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

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

Jun "QJ" Qian
Shanghai Adv. Inst. of Finance
Shanghai Jiao Tong University
jqian@saif.sjtu.edu.cn

Zhishu Yang
School of Economics and Mgmt.
Tsinghua University
yangzhsh@sem.tsinghua.edu.cn

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Abstract

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 that (1) 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; (2) 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); and (3) 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.

JEL Classifications: G2, E4, L2.
Keywords: Shadow banking, regulatory arbitrage, off-balance sheet activity, rollover risk, SHIBOR.

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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 are lightly regulated compared to banks. Due to the opaqueness and complexity of this sector, shadow banking is more difficult to monitor and is 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 academic research, however, 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 addition to standard capital and reserve requirements, Chinese banks face regulations on deposit rates and on-balance-sheet lending, and have significantly increased off-balance-sheet activities in recent years. In this paper, we examine the largest component of China's shadow banking sector—wealth management products (WMPs) issued by banks.

[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. See http://data.worldbank.org/data-catalog/GDP-PPP-based-table for the complete rankings of GDPs in PPP terms, last updated on 09/15/2015.

[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).

We study issue size, initial promised rates and maturity of WMPs, and find that these product characteristics are closely linked with the risk characteristics of the issuing banks. Furthermore, the issuance of WMPs exposes issuing banks to significant rollover risk at the time of maturity of the products. Our tests and results thus shed light on how the fragility of shadow banking relates to the overall safety of China's financial system.

Our data covers all the WMPs issued by the largest 25 banks from 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. With the longest history and extensive branches throughout the country, the largest five banks are among the largest institutions in the world, and are owned by the central government and have been dominant players in the financial system including attracting deposits and lending.[4] All of the 'Big 5' banks are listed in both the domestic A-share market and in the Hong Kong Stock Exchange. The rest of banks are much smaller in size and many of them concentrate their lending in certain regions, with local governments as the largest shareholder; some of these second-tier banks are not publicly listed. Standard measures such as capital adequacy ratio and non-performing loans (NPLs) show that the Big 5 banks are safer than the second-tier banks during much of our sample period.

During our sample period, China's central bank—People's Bank of China (PBOC) set base interest rates (as part of the macro-prudential policies), and, in particular, deposit rates were capped; at the same time a bank's (on-balance-sheet) lending could not exceed 75% of its deposits. Following the literature on shadow banking and regulatory arbitrage, we

[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).

hypothesize that riskier banks have a stronger incentive to issue more WMPs as they are low on liquidity and capital, and on-balance-sheet deposits would require them to raise liquidity and capital at the expense of current shareholders (Jensen and Meckling, 1976). If there are constraints on on-balance-sheet lending that are binding, as it is typically the case for smaller banks in China, then issuing WMPs could be driven also by the desire to expand loan portfolio. In either case, we hypothesize that WMPs by riskier and smaller banks should have weaker implicit guarantees than on-balance-sheet deposits or WMPs of safer and larger banks, especially for WMPs that are issued to institutions compared to individuals. Finally, the incentive to issue WMPs should be the strongest for riskier banks during periods when the regulated deposit rates are low, as expected profits from borrowing at short maturities and at low rates then lending long and into illiquid assets, a form of 'carry trades' (e.g., Acharya and Plantin, 2015), are the highest.

We find three sets of results that are broadly consistent with our hypothesis that the size and risk of WMPs are positively associated with the risk of the issuing banks. First, the scale of issuance, as measured by the issue size over bank equity, is greater for banks constrained more by on-balance-sheet lending quotas and those with lower capital adequacy ratios. Banks offer three types of WMP products: first, those that guarantee both the principal and interest, second, those guaranteeing only the principal, and third, those that do not guarantee the principal or the interest. We find that the relationship between issue size and banks' lending constraint and capital level is particularly strong for non-guaranteed products (second and third type of products), and when the spread between the market rate—SHIBOR (Shanghai Interbank Offered Rate) and the regulated deposit rate is high.

Second, we study how the initial yields on the products—a continuous measure for the riskiness of the products, relate to risk of the issuing banks, as measured by both capital adequacy and NPL ratios. We find a positive and significant relation between the two, especially for non-guaranteed products. We also differentiate products issued to institutional investors vs. those issued to individuals, and find that the relationship is strong (weak) for those issued to institutional (retail) investors. These results suggest that, unlike institutional investors, individual buyers do not fully 'price' the risk of these products (at least at the point of issuance), which could potentially be explained by their perception that these products have implicit government guarantees in case of default by the issuer.

Third, we find that the issuance of WMPs poses a substantial rollover risk for issuers, especially on days when large amount of products mature. The median maturity of the products is about three months; many short-term products mature on the last day or second-to-last day of a quarter, when the loan-to-deposit (LTD) ratio is calculated and monitored by the CBRC (China Banking Regulatory Commission). These patterns suggest that issuing banks anticipate that once receiving the payoff from the WMPs, bank depositors (or new investors) who bought the products would immediately put the money back in the bank as deposits and thus boosting deposit level so that the LTD remains below the 75% upper bound. And, on these maturity dates, according to the interbank (SHIBOR) transactions data, banks are willing to pay high interest rates to borrow funds from the market, apparently to ease the liquidity burden of the banks.

We also study whether the market understands the relationship between the risk of shadow banking and the risk of the banks. We look at announcement period returns (for

listed banks) during several 'credit events,' including the summer of 2013 during which SHIBOR rates spiked up to historical highs. We find that stock prices of all the listed banks drop during this period, and the magnitude of the drop (in both the domestic A share and the Hong Kong stock markets) is positively related to the size (total amount outstanding) and initial yields of a bank's WMPs. This result supports the notion that the market (partially) prices the risk of WMPs as related to their issuing banks during credit events.

Our paper contributes to and extends the literature on the formation and risk of shadow banking and its impact on the stability of the overall financial system. There are at least two important differences between the US shadow banking sector and its counterpart in China. First, the process of moving debt obligations from institutions' balance sheets and packing and re-packaging into structured products makes these products complicated and opaque. 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 often 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

[5] Some of the funds raised from selling WMPs do go into risky and speculative areas, through trust companies, such as leveraged trading in the stock market.

(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. Hachem and Song (2015) also look at the WMPs and the issuing banks, but their focus is 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 examine the relationship between product characteristics and those of the issuing banks, and conclude that product risks are related to bank risks and that the risk of the shadow banking increases the overall risk of the issuing banks.

The rest of the paper is organized as follows. In Section II, we describe China's banking sector and the regulatory framework, and how shadow banking in the form of WMPs arises and its relation with the banking sector. In Section III, we describe our sample of WMPs and their issuing banks, and then present the empirical tests, results and discussions. Section IV concludes the paper. The Appendix contains explanations of the variables used in the tests.

II. INSTITUTIONAL ENVIRONMENT, SHADOW BANKING AND THE BANKING SYSTEM

We begin with an introduction of China's banking sector regulations. 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 at the end of 2015 it was 17.5% for large banks—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, but during our sample period (last year is 2014) the upper bound of deposit rates was still binding—up to 1.5 times of base rates. 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). On the asset side, banks cannot lend more than 75% of their total deposits, and this upper bound on lending was also binding during our sample period.[7] Finally, banks cannot invest in certain sectors (e.g., stock market) or conduct investment-banking services (e.g., underwriting and trading).

These regulations give rise to the growth of shadow banking in China. For banks, they have an incentive to offer off-balance sheet products, which are not subject to loan-to-deposit (LTD) ratio or capital requirements, in order to earn higher profits on illiquid, longer-term assets. This strategy, similar to "carry trades," earns higher expected payoffs if regulated deposit rates remain low, and banks' incentive to offer more such products is stronger (Acharya and Plantin, 2015). The broadest definition of 'shadow banking' is all the investment products in the market that are off-the-balance sheet of Chinese banks. We study

[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).

[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.

the largest component in this paper—WMPs offered by banks. Similar products are also offered by non-bank institutions, with perhaps the most famous one being *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 non-bank institutions. Through both WMPs and entrusted loans, banks can invest in some sectors (e.g., real estate and stock market) that they cannot directly do so. Finally, there are also many private credit agencies throughout the country, and they primarily lend to small (unlisted) firms that do not have access to bank lending.[9]

With the rise of shadow banking, there is a 'dual-track' system of intermediation in China's financial system. On the one hand, there are regulated deposits and on-the-balance sheet lending by the banks, with low funding costs due to capped deposit rates but lending is constrained by the LTD ratio and capital requirements. Hence, greater leverage would require unregulated deposits for the banks, and when regulated rates are (and more likely to remain) low, maturity transformation is more attractive. On the other hand, 'shadow banking' (off-balance-sheet) activities are linked to banks' overall risks: WMPs can allow banks to take on significant rollover risk and invest in sectors that they cannot do through on-balance-sheet lending. As described earlier, WMPs' returns and principal may or may not be guaranteed and can provide banks with different risk-return profiles.

Our main hypothesis is that, worse capitalized banks, seeking greater risk and

[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] Many of these agencies do not have formal contracts with borrowers, and some agencies are deemed illegal. See, e.g., Allen, Qian and Qian (2005) for more information on this sector.

leverage, are more likely to take on rollover risk by issuing WMPs. And, greater risk should be priced as higher yields, at least for investors who can 'price' the risk in the WMPs. More specifically, we ask three broad research questions. First, as motivated by regulatory arbitrage, how do the WMPs relate to interest rate policies and other banking regulations? Deposit-rate ceilings, capital requirements and LTD ratios give rise to off-balance-sheet deposits and investment, akin to the growth of money market funds around Regulation Q and the growth of asset-backed commercial paper around capital requirements in the US.

Second, how do the WMPs relate to bank health? Under-capitalized banks should engage in greater regulatory arbitrage, and "carry trades" are more profitable when interest rates are low. Finally, how do the WMPs affect bank health? To examine this question, we study interbank activities of issuing banks on days when large amounts of WMPs mature. We also study the impact of "credit" events, such as the spike in SHIBOR during the summer of 2013. Overall, our tests and answers to these questions will shed light on how the fragility of shadow banking relates to the overall safety of China's large banking sector and entire financial system.

III. DATA, EMPIRICAL METHODS AND RESULTS

We focus our study on the 25 largest banks in China, including the Big Five banks, namely ICBC, CCB, ABC, BoC and BComm. The sample period is from 2008 to 2014 and most of the bank-level variables are published and observed on a quarterly basis. We collect information on all the WMPs issued by the 25 banks during the sample period. Our matched bank-WMP product data primary comes from two sources. Listed banks and banks that have

issued bonds publicly publish their financial information on the WMPs. Most listed banks publish on a semi-annual basis while some on a quarterly basis. We collect the information on various sources like public firm datasets and central bank reports. For the rest few smaller banks and WMPs information that is not publicly available, we contacted the banks directly and obtained their financial information as well as detailed information on their WMPs.

The final data we obtain from public sources and surveys run from 2008 to 2014 for each of the 25 banks and include quarterly bank equity, total loan and deposit balances, Capital Adequacy Ratio as well as aggregate WMP issuance for each bank and each quarter. The data also include quarterly loan-to-deposit ratio (LDR) and non-performance loan ratio (NPLR) for the 20 small and medium-size banks. Our second data source is WIND, a leading data provider in China. We collect yield information for all the WMPs issued by the 25 banks during the sample period. Data of NPLR for the big 5 banks are also available from WIND. Another data that we use are Shanghai Interbank Offered Rate (Shibor) and each bank's quoted price downloaded directly from the official website.

III.1 Summary Statistics

Table 1 reports summary statistics for both bank and WMP characteristics. In Panel A, Big 5 banks are typically 10 times the size of small and medium-size banks in terms of equity, total deposit balance and total loan balance. The two groups are similar in average capital adequacy ratio (CAP); according to the Basel III Accord, this ratio cannot be lower than 8%. Most banks are qualified long before our sample period except Agricultural Bank of China (ABC). Before 2009, ABC has negative Cap Adequacy Ratio and only after a new capital investment from the government does its Cap Adequacy Ratio become qualified in 2009 Q4.

In 2013 a new approach to calculate Cap Adequacy Ratio is adopted but the former approach is in use too. For consistence we report empirical results using the former approach. Results using the updated Cap Adequacy Ratio barely change.

LDR is only available for small and medium-size banks. 72 out of the 560 bank-quarter observations have LDR exceeding the regulatory threshold 75%. When this happens, banks will typically receive a warning from the CBRC to 'adjust its business model to comply the LDR requirement.' Note that LDR is not a simple ratio between total loan and total deposit but weighted average loan divided by total deposit. The weight is decided by CBRC and the calculation requires detailed information on various items. Despite this, it is helpful to calculate the simple ratio between total loan and total deposit. The average value for Big 5 banks is 0.64 while for small and medium-size banks is 0.68. Small and medium-size banks generally suffer more from the quantity regulation.

Insert Table 1 here.

Bank loans are classified into five groups according to default risk: normal, attention, junior, suspicious and loss. NPLR is calculated as the percentage of suspicious and loss loans. Again, we only have data of quarterly NPLR for small and medium-size banks, but we managed to obtain most NPLR values for the Big 5 banks from WIND, with only 9 out of 140 bank-quarter observations missing (because banks typically only report annual and semi-annual data). From Panel A, Big 5 banks seem to have slightly higher NPLR than small and medium-size banks.

All the Big 5 banks take part in the Shibor bid and ask process while only 8 to 9 small and medium-size banks do so. We calculate bank's quoted price minus Shibor for different

maturities but only reports overnight quotes in the table. Small and medium banks seem to ask for higher prices than Big 5 banks; this is in accordance with the fact the small and medium banks are in more shortage of liquidity.

Panel B reports summary statistics of WMPs. Big 5 banks issue significantly more WMPs than non-Big 5 banks, but the ratio between issuance and bank equity is similar between the two groups. If we divide WMPs according to the return (guaranteed or not) type, Big 5 banks issue similar amount of principal-guaranteed and principal-non-guaranteed WMPs while small and medium-size banks issue much more principal-non-guaranteed WMPs. This difference between Big 5 and non-Big 5 banks is more evident in Figure 1, which also shows the time series trend of WMP issuance. Although there is no explicit regulation on this, most of the principal-guaranteed WMPs are recorded on the balance sheet of the issuing banks, with the investor's capital as deposits and the investment of WMPs as loans, and hence principal-guaranteed WMPs won't help with quantity regulations like Cap Adequacy Ratio or LDR. However, principal-non-guaranteed WMPs are completely off the balance sheet and can help issuing banks circumvent quantity regulation such as the LDR. Therefore, small and medium-size banks prefer to issue principal-non-guaranteed WMPs, since the quantity regulations such as the LDR are more likely to be binding for these banks.

Insert Figure 1 here.

Panel B also shows that, WMPs issued by non-Big 5 banks generally have higher annualized expected return than those issued by Big 5 banks, especially for principal-non-guaranteed WMPs. WMP expected returns are stated in the contract (similar to the bond prospectus); data on this item are winsorized by replacing values larger than the 99%

percentile with the 99% percentile value. It is evident from the data that principal-non-guaranteed WMPs have higher average expected returns than principal-guaranteed WMPs. Figure 2 shows the dynamic change of WMP annualized return as well as the Shibor and deposit rate ceiling. Except for the first half year in 2009 when Shibor dropped dramatically because of major liquidity offered by the government in response to the financial crisis, Shibor remains well above the deposit rate ceiling.

As shown in the last three columns of Panel B, the average maturity of WMPs is about 3.5 months while the median is about 2.5 months, indicating most WMPs are very short-term. The investment is actually long-term which causes great rollover risk as we will discuss later. For principal-guaranteed WMPs, those issued by small and medium-size banks seem have longer maturity than issued by Big 5 banks. But for principal-non-guaranteed WMPs, there is no big difference between big and small banks. Finally, Panel C provides a list of the 25 banks in our sample.

Insert Figure 2 here.

III.2 Empirical Strategies

The basic strategy is to use panel regressions and answer three questions: what factors drive banks to issue WMPs? Do bank characteristics affect WMP expected return? How do WMPs affect bank health? Deposit rate ceiling and loan quantity regulation 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. The ceiling is effective and banks want to lend more than the otherwise market equilibrium level. In response, the CBRC imposes quantity regulation such as Cap Adequacy Ratio, 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.

Therefore, the issuance of WMPs depends on two factors: the spread between deposit rate and market rate and banks' need to circumvent the quantity regulation. We should expect banks near the regulation limit at a time of higher spread to issue more WMPs. Two variables are used to measure banks' stress to circumvent the quantity regulation: Cap Adequacy Ratio and LDR. The lower Cap Adequacy Ratio is or the higher LDR is, the more stressful the bank is. The spread between deposit rate ceiling and market rate is calculated using 3-month Shibor minus 3-month deposit rate ceiling and take average within each quarter. The choice of 3-month is because except demand deposit, the shortest maturity of bank deposit is 3-month. The empirical model is:

$$issue\_e_{bt} = CAR_{bt} + spread_t + spread_t \times CAR_{bt} + bank_b + quarter_t + e_{bt} \quad (1)$$

$$issue\_e_{bt} = LDR_{bt} + spread_t + spread_t \times LDR_{bt} + bank_b + quarter_t + e_{bt} \quad (2)$$

The dependent variable $issue\_e$ is total WMP issuance divided by bank equity and CAR is short for Cap Adequacy Ratio. We should expect coefficient of the interaction term to be significantly negative for Model (1) and positive for Model (2). Also, coefficient of $spread$ should be significantly positive. To get the net effect of Cap Adequacy Ratio and LDR, we sort $spread$ and divide the sample into three groups and then estimate Model (1) and (2) without the interaction term again.

When banks issue WMPs, the return type is explicitly stated, e.g. whether the principal is guaranteed or not. Principal-guaranteed WMPs are often recorded on the balance

sheet with the investor's money as deposit and the investment as loans, so principal-guaranteed WMPs won't help with quantity regulations like Cap Adequacy Ratio or LDR. However, principal-nonguaranteed WMPs are totally recorded off the balance sheet and can circumvent quantity regulation. Therefore, the above relation should be more profound for principal-nonguaranteed WMPs. We re-estimate Model (1) and (2) for principal-nonguaranteed and principal-guaranteed WMPs, respectively.

Banks are not merely intermediaries in the lifecycle of WMPs. The money is often invested in the banks' own asset like loans. Investors who buy the WMPs typically don't know the exact risk of the investment objective so they can only infer it from the bank's overall asset quality. More often money collected from different WMPs form a pool to fund many investments so the bank's overall asset quality is a good sign of the WMP default risk. A third reason why bank's overall asset quality matters is implicit guarantee of the WMP return offered by banks and perceived by investors. Banks with worse asset quality may run into trouble and can provide less implicit guarantee. In response investors may require higher expected return.

We use NPLR at the end of last quarter to measure individual bank's risk. Investors purchasing WMPs in this quarter may refer to NPLR at the end of last quarter for inference. Besides NPLR, total WMP due in this quarter may matter too. WMPs are often short-term while the investment long-term. This mismatch creates rollover risk, e.g. banks with more WMP due this quarter would need to issue more WMPs in order to pay matured WMPs. Banks would probably raise the expected WMP return so as to attract more investment into the new WMPs.

The third factor to affect expected WMP return is Shibor. On one hand, as an alternative to WMPs, investors can invest in money market funds. So the higher Shibor is, the higher investors require of expected WMP return. On the other hand, interbank money market is another source for banks to get money for investment. Banks can pack the loan asset as trust product and use the money from interbank market to purchase it. This approach wouldn't help to reduce Cap Adequacy Ratio but can circumvent LDR. So the higher Shibor is, the more costly this approach is, and the higher expected WMP return that banks offer to attract WMP purchases. To summarize, the empirical model is

$$WMPreturn_{it} = NPLR_{bt-1} + Shibor_t + WMPdue_{bt} + bank_b + e_{it} \qquad (3)$$

Where the subscript i indicates the individual WMP and t indicates the quarter that the WMP is issued. $NPLR$ is the issuing bank's NPLR at last quarter end, $WMPdue$ is the issuing bank's total WMP due in this quarter divided by bank equity, and $Shibor$ is Shibor on the WMP beginning date with the same maturity as the WMP.

Another specification is to deduce the deposit rate ceiling from WMP expected return and Shibor because what actually matters is the spread. So another model is

$$WMPreturn\_d_{it} = NPLR_{bt-1} + Shibor\_d_t + WMPdue_{bt} + bank_b + e_{it} \qquad (4)$$

The effect of bank risk on WMP expected return should differ between principal-guaranteed and principal-nonguaranteed WMPs. Principal-guaranteed WMPs are like senior debts and principal-nonguaranteed WMPs like junior debts. Thus bank risk should affect principal-nonguaranteed WMPs much more than principal-guaranteed WMPs.

The target investors of individual WMP can be exclusively individual investors or include institutional investors. Institutional investors often invest more than individual

investors and have more expertise to analyze bank risk. Therefore, the effect of bank risk on WMP expected return should be bigger for WMPs targeted to institutional investors than WMPs targeted to individual investors.

Big 5 banks are generally perceived less risky than small and medium-size banks even if they have the same NPLR because big 5 banks are much larger and more diversified. Also, because of their critical importance, the central bank will guarantee their safety. Therefore, for big 5 banks NPLR may not affect WMP expected return no matter NPLR is the maximum 4.32% or the minimum 0.81%. To summarize, the effect of NPLR on WMP expected return is more important for principal-nonguaranteed WMPs issued by small and medium-size banks to institutional investors.

WMPs are often short-term while the investment is long-term. This mismatch is because banks want to use cheaper short-term money to get higher long-term investment return so as to make more profit. Also, investors value liquidity and are reluctant to purchase long-term WMPs. This mismatch can cause significant rollover risk for the banks. When WMP matures while the investment doesn't, banks need to issue new WMPs and use the money to pay former investors. The more WMPs mature, the more liquidity the bank needs.

This effect is reflected in part b) where we argue that banks may raise the WMP expected return if total WMPs due is high. It can also be reflected by the banks' quoted price for Shibor. Banks in more need of liquidity would report a higher ask price for interbank money. For each bank, we calculate its Shibor ask price minus Shibor for each day and then take average within each quarter. We regress this average difference on Cap Adequacy Ratio and total WMP due divided by bank equity. The model is

$$ask\_d_{bt} = CAR_{bt} + WMPdue_{bt} + quarter_t + e_{bt} \quad (5)$$

Where ask_d_{bt} is bank b's average ask price minus Shibor within quarter t, CAR_{bt} is bank b's Cap Adequacy Ratio at end of quarter t and $WMPdue_{bt}$ is bank b's total WMP due divided by its equity at end of quarter t. We expect the estimated coefficient of $WMPdue_{bt}$ to be significantly positive.

Equity Market Response

Not only does the bank itself reveal the effect of WMPs on its liquidity, the equity market may also respond to WMP rollover risk, especially when Shibor is unexpectedly high.

When WMPs mature, banks may go to the interbank market for short-term money to repay the principal and interests, while at the same time issue new WMPs to pay back the money from the interbank market. As the cost of such short-term money, 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. We calculate the daily change in 1-week Shibor and regard it as unexpected especially when the change is 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 choice of 1-week is because 1-week Shibor is more likely what banks borrow at for the liquidity needs, and the overnight Shibor is also highly correlated with it too if banks borrow at overnight Shibor.

To empirically test the equity market response, we estimate the following models:

$$return_{bt} = WMPdue_{bt} + \Delta Shibor_t + \varepsilon_{bt} \quad (6)$$

$$return_{bt} = WMPbal_{bt} + \Delta Shibor_t + \varepsilon_{bt} \quad (7)$$

where $return_{bt}$ is stock daily return calculated using closing price, $WMPdue_{bt}$ is total amount of WMPs due in that month divided by bank equity at month end, $WMPbal_{bt}$ is total WMP balance divided by bank equity at month end, and $\Delta Shibor_t$ is today's 1-week Shibor minus last trading day's 1-week Shibor. We group the observations into different subsamples according to $\Delta Shibor_t$ and estimate the models separately. Coefficients of the three independent variables are expected to be negative when $\Delta Shibor_t$ is high.

Before 2012, we only have quantity information of WMPs issued to individual investors while starting from 2012, we only have quantity information of WMPs issued to all investors. So $WMPdue_{bt}$ and $WMPbal_{bt}$ are not comparable between before 2012 and after 2012. To correct for possible biases, we allow the coefficients of $WMPdue_{bt}$ and $WMPbal_{bt}$ between the two periods to be different.

There are some merits with Model (6) and (7). First, we use daily stock return as dependent variable. Within one day the bank fundamental is unlikely to have any change expect the rollover risk. So we could safely exclude all other variables from the model. Second, there is a mismatch in maturity since stock return is calculated daily while amount of WMPs is calculated monthly. While we do admit this is because we don't have information on daily amount of WMPs mature, we argue this is not likely to be a serious problem. Because from the investors' perspective, they may not know the exact amount of WMPs mature on the single day but only a rough idea of the total WMPs in that month.

III.3 Results

Determinants of WMP Issuance

Results are shown in Table 2. In panel A, spread has a significantly positive effect on WMP issuance, just as predicted. The interaction term between Cap Adequacy Ratio and spread is significantly negative, which means the effect of Cap Adequacy Ratio on WMP issuance is more negative when spread is high.

To get an idea of the net effect of Cap Adequacy Ratio on WMP issuance, we sort spread and divide the sample into three groups and estimate model (1) without the interaction term. As shown in Panel B, the effect of Cap Adequacy Ratio on WMP issuance is only significantly negative when spread is really high. This confirms our prediction. Estimation using LDR instead of Cap Adequacy Ratio gives similar results. In Panel C, the interaction term between LDR and spread is significantly positive when quarter fixed effect is included in the estimation. And in Panel D, the net effect of LDR on WMP issuance increases monotonically with spread.

Insert Table 2 here.

A further test is to analyze the effect of Cap Adequacy Ratio and LDR on principal-guaranteed and principal-nonguaranteed WMPs separately. As argued above, principal-guaranteed WMPs may not help banks to circumvent the quantity regulation while principal-nonguaranteed WMPs can. So the findings above should be more profound for principal-nonguaranteed WMPs.

Table 3 estimates Model (1) and (2) again but separate WMPs into two categories. In Panel A, the interaction term between Cap Adequacy Ratio and spread is significantly negative only for principal-nonguaranteed WMPs. And if we sort the sample according to spread, the effect of Cap Adequacy Ratio on WMP issuance is significantly negative only

when spread is high for both WMPs but the effect on principal-nonguaranteed WMPs is much bigger than on principal-guaranteed WMPs.

Similarly, Panel C shows that the interaction term between LDR and spread is much bigger for principal-nonguaranteed WMPs than on principal-guaranteed WMPs. And if we sort spread and divide the sample, the net effect of LDR on WMP issuance is bigger for principal-nonguaranteed WMPs than on principal-guaranteed WMPs.

Insert Table 3 here.

The above results are in accordance with our prediction. Banks that suffer more from the quantity regulation, e.g. with lower Cap Adequacy Ratio or higher LDR, tend to issue more WMPs especially principal-nonguaranteed WMPs in times when the market rate is well above the deposit rate ceiling.

There is yet another way that WMPs can help with the quantity regulation. When WMPs mature, the principal and gain is collected and the money will be transferred to investors' deposit account with the same banks, so the banks' total deposit will increase. At the same time, LDR is calculated using balances on the last day of each quarter. Therefore, many banks intentionally choose WMP mature date as the last day of each quarter so when LDR is calculated, it's lowered by the increase in total deposit. This is also another reason that WMPs are usually short-term despite that the investment is long-term.

In Figure 3 we show the total number of WMPs matured on each day within a quarter. Since Q1 has 90 days and 91 days in case of leap year, Q2 has 91 days, Q3 and Q4 have 92 days, we label the last day of each quarter in our sample as the 90^{th} day and then label other days backwards. The number of WMPs matured on the last day jumps dramatically as shown

in Figure 3.1. Compare Figure 3.2 and 3.3 we can see that the jump on the last day is exclusively driven by small and medium-size banks.

Insert Figure 3 here.

Compare Figure 3.4 and 3.5, we can see that the jump on the last day is mainly due to principal-nonguaranteed WMPs. As we discussed above, principal-guaranteed WMPs are often records on the balance sheet as deposit and loan, so they cannot help decrease LDR when they mature. But principal-nonguaranteed WMPs are recorded off balance sheet and the maturity effect exists. Banks that want to reduce their LDRs may issue more principal-nonguaranteed WMPs which mature on the last second day of each quarter. We also repeat the analysis for Q1, Q2, Q3 and Q4 separately to make sure the above pattern is not totally driven by the WMPs matured on the second last day of the year. In fact, the pattern exists for all Q1, Q2, Q3 and Q4.

Determinants of WMP Yield

Results are shown in Table 4. For each panel, we classify WMPs according to their target investors and return type and do the estimation for 9 groups. Panel A and B report results using Model (3) for non-big 5 banks and big 5 banks separately and Panel C and D report results using Model (4) for non-big 5 banks and big 5 banks separately.

First consider Panel A. Column (1)-(3) show a slightly significantly positive effect of NPLR on WMP return but only for principal-nonguaranteed WMPs. When we divide WMPs according to the target investors, column (4)-(6) shows that NPLR has a strong positive effect on return of WMPs issued to institutional investors and the effect is much stronger for

principal-nonguaranteed WMPs. For WMPs issued to individual investors, column (7)-(9) show that NPLR doesn't have a significant effect on WMP return.

Insert Table 4 here.

Now turn to Panel B. No matter how we specify WMPs according to the target investors and return type, NPLR doesn't have any significant effect on WMP expected return. Big 5 banks, due to their critical importance to the economy, is almost impossible to go into any measurable trouble because the government offers implicit guarantee for their safety. So the small change in NPLR from 0.81% to 4.32% doesn't indicate meaningless change in bank risk. Small and medium-size banks, however, are in a worse position. For example, in 1998 Hainan Development Bank, a state-owned small bank sponsored by Hainan Province government, was shut down due to liquidity problems. So a small change in NPLR for small and medium-size banks can imply meaningful bank risk change.

In both Panel A and Panel B, Shibor and WMPdue are significantly positive, as predicted. Estimation using Model (4) give similar results, as shown in Panel C and D. In Panel C, the effect of NPLR on principal-nonguaranteed WMP expected return is significantly positive at 1% confidence interval for both institutional and individual investors, and the estimated coefficients are very close to each other. For principal-guaranteed WMPs, however, NPLR doesn't have a significant effect. Estimated coefficients for Shibor and WMPdue are significantly positive and barely change for all 9 regressions.

Now turn to Panel D. Similarly, NPLR doesn't have any significant effect on WMP expected return no matter how we specify WMPs. The above results are in accordance with

our predictions again. Bank risk, measured by NPLR, are reflected in the WMP expected return but only for principal-nonguaranteed WMPs issued by small and medium-size banks.

WMP Rollover Risk

The last step of our analysis is to consider the effect of WMP on bank health. Estimation results for Model (5) are shown in Table 5. 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. Also, WMPdue seems very persistent across time so including bank fixed effect in the regressions would remove all cross-sectional variance. Therefore, bank fixed effect is not included in the regressions.

As shown in Table 5, WMPdue has a significantly positive effect on the difference between average quoted price and Shibor. The effect is also economically important, too. The effect of one standard deviation increase in WMPdue on ask_d is 10%-20% the standard deviation of ask_d.

Insert Table 5 here.

Table 5 also shows that WMPdue mainly affect shor-term Shibor quoted prices up to one-month Shibor. 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. We also do the estimation on monthly basis and the results are similar.

Table 6 reports the estimation results for different groups based on $\Delta Shibor_t$. The 99% percentile for $\Delta Shibor_t$ is 1.2441. Panel A and B show when $\Delta Shibor_t$ is extremely high, namely, bigger than 1.5, the coefficients of $WMPdue_{bt}$ and $WMPbal_{bt}$ are significantly

negative but only for periods starting from 2012 not before. Before 2012, the extent of WMP issuance is far less common among banks and could be irrelevant in pricing bank stocks. But starting from 2012, the issuance of WMP went up to a level that investors couldn't ignore.

Insert Table 6 here.

When $\Delta Shibor_t$ is bigger than 1.5, the estimated coefficient for $\Delta Shibor_t$ is also significantly negative, just as predicted. The R square is big too, indicating a great prediction power of the models. For other subsamples including the one with extremely low $\Delta Shibor_t$, no independent variables have any significant effect, and the R square is ignorable. These results imply a minor rollover risk when Shibor didn't go up so unexpectedly.

IV. CONCLUSIONS

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 1 Summary Statistics

The sample is from January 2008 to December 2014, including 25 banks as listed in Panel C. Big 5 banks are those listed at the top left column of Panel C and the left are small and medium-size banks. Panel A reports bank characteristics at the end of each quarter. LDR is only available for small and medium-size banks. For NPLR of big 5 banks, data are obtained from WIND and 9 out of 140 observations are missing. For each bank, (Quoted price – Shibor) is the average value within each quarter for overnight Shibor. Big 5 banks all participate in the Shibor bid and ask process but only 8 or 9 small and medium-size banks do. Panel B reports total WMP issuance for each bank and each quarter as well as annualized expected return of individual WMPs issued by the 25 banks during the sample period. Return data are winsorized at the 99% percentile. For both issuance and return, statistics are also shown by whether the principal is guaranteed or not.

Panel A: Summary Statistics of Bank Characteristics

Variables		Big 5 Banks	Small and Medium-size Banks
Equity	Max	1510	311
(Billion RMB)	Min	134	2.38
	Mean	645	59.6
Deposit Balance	Max	15600	3290
(Billion RMB)	Min	1770	27.4
	Mean	8400	735
Loan Balance	Max	10400	2290
(Billion RMB)	Min	1130	21.3
	Mean	5330	520
Cap Adequacy Ratio	Max	0.15	0.27
	Min	-0.17	0.06
	Mean	0.12	0.12
LDR	Max	-	93.13
(%)	Min	-	44.49
	Mean	-	68.28
NPLR	Max	4.32	5.21
(%)	Min	0.81	0.01
	Mean	1.36	0.90
Quoted Price - Shibor	Max	0.0983	0.0497
(%)	Min	-0.1719	-0.0302
	Mean	0.0008	0.0031

Panel B: Summary Statistics of WMPs

Variables		Big 5 Banks	Small and Medium-size Banks
Issuance	Max	4250	2180
(Billion RMB)	Min	1.00	0
	Mean	1050	155
Issuance/Equity	Max	9.17	9.95
	Min	0.00	0.00
	Mean	1.60	1.37
Principal-guaranteed	Max	6.51	3.57
Issuance/Equity	Min	0.00	0.00
	Mean	0.73	0.43
Principal-nonguaranteed	Max	3.98	9.49
Issuance/Equity	Min	0.00	0.00
	Mean	0.87	0.95
WMP annualized	Max	7.00	7.00
expected return	Min	0.36	0.36
(%)	Mean	4.48	4.75
Principal-guaranteed	Max	7.00	7.00
WMP expected return	Min	0.36	0.36
(%)	Mean	4.21	4.10
Principal-nonguaranteed	Max	7.00	7.00
WMP expected return	Min	0.80	1.00
(%)	Mean	4.60	4.98
Maturity	Max	2920	3617
(days)	Min	1	1
	Mean	108.96	115.07
	Median	76	88
Principal-guaranteed	Max	1097	2920
Maturity	Min	1	2
(days)	Mean	75.88	96.90
	Median	49	70
Principal-nonguaranteed	Max	2920	3617
Maturity	Min	1	1
(days)	Mean	124.49	121.60
	Median	90	90

Panel C: List of Sample 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 2 Determinants of WMP Issuance

The sample period is from 2008Q1 to 2014Q4. Cap Adequacy Ratio and LDR are values taken at the end of each quarter. Spread is the average difference between 3-month Shibor and 3-month deposit rate ceiling within each quarter. Panel A and C reports results on the whole sample while Panel B and D reports results on subsamples divided by spread. All regressions are clustered by bank.

Panel A: How does Cap Adequacy Ratio affect WMP issuance?

Dep Var: issue/equity	(1)	(2)	(3)	(4)
Cap Adequacy Ratio	9.888**	13.26**	9.005**	11.13**
	(4.657)	(5.576)	(4.173)	(4.779)
Cap Adequacy Ratio*spread	-10.36**	-7.967*	-13.49**	-11.04**
	(4.917)	(4.596)	(4.905)	(4.422)
Spread	1.998***	1.694***	8.135***	7.674***
	(0.603)	(0.550)	(1.182)	(1.078)
Bank fixed effect	No	Yes	No	Yes
Quarter fixed effect	No	No	Yes	Yes
Constant	-0.696	-1.488*	-8.367***	-8.740***
	(0.521)	(0.750)	(1.272)	(1.440)
Observations	700	700	700	700
R-squared	0.154	0.430	0.415	0.680
Cluster	bank	bank	bank	Bank

Panel B: How does spread affect the effect of Cap Adequacy Ratio on WMP issuance?

Dep Var: issue/equity	(1)	(2)	(3)
spread	>1.89	(0.83,1.89)	<0.83
Cap Adequacy Ratio	-42.69***	-2.966	-2.179*
	(10.22)	(2.902)	(1.129)
Spread	21.83***	6.307***	1.373
	(3.301)	(0.975)	(2.521)
Quarter fixed effect	Yes	Yes	Yes
Bank fixed effect	No	No	No
Constant	-42.15***	-6.661***	-0.451
	(6.916)	(1.139)	(2.071)
Observations	200	300	200
R-squared	0.299	0.324	0.095
Cluster	bank	bank	bank

Panel C: How does LDR affect WMP Issuance?

Dep Var: issue/equity	(1)	(2)	(3)	(4)
LDR	-0.00120	0.0210**	-0.0944**	-0.0342
	(0.00809)	(0.00999)	(0.0408)	(0.0319)
Spread	-0.501	5.169***	-0.459	4.465***
	(0.661)	(1.054)	(0.865)	(1.081)
LDR*spread	0.0188*	0.0292**	0.0151	0.0292**
	(0.0104)	(0.0105)	(0.0128)	(0.0106)
Quarter fixed effect	NO	YES	NO	YES
Bank fixed effect	NO	NO	YES	YES
Constant	0.497	-9.634***	6.642**	-5.120*
	(0.578)	(1.702)	(2.690)	(2.483)
Observations	560	560	560	560
R-squared	0.151	0.472	0.461	0.697
Cluster	Bank	Bank	Bank	Bank

Panel D: How does spread affect the effect of LDR on WMP Issuance?

Dep Var: issue/equity	(1)	(2)	(3)
spread	>1.99	(0.79,1.99)	<0.79
LDR	0.0797***	0.0718**	0.00902*
	(0.0272)	(0.0258)	(0.00445)
Spread	24.93***	7.300***	0.199
	(3.964)	(1.169)	(0.364)
Quarter fixed effect	YES	YES	YES
Bank fixed effect	NO	NO	NO
Constant	-59.52***	-13.32***	-0.437
	(10.02)	(2.776)	(0.386)
Observations	140	280	140
R-squared	0.312	0.429	0.095
Cluster	bank	bank	bank

Table 3 Issuance of principal-guaranteed and principal-nonguaranteed WMPs

The sample period is from 2008Q1 to 2014Q4. Cap Adequacy Ratio and LDR are values taken at the end of each quarter. Spread is the average difference between 3-month Shibor and 3-month deposit rate ceiling within each quarter. Panel A and C reports results on the whole sample while Panel B and D reports results on subsamples divided by spread. All regressions are clustered by bank.

Panel A: Effect of Cap Adequacy Ratio on different WMP issuance

	Principal-nonguaranteed		Principal-guaranteed	
Dep Var: issue/equity	(1)	(2)	(3)	(4)
Cap Adequacy Ratio	10.05**	8.732***	3.208	2.395
	(3.680)	(2.994)	(3.595)	(3.651)
Cap Adequacy Ratio*spread	-6.088**	-8.175***	-1.879	-2.861
	(2.822)	(2.842)	(3.171)	(3.166)
Spread	1.214***	5.186***	0.480	2.489***
	(0.355)	(0.857)	(0.368)	(0.635)
Bank fixed effect	Yes	Yes	Yes	Yes
Quarter fixed effect	No	Yes	No	Yes
Constant	-1.530***	-6.294***	0.0418	-2.446***
	(0.513)	(1.058)	(0.456)	(0.815)
Observations	700	700	700	700
R-squared	0.396	0.598	0.401	0.564
Cluster	bank	bank	bank	bank

Panel B: How does spread affect the effect of Cap Adequacy Ratio on WMP issuance?

	Principle-nonguaranteed			Principle-guaranteed		
Dep Var: issue/equity	(1)	(2)	(3)	(4)	(5)	(6)
Spread	>1.89	(0.83,1.89)	<0.83	>1.89	(0.83,1.89)	<0.83
Cap Adequacy Ratio	-28.54***	-2.387	-0.908	-14.15**	-0.579	-1.272*
	(9.253)	(2.109)	(0.919)	(6.252)	(1.340)	(0.647)
Spread	13.98***	4.193***	2.313	7.858***	2.114***	-0.940
	(2.676)	(0.697)	(1.832)	(2.050)	(0.506)	(1.839)
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effect	No	No	No	No	No	No
Constant	-26.80***	-4.333***	-1.508	-15.35***	-2.328***	1.057
	(5.369)	(0.772)	(1.480)	(4.286)	(0.632)	(1.515)
Observations	200	300	200	200	300	200
R-squared	0.200	0.279	0.084	0.204	0.176	0.050
Cluster	bank	bank	bank	bank	Bank	bank

Panel C: Effect of LDR on different WMP issuance

	Principal-nonguaranteed		Principal-guaranteed	
Dep Var: issue_e	(1)	(2)	(3)	(4)
LDR	-0.0671**	-0.0268	-0.0273	-0.00742
	(0.0287)	(0.0262)	(0.0164)	(0.0133)
Spread	-0.361	3.118***	-0.0982	1.347***
	(0.648)	(0.981)	(0.365)	(0.433)
Spread*LDR	0.0111	0.0197**	0.00399	0.00949*
	(0.00973)	(0.00865)	(0.00522)	(0.00512)
Quarter fixed effect	NO	YES	NO	YES
Bank fixed effect	YES	YES	YES	YES
Constant	4.290**	-3.706	2.352**	-1.415
	(1.879)	(2.387)	(1.097)	(1.030)
Observations	560	560	560	560
R-squared	0.423	0.608	0.434	0.635
Cluster	Bank	Bank	Bank	Bank

Panel D: How does spread affect the effect of LDR on WMP issuance?

	Principal-guaranteed			Principal-nonguaranteed		
Dep Var: issue/equity	(1)	(2)	(3)	(4)	(5)	(6)
spread	>1.99	(0.79,1.99)	<0.79	>1.99	(0.79,1.99)	<0.79
LDR	0.0271**	0.0266***	0.00530*	0.0527**	0.0452*	0.00372
	(0.0111)	(0.00803)	(0.00299)	(0.0226)	(0.0232)	(0.00267)
Spread	8.131***	2.263***	0.278	16.79***	5.036***	-0.0782
	(1.936)	(0.481)	(0.247)	(3.362)	(0.971)	(0.164)
Quarter fixed effect	YES	YES	YES	YES	YES	YES
Bank fixed effect	NO	NO	NO	NO	NO	NO
Constant	-19.52***	-4.474***	-0.395	-40.00***	-8.848***	-0.0415
	(4.745)	(0.985)	(0.258)	(8.398)	(2.487)	(0.213)
Observations	140	280	140	140	280	140
R-squared	0.296	0.325	0.099	0.196	0.348	0.053
Cluster	bank	Bank	bank	bank	bank	bank

Table 4 Determinants of WMP Expected Return

The sample includes all WMPs issued by the 25 banks from 2008 to 2014. WMP expected annualized return is stated on the issuing date. Shibor is the value taken on the beginning date with the same maturity. NPLR is value at the end of the last quarter and WMPdue is total WMP due divided by bank equity in this quarter. We classify the investor to be "institution" if the investor targets include institutional investors and "individual" if the investor targets are exclusively individual investors. "P-G" if short for principal-guaranteed WMPs and "P-NG" for principal-nonguaranteed WMPs. Al regressions are clustered by bank.

Panel A: Effect of NPLR on WMP expected return for non-big 5 banks using Model (3)

Investor	All			Institution			Individual		
Return Type	all	P-G	P-NG	all	P-G	P-NG	all	P-G	P-NG
Dep Var: WMPreturn	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shibor	0.439***	0.443***	0.408***	0.418***	0.374***	0.415***	0.426***	0.425***	0.395***
	(0.0204)	(0.0240)	(0.0229)	(0.0197)	(0.0536)	(0.0183)	(0.0249)	(0.0355)	(0.0257)
NPLR	0.356*	-0.00616	0.434*	0.572***	0.230*	0.636**	0.257	-0.0999	0.353
	(0.202)	(0.157)	(0.249)	(0.179)	(0.120)	(0.246)	(0.206)	(0.184)	(0.252)
WMPdue	0.182***	0.164***	0.170***	0.181***	0.165***	0.162***	0.192***	0.177***	0.178***
	(0.0253)	(0.0251)	(0.0321)	(0.0205)	(0.0368)	(0.0379)	(0.0289)	(0.0245)	(0.0296)
Bank fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Quarter fixed effect	NO	NO	NO	NO	NO	NO	NO	NO	NO
Constant	1.906***	1.522***	2.579***	2.516***	1.681***	2.950***	2.022***	1.649***	2.688***
	(0.195)	(0.127)	(0.245)	(0.0952)	(0.230)	(0.0843)	(0.197)	(0.170)	(0.255)
Observations	75,204	19,826	55,378	15,604	4,407	11,197	59,600	15,419	44,181
R-squared	0.481	0.519	0.513	0.523	0.620	0.542	0.494	0.553	0.514
Cluster	Bank	bank	bank	bank	bank	bank	bank	bank	bank

Panel B: Effect of NPLR on WMP expected return for big 5 banks using Model (3)

Investor		All			Institution			Individual	
Return Type	All	P-G	P-NG	all	P-G	P-NG	all	P-G	P-NG
Dep Var:WMPreturn	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shibor	0.432***	0.400***	0.403***	0.455***	0.435***	0.459***	0.398***	0.372***	0.369***
	(0.0511)	(0.0619)	(0.0385)	(0.0687)	(0.0585)	(0.0900)	(0.0568)	(0.0741)	(0.0367)
NPLR	-0.293	0.108	-0.292	-0.0365	0.0521	-0.284	-0.746**	0.0424	-0.540
	(0.365)	(0.214)	(0.383)	(0.524)	(0.335)	(0.641)	(0.177)	(0.158)	(0.415)
WMPdue	0.204***	0.228***	0.222***	0.136	0.209*	0.0853	0.213***	0.247***	0.233***
	(0.0167)	(0.00457)	(0.0205)	(0.0805)	(0.0817)	(0.120)	(0.0216)	(0.00762)	(0.0226)
Bank fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Quarter fixed effect	NO	NO	NO	NO	NO	NO	NO	NO	NO
Constant	1.794**	1.143**	1.895**	2.157	1.735	2.881	2.364***	1.172**	2.237**
	(0.532)	(0.400)	(0.524)	(1.095)	(0.815)	(1.442)	(0.297)	(0.341)	(0.489)
Observations	56,018	17,836	38,182	14,239	6,050	8,189	41,779	11,786	29,993
R-squared	0.506	0.652	0.519	0.400	0.491	0.438	0.549	0.709	0.559
Cluster	Bank	bank	bank	bank	bank	bank	bank	bank	bank

Panel C: Effect of NPLR on WMP expected return for non-big 5 banks using Model (4)

Investor	All			Institution			Individual		
Return Type	All	P-G	P-NG	all	P-G	P-NG	all	P-G	P-NG
Dep Var:WMPreturn_d	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shibor_d	0.629***	0.607***	0.630***	0.555***	0.521***	0.573***	0.647***	0.603***	0.646***
	(0.0206)	(0.0383)	(0.0153)	(0.0259)	(0.0290)	(0.0239)	(0.0199)	(0.0346)	(0.0159)
NPLR	0.382***	0.0532	0.448***	0.391***	-0.0486	0.464***	0.348**	0.0408	0.424***
	(0.108)	(0.160)	(0.136)	(0.131)	(0.174)	(0.145)	(0.131)	(0.179)	(0.140)
WMPdue	0.138***	0.111***	0.128***	0.139***	0.121***	0.122***	0.141***	0.110***	0.130***
	(0.0145)	(0.0215)	(0.0208)	(0.0164)	(0.0334)	(0.0250)	(0.0175)	(0.0171)	(0.0198)
Bank fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Quarter fixed effect	NO	NO	NO	NO	NO	NO	NO	NO	NO
Constant	0.358***	0.117	0.817***	1.262***	0.842***	1.449***	0.338**	0.137	0.792***
	(0.106)	(0.177)	(0.111)	(0.0653)	(0.0952)	(0.0467)	(0.128)	(0.182)	(0.118)
Observations	75,204	19,826	55,378	15,604	4,407	11,197	59,600	15,419	44,181
R-squared	0.650	0.650	0.690	0.597	0.642	0.634	0.677	0.691	0.711
Cluster	bank	bank	bank	bank	bank	bank	bank	bank	bank

Panel D: Effect of NPLR on WMP expected return for big 5 banks using Model (4)

Investor	All			Institution			Individual		
Return Type	All	P-G	P-NG	all	P-G	P-NG	all	P-G	P-NG
Dep Var:WMPreturn_d	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Shibor_d	0.629***	0.693***	0.619***	0.616***	0.676***	0.588***	0.633***	0.702***	0.625***
	(0.0166)	(0.0392)	(0.0261)	(0.0181)	(0.0128)	(0.0147)	(0.0219)	(0.0578)	(0.0339)
NPLR	0.168	0.401	0.220	-0.0651	-0.199*	-0.102	0.274	0.911*	0.430
	(0.214)	(0.318)	(0.258)	(0.275)	(0.0803)	(0.409)	(0.214)	(0.394)	(0.301)
WMPdue	0.150***	0.165***	0.141***	0.0810*	0.0853*	0.0650	0.156***	0.185***	0.147***
	(0.0150)	(0.0122)	(0.0227)	(0.0366)	(0.0330)	(0.0620)	(0.0171)	(0.00441)	(0.0244)
Bank fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
Quarter fixed effect	NO	NO	NO	NO	NO	NO	NO	NO	NO
Constant	0.310	-0.278	0.325	1.317**	1.238***	1.626*	0.136	-1.041	0.0394
	(0.297)	(0.466)	(0.303)	(0.463)	(0.215)	(0.716)	(0.309)	(0.612)	(0.328)
Observations	56,018	17,836	38,182	14,239	6,050	8,189	41,779	11,786	29,993
R-squared	0.667	0.716	0.664	0.646	0.721	0.631	0.678	0.732	0.679
Cluster	bank	bank	bank	bank	bank	bank	bank	bank	bank

Table 5 WMP Rollover Risk and Shibor Quoted Price

The sample period is from 2008Q1 to 2014Q4. Cap Adequacy Ratio is the value taken at the end of each quarter. WMPdue is total WMP matured in this quarter divided by bank equity at quarter end. We standardize WMPdue by dividing its standard deviation. Because there are only 14 banks in the sample, we clustered the regression by quarter. The last row reports the standard deviation of the corresponding dependent variables.

Dep Var: ask_d	Overnight	1-week	2-week	1-month	3-month	6-month
	(1)	(2)	(3)	(4)	(5)	(6)
Cap Adequacy Ratio	-0.0145	-0.0624**	-0.0533	-0.0323	0.0326	-0.00819
	(0.0142)	(0.0265)	(0.0333)	(0.0417)	(0.0482)	(0.0449)
WMPdue	0.00126***	0.00465**	0.00794***	0.00703**	0.00458	0.0115
	(0.000403)	(0.00192)	(0.00209)	(0.00320)	(0.00426)	(0.00742)
Quarter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.00234	0.0138***	0.00527	-0.000869	-0.00859*	0.00243
	(0.00138)	(0.00254)	(0.00313)	(0.00390)	(0.00479)	(0.00514)
Observations	383	383	383	383	383	383
R-squared	0.059	0.063	0.053	0.070	0.051	0.105
Cluster	Quarter	Quarter	Quarter	Quarter	Quarter	Quarter
sd of dep variable	0.0105	0.0287	0.0395	0.0646	0.0589	0.0672

Table 6 WMP Rollover Risk and Equity Market Response

The sample period is from Jan, 2009 to Dec, 2014. For each day, stock daily return is calculated using closing price, due_e is total amount of WMPs due in that month divided by equity at month end, balance_e is total WMP balance divided by bank equity at month end, and 1-week Shibor change in the today's 1-week Shibor minus yesterday's 1-week Shibor. All regressions control for heterogeneity.

Panel A: Total WMPs due as independent variable

1-week Shibor change	(1.5,∞)	(1.1.5]	(0.5,1]	(-∞,-1.5]
Dep Var: daily return	(1)	(2)	(3)	(4)
WMPdue*before	-0.861*	-0.809	0.105	-0.215
	(0.457)	(0.678)	(0.157)	(0.394)
WMPdue*after	-1.038***	-0.378	0.154	-0.236
	(0.250)	(0.229)	(0.0984)	(0.198)
ΔShibor	-0.996***	2.009*	-0.173	-0.109*
	(0.206)	(1.184)	(0.265)	(0.0618)
Constant	2.115***	-1.876	-0.0864	0.00607
	(0.485)	(1.513)	(0.199)	(0.281)
Observations	160	176	972	144
R-squared	0.193	0.029	0.005	0.023

Panel B: Total WMP balance as independent variable

1-week Shibor change	(1.5,∞)	(1.1.5]	(0.5,1]	(-∞,-1.5]
Dep Var: daily return	(1)	(2)	(3)	(4)
WMPbal*before	-0.593	0.381	0.0623	0.142
	(0.426)	(0.482)	(0.138)	(0.289)
WMPbal*after	-0.683***	-0.0241	0.0826	-0.0810
	(0.161)	(0.161)	(0.0628)	(0.111)
ΔShibor	-1.069***	2.213*	-0.161	-0.0896
	(0.212)	(1.140)	(0.268)	(0.0639)
Constant	2.400***	-2.569*	-0.0928	-0.0690
	(0.560)	(1.462)	(0.216)	(0.283)
Observations	160	176	972	144
R-squared	0.189	0.017	0.003	0.020

Figure 1 WMP Issuance across Time

Figure 1.1 reports average WMP issuance across big 5 banks and non-big 5 (small and medium-size) banks for each quarter. Figure 1.2 reports the average value of WMP issuance divided by bank equity at quarter end across big 5 and non-big 5 banks. In Figure 1.3 and Figure 1.4, WMPs are divided by whether the principal is guaranteed or not. Figure 1.3 and Figure 1.4 report statistics for big 5 banks and non-big 5 banks, respectively.

Figure 1.1: Total WMP Issuance across time

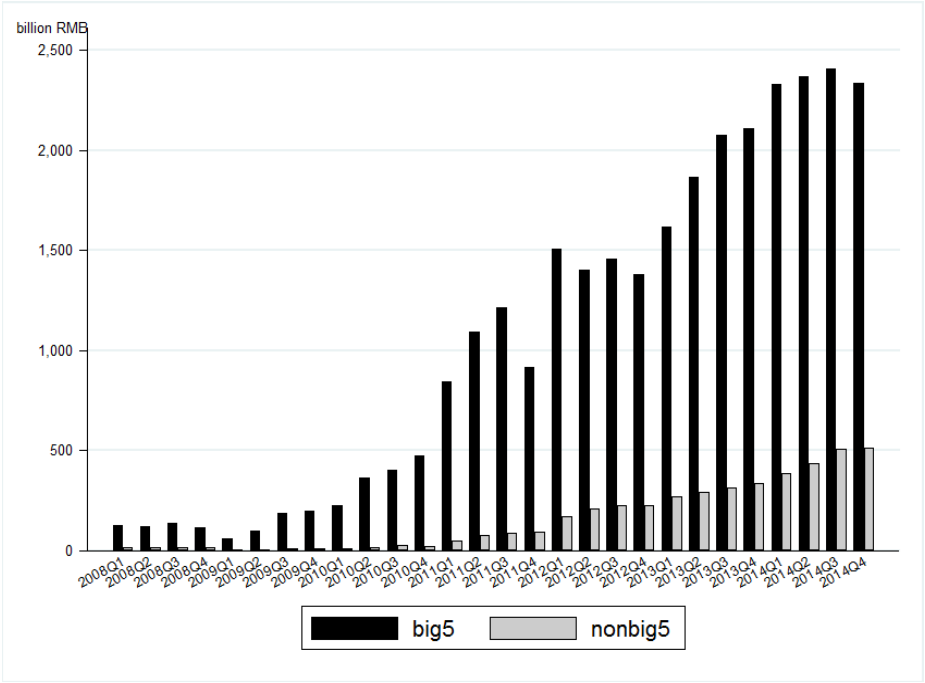

Figure 1.2: Total WMP Issuance / bank equity

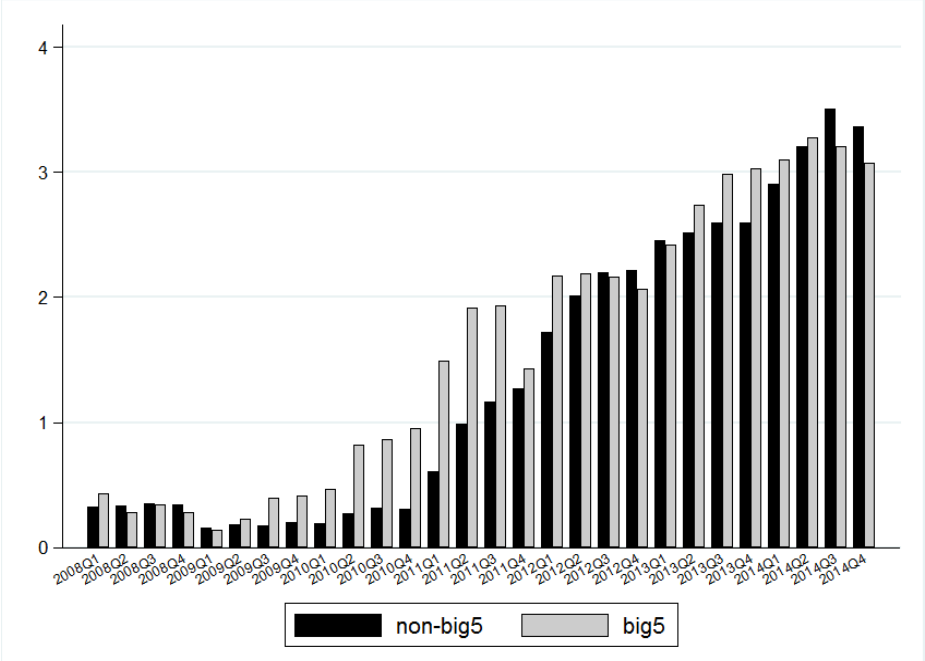

Figure 1.3: (Total WMP Issuance / bank equity) grouped by return type of big5 banks

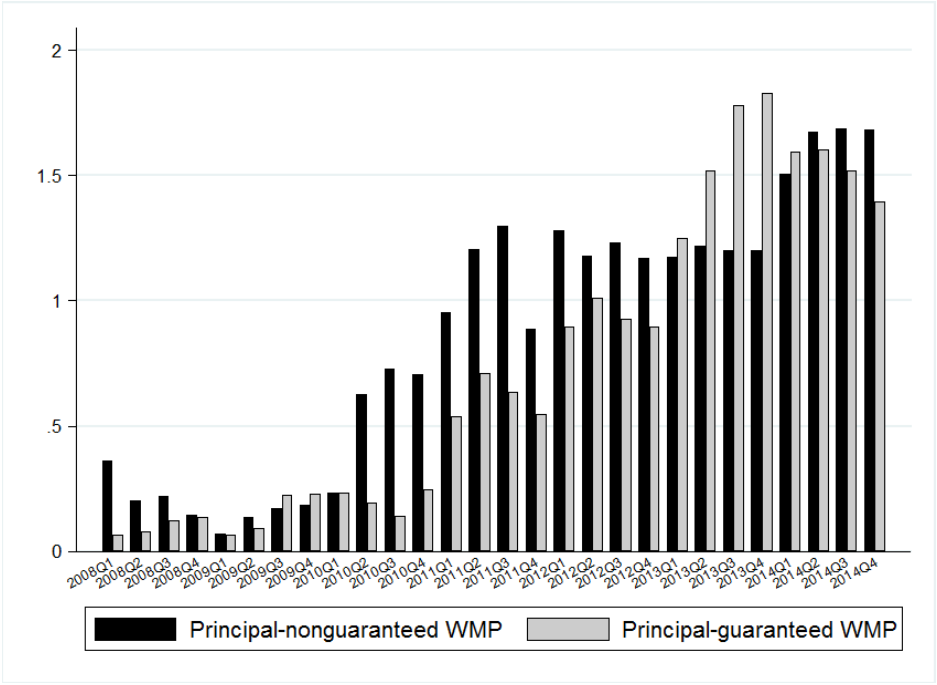

Figure 1.4: (Total WMP Issuance / bank equity) grouped by return type of non-big5 banks

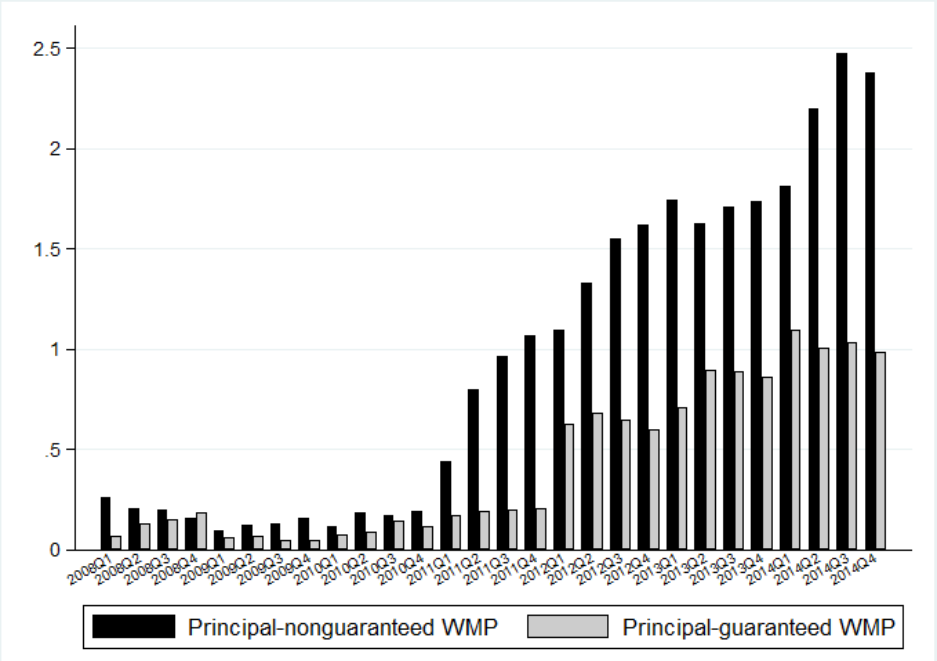

Figure 2 Interest Rate Change across Time

Figure 2.1 divides WMPs into four categories: whether it's issued by big5 banks and whether it's principal-guaranteed (P-G) or principal-nonguaranteed (P-NG) and reports change of WMP expected annualized return across sample period. Figure 2.2 reports the 3-month Shibor rate and 3-month deposit rate ceiling across sample period.

Figure 2.1: WMP expected annualized return across time

Figure 2.2: 3-month Shibor and deposit rate ceiling across time

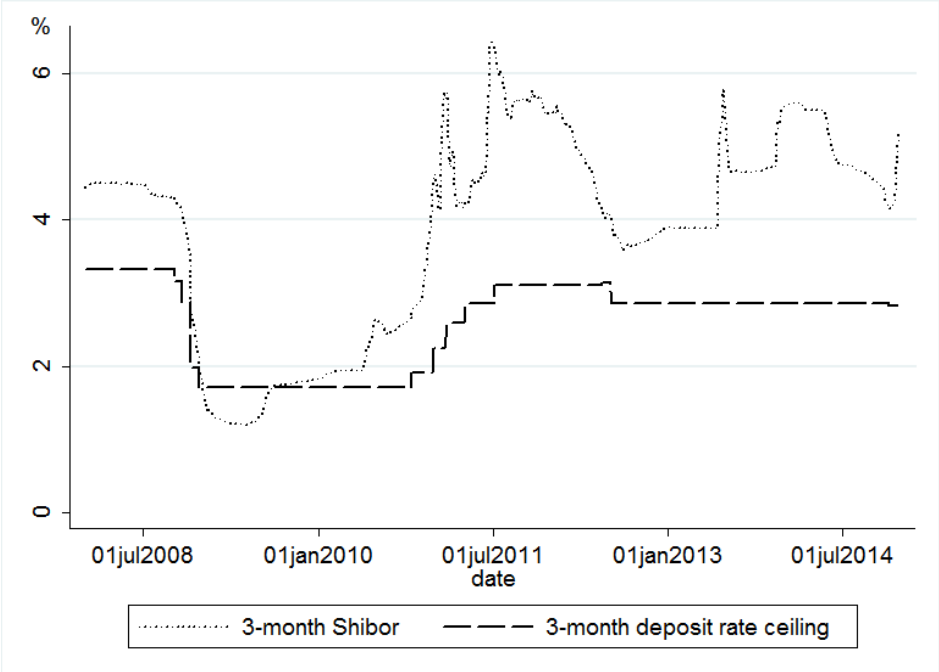

Figure 3 WMP Maturity Date Timing

All the individual WMP information is collected from WIND. We label the last day of each quarter in our sample as the 90th day and then label other days backwards. Figure 3.1 shows total number of WMPs matured on each day of a quarter. Figure 3.2 and 3.3 shows the total number of WMPs issued by big 5 band non-big 5 banks, respectively. Figure 3.4 shows the total number of principal-nonguaranteed WMPs matured on each day of a quarter while Figure 3.5 shows principal-guaranteed WMPs.

Figure 3.1: Number of WMPs due on each day within a quarter

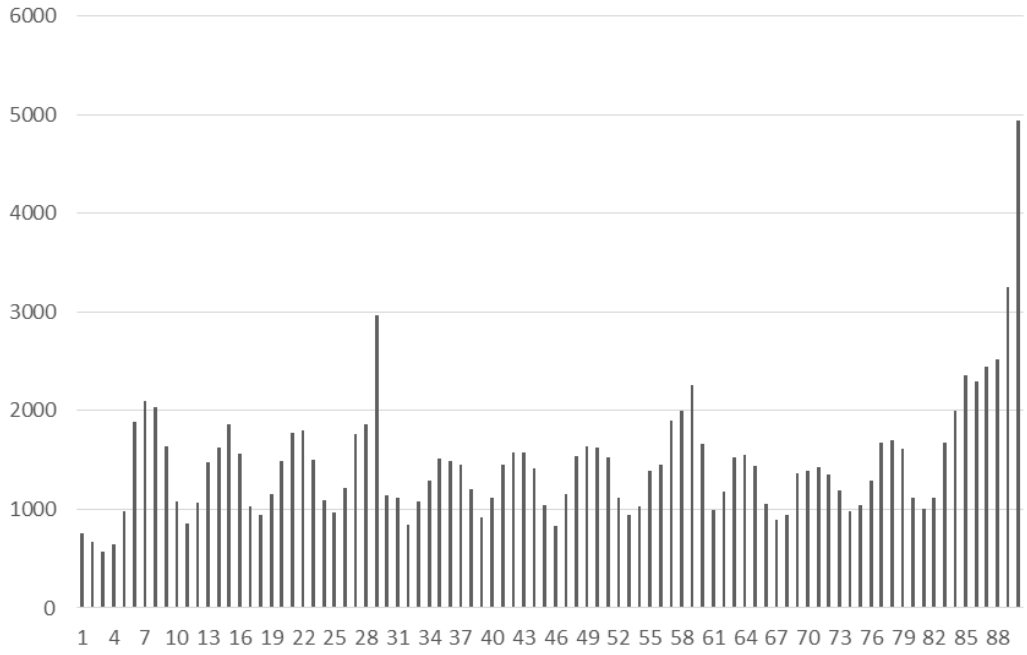

Figure 3.2: Number of WMPs issued by big 5 banks due on each day within a quarter

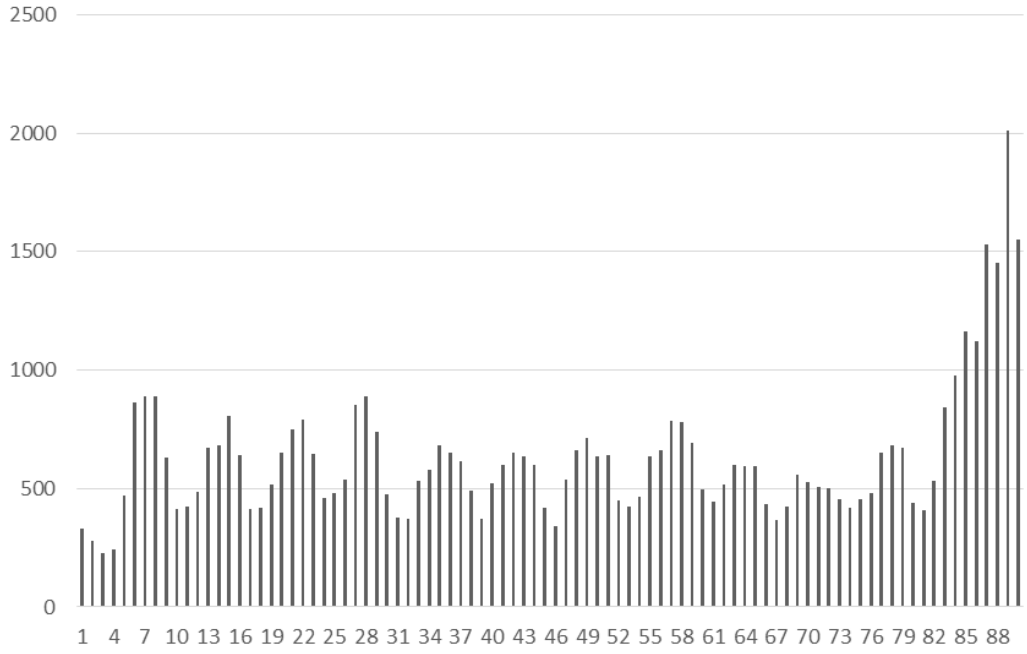

Figure 3.3: Number of WMPs issued by non-big 5 banks due on each day within a quarter

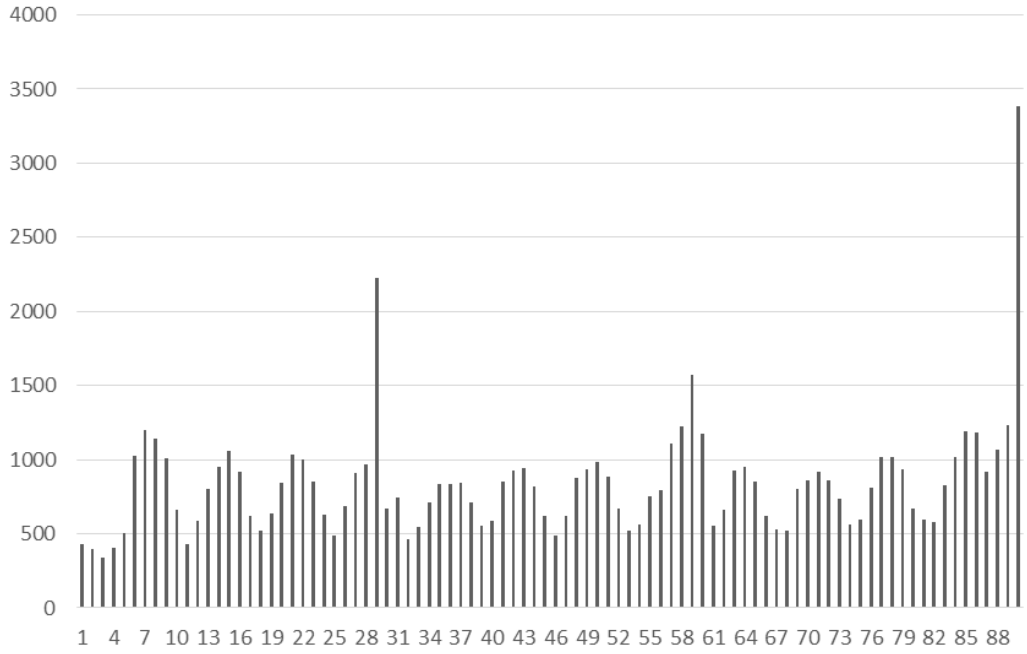

Figure 3.4: Number of principal-nonguaranteed WMPs due on each day within a quarter

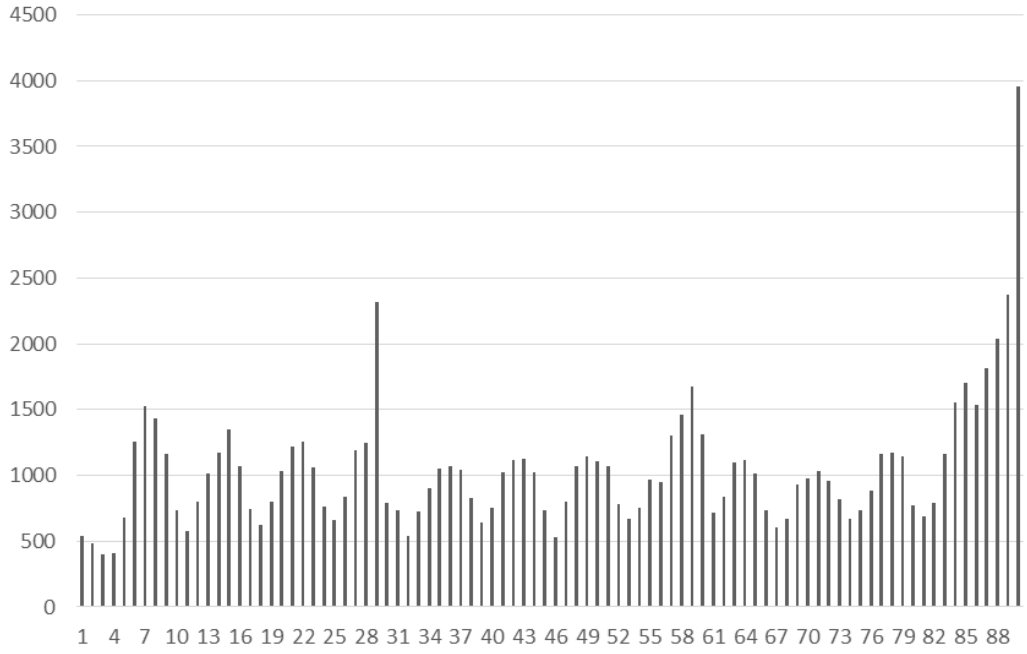

Figure 3.5: Number of principal-guaranteed WMPs due on each day within a quarter