural commercial banks, which are founded by the city or the province governments. They are usually very small, but some urban commercial banks could be very big.

All commercial banks are under the supervision of PBOC and China Banking Regulatory Commission (CBRC). Standard regulations such as capital requirements, in conjunction with the Basel III Accords, are in place for all the banks. Banks' reserve ratios have been quite high—21.5% in June 2011 and 17.5% for big banks at the end of 2015—in part to help sterilize large amount of foreign currency reserves accumulated over the past decade.[6]

Interest rates have been tightly regulated in China: as part of the macroeconomic policies, PBOC sets base interest rates along with upper and lower bounds, and these rates and bounds vary over business cycles and with loan maturities. Lending rates had been gradually liberalized as well as the lower bound of deposit rate. The key is the upper bound of deposit rates which was effective until 2015. The upper bound, up to 1.5 times of base rates,

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

was binding during our sample period (2008-2014). These interest rate policies were also part of China's investment-driven growth model--'forced' transfers from savers to borrowers such as large industrial enterprises (e.g., Song, Storesletten, and Zilibotti, 2011).

The difference between deposit rate and market rate gives banks strong incentives to make excessive lending. In response, CBRC sets limits on total bank lending. Tools include Capital Ratio and LDR. Bank cannot lend more than 75% of their total deposits, and this upper bound on lending was also binding during our sample period[7] especially for SMBs.

These regulations give rise to the growth of shadow banking in China. First, to maintain a high level of capital ratio, banks can increase their capital by issuing new equity and junior bond. They can also conduct more off-balance sheet activities which won't increase banks' on-balance sheet asset. The most important off-balance sheet activity is the issuance of WMPs especially principal-floating WMPs. Principal-guaranteed WMPs are often recorded on the balance sheet as required by the CBRC. Second, to depress the level of LDR, banks can attract more deposit or conduct less on-balance sheet lending. Again, WMPs can help in two ways. Loans financed by principal-floating WMPs don't increase on-balance sheet loan balance, and banks can offer higher return on WMPs to attract more deposit. Banks cannot offer a higher deposit rate than the deposit rate ceiling.

The broadest definition of 'shadow banking' refers to all the investment products in the market that are off-the-balance sheet of banks. In this paper we only study the largest component—WMPs offered by banks. Similar products are also offered by non-bank institutions. Although there is no regulatory ceiling on the interest rate these non-bank financial institutions can offer, they also benefit from the low deposit rate since the presence of a deposit rate ceiling lowers the asked return by investors. The most famous product is probably *Yu'e'Bao*, offered by *Alibaba* along with a money market fund.[8] Another important component of China's shadow banking sector is entrusted loans offered by trust companies. Usually trust companies will package their loan assets, which banks can invest with money raised from WMPs.[9]

With the rise of shadow banking, there is a 'dual-track' system of intermediation in

[7] The restrictions on deposit rates as well as the lending-to-deposit ratio are currently in the process of being lifted. However, Chinese banks still face high reserve ratios and their lending remains capped by the PBOC; hence, there is still incentive for them to continue off-balance-sheet activities including the issuance of WMPs.

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

[9] There are also many private credit agencies throughout the country, and they primarily lend to small firms that do not have access to formal bank lending. See, e.g., Allen, Qian and Qian (2005) for more information.

China's financial system. On the one hand, bank deposits are constrained by interest rate control and on-balance sheet lending by capital ratio and LDR. Excessive lending is always appealing especially when the regulated rate is way below the market rate. On the other hand, the shadow banking sector is relatively lightly regulated. Both commercial banks and non-bank financial institutions want to benefit from the low cost of funding. As we will see later, some regulations by the CBRC attempting to control the risk actually made the shadow banking sector more complex and prone to systematic risks.

The first WMPs were produced through bank-trust cooperation. Banks sell their loan assets to the lightly-regulated financial institutions called trust companies. Trust companies then package these loan assets to form a trust plan. In the meantime, banks issue WMPs and invest the WMP money into the trust plan. In this way, borrowers get financed, banks and trust companies get paid by the interests from the trust plan, and banks' on-balance sheet loan balance doesn't increase.

This strategy was soon realized by CBRC. Concerned about its influence on the effectiveness of monetary policy, on July 6th, 2009, CBRC forbade banks from investing money raised from WMPs into banks' own loan assets. This policy didn't work. Bank A can sell its loan assets to trust companies to form a trust plan and ask Bank B to issue WMPs and invest the WMP money to the trust plan. The borrower gets financed, both Bank A and B get paid and neither loan balance doesn't increase.

On August 10th, 2010, CBRC required WMPs targeted to loan assets shall not exceed 30% of all bank-trust cooperation WMPs. Again, banks circumvented such a policy by adding another channel—investment banks. First, the trust companies make loans to borrowers and package the loan assets into a trust plan. Second, banks issue WMPs and delegate the investment bank to manage the money. In fact, the banks would require the investment bank to invest the money into the trust plan. In this way, banks claim to delegate the job to investment banks. The WMPs are not targeted to loan assets by banks themselves.

The game between CBRC and banks went on. In late March, 2013, CBRC passed a new policy: WMPs invested in non-standard financial assets (including all trust assets) couldn't exceed 35% of all WMPs or 4% of bank assets. To circumvent this policy, banks need to invest the money into some standard financial assets which can facilitate firm borrowing and somehow get riskless return higher than deposit rate for WMP investors. Banks and trust companies developed a new counterpart business model. In short, Bank A places WMP money in Bank B as some kind of contracted deposits. Bank B invests its own money or delegates investment banks to invest the money in certain trust plans packaged by trust

companies. The contracted deposits wound be pledged as guarantee for the trust plans and in return swap its interest rate with return on the trust plans. In this process, for Bank A the WMP money is invested in some standard deposits, for Bank B it uses its own money not WMP money to invest in non-standard financial assets, for WMP investors they get a safe (implicitly guaranteed by Bank A) return higher than deposit rate from the trust plans, and for the borrowers they get financed.

Figure 2 shows the WMP balances by the 4 main investment targets starting from Dec, 2011. As we can see, balance of WMPs targeted loan assets peaked in March, 2013 when CBRC passed the new policy and was stable since then. WMPs targeted deposits increased a lot in Jan, 2014 when banks developed the new counterpart business model.

WMPs targeted the money market also increased a lot across time. Banks can invest WMP money in treasury bonds and make arbitrage profits. Or banks can lend the WMP money to other banks who then can purchase non-standard financial assets like trust plans. The complicated interaction among banks makes it almost impossible to stop WMP money channeled to trust plans.

The dynamic game between CBRC and commercial banks reflects the inefficiency of the banking industry when the market economy and planned economy coexist. The deposit rate ceiling and on-balance sheet lending restriction leave a large credit market unsatisfied and banks want to profit from it. No matter how CBRC sets the cannot-do list, banks will always find a way to channel WMP money to borrowers. The fact that banks can circumvent these restrictions doesn't imply the equilibrium is as efficient as if there were no such restrictions. Inefficiency arises as additional channels add more transaction costs for the borrowers, reduce transparency and increase agency problems. In fact, the longer the cannot-do list is, the more channels there are, and the more inefficiency occurs.

In addition, there are two important risks involved. The first is rollover risk. Loans financed by WMPs are usually long-term, but WMP investors want liquid assets. The counterpart banks want liquidity too because they don't want to take on long-term risks. The issuing banks also prefer the WMPs to mature soon because when WMPs mature, WMP money is transferred to the deposit accounts and can help with LDR. This maturity mismatch causes rollover risk. That is, banks face great liquidity management pressure to rollover these WMPs. Banks can usually go to the inter-bank market for liquidity and in the meanwhile, issue new WMPs to refinance these loans. But if there is not enough liquidity in the market, as the situation in June, 2013, banks with lots of WMPs mature go into trouble.

Second, the rollover risk of an individual bank can get spread to the whole market. The

multiple channels of WMPs make financial institutions more closely connected to each other than ever. If one individual bank goes into liquidity shortage, banks closely connected to it may go into trouble too, and then the process will go on and it may even lead to another Lehman story. In this paper we are able to provide empirical evidence for the rollover risk.

III. Data and Summary Statistics

We focus our study on the 25 most important banks in China, including the big 4 banks, all the 13 national joint-equity commercial banks and 8 biggest city commercial banks. All banks except the big 4 are considered as SMBs in this paper. Our data come from multiple sources.

First, bank financial and WMP information comes from public datasets and surveys. Listed banks and banks that have issued bonds will publish their financial information. Most listed banks do it on a semi-annual basis while some do it on a quarterly basis. We collect the information from various sources like listed firm datasets and central bank reports. For information missing of these banks and information of other banks, we conducted a survey of each bank asking about their financial and WMP information. The final data we obtain from public sources and surveys run from 2008 to 2014 for each of the 25 banks and include bank equity, total loan and deposit balance, Capital Ratio, LDR as well as aggregate WMP quantity information for each bank in each quarter.

Second, bank branch information is from the website of CBRC. Each individual branch of all financial institutions needs to acquire a unique financial license from CBRC. From Nov. 2007, CBRC publishes the information of all these licenses, information including the opening date, the closing date if closed, operation location, and subordination of the branch. Third, individual WMP information is WIND, a leading data provider in China. We collect yield and maturity information for all the WMPs issued by the 25 banks during the sample period. We also collect bond and stock price data for listed banks from WIND. Fourth, Shanghai Interbank Offered Rate (Shibor) and each bank's quoted rate are downloaded from the official website.

Table I reports summary statistics for both bank and WMP characteristics. See the appendix for detailed definition of all the variables. In Panel A, big 4 banks are typically 10 times the size of SMBs in terms of equity, total deposit balance and total loan balance. The two groups are similar in terms of Capital Ratio. According to Basel Accord, banks' Capital Ratio cannot be lower than 8%. Most bank are qualified long before our sample period except

Agricultural Bank of China. Before 2009, ABC had negative Capital Ratio and only after a new capital injection from the government did its Capital Ratio become qualified in 2009 Q4. Starting from 2013 a new approach to calculate Capital Ratio is adopted but the former approach is still in use. For consistence we report empirical results using the former approach. Results using the updated Capital Ratio barely change.

The average LDR of SMBs is higher than that of big 4 banks. SMBs generally suffer more from the quantity regulation.75 out of the 700 bank-quarter observations have *LDR* exceeding the regulatory threshold 75%. Among the 75 observations, only one observation is of a big 4 bank. When this happens, banks will get a severe warning from the CBRC. Although not absolutely infrangible, the regulation of 75% is very strict and stressful for the banks.

All the big 4 banks take part in the Shibor bid and ask process while only 9 to 10 SMBs do so. We calculate bank's Shibor quoted rate minus Shibor for different maturities but only reports overnight to save space. SMBs seem to ask for higher rates than big 4 banks. This is in accordance with the fact that SMBs are in more shortage of liquidity.

Panel B reports statistics of WMPs. Big 4 banks issue much more WMPs than SMBs, but if we scale total WMP issuance by bank equity, SMBs are more aggressive in issuing WMPs. If we divide WMPs according to the yield type, both big 4 and SMBs issue more principal-floating WMPs than principal-guaranteed WMPs. The reason is that most of the principal-guaranteed WMPs are recorded on the balance sheet while principal-floating WMPs are off the balance sheet. So principal-guaranteed WMPs will still increase banks' total asset and don't help maintain Capital Ratio but principal-floating WMPs do. The same pattern is found for the amount of WMP due.

Panel B also shows that, WMPs issued by SMBs generally have higher annualized expected yield than those issued by big 4 banks, especially principal-floating WMPs. Principal-floating WMPs have higher expected yield than principal-guaranteed WMPs. WMP expected yield is stated in the prospectus. Figure 3 shows the change of WMP annualized yield as well as the Shibor and deposit rate ceiling over time. The yield of WMPs tracks 3-month Shibor very closely. Except for the first half year in 2009 when Shibor dropped dramatically because of major liquidity injection by PBOC in response to the financial crisis, Shibor remains way above the deposit rate ceiling.

Panel C shows a decreasing trend of the maturity of WMPs issued by both groups of banks and with both types of yield. As talked above, this pattern reflects banks' strategic response to the LDR regulation. When WMPs mature, the principal and the return is collected

and transferred to investors' deposit account with the same banks, so the banks' total deposit will increase. Therefore, banks strategically choose WMPs' maturity date so that they can report a higher deposit balance when LDR is calculated. At first, CBRC policed end-of-year *LDR*. In 2008 before the 4-trillion stimulus plan, the PBOC was worried about the inflation and tightened liquidity in the inter-bank market. In response, banks especially SMBs cut the WMP maturity a lot so most of the WMPs can mature before year end so that banks can report a higher deposit balance. In late 2009 CBRC switched to end-of-quarter ratios which caused banks to further cut the WMP maturity. In 2014 the average maturity is around 3-4 months which coincides with the quarterly regulation basis. The decreasing trend of WMP maturities implies banks' more dependence on WMP financing and also greater maturity mismatch and rollover risk. Panel D is a list of the 25 banks in our sample.

IV WMP Issuance and Quantity Regulation

A. Hypothesis

It's widely recognized by the market that the rising of WMPs is regulatory arbitrage. Deposit rate ceiling and on-balance sheet lending restriction are the core driving forces for banks to issue WMPs. Before 2015, bank deposit rate is strictly controlled by the CBRC, e.g. no banks can offer a rate higher than a specified ceiling. As shown in Figure 3.2, the ceiling is quite effective. Most of the time market rate is at least 1% above the deposit rate ceiling. Banks want to lend more than the otherwise market equilibrium level. In response, the CBRC imposes quantity regulation such as Capital Ratio and *LDR* to prevent excessive liquidity and inflation. The high *Spread* between deposit rate ceiling (cost of money for banks) and loan rate (return of money for banks) drives banks to disguise their loans as items not included in the quantity regulation, the most important of which is WMPs. CBRC set a long cannot-do list for WMPs attempting to shut down the channeling of WMP money to loan assets, but as mentioned in Section II.B, it didn't work.

But whether it is Capital Ratio that matters or it is LDR? The two are related but different. There are two hypotheses.

First, it is Capital Ratio that plays the big role. Capital Ratio targets the asset side, aimed to control the total size of the bank relatively to its capital. To maintain its Capital Ratio, a bank can conduct more off-balance sheet activities or move some on-balance sheet assets off balance sheet. WMPs do the trick, especially principal-floating WMPs. Banks are not truly intermediaries here because the target assets are traditional loans. To test this hypothesis, we estimate the following model:

$$issue_e_{it} = \alpha + \beta_1 Cap_{i,t-1} + \beta_2 spread_t + \beta_3 spread_t \times Cap_{i,t-1} + bank_i + quarter_t + e_{it} \quad (4.1)$$

The dependent variable is total amount of WMP issued in quarter *t* divided by bank equity at the end of quarter *t-1*. We also use lagged value for Capital Ratio. The variable *spread* is defined as the difference between 3-month market rate (SHIBOR) and deposit rate ceiling. We use 3-month rates because it matches the maturity of WMPs and 3-month rates are driven by market rate for loans while shorter-term rates are driven by inter-bank market liquidity. The first prediction is that β_3 is negative. That is, when the market rate is high above the deposit rate ceiling, banks with lower Capital Ratio will issue more WMPs. The second prediction is that the effect should be more important for principal-floating WMPs since principal-guaranteed WMPs are often regarded as on-balance sheet activities especially during later years.

Second, it is LDR that plays the big role. LDR targets both sides of the balance sheet, aimed to control loan balance relative to deposit balance. To control LDR, banks can either increase deposit or decrease on-balance sheet loans. WMPs do tricks in both sides. On one hand, the higher yield of WMPs compared to deposit rates can attract more money from WMP investors. principal-guaranteed WMPs are directly regarded as deposits. Principal-floating WMPs are off-balance sheet, but banks can set the maturity date right before the end of the quarter when LDR is calculated and censored. In this way principal-floating WMPs can increase deposit too. Banks are not truly intermediaries when issuing WMPs because they offer implicit guarantee to WMP investors. Not a single bank WMP has ever defaulted on principal up to now, even principal-floating WMPs. On the other hand, loans financed by principal-floating WMPs are off-balance sheet and won't increase banks' on-balance sheet loan balances. We estimate the following model:

$$issue_e_{it} = \alpha + \beta_1 LDR_{i,t-1} + \beta_2 spread_t + \beta_3 spread_t \times LDR_{i,t-1} + bank_i + quarter_t + e_{it} \quad (4.2)$$

The definition of variables is the same as Model (1). Similarly, we use lagged value for LDR. The first prediction is that β_3 is positive. That is, when the market rate is high above the deposit rate ceiling, banks with higher LDR will issue more WMPs. As to the difference between principal-guaranteed and principal-floating WMPs, the effect should hold for both since both can help attract deposits.

Big 4 banks and SMBs may also act differently. The assets of SMBs are not of the same magnitude as big 4 banks. Table 1 shows the two groups are similar in Capital Ratio but different in LDR. So we also estimate the models by banks separately.

B. Empirical Results

Results are shown in Table 2. The empirical results seem to indicate that LDR matters more. In Panel A, as predicted, the coefficient of the interaction between *spread* and Capital Ratio is significant for principal-floating WMPs and insignificant for principal-guaranteed WMPs, and this pattern holds for both groups of banks. However, the interaction term is only significant at 10% confidence interval.

In Panel B we repeat the same estimation but replace Capital Ratio with LDR. LDR doesn't matter for big 4 banks on average, but has a quite significant effect on WMP issuance for SMBs. In Column (4), the estimated coefficient of the interaction term is 3.449, significant at 1% confidence interval, and remains significant for both principal-floating WMPs and principal-guaranteed WMPs.

Not just more significant, the effect of LDR is also bigger in terms of magnitude. For example, for SMBs the standard deviation is 0.03 for Capital Ratio and 0.08 for LDR. If we use the estimated coefficient, then one standard deviation decrease in Capital Ratio will increase WMP issuance over bank equity by $0.25 \times spread\text{-}0.25$, and one standard deviation increase in LDR will increase WMP issuance over bank equity by $0.28 \times spread$.

The different importance of Capital Ratio and LDR may reflect the relative difficulty in increasing capital and deposit. Capital Ratio is capital over asset, and LDR is loan over deposit. Asset and loan are closely related, but capital and deposit are different. It's really easy for banks to increase equity and junior bond, especially for listed banks. A small increase in capital can increase Capital Ratio considerably. In our sample, the average Capital Ratio for both big 4 banks and SMBs is 12%, well above the regulatory floor.

In contract, it is hard to attract more deposits for SMBs. SMBs have far less branches than big 4 banks and are usually regional. Households and firms prefer to deposit money in banks with wide-spread branches that they can have easy access to. SMBs usually offer higher deposit rates than big 4, but the presence of a deposit rate ceiling limits their ability to do so. Generally, SMBs suffer from LDR regulation, but not Capital Ratio.

With all being said, too things remain unexplained. First, what explains the variation of LDR across SMBs in the first place? The variation could come from the deposit side, namely, different SMBs have different ability to attract deposits or face different competition in the local deposit market. The variation could also come from the loan side, namely, different SMBs face different loan investment opportunities and thus suffer differently from the LDR regulation. Second, why did WMPs increase dramatically from 2008, right after the massive

stimulus plan China's government conducted in response to the financial crisis? Is there a possible connection between the two events? The following section answers these questions.

V. Shadow Banking and the Four-trillion Stimulus Plan

A. *The Stimulus Plan during 2008Q4-2010Q4*

As an economy that heavily relied on exports, China was severely hit by the financial crisis. In Sept, 2008, the rapid increasing trend of total exports suddenly stopped and decreased from 136.7 billion U.S. dollars to 64.86 billion U.S. dollars in Feb, 2009. Net export also declined from 2.4 trillion RMB in 2008 to 1.5 trillion RMB in 2009, a drop of 37.9%. GDP growth rate sharply decreased from 13.9% in 2007 Q4 to 6.2% in 2009 Q1, an unprecedented slowdown since China's entry into WTO. At the end of 2008, PMI dropped to 38.8 and CPI to 1.2%.

China's government responded by introducing a massive stimulus plan, commonly known as the 4-trillion Stimulus Plan. According to the National Development and Reform Commission, from 2008 Q4 to 2010Q4 the government planned to initiate 400 billion RMB investment to indemnificatory housing, 370 billion to rural infrastructure, 1,500 billion to transportation infrastructure and electricity network, 150 billion to public health and education, 210 billion to energy conservation and emission reduction, 370 billion to innovation and structural adjustment and 1,000 billion to reconstruction following the Wenchuan Earthquake. The plan was meant to increase domestic demand and improve public services.

This massive investment plan involved three parties. The central government led the plan by investing 1,180 billion RMB using its fiscal revenue and other incomes. The other 2,820 billion RMB investment was mostly conducted by local governments through state-owned City Infrastructure Investment Corporations (CIICs). These CIICs can borrow bank loans and issue bonds against land properties contributed by the local governments. Officials of local governments were so eager to gain favor from the central government that total investment by these CIICs turned out to be far larger than 2,820 billion RMB.

The last party involved was banks. Most of the investment projects were financed by banks either through bank loans or bank purchase of CIIC bonds. In response to the call of the government, most major banks announced credit support for the plan. For example, BOC initiated 10 plans to support the construction of railways, airports, urban and rural infrastructures, CCB claimed to supply another 50 billion RMB credit to the construction of major infrastructure projects and post-earthquake reconstruction in 2009, and the ABC

promised to expand its credit support to agriculture-related industries, small and medium-sized firms and post-earthquake reconstruction.

Figure 4.1 shows total loan balances during the period of all 4 big banks and all national SMBs, respectively. For these SMBs data became available only from 2010. Most of infrastructure projects were medium and long-term and thus financed by medium and long-term bank loans. Figure 4.1 shows a fast increase of big 4 banks' medium and long-term loan balance while their short-term loan balance remained relatively stable. From Jan, 2009 to Dec, 2010, big 4 banks' medium and long-term loan balance increased by 5.80 trillion RMB (66%) and short-term loan balance by 1.26 trillion RMB (31%). In the contrast, for the national SMBs both short-term and medium and long-term loan balances remained relatively stable. From Jan, 2010 to Dec, 2010, these banks' medium and long-term loan balance increased by 1.27 trillion RMB (25%) and short-term loan balance by 0.82 trillion RMB (18%). Big 4 banks were definitely the major lenders during the stimulus plan.

B. Difference Among the Big 4 Banks

Among the big 4 banks, they are not equally supportive for the stimulus plan. Figure 4.2 shows total loan balance of the 4 big banks, respectively. For purpose of comparison, I scale each by the bank's loan balance at the end of 2008, the beginning of the stimulus plan. From 2006 Q4 to 2008 Q4, each bank exhibited similar growth rate. There were two jumps with ABC because it was preparing for IPO. New capital was injected to it and bad loans were separated from it. ABC went public in 2009. Except the two jumps at the beginning and the end of the period, ABC also exhibited similar growth rate. Things started to change in 2009. Bank of China took a much steeper growth path than the other three. From 2009 Q1 to 2010 Q4, BOC's total loan balance increased by 77%, while ABC by 60% and CCB and ICBC by only 48%.

The same conclusion can be drawn from Figure 4.3. At the end of 2008 Q4, none of these banks' LDR exceeded 0.65, way below the regulation ceiling 0.75. But starting from 2009, BOC's LDR jumped high approaching the ceiling, while LDR of the other banks went even lower than before.

The difference between BOC and the other 3 banks is widely believed to result from the presidents' personal preference. The extent to which the bank supported the government's call during the stimulus plan played a big role in the bank president's later political career. The president of BOC at that time was Gang Xiao. Xiao joined the People's Bank of China upon graduation in 1981 and worked there until 2003, when he began to serve as president of BOC.

His deep connection with the central bank might explain his support for the government. In 2013, he was promoted as the president of CSRC. In Feb, 2016, due to his poor performance as president of CSRC, the State Council relieved him from his position. In the contrast, the president of ICBC at that time was Jianqing Jiang. Jiang has a doctor's degree in management and spent some time studying in Columbia University. He had a lot of working experience both in academics and industry. After serving as president of ICBC in 2000, He led ICBC to the biggest and most profitable company in China. His deep understanding of and respect for the market might explain why he was the least supportive for the stimulus plan. "The government recent decision to boost domestic demand provides great opportunities for banks. But ICBC is a commercial bank, and we should consider these opportunities from a commercial standpoint." Said Jiang during an interview with McKinsey Quarterly in March, 2009. Despite his great performance as the president, he didn't receive any political promotion. In May, 2016, he retired from ICBC and became a professor in China Europe International Business School.

The rising of loan balance and LDR would, of course, put much pressure on the deposit side. All banks became more aggressive in the deposit market competition. Figure 4.4 shows the change of total deposit balance for these banks, respectively. Similarly, I scale it by the bank's deposit balance at the end of 2008. From 2006 Q4 to 2008 Q4, all banks were on an almost same growth path. There was a kink in 2009 Q1, when the growing rate suddenly took off. But since BOC was suffering more from the quantity regulation, it was the most aggressive in the deposit market. From 2009 Q1 to 2010 Q4, BOC's total deposit balance increased by 58%, while ABC by 47%, CCB by 43% and ICBC by only 35%. Considering the massive size of these banks' size, the increase was huge.

C. Shadow Banking Triggered by Deposit Competition

It's no coincidence that the rise of bank WMPs right followed the 4-trillion stimulus plan. Big 4 banks enjoyed a big advantage in the deposit market because of their extensive branches across the country. So traditionally quantity regulation like LDR didn't matter for big 4 banks. SMBs, however, suffered from deposit shortage with their LDR just below the regulatory ceiling 0.75. SMBs would usually offer a deposit rate higher than that of big 4 banks to attract some deposit.

Things changed in 2009 because of the stimulus plan. With increasingly pressure from LDR regulation, big 4 banks became more aggressive in the deposit market. This put SMBs into an even more difficult situation in the deposit market, and the deposit war among banks

got worse and worse. First, to circumvent the regulatory ceiling of deposit rate, banks offered extra gifts to depositors as long as they deposit certain amount of money to the bank on certain days[10]. These gifts include cooking oil, gold bar and even cash. The closer it was to the day when LDR was censored, the more generous the gifts were. Second, the war among banks went down to individual level. Every individual employee of banks was assigned a certain amount of deposits that the employee must attract before some deadline. Failure to reach that amount may cause deduction in salaries or even loss of the job. Everyone at the bank was doing everything they could and making use of every relationship he had to attract as many deposits as possible.

The chaotic phenomenon soon caught the attention of CBRC. Concerned about the effectiveness of the interest rate policy, CBRC forbade banks from giving extra gifts in all forms to depositors. The WMPs, however, seemed to gained favor from the CBRC. Since there was no restriction on the interest rate of WMPs, and WMPs were implicitly guaranteed by the banks, WMPs were perfect substitutes of deposits. WMPs were therefore thought by the government to be a tool to slowly liberate the deposit rate. With acquiescence from the CBRC and the need to attract deposits, issuance of WMPs soon took off.

D. Empirical Strategy and Results

D.1 Empirical Strategy

The traditional explanation for the rise of WMPs is LDR, but what affected LDR in the first place? In this section we argue it is a deposit-competition story. In response to the call of the government, the big 4 banks greatly increased their credit supply, which made them more aggressive in the deposit market so as to control their LDR. This worsened SMB's LDR and pushed SMBs to issue WMPs as an alternative to deal with their quantity requirement.

We exploit cross-sectional evidence to support the story. The empirical test assumes that the deposit market is local, namely, households and firms make deposits in the local bank branches. So, only if the SMB has branches in the same city as the big banks will the aggressiveness of the big banks in the deposit market affect the SMB. And since most SMBs concentrate their branches in different regions, they face different exposure to the big bank's deposit competition. We construct a measure $banknm_{it}$, which is the competition that SMB i faces from the big bank $banknm$ during time t.

Our second identification comes from the differences of the big 4 banks. As we

[10] See a collection of news reports here: http://finance.qq.com/zt2010/banklc/

document above, BOC was the most supportive for the 4-trillion stimulus plan and also the most aggressive in the deposit market. So exposure to competition from BOC would have a bigger effect on the SMB's WMP issuance behavior. We construct the competition measure that a SMB faces from each of the big 4 banks, respectively.

To test our story, we first look at whether $banknm_{it}$ has a positive effect on SMBs' LDR. We run the following regression:

$$LDR_{it} = \alpha_0 + \alpha_1 BOC_{it} + \alpha_2 ABC_{it} + \alpha_3 ICBC_{it} + \alpha_4 CCB_{it} + quarter_t + \varepsilon_{it} \quad (5.1)$$

We should expect α_1 to be significantly positive and bigger than α_2, α_3 and α_4. We choose to cluster the regression by bank instead of introducing a bank fixed effect because the competition measure seems quite stable over time. For robustness check, we do try to control for bank size at the end of 2006.

Secondly, we introduce the competition measure into the WMP issuance regression. Given the bank's LDR at the beginning of this period and the deposit competition the bank faces during this period, the SMB determines how many WMPs to issue.

$$\begin{aligned} issue_e_{it} = {} & \gamma_0 + \beta_1 LDR_{i,t-1} + \beta_2 spread_t + \beta_3 spread_t \times LDR_{i,t-1} + \\ & \gamma_1 BOC_{it} + \gamma_2 ABC_{it} + \gamma_3 ICBC_{it} + \gamma_4 CCB_{it} + quarter_t + \varepsilon_{it} \end{aligned} \quad (5.2)$$

Similarly, We should expect γ_1 to be significantly positive and bigger than γ_2, γ_3 and γ_4. Again, we don't include the bank fixed effect in the model because of the persistence of competition measure.

D.2 Measure Exposure to Big 4 Competition

The basic idea is to calculate the number of the big bank's branches located in the same city as the SMB's. To take into account the market size of the city, we scale it by total number of bank branches in that city. Denote $n_{i,j,t}$ as the number of bank i's branches in city j at the beginning of quarter t.

First, calculate the market share of big bank b in each city j at the beginning of quarter t.

$$MarSha_{b,j,t} = \frac{n_{b,j,t}}{\sum_i n_{i,j,t}} \quad (5.3)$$

Second, although most SMBs are regional, they have branches in multiple cities. We calculate a weighted average of $MarSha_{b,j,t}$ for each SMB i.

$$banknm_{i,t} = \frac{\sum_j n_{i,j,t} MarSha_{b,j,t}}{\sum_j n_{i,j,t}} \qquad (5.4)$$

The variable $banknm_{i,t}$ measures on average, how much bank i's deposit market interacts with that of the big bank b. We calculate $BOC_{i,t}$, $ICBC_{i,t}$, $ABC_{i,t}$ and $CCB_{i,t}$, respectively. Name the sum of these 4 variables as $BIG4_{i,t}$.

The variation in $banknm_{i,t}$ across SMBs comes from two sources. First, if SMBs proportionally allocate their branches across cities, e.g., $\frac{n_{i,j,t}}{\sum_j n_{i,j,t}}$ doesn't depend on i, then there is no variation in $banknm_{i,t}$. Second, if big banks equally allocate their branches across cities, e.g., $MarSha_{b,j,t}$ doesn't vary with j, then there is no variation in $banknm_{i,t}$.

The first issue is not a problem because most of the SMBs concentrate their branches in certain regions. Among the 21 SMBs in our sample, the 8 city commercial banks are regional, which means they can only operate in a restricted area. For example, Bank of Chongqing only operates in 3 provinces (Chongqing, Ningxia, Sichuan and Guizhou), and Huishang Bank only operates in 2 provinces (Jiangsu and Anhui). For the other 13 national banks, most concentrate their business in regions where they originated. For example, a national bank as it is, as the end of 2012, Guangdong Development Bank locates about 60% of its branches in Guangdong Province, where it was founded. China Minsheng Bank locates about 45% of its branches in only 6 provinces. The online appendix offers the choropleth map of branch allocation across the country for each SMB.

The second issue is not likely to be a concern, either. We calculate (5.3) for each big bank in each province on 2012/12/31, a representative time point of our sample period. Figure 5 shows the choropleth map of each big bank. National as they are, the big 4 banks seem to avoid competition in the same area. ABC has most branches in the western area, ICBC in the upper and lower middle area, CCB in the middle area, and BOC in the coastal and upper middle area. If we aggregate the 4 banks together, the big 4 banks have more existence in less developed areas, a market where SMBs are not likely to enter.

The two sources of variation give us confidence that our competition measure is exogenous for our analysis. Because SMBs are regional, we can think of the variation of the competition measure coming from big banks' local market share. Reverse causality is not likely to happen, so the only concern is omitted variables. What factors could affect the local SMBs' LDR, WMP issuance and big banks' market share? Local economic environment might do, that is, poor areas might have more big 4 presences and the local banks have higher

LDR and WMP issuance. This only seems true for ABC, but not for the other 3 big banks, as shown in Figure 5. Even so, we rely on our second identification: effect of BOC should be bigger than other three. As discussed above, the uniqueness of BOC is due to Gang Xiao's personal preference, not that BOC strategically allocate branches in areas with higher LDR or more WMP issuance.

Figure 6.1 plots the change of average market share over time for the 4 banks, respectively. ABC has the biggest market share in terms of number of branches. For historical reasons, many branches of ABC were located in under-developed areas to support local economy instead of making profit. After China's entry into WTO, ABC went through massive branch adjustment, as shown by the picture. The declining trend of big 4 bank's market share coincides with the rising of SMBs which are set up by local governments and rich enterprises.

Figure 6.2 plots the average exposure to big 4 competition of the 21 SMBs and Table 3 shows some statistics.

D.3 Empirical Results

Table 4 reports estimation results for model (5.1). In the first column, we run estimation for all the 21 SMBs from 2007 to 2014. The variable *BOC* has a significantly positive effect on SMBs' *LDR*, which is in accord with the story. When exposed to the competition of *BOC,* SMBs find it harder to attract deposits and their *LDR* goes higher. Coefficients of *ICBC*, *CCB* and *ABC* are not significant, which is also predicted since BOC is the most aggressive supporter for the 4 trillion stimulus plan and thus the most aggressive competitor in the deposit market.

To control for bank heterogeneity, in the second column we include bank size as the end of 2006. We do not use a time-varying measure for bank size because the change of bank size is very much affected by its *LDR* and is thus endogenous. We find similar results in Column (2). The effect is not driven by bank size.

The stimulus plan mainly happened between 2009 and 2010, and BOC became more aggressive afterwards, so should the effect be. Column (3) – (6) repeat the estimation every two years. First, the basic conclusion holds no matter what subsample we use. It seems that even before the stimulus plan started, SMBs were affected by BOC's competition. Second, the coefficient of *BOC* becomes bigger and bigger over time. After the stimulus plan, BOC became more stressful with its LDR and more aggressive towards SMBs.

In unreported tables, we also control for bank size for regression (3) – (6). The results are quite robust and barely change.

Table 5 reports estimation results for model (5.2). In Column (1), *BIG4* has a significantly positive effect on WMP issuance after we control for other variables. In Column (2), we decompose *BIG4* into four components and find that only *BOC* matters. Again, effect of BOC should be more important after the stimulus plan, so Column (3) – (6) repeat the estimation for different time periods. The coefficient of *BOC* increases dramatically over time. In 2008, *BOC* is only marginal significant. From 2008 to 2014 both its significance and magnitude increases.

The coefficients of *ICBC*, *CCB* and *ABC* remain insignificant in all the estimations. Theoretically we expect competition from these banks matters too since they all expand their credit supply during the stimulus plan to some extent. The insignificance of the coefficients could be due to collinearity among the 4 measures. So in Panel B, we include only one competition measure each time. The coefficients of all four variables become significant, but *BOC* has the biggest effect WMP issuance than the other two. This is in accord with our prediction.

Table 5 strongly supports the deposit-competition story. BOC has a significant positive effect on WMP issuance even if LDR is in the model. This implies that BOC not only affects WMP issuance through LDR, but has direct effect too. Faced with the local level of big 4 competition, SMBs strategically choose the amount of WMPs to issue to compete for deposits.

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

So much said about why SMBs issue WMPs, why the issuance of WMPs by big 4 banks also took off following the stimulus plan? We address this question in this section.

During the stimulus plan, most of the bank loans eventually went to CIICs. The government didn't regularly publish bank loan balances to CIICs but did it occasionally. At the end of 2008, bank loan balances to CIICs was 4.33 trillion, almost doubled to 7.66 trillion RMB in June, 2009, and then slowly increased to 9.20 trillion RMB at the end of 2012.

The sharp increase in debt of CIICs worried the central government a lot. As the main source of money to repay the debt, the total income of local governments in 2010 was only 11.51 trillion RMB (including fiscal income, extra-budget financial revenue, land sell profit, transfer from the central government and government bond income) while total CIIC debt balance at the end of 2010 was over 7.66 trillion RMB. On 10th June, 2010, the State Council passed a new regulation regarding CIICs and required certain CIICs be shut down, commercial banks tighten credit supply to CIICs, and local governments support the CIICs

within their contributed capital. Existing debt shall be reduced and new debt shall be strictly controlled.

A lot of the extra credit supply also went to the real estate sector and pushed up housing price, which also worried the central government. After an average increase of 7.93% in house price in 2011, the increase in banks loans to real estate shrank from 2.02 trillion RMB in 2009 and 2010 to only 1.38 trillion RMB in 2011 and 2012.

These regulation changes brought about a sharp increase in shadow banking activities. On one hand, investment by CIICs like infrastructure and indemnificatory housing has very low return, and CIICs mainly relied on government support to repay the debt. Government transfer was only enough to repay the interest, and when the principal was due, CIICs need to turn to banks to refinance their debt. It was estimated that 1.84 billion RMB of bank loans for CIICs was due in 2012. Real estate companies also depend heavily on banks for liquidity support. On the other hand, commercial banks would want to refinance these loans too because otherwise, these loan assets would go default. But banks simply cannot do so by granting new bank loans. Shadow banking naturally showed up as a solution. Banks can refinance these loans by money raised from WMPs, with which they move these on-balance loans off the balance sheet.

We don't have information about how banks dealt with those loans granted due to the stimulus plan when they matured, but since most of these loans are medium and long-term, we can look at the percentage change of medium and long-term loans over time. Figure 7.1 shows that the percentage of medium and long-term loan balances increased from 56% (68%) in 2008 to 63% (73%) in 2010 for all banks (big 4 banks), but then slowly decreased back to the original level. This decreasing trend reflects banks' efforts to transfer loans to CIICs and real estate companies off the balance sheet.

To directly test the story, we estimate the loan increase due to the stimulus plan for each bank and analyze its relation with banks' WMP balance in later years. First, for each bank we estimate the linear trend of total loan balances using quarterly observations from 2006 Q4 to 2008 Q4 and calculate the predicted loan balances in 2010 Q4, which would be the value if there hadn't been the stimulus plan. We then calculate the difference between the actual loan balances and the predicted loan balances in 2010 Q4, and use it as a proxy of loan increases due to the stimulus plan. Finally, we scale this proxy and WMP balance by banks' loan balances in 2008.

Figure 7.2 shows that there is a clear and positive relationship between bank's WMP balance at the end of 2013 and the estimated loan increase. In Table 6, we regress banks'

WMP balance in each year on our proxy of loan increases. For principal-floating WMP balance, the effect grows stronger and stronger over time because more medium and loan-term loans matured as times passed. But for principal-guaranteed WMPs, there is no such pattern since principal-guaranteed WMPs cannot move loans off the balance sheet.

Overall, there are two mechanisms in which the 4-trillion stimulus plan triggered the rising of China's shadowing banking in forms of WMPs. For SMBs, the local deposit market became more competitive as a result of big 4 especially BOC's massive credit support for the stimulus plan and desire to decrease their LDR. The increasing competition in the deposit market pushed SMBs to issue WMPs and offer higher return to investors so as to attract more deposit. For big 4 banks, they granted too many loans to CIICs and the real estate during the stimulus plan and later when CBRC tightened credit supply to these sectors, banks use WMPs to refinance these loans and move them off the balance sheet.

VI. Rollover Risk of WMPs

A. Maturity Mismatch of WMPs

We have already showed some evidence about the maturity mismatch of WMPs and the target assets in Table 1, Panel C. Banks deliberately set the maturity date of WMPs right before the end of the quarter when LDR is calculated and censored. The average maturity of about 3-4 months coincides with the quarterly basis.

The more direct evidence is to see, whether an abnormal proportion of WMPs mature on the last day of each quarter. We collect information of individual WMPs from WIND and count the number of WMPs mature on each day within a quarter. WIND doesn't cover all WMPs in China, but does cover the majority of them. Figure 8 shows the results.

Firstly, both big 4 banks and SMBs deliberately choose the last day of a quarter as the maturity day. Figure 8.1 shows that big 4 banks set quite a large number of WMPs mature on the last 4 days of a quarter, and Figure 8.2 shows that SMBs let an abnormally high proportion of WMPs mature exactly on the last day of the quarter.

However, it is possible that the cluster of maturity date is purely for accounting convenience. So secondly, we divide the sample by yield type. As we claimed, principal-floating WMPs are all off-balance sheet. So banks need to make them mature before the end of the quarter to help increase the deposit balance, as shown in Figure 8.3. Principal-guaranteed WMPs, however, are already on the balance sheet so the cluster of maturity date is less extreme for them, as shown in Figure 8.4.

The key of rollover risk is that when WMPs mature but the target assets haven't, banks

need to refinance these loans by issuing new WMPs. We construct a variable *WMPdue*, which is the amount of WMPs due in each quarter over bank equity at the end of last quarter, and study its effect on bank's behaviors.

B. Rollover Risk and WMP Yield

The first effect is on new WMP yield. To issue new WMPs and raise money to refinance the asset as quickly as possible, the most obvious approach is to offer higher yield on new WMPs. We estimate the following regression for individual WMP expected yield:

$$WMPreturn_d_{it} = \alpha + \beta_1 WMPdue_{it} + \beta_2 Shibor_d_{it} + bank_i + e_{it} \qquad (6.1)$$

The dependent variable is the difference between WMP's annualized yield and bank deposit rate ceiling, and $Shibor_d_t$ is the difference between Shibor and bank deposit rate ceiling. We choose deposit rate and Shibor with the same maturity as the WMP and take value on the day when the WMP is issued. We deduct the deposit rate ceiling from the WMP yield and Shibor because for the investors, it is the difference above the deposit rate ceiling that matters. Quarter fixed effect is not included because of the presence of $Shibor_d_t$.

The key independent variable is *WMPdue*. For principal-floating WMPs, we use only the total amount of principal-floating WMPs that mature in that quarter over bank equity. Similarly, for principal-guaranteed WMPs, we use only total amount of principal-guaranteed WMPs that mature over bank equity. We should expect β_1 to be significantly positive.

Table 7 shows the results. No matter what the yield type of the product is and what banks issue it, the estimated value for β_2 is stable. Our key independent variable, *WMPdue*, shows two interesting results.

First, *WMPdue* only matters for SMBs, not for big 4 banks at all. This is not surprising. On one hand, big 4 banks are not as aggressive as SMBs in issuing WMPs, so the amount of WMPs due in each quarter is not big enough to cause liquidity problem for them. On the other hand, due to their great advantage in the deposit market, big 4 banks don't necessary need to increase WMP yield to attract enough money. SMBs, however, face greater liquidity needs and need to offer a considerably high yield on WMPs to attract enough money.

Second, the effect of *WMPdue* on new WMP yield is bigger for principal-floating WMPs than for principal-guaranteed WMPs, but both effect is significant at 1% confidence interval. WMP investors require higher yield on principal-floating WMPs that are riskier.

C. Rollover Risk and the Interbank Market

Besides raising new money as soon as possible, banks can go to the inter-bank market for liquidity. The great amount of WMP rollover poses great liquidity management pressure on the bank and the market as well. This is probably the most important risk associated with the rapid development of WMPs. We first analyze how *WMPdue* affects individual banks' liquidity management and then see how *WMPdue* affects the interbank market as a whole.

First, *WMPdue* should affect the bank's ask rate in the inter-bank market. The ask rate in the interbank market reflects bank's marginal cost of money, and banks will ask for a higher rate when they are in greater need for liquidity. We run the following regression:

$$Ask_d_{it} = \alpha + \beta_1 WMPdue_{it} + \beta_2 Cap_{i,t-1} + \beta_3 LDR_{i,t-1} + quarter_t + e_{it} \qquad (6.2)$$

The dependent variable is the bank's average ask quoted rate minus Shibor within quarter *t*. We are more interested in cross-sectional effect, namely, how the variation in *WMPdue* across banks affects the variation of ask rate. So we don't include bank fixed effect in the model. We do control for Capital Ratio and LDR.

We estimate the model using quarterly observations of banks that participate in the Shibor ask and bid process from 2008 Q1 to 2014 Q4. We standardize Ask_d by diving it over it standard deviation. There are only 14 banks in the regression sample, so clustering by bank will dramatically reduce the significance. Instead we cluster the regressions by quarter.

The results are reported in Table 8. Panel A shows that *WMPdue* has a significantly positive effect on the average difference between bank's quoted rate and Shibor. Also, *WMPdue* mainly affect very short-term Shibor quoted rate. This makes sense because banks turn to interbank market only for liquidity to refinance their WMP investment. Long-term Shibor is more related to economic growth other than liquidity needs.

In Panel B, we run the estimation by Big 4 and SMBs, separately. There is a great difference between Big 4 and SMBs: *WMPdue* only affect Shibor quoted rate of Big 4. The magnitude of the effect is also very big. Take 1-week Shibor for example, a one-standard deviation increase in *WMPdue* increases Big 4 quoted rate difference by 2.5 standard deviations.

The difference between Big 4 and SMBs are probably due to their different roles in the inter-bank market. Big 4 are usually the main liquidity providers and SMBs are the net borrowers. Due to their great impact on the inter-bank market, Big 4 are to some extend the price makers and SMBs are passive price takers. Therefore, only quoted rate by Big 4 matters to the market participants. As a result, Big 4 carefully choose their quoted rates by first

considering their own liquidity needs while SMBs are more likely to just passively follow the market rate.

Second, to analyze how *WMPdue* affects the inter-bank market as a whole, we look the relationship between aggregate WMPdue and 1-week Shibor during our sample period. In Figure 9, we calculate the aggregate WMPdue over M2 of all big 4 banks and all SMBs separately and plot them again 1-week Shibor. The first graph shows that 1-week Shibor closely tracks big 4 *WMPdue*. In the second graph, SMB *WMPdue* steadily increases over time and there is no apparent relation between the two. The two graphs support the idea that Shibor is mostly decided by Big 4 and thus strongly affected by big 4 *WMPdue*.

To conclude, the rollover of WMPs puts pressure on banks' liquidity management and increases their marginal cost of money, which is reflected in their higher ask rate in the interbank market. What's more, since the big 4 are the price markers in the interbank market, their total *WMPdue* almost determines the short-term market rate. This is something of great significance considering the great importance of Shibor in China.

D. Rollover Risk and Stock Market's Response

Not only does the bank itself reveal the effect of WMP rollover on its liquidity, the stock market may also respond to the WMP rollover risk if it is efficient.

When WMPs mature, banks go to the interbank money market for short-term money to pay the investors and meanwhile issue new WMPs to refinance the investment project. As the cost of rollover, the higher Shibor is, the greater cost banks with lots of WMPs mature will bear.

Efficient market hypothesis claims stock price only responds to unexpected news. When Shibor suddenly jump high, hopefully in an unexpectedly way, then the cost of rollover risk suddenly increases, so the stock price should decrease if market is efficient. We calculate the daily change in overnight and 1-week Shibor and regard the changes as unexpected if both changes in overnight and 1-week Shibor are high. Today's 1-week Shibor has 6 days overlap with next day's, so if banks expect the next day's Shibor to increase sharply, they would increase their borrowing in the interbank market today and thus force today's Shibor to grow and approach the next day's level. The change in overnight Shibor also carries information about how tight the interbank market is, so we conditional on it too.

On each business day, Shibor is announced at 11:30 (9:30 from 08/01/2014). If it is unexpectedly high compared to yesterday, the stock close price on that day should adjust accordingly. To empirically test the stock market response, we estimate the following models:

$$return_{it} = \alpha + \beta WMPdue_{it} + \varepsilon_{it} \quad (6.3)$$

The independent variable $WMPdue_{it}$ is total amount of WMPs due in that month divided by bank equity at the end of last quarter and $return_{it}$ is stock return from yesterday to today. We choose days when both the changes in overnight and 1-week Shibor are above a certain threshold. The coefficient β is expected to be negative only when the threshold is high enough.

Table 9 reports the results. We choose four different thresholds. The highest is 1%, and there are 9 trading days when both the changes in overnight and 1-week Shibor is bigger than 1%. The second is 0.8% with 16 trading days, the third is 0.6% with 25 trading days and the last is 0.4% with 48 trading days. Big changes in Shibor usually happen in the middle of the year or at year end right before the on-balance sheet lending requirement is conducted, such as Capital Ratio and *LDR*.

The first row uses raw return as the dependent variable. We find that $\hat{\beta}$ is significantly negative when c is bigger than 0.6 and decreases in magnitude when c decreases. In Figure 10, we plot raw return against *WMPdue* with c=1%. This graph shows a clear negative relation between stock price reaction and *WMPdue*.

We use three risk-adjusted returns. The second row uses raw daily return minus market return as the dependent variable. In the third row we apply a linear projection of raw daily return on market return for the past 60 days and use the estimated residual today as dependent variable. In the fourth row we estimate CAPM using observations for the past 60 trading days and use the estimated residual today as dependent variable. We use 3-month Shibor as the risk-free rate.

We find a similar trend for $\hat{\beta}$ using all the three risk-adjusted return measures, although the trend seems not monotonic at c=0.8%. This may be because of error-in-variable problem, e.g., estimation using 60 observations doesn't give consistent estimates so that the estimated residual today is not consistent.

The effect is very big too. Take c=1% for example, one standard deviation (0.68) increase in *WMPdue* decreases the raw return by 0.64%. This is not annualized, one single day return.

VII. Conclusion

Much attention has been paid to the rise of shadow-banking as a result of 'regulation arbitrage' by financial institutions and its impact on the safety of the overall financial system. There is little academic research, however, studying shadow banking in emerging markets. In this paper, we examine the largest component of China's shadow banking sector—wealth management products (WMPs) issued by banks. We study issue size, initial promised rates and maturity of WMPs, and find that these product characteristics are closely linked with those of the issuing banks. Our tests and results thus shed light on how the fragility of shadow banking relates to the overall safety of China's financial system, an issue that is now of first-order importance for the stability of the global financial system.

With regulations on deposit rates and on-balance-sheet lending, Chinese banks have significantly increased off-balance-sheet activities in recent years, most notably by issuing wealth management products. We examine the relationship between the product characteristics and the issuing banks and find three sets of results. First, the scale of product issuance is greater for banks constrained more by on-balance-sheet lending quotas, especially for non-guaranteed products and when the difference between market rate and the regulated deposit rate is high. Second, the initial promised yields on the products are positively related to the risk of the issuing banks, especially for non-guaranteed products that are issued to institutional investors (as compared to those issued to individuals). Third, the issuance poses a substantial rollover risk for issuers on days when large amount of products mature. Overall, the large shadow-banking sector in China appears to be a regulatory arbitrage response, contributing to the fragility of the Chinese banking system.

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Table I Summary Statistics

The sample includes quarterly observations of 25 banks from 2008 Q1 to 2014 Q4. Big 4 banks are those listed at the top left column of Panel D and the remaining are small and medium-size banks. Panel A reports bank characteristics at the end of each quarter. Panel B reports total WMP issuance and amount due for each bank in each quarter as well as annualized expected yield of individual WMPs issued by the 25 banks during the sample period. Panel C reports the average maturity of WMPs issued by Big 4 banks and SMBs in each year. All statistics are shown by whether the principal of the WMP is guaranteed or floating. See the appendix for definitions of all variables.

Panel A: Summary Statistics of Bank Characteristics

Variables		Big 4 Banks	SMBs
Equity	Max	1507.3	463.7
(Billion RMB)	Min	148.0	2.4
	Mean	737.5	69.9
Deposit Balance	Max	15591.3	4719.5
(Billion RMB)	Min	3965.6	27.4
	Mean	9660.8	860.0
Loan Balance	Max	10441.7	3473.4
(Billion RMB)	Min	2638.5	21.3
	Mean	6053.4	610.3
Capital Ratio	Max	0.15	0.26
	Min	0.00	0.06
	Mean	0.12	0.12
LDR	Max	0.76	0.93
	Min	0.51	0.44
	Mean	0.63	0.68
Overnight Ask Rate	Max	0.0982	0.0497
(%)	Min	-0.1718	-0.0302
	Mean	-0.0018	0.0039

Panel B: Summary Statistics of WMPs

Variables		Big 4 Banks	SMBs
WMP Issuance	Max	3022.3	4249.5
(Billion RMB)	Min	1.0	0.0
	Mean	1002.2	206.8
WMP Issuance/Equity	Max	4.41	10.53
	Min	0.00	0.00
	Mean	1.22	1.55
Principal-guaranteed WMP	Max	3.74	6.57
Issuance/Equity	Min	0.00	0.00
	Mean	0.41	0.54
Principal-floating WMP	Max	1.83	10.05
Issuance/Equity	Min	0.00	0.00
	Mean	0.82	1.01
WMP Due/Equity	Max	4.21	11.72
	Min	0.00	0.00
	Mean	1.19	1.41
Principal-guaranteed WMP	Max	3.34	6.70
Due/Equity	Min	0.00	0.00
	Mean	0.40	0.50
Principal-floating WMP	Max	1.73	11.72
Due/Equity	Min	0.00	0.00
	Mean	0.78	0.91
WMP annualized return	Max	45.00	50.00
(%)	Min	0.36	0.36
	Mean	4.51	4.71
Principal-guaranteed	Max	20.00	30.00
WMP return	Min	0.36	0.36
(%)	Mean	4.11	4.19
Principal-floating	Max	45.00	50.00
WMP return	Min	1.45	0.80
(%)	Mean	4.70	4.90

Panel C: Maturity (in days) of WMPs

Banks		Big 4		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

Panel D: List of banks

Industrial and Commercial Bank of China	Huishang Bank
China Construction Bank	China Minsheng Bank
Bank of China	Bank of Nanjing
Agricultural Bank of China	Bank of Ningbo
Bank of Communications	Ping An Bank
Bank of Beijing	Shanghai Pudong Development Bank
Bohai Bank	Bank of Shanghai
China Everbright Bank	Shengjing Bank
Guangdong Development Bank	Industrial Bank
Harbin Bank	China Merchants Bank
Evergrowing Bank	China Zheshang Bank
Hua Xia Bank	China Citic Bank
	Bank of Chongqing

Table II Determinants of WMP Issuance

The sample includes quarterly observations of the 25 banks from 2008Q1 to 2014Q4. Both Capital Ratio and *LDR* take values at the end of last quarter. "Floating" refers to principal-floating WMPs and "Guarantee" refers to principal-guaranteed WMPs. Panel A and B report whether Capital Ratio and *LDR* affect the issuance of WMP, respectively. Regressions are all clustered by bank. Robust *t*-statistics are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Effect of Capital Ratio on WMP Issuance by banks

Bank		Big 4			SMBs	
Yield Type	All	Floating	Guarantee	All	Floating	Guarantee
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)	(5)	(6)
Capital Ratio	5.040	5.696	-0.861	8.247*	6.619*	1.625
	(0.663)	(2.123)	(-0.167)	(1.811)	(1.760)	(0.446)
Spread	3.835***	2.772***	1.086**	8.316***	5.575***	2.757***
	(11.18)	(6.581)	(4.784)	(6.551)	(5.496)	(3.992)
Capital Ratio*Spread	-5.571	-5.108*	-0.440	-8.469*	-6.141*	-2.378
	(-1.329)	(-2.632)	(-0.174)	(-2.039)	(-1.928)	(-0.839)
Bank fixed effect	√	√	√	√	√	√
Quarter fixed effect	√	√	√	√	√	√
Constant	-4.195***	-2.929***	-1.280**	-9.471***	-6.772***	-2.713**
	(-11.05)	(-8.378)	(-3.337)	(-4.990)	(-5.070)	(-2.715)
Observations	112	112	112	588	588	588
R-squared	0.830	0.787	0.481	0.697	0.605	0.606
Cluster	bank	bank	bank	bank	Bank	bank

Panel B: Effect of *LDR* on WMP Issuance by banks

Bank		Big 4			SMBs	
Yield Type	All	Floating	Guarantee	All	Floating	Guarantee
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)	(5)	(6)
LDR	-3.822	-3.489	-0.537	-1.215	-2.541	1.336
	(-1.419)	(-1.469)	(-0.360)	(-0.326)	(-0.971)	(0.576)
Spread	2.488*	2.598***	-0.113	5.222***	3.355***	1.867***
	(2.731)	(7.013)	(-0.0953)	(3.921)	(3.195)	(2.873)
LDR*Spread	1.073	-0.259	1.376	3.449***	2.204**	1.263*
	(0.847)	(-1.018)	(1.351)	(2.902)	(2.443)	(1.948)
Bank fixed effect	√	√	√	√	√	√
Quarter fixed effect	√	√	√	√	√	√
Constant	-1.194	-0.419	-0.685	-7.904**	-4.239*	-3.690
	(-0.548)	(-0.330)	(-0.713)	(-2.470)	(-1.901)	(-1.693)
Observations	112	112	112	588	588	588
R-squared	0.836	0.807	0.498	0.707	0.608	0.629
Cluster	bank	bank	bank	bank	bank	bank

Table III Summary Statistics of the Competition Measure

BOC measures the SMB's exposure to competition from BOC. We take quarterly observation from 2007Q1 to 2014Q for the 21 SMBs in our sample. Similar for ICBC, CCB, and ABC. BIG4 is sum of the 4 measures. The first table reports summary statistics and the second reports correlation of these four.

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
BIG4	672	0.447	0.069	0.268	0.719

	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 IV Effect of big 4 competition on SMB's LDR

The sample includes quarterly observations of 21 SMBs from 2007 Q1 to 2014 Q4. Regression (1) (2) include all observations and Regression (3) - (6) repeat the estimation for every two years. All regressions are clustered by bank. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Year	07-14	07-14	07-08	09-10	11-12	13-14
Dep Var: LDR	(1)	(2)	(3)	(4)	(5)	(6)
BOC	4.311***	3.152***	4.207***	3.330**	5.316***	7.731***
	(4.703)	(3.462)	(3.039)	(2.573)	(3.579)	(3.920)
ICBC	-0.815	-0.931	-0.669	-2.105	-0.0556	2.134
	(-0.893)	(-1.059)	(-0.792)	(-1.369)	(-0.0273)	(0.982)
CCB	-0.905	-0.925	0.329	0.674	-3.132	-5.601**
	(-0.713)	(-0.794)	(0.271)	(0.342)	(-1.267)	(-2.094)
ABC	-0.726	-0.488	-0.864	-0.952	-0.453	-0.622
	(-1.077)	(-0.757)	(-1.331)	(-1.027)	(-0.257)	(-0.328)
size		0.0218**				
		(2.703)				
Quarter fixed effect	√	√	√	√	√	√
Constant	0.739***	0.460***	0.588***	0.798***	0.680***	0.465**
	-8.003	-4.6	-3.81	-6.109	-4.357	-2.771
Observations	672	672	168	168	168	168
R-squared	0.335	0.444	0.332	0.279	0.362	0.342
Cluster	bank	bank	bank	bank	bank	bank

Table V Effect of big 4 competition on WMP issuance

The sample includes quarterly observations of 21 SMBs from 2008 Q1 to 2014 Q4. In Panel A, Regression (1) – (2) include all observations and Regression (3) - (6) repeat the estimation using subsamples. All regressions are clustered by bank. Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Estimation with LDR

Year	08-14	08-14	08	09-10	11-12	13-14
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)	(5)	(6)
LDR	2.468	1.724	-1.304	0.826**	9.422	7.646
	(1.551)	(0.875)	(-0.737)	(2.312)	(0.972)	(1.483)
Spread	6.960***	6.656***	-1.031	-0.969**	-1.252	3.469**
	(4.713)	(4.317)	(-0.886)	(-2.098)	(-0.460)	(2.600)
LDR*Spread	3.914***	3.709**	1.435	1.626**	-0.711	-0.486
	(2.849)	(2.603)	(0.906)	(2.269)	(-0.169)	(-0.440)
BIG4	6.702***					
	(3.174)					
BOC		30.04*	14.46*	9.172**	40.93**	133.1**
		(1.725)	(1.880)	(2.789)	(2.088)	(2.113)
ICBC		11.48	-1.534	0.503	41.89*	38.63
		(0.970)	(-0.470)	(0.247)	(2.059)	(0.589)
CCB		-7.697	1.149	-0.365	-50.17	-78.58
		(-0.437)	(0.261)	(-0.112)	(-1.547)	(-1.022)
ABC		-1.020	-2.597	-2.234	23.54*	53.16
		(-0.123)	(-1.463)	(-1.173)	(1.787)	(1.216)
Quarter fixed effect	√	√	√	√	√	√
Bank fixed effect	×	×	×	×	×	×
Constant	-16.05***	-14.70***	0.612	-0.782**	-8.205	-18.39**
	(-5.776)	(-4.548)	(0.477)	(-2.285)	(-1.361)	(-2.576)
Observations	588	588	84	168	168	168
R-squared	0.523	0.530	0.098	0.274	0.341	0.400
Cluster	bank	bank	bank	bank	bank	bank

Panel B: Estimation with and LDR and separated competition measure

Year	08-14	08-14	08-14	08-14
Dep Var: Issuance/Equity	(1)	(2)	(3)	(4)
LDR	0.944	3.256**	2.513*	2.181
	(0.582)	(2.317)	(1.737)	(1.652)
Spread	6.260***	6.779***	6.304***	6.096***
	(5.021)	(4.709)	(4.452)	(4.427)
LDR*Spread	3.964***	3.682**	4.088***	4.063***
	(2.866)	(2.610)	(2.960)	(3.085)
BOC	35.22***			
	(3.345)			
ICBC		16.78***		
		(3.295)		
CCB			18.96**	
			(2.165)	
ABC				11.23*
				(1.865)
Quarter fixed effect	√	√	√	√
Bank fixed effect	×	×	×	×
Constant	-13.75***	-15.25***	-14.39***	-13.27***
	(-6.570)	(-6.285)	(-5.627)	(-5.015)
Observations	588	588	588	588
R-squared	0.527	0.519	0.514	0.504
Cluster	bank	bank	bank	bank

Table VI The 4-trillion stimulus plan and banks' WMP issuance

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

year	2010	2011	2012	2013	2014
yield type	floating	floating	floating	floating	floating
Dep Var: WMP Balance/Loan Balance in 2008	(1)	(2)	(3)	(4)	(5)
Estimated loan increase/Loan balance in 2008	0.0237	-0.000119	1.227***	1.364***	2.093***
	(0.354)	(-0.00240)	(5.547)	(5.174)	(3.068)
Constant	0.0463	0.0865***	-0.116	-0.0959	-0.0997
	(1.637)	(3.287)	(-1.022)	(-0.744)	(-0.383)
Observations	25	25	25	25	25
R-squared	0.006	0.000	0.448	0.485	0.391

year	2010	2011	2012	2013	2014
yield type	guarantee	guarantee	guarantee	guarantee	guarantee
Dep Var: WMP Balance/Loan Balance in 2008	(1)	(2)	(3)	(4)	(5)
Estimated loan increase/Loan balance in 2008	-0.00646	0.00559	0.252	0.398	0.202
	(-0.708)	(0.149)	(1.233)	(1.166)	(0.558)
Constant	0.0149**	0.0316*	0.0230	0.0227	0.234
	(2.322)	(1.950)	(0.280)	(0.173)	(1.570)
Observations	25	25	25	25	25
R-squared	0.004	0.001	0.161	0.150	0.029

Table VII Rollover risk and WMP expected yield

The sample includes all WMPs issued by the 25 banks from 2008 to 2014. "Floating" refers to principal-floating WMPs and "Guarantee" refers to principal-guaranteed WMPs. For regressions on principal-floating (guaranteed) WMPs, *WMPdue* is total amount of principal-floating (guaranteed) WMPs due in this quarter over bank equity at the end of last quarter. All regressions are clustered by quarter. Robust *t*-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Bank type	Big 4		SMBs	
Yield type	Floating	Guarantee	Floating	Guarantee
Dep Var: WMPReturn_d	(1)	(2)	(3)	(4)
Shibor_d	0.629***	0.676***	0.621***	0.630***
	(13.64)	(12.42)	(13.8)	(14.66)
WMPdue	0.18	0.07	0.132***	0.225***
	(1.275)	(0.806)	(4.37)	(4.784)
Bank fixed effect	√	√	√	√
Quarter fixed effect	×	×	×	×
Constant	0.960***	0.618***	1.319***	0.04
	(5.964)	(3.879)	(15.7)	(0.358)
Observations	29,589	14,073	64,322	23,839
R-squared	0.660	0.717	0.671	0.659
Cluster	Quarter	Quarter	Quarter	Quarter

Table VIII Rollover Risk and Shibor Quoted Rate

The sample includes quarterly observations for banks participating in the Shibor ask and bid process from 2008Q1 to 2014Q4. See the appendix for definitions of variables. Both Capital Ratio and *LDR* take values at the end of last quarter while *WMPdue* take value in the current period. We standardize *WMPdue* by dividing it over its standard deviation. Because there are only 14 banks in the sample, we clustered the regression by quarter. Panel A reports regression results on all the 14 banks while Panel B separates Big 4 and SMBs. Robust *t*-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Panel A: Effect of WMPdue on Shibor quoted rate

Term	overnight	1-w	2-w	1-m	3-m	6-m
Dep Var: Ask_d	(1)	(2)	(3)	(4)	(5)	(6)
WMPdue	1.49e-05**	4.89e-05**	9.07e-05***	7.75e-05*	5.84e-05	0.000102
	(2.340)	(2.274)	(2.996)	(1.803)	(0.865)	(1.681)
Capital Ratio	-0.000254	-0.00119**	-0.000797	0.000109	0.00140	0.000270
	(-0.881)	(-2.477)	(-1.060)	(0.131)	(1.500)	(0.360)
LDR	0.000189	0.000452**	0.000632***	0.00118***	-0.000283	-0.00104
	(1.640)	(2.749)	(2.984)	(2.892)	(-0.373)	(-0.858)
Bank fixed effect	×	×	×	×	×	×
Quarter fixed effect	√	√	√	√	√	√
Constant	0.0209***	0.0285***	0.0312***	0.0337***	0.0449***	0.0463***
	(210.3)	(244.5)	(184.1)	(117.7)	(95.36)	(60.47)
Observations	383	383	383	383	383	383
R-squared	0.999	0.999	0.998	0.997	0.996	0.993
Cluster	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter

Panel B: Effect of WMPdue on Shibor quoted rate by banks

Bank	Big 4				SMB			
Term	overnight	1-w	2-w	1-m	overnight	1-w	2-w	1-m
Dep Var: Ask Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
WMPdue	0.000133*	0.000800***	0.00109**	0.00115**	6.44e-07	2.53e-06	2.45e-05	1.49e-05
	(1.872)	(2.898)	(2.609)	(2.498)	(0.0790)	(0.117)	(0.970)	(0.393)
Capital Ratio	-0.000182	-0.00202***	-0.00287***	-0.00406***	-0.000472	-0.000731	0.00117	0.00466*
	(-0.624)	(-3.651)	(-3.019)	(-3.758)	(-0.741)	(-0.618)	(0.667)	(1.866)
LDR	-0.000108	-0.00134**	-0.00119	-0.00216**	-0.000262	-0.000282	7.11e-05	0.00233*
	(-0.395)	(-2.190)	(-1.529)	(-2.122)	(-0.839)	(-0.708)	(0.117)	(1.723)
Bank fixed effect	×	×	×	×	×	×	×	×
Quarter fixed effect	√	√	√	√	√	√	√	√
Constant	0.0211***	0.0295***	0.0324***	0.0361***	0.0213***	0.0290***	0.0314***	0.0324***
	(114.0)	(73.53)	(61.59)	(53.78)	(74.62)	(78.53)	(53.51)	(26.86)
Observations	112	112	112	112	271	271	271	271
R-squared	0.999	0.998	0.997	0.996	1.000	0.999	0.999	0.998
Cluster	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter

Table IX Rollover Risk and Stock Market Response

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

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

Figure 1 WMP Issuance across Time

Figure 1.1 reports average (WMP balance/bank asset) and (deposit/bank asset) over time for big 4 banks and SMBs, respectively. Figure 1.2 divides WMP according to their yield type and reports (WMP balance/bank asset) over time for big 4 banks and SMBs, respectively.

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

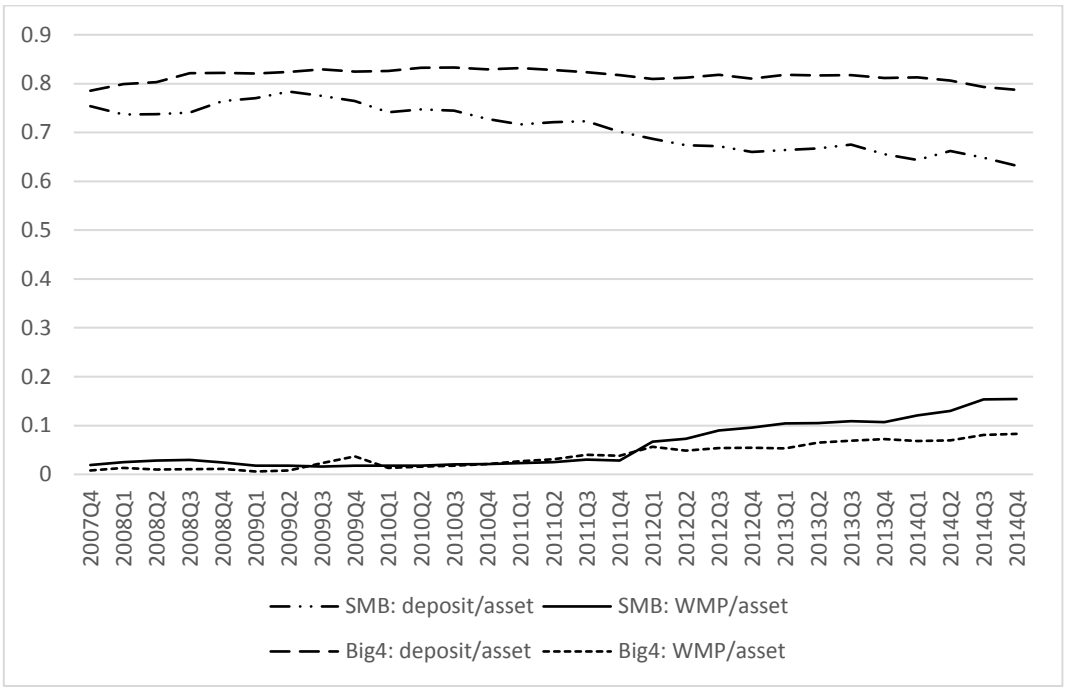


Figure 1.2: (WMP Balance/Bank asset) across time by yield type

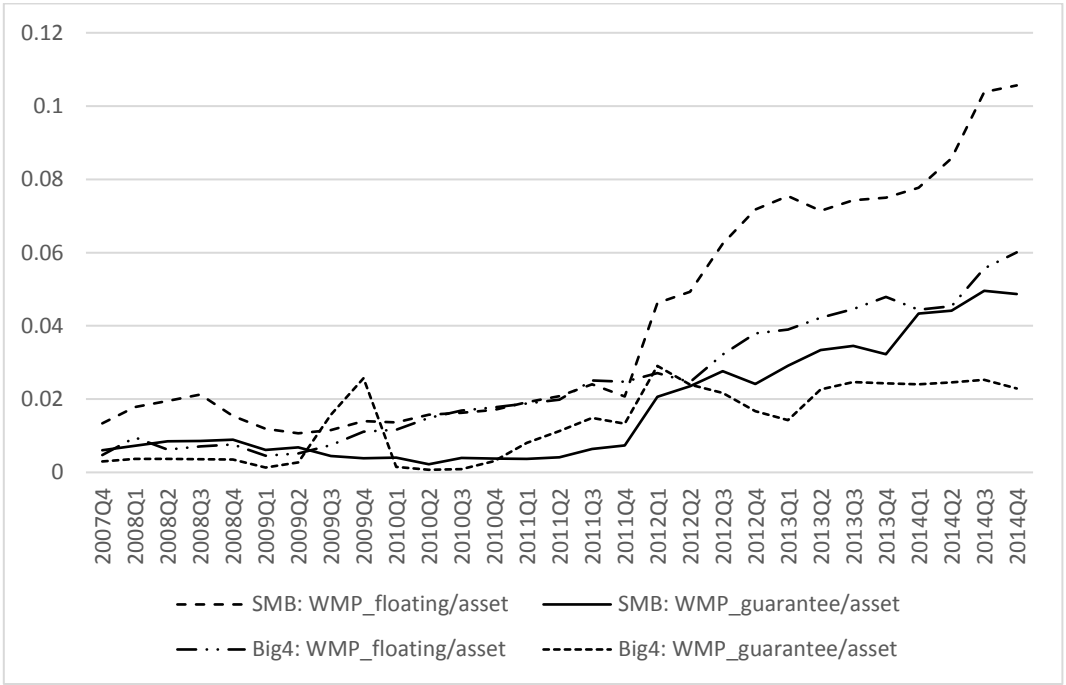


Figure 2 WMP Balances by Investment Targets

Money raised by WMPs can be channeled to 4 main investment targets: market money, bank deposits, loan assets and equity assets. This graph shows the average WMP balances for each targets at the end of each month from Dec, 2011 to Dec, 2014.

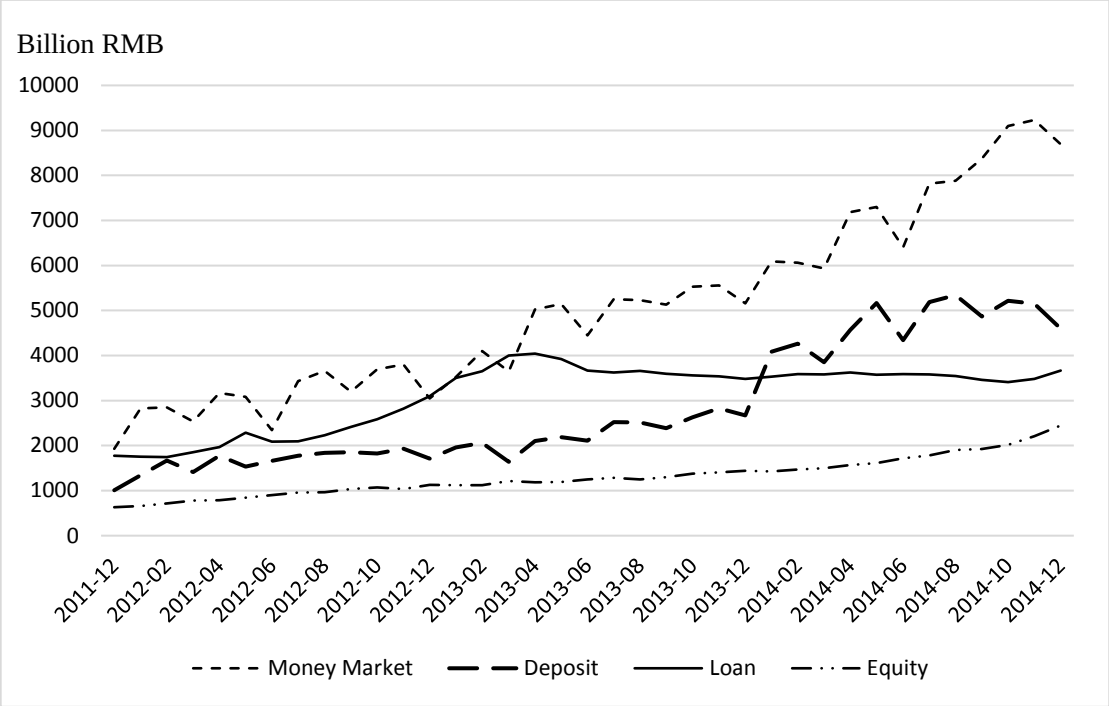


Figure 3 Interest Rate Change across Time

Figure 3.1 divides WMPs into four categories: whether it's issued by big4 banks and whether it's principal-guaranteed or principal-floating and reports change of WMP expected annualized yield across sample period. Figure 3.2 reports the 3-month Shibor rate and 3-month deposit rate ceiling across sample period.

Figure 3.1: WMP expected annualized yield across time

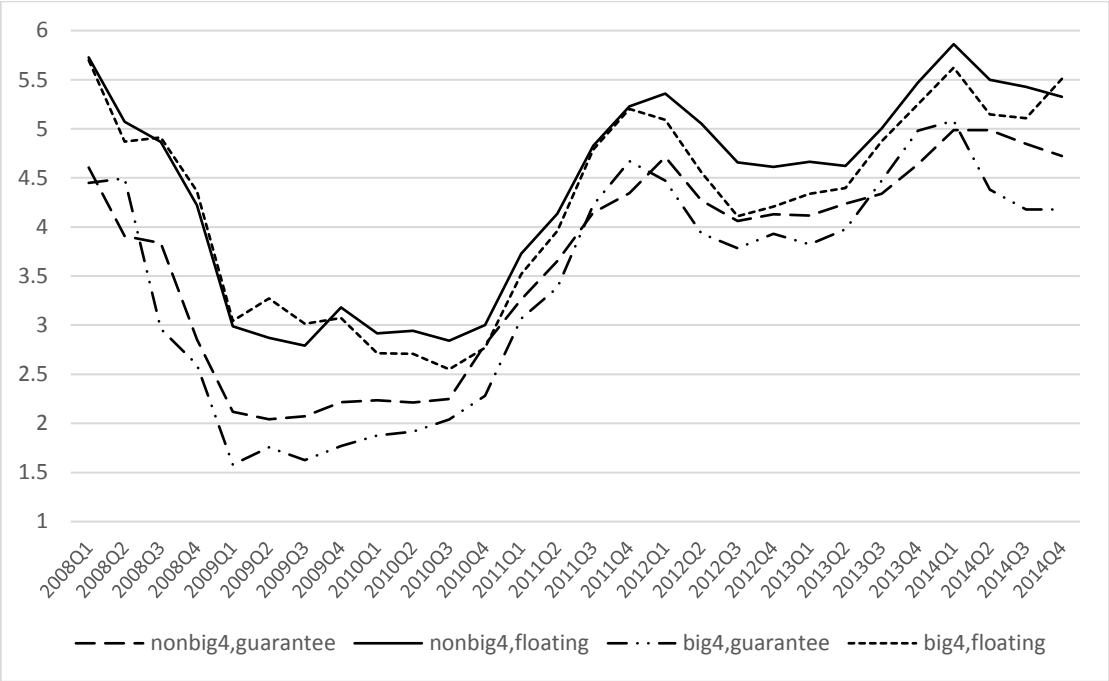


Figure 3.2: 3-month Shibor and deposit rate ceiling across time

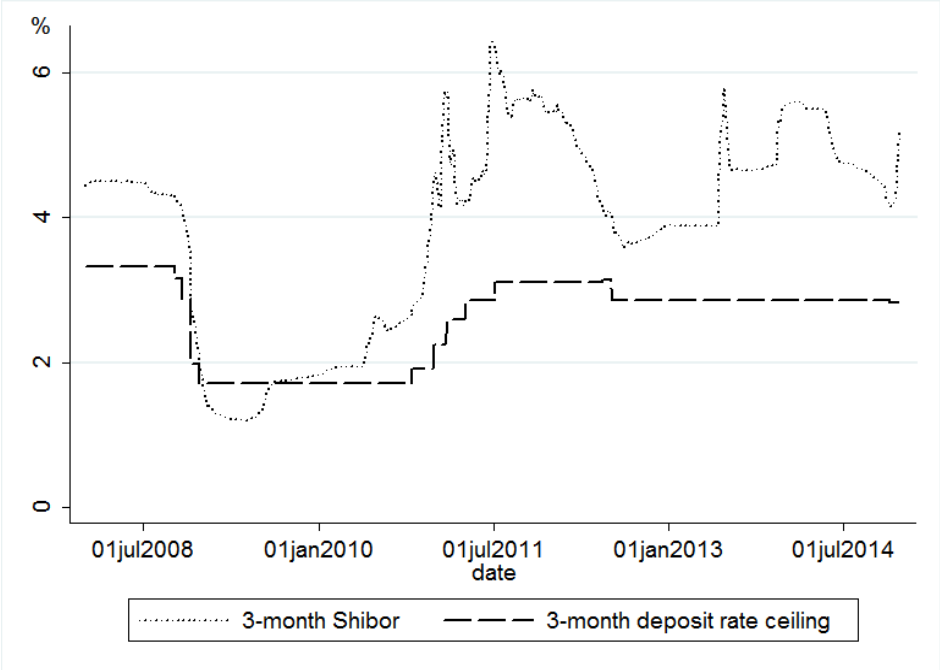


Figure 4 Banks during the 4-trillion stimulus plan

Figure 4.1: Total loan balance of all national banks

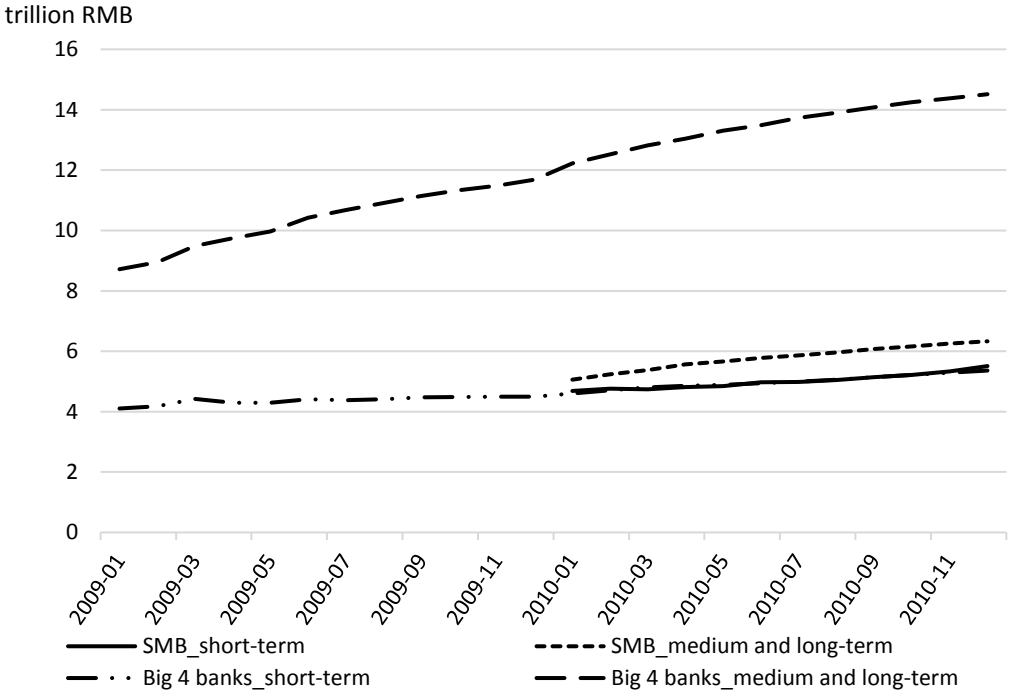


Figure 4.2: Total loan balance of big 4 banks

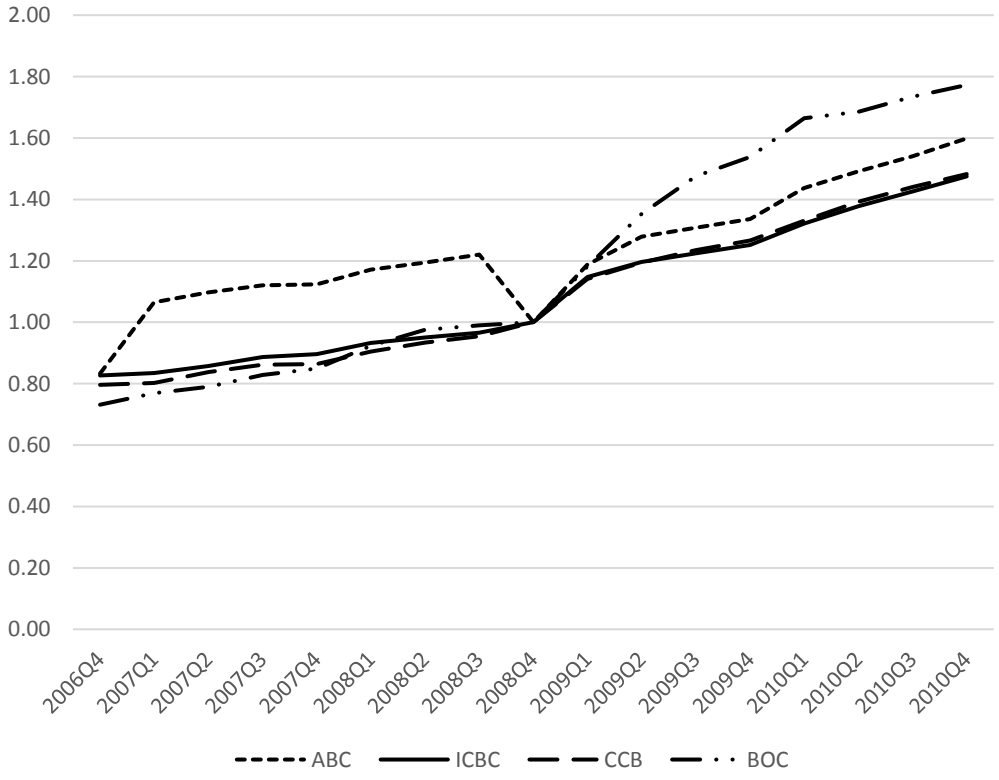


Figure 4.3: LDR of big 4 banks

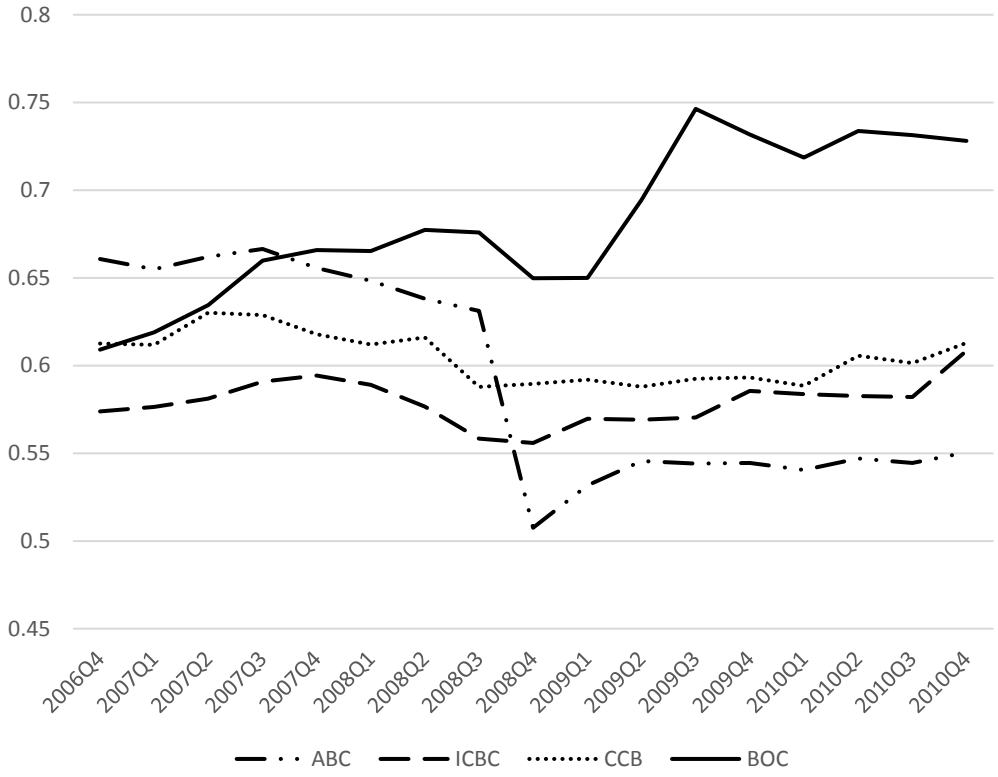


Figure 4.4: Total deposit balance of big 4 banks

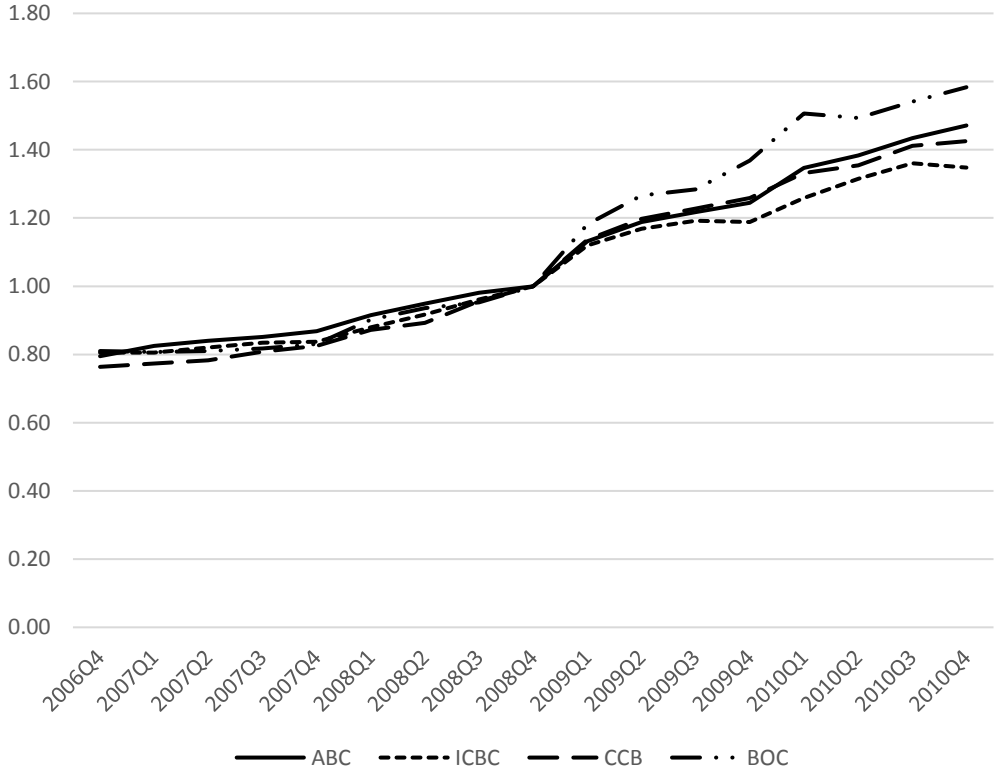
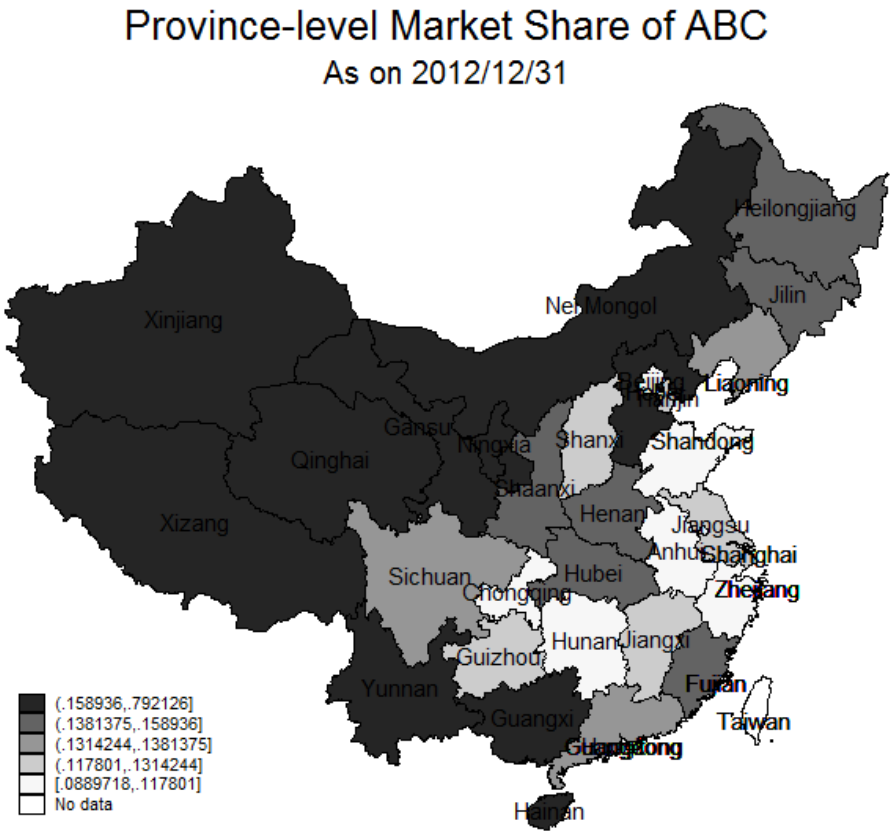
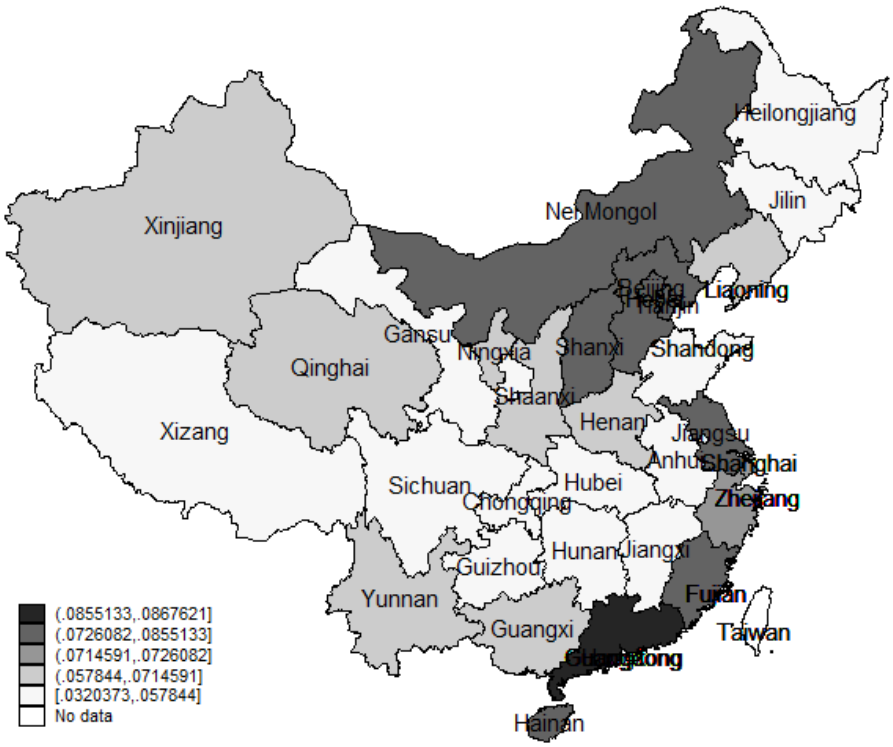


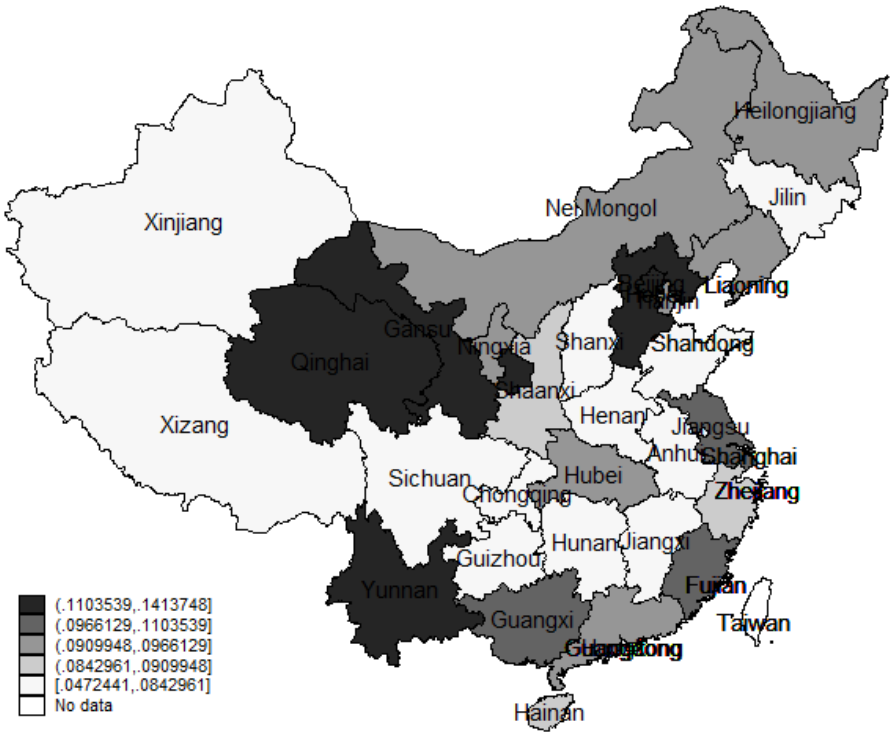
Figure 5 Province-level market share of the big 4 banks





Province-level Market Share of CCB

As on 2012/12/31



Province-level Market Share of ICBC

As on 2012/12/31

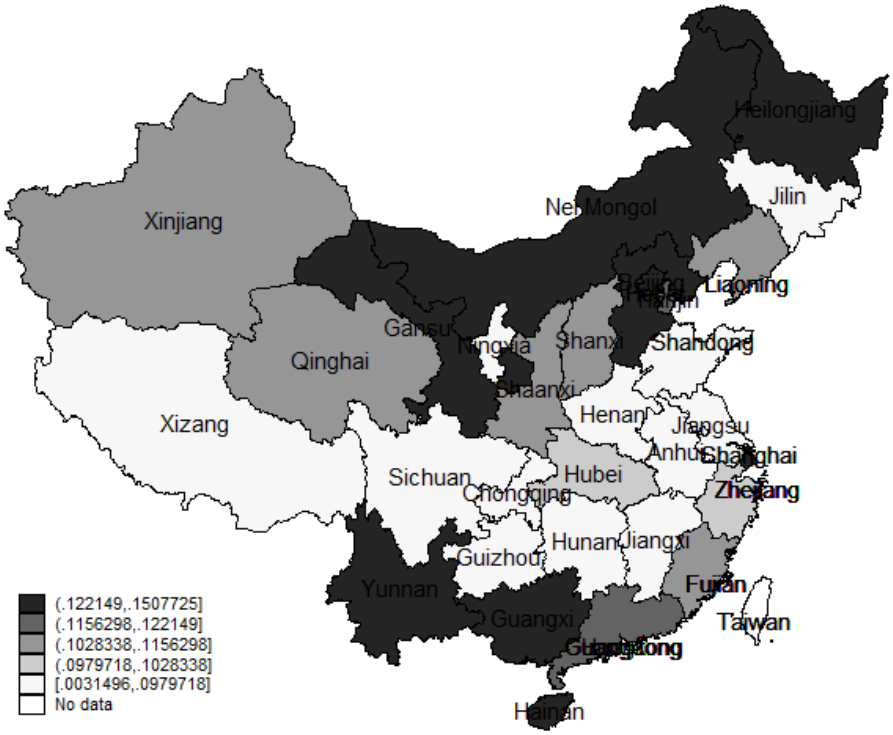


Figure 6 Change of big 4's market shares and competition over time

Figure 6.1: Market share of the big 4 banks over time

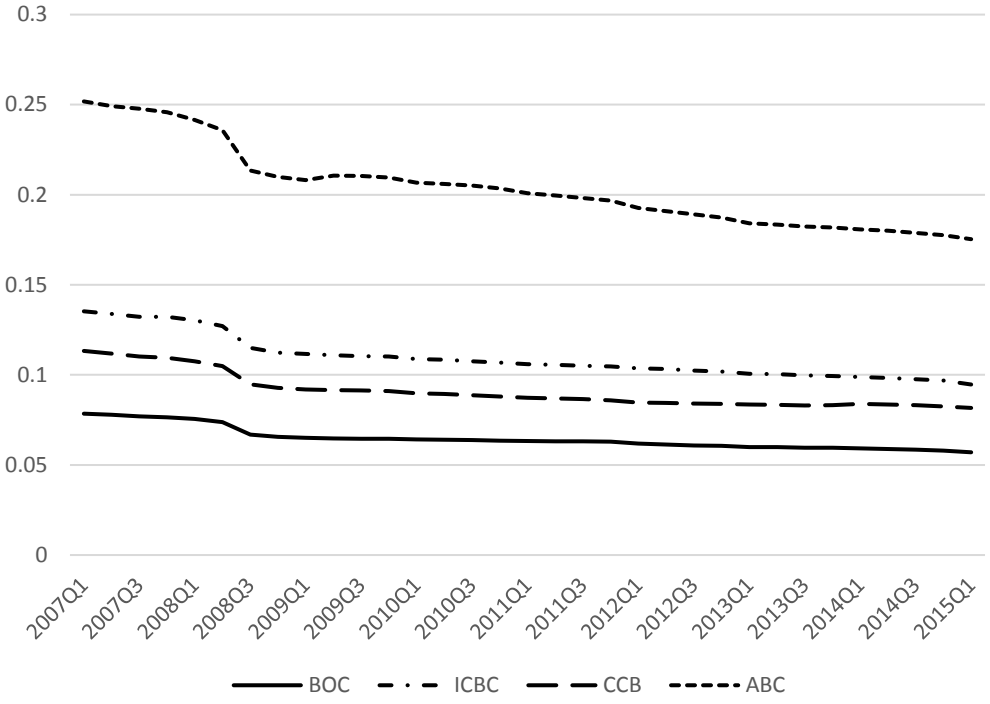


Figure 6.2: Average exposure to big 4 competition over time

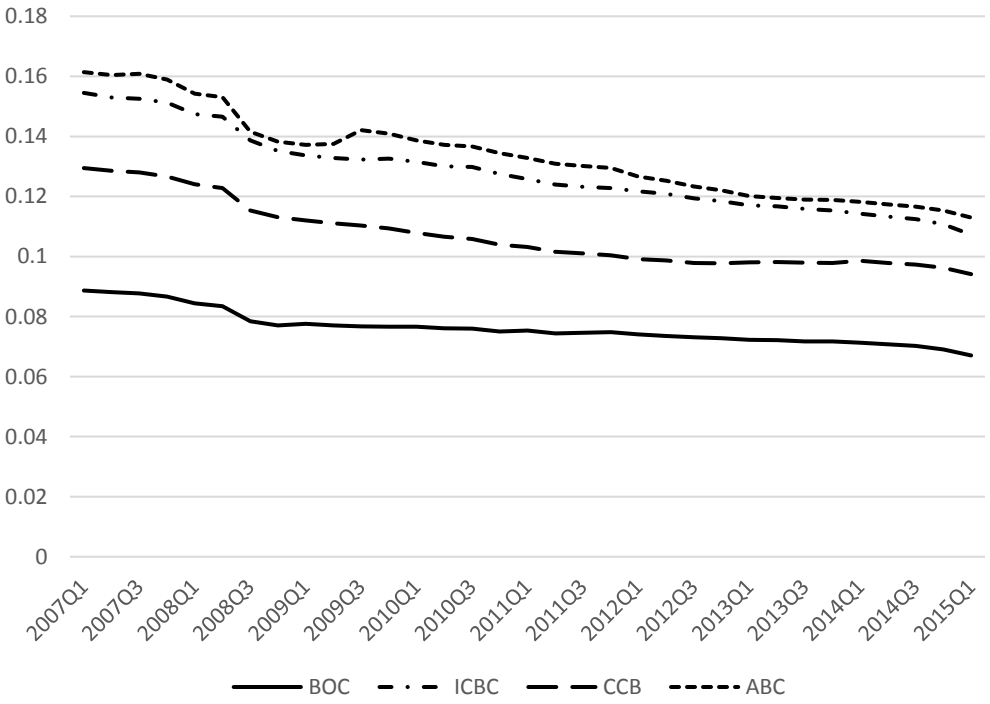


Figure 7 Banks during the 4-trillion stimulus plan

Figure 7.1: Change of percentage of medium- and long-term bank loans

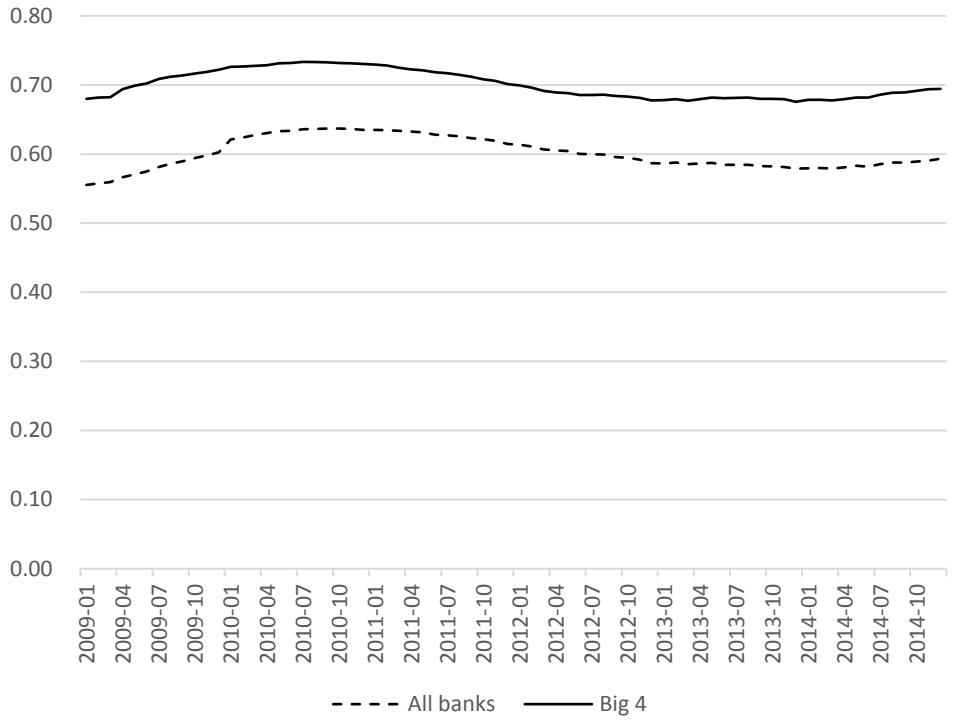


Figure 7.2: Relation between WMP balance in 2013 and estimated loan increase

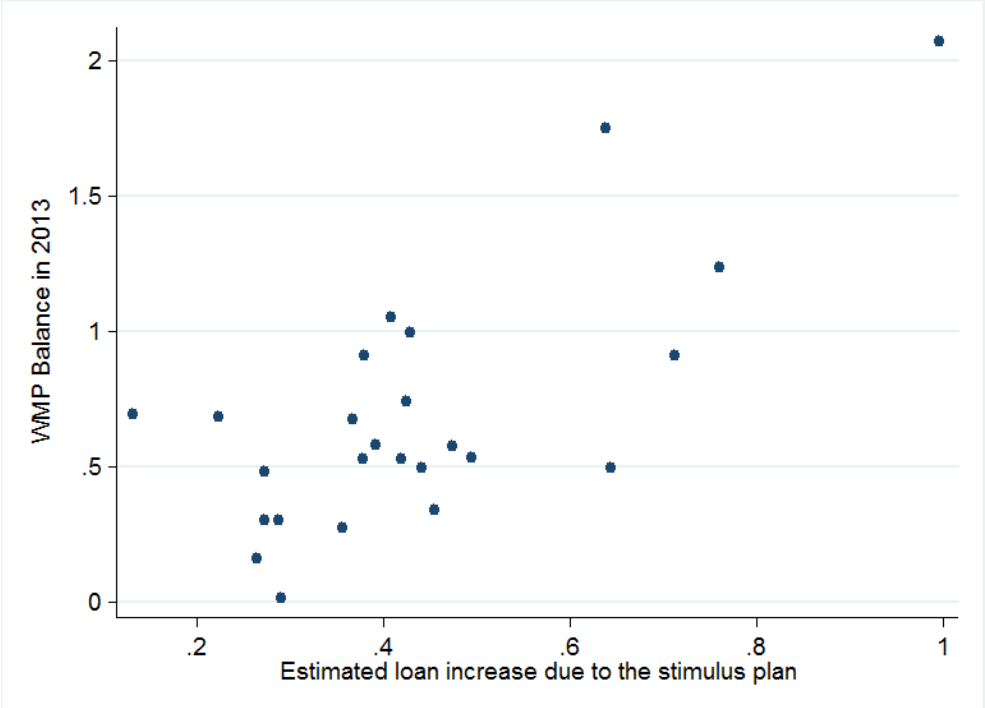


Figure 8 WMP Maturity Date Timing

All the individual WMP information is collected from WIND. We label the last day of each quarter as the 90th day and then label other days backwards. Figure 8.1 and 8.2 shows the total number of WMPs issued by big 4 band non-big 4 banks, respectively. Figure 8.3 and 8.4 shows the total number of principal-floating and principal-guaranteed WMPs matured on each day of a quarter, respectively.

Figure 8.1: Number of WMPs issued by big 4 banks due on each day within a quarter

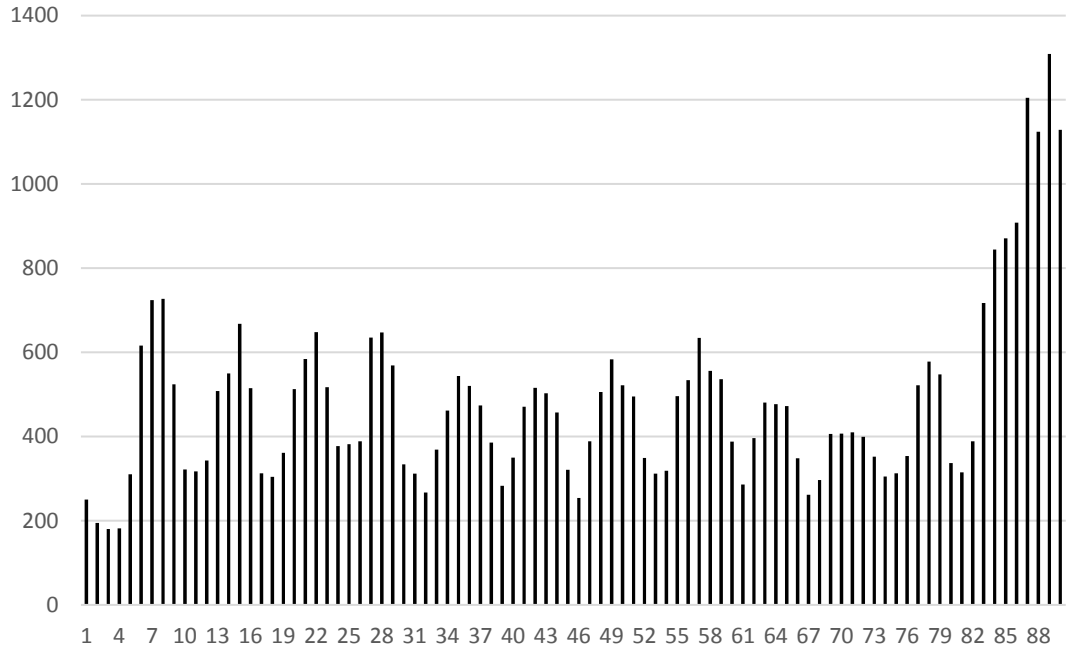


Figure 8.2: Number of WMPs issued by SMBs due on each day within a quarter

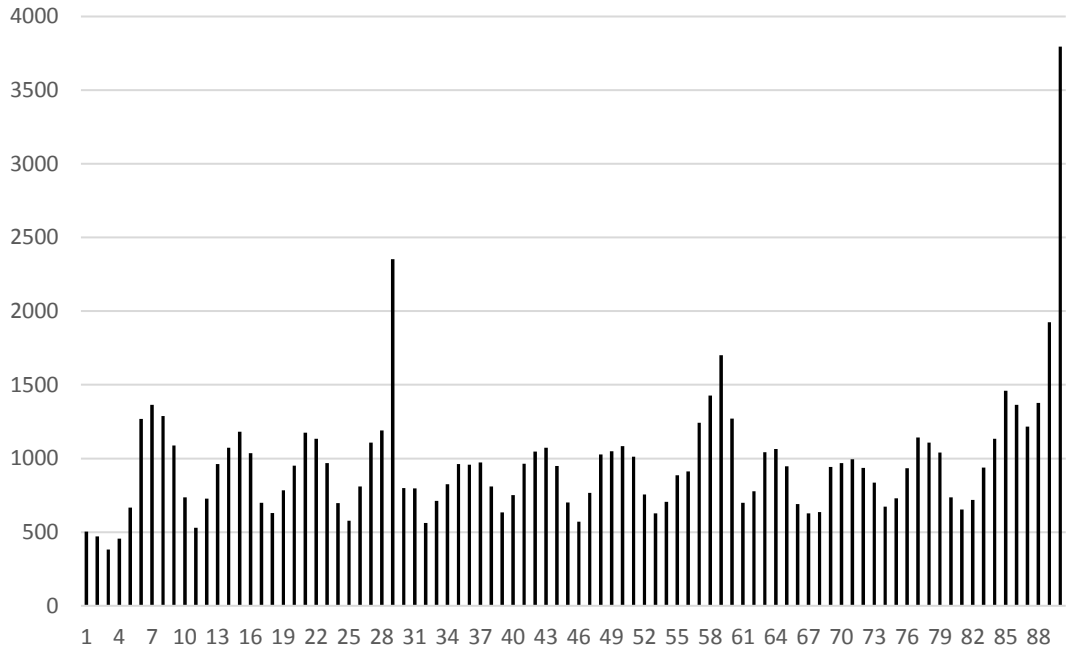


Figure 8.3: Number of principal-floating WMPs due on each day within a quarter

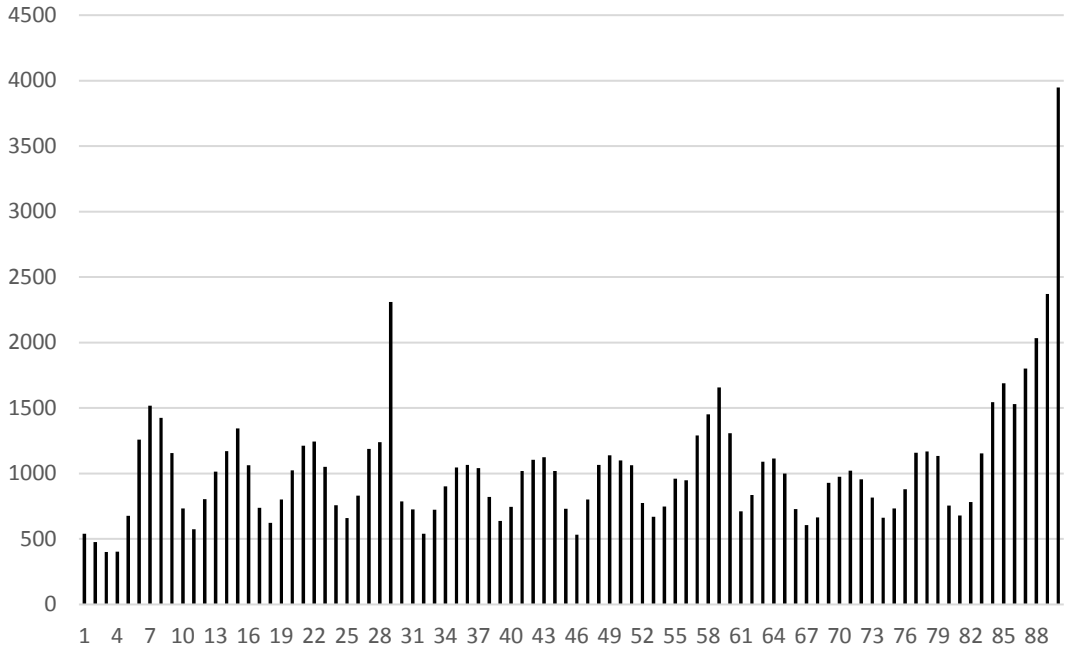


Figure 8.4: Number of principal-guaranteed WMPs due on each day within a quarter

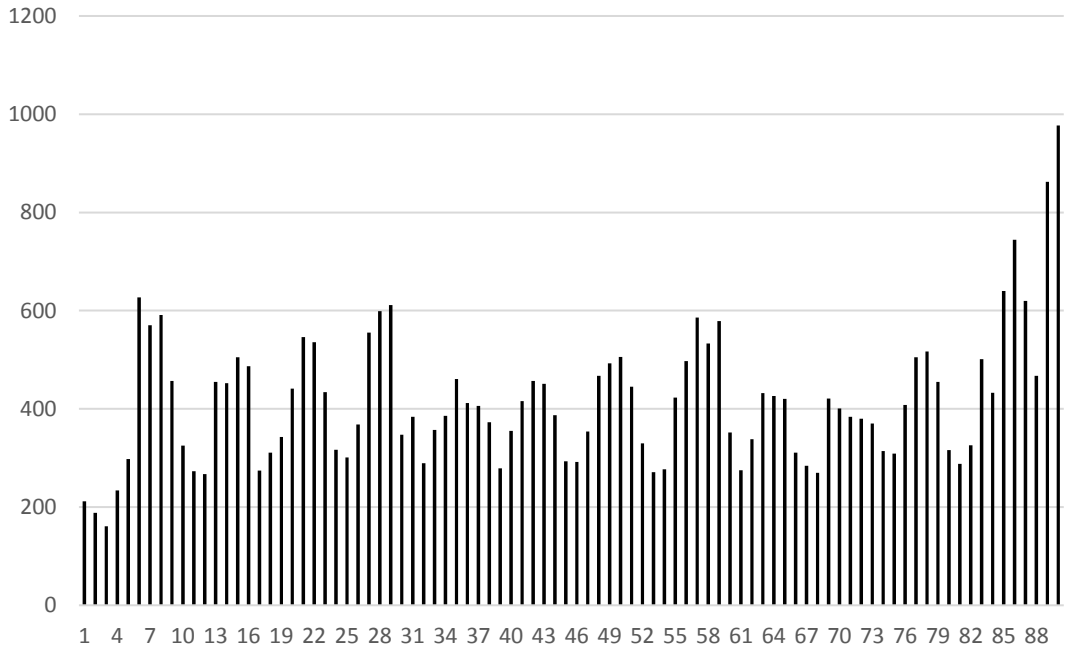


Figure 9 Aggregate *WMPdue* and 1-week Shibor

The figure shows the relation between aggregate *WMPdue* and Shibor. For each month, we calculate the aggregate *WMPdue* of Big4 and SMBs and divide it by M2 at the end of the month. We also calculate the average daily 1-week Shibor within each month.

Figure 9.1 Aggregate WMPdue of Big 4 and 1-week Shibor

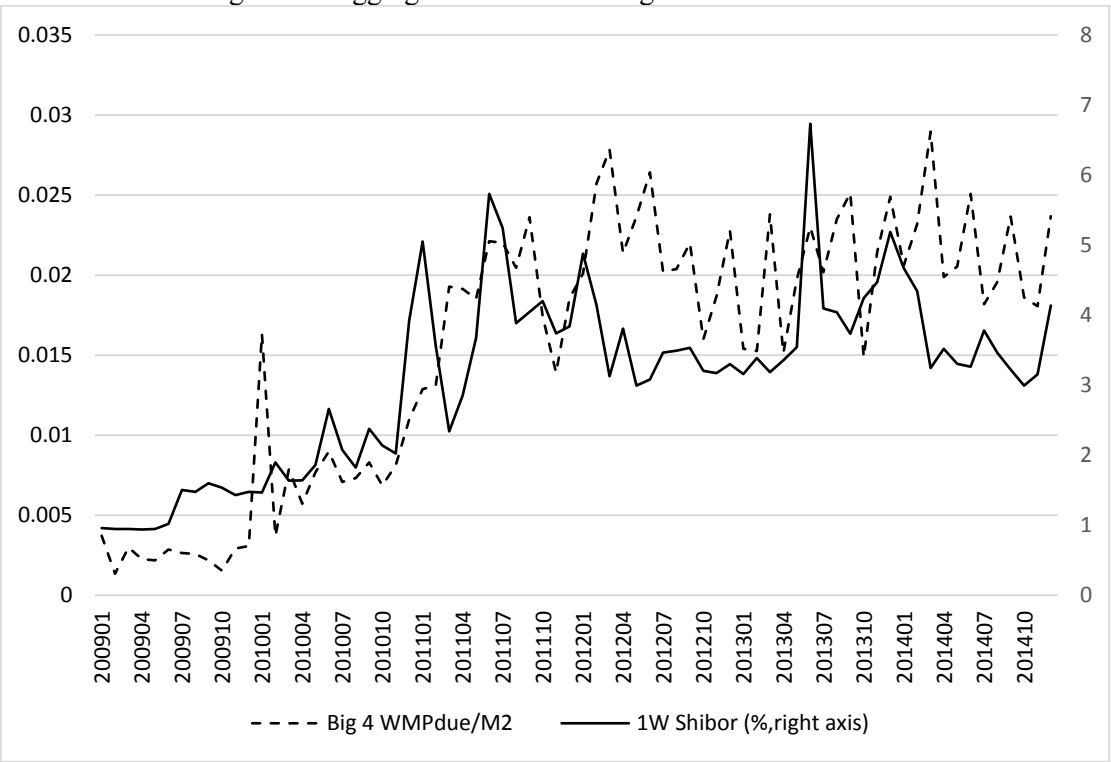


Figure 9.2 Aggregate WMPdue of SMBs and 1-week Shibor

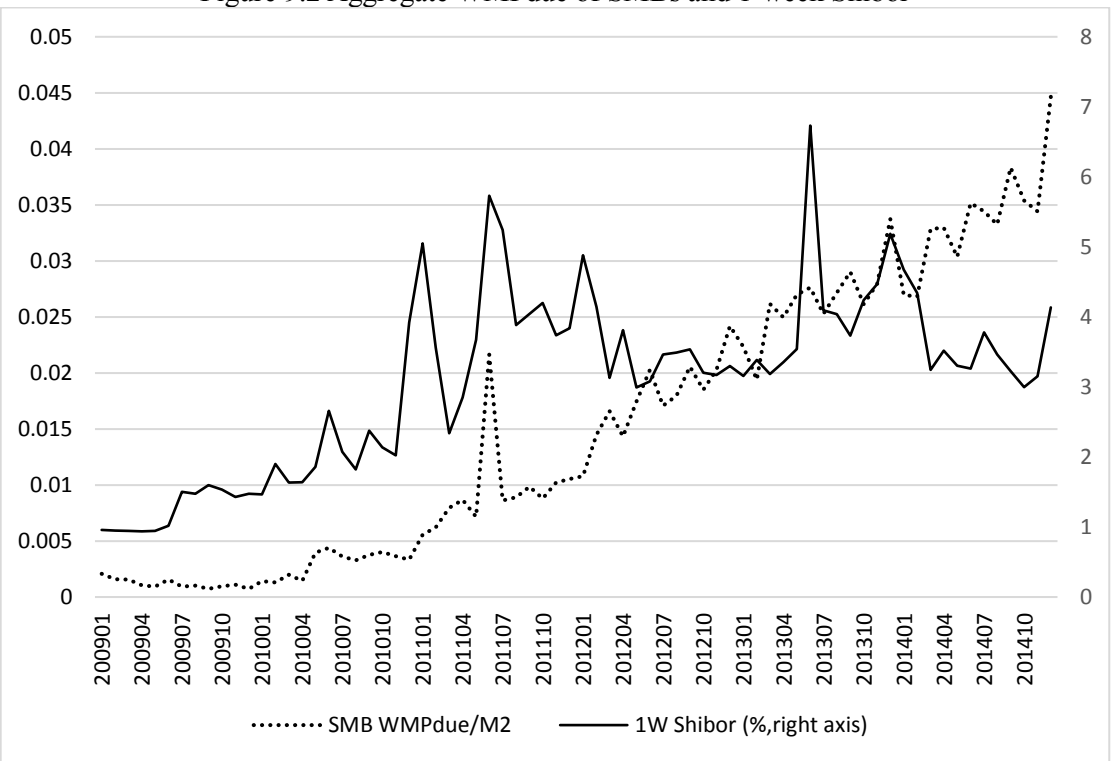
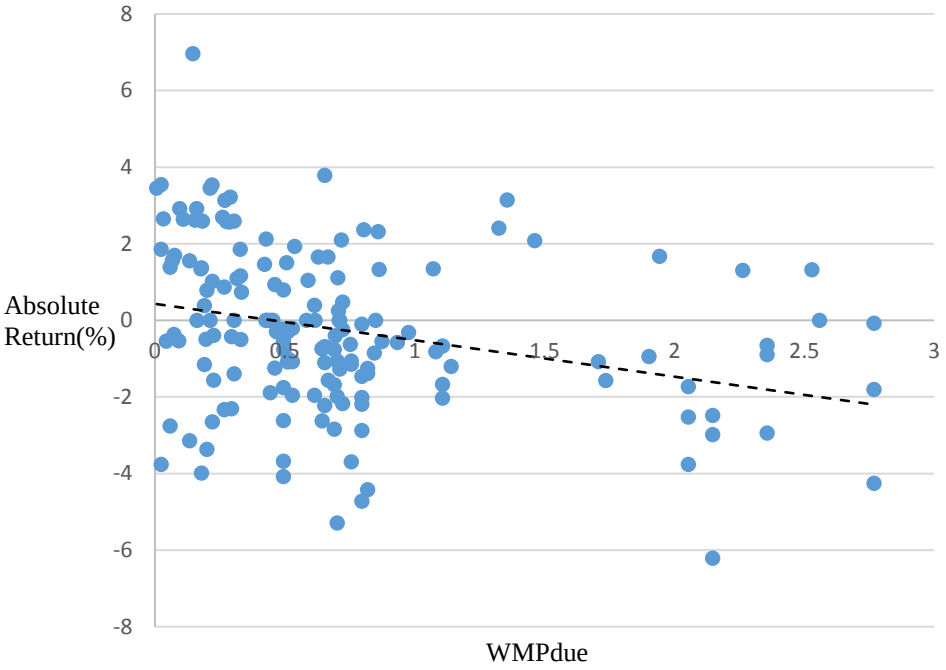


Figure 10 Rollover Risk and Stock Market Response

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



Appendix A: Variable Definition

Variable	Definition
Issuance/Equity	The total amount of WMP issued in this quarter divided by bank equity at the end of last quarter.
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. Values of loan balance and deposit balance are adjusted according to the risk to different deposits and loan assets.
NPLR	Non-performance loan ratio. Bank loans are classified into five groups according to default risk: normal, attention, junior, suspicious and loss. NPLR is the percentage of loans under the group of suspicious and loss. Values greater than 99% percentile are replaced 99% percentile.
Spread	Difference between market rate and regulatory rate, calculated using 3-month Shibor minus 3-month bank deposit rate ceiling and take average across days within the same quarter.
Big4Comp	Bank's exposure to Big 4 competition, measured by weighted average of Big4Ratio using bank's number of branches in each city as weight, and Big4Ratio is the percentage of Big 4 branches in each city. Data of bank branches come from www.yhwdt.com on 2016/04/10.
BankSize	logarithm of total bank asset at the end of last quarter.
ROA	bank's Return on 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.
Shibor_d	Shibor of the same maturity as the WMP minus bank deposit rate ceilling with the same maturity on the issuing date.
WMPdue	Total amount of WMP due in this quarter (month in Table 8) over bank's equity at the end of last quarter.
Ask Rate	The average of bank's Shibor Ask rate within the same quarter. Big 4 banks all participate in the Shibor bid and ask process but only 9 or 10 small and medium-size banks do. Winsorized at both sides by 1%.
BondIssue	1 if the bank has issued any bonds with the specified maturity in this month, 0 otherwise.
BondSize	logarithm of total amount of money raised by that bond.