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FISCAL STIMULUS, DEPOSIT COMPETITION, AND THE RISE OF SHADOW BANKING: EVIDENCE FROM CHINA

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ABSTRACT

The rise of shadow banking and attendant financial fragility in China can be traced to intensified deposit competition following the global financial crisis (GFC). Deposit competition intensified after the GFC because the GFC slowed down banks' deposit growth from cross-border money inflows and simultaneously led to fiscal stimulus supported by banks' credit expansion. Exploiting the fact that one big state-owned bank was particular affected by the GFC through these two channels, we document—by exploring small and medium-sized banks' branch-level overlap with this big bank—that deposit competition increased banks' reliance on shadow banking. In particular, exposed banks issued Wealth Management Products (WMPs)—short-maturity, off-balance-sheet substitutes for deposits—creating rollover risks for the issuers, as reflected by higher yields on new WMPs, higher borrowing rates in the interbank market, and lower stock-market performance during liquidity stress.

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I. INTRODUCTION

Shadow banking – unregulated or lightly regulated non-bank part of the financial sector lacking an explicit safety net – has evolved into a significant fraction of the overall financial sector in not just developed but also emerging market economies. IMF (2014) notes that under some measures, shadow banking grew not only before the global financial crisis but also after, and in emerging markets too, its growth outpaced the growth of the traditional banking system. Understanding the causes and consequences of its growth is thus becoming an important area of research in academia, policy, and practice. While the focus in the extant literature has been on monetary policy (the level of interest rates in particular) and on private incentives to arbitrage bank regulation (most notably capital requirements)[1], we show in this paper that large-scale *fiscal* policies can also give rise to a rapid growth of the shadow banking system.

We hypothesize that as banks, especially state-owned banks, dramatically increase lending to implement the fiscal policy (absent monetary easing), they will compete more aggressively for deposits. Intensified deposit competition will not only increase deposit rates and reduce bank profits but also drive banks to other funding sources as they seek to maintain accounting profitability at least for the short term, for instance, by issuing off-balance-sheet shadow-banking products which can increase profits but are not subject to balance-sheet regulations. Given the different maturity structures and safety-net privileges between deposits and deposit-like shadow-banking products, such a shift induced by fiscal policy can materially influence the rollover risk of the banking sector.

We establish this mechanism by studying the role of the RMB 4 trillion fiscal stimulus in China following the global financial crisis (GFC) in spurring growth and fragility in its shadow banking sector.[2] We focus on banks' issuance of Wealth Management Products (WMPs), which are short-maturity, deposit-like shadow-banking products that took off in scale after 2010 (see Figure 1). The fiscal stimulus was implemented with unprecedented credit expansion of banks during 2009-2010; meanwhile, the GFC slowed down bank deposit growth from *cross-border* money inflows. As a result, bank deposit competition intensified since 2011 when the monetary easing ended.

[1] Recent research finds – we elaborate in Related Literature (Section 2) – that the shadow banking sector can arise outside the traditional banking system due to tightened regulations on banks (Buchak et al., 2018; Xiao, 2020), or within the banking system in the form of regulatory arbitrage (Acharya et al., 2013a, 2013b; Borst, 2013), but regardless remains connected to the banking system (Acharya et al., 2023a).

[2] The *Financial Times* reports that according to an analysis of 103 Chinese banks by Wigram Capital Advisors, shadow bank lending accounts for 16.5% of the formal loan book (*FT* May 2 2016, *China financial regulator clamps down on shadow banking*, by Don Weinland and Gabriel Wildau).

To find plausibly exogenous variation of deposit competition in the cross section, we exploit the fact that while all large banks experienced credit expansion to support the fiscal stimulus, one of the "Big Four" state-owned banks, Bank of China (BOC), was much more aggressive than others. BOC was also the most predominant financial institution serving the import-export sectors and suffered disproportionately large losses in foreign currency deposits due to the export slump.[3] Starting in 2011, when the stimulus ended and the monetary policy was tightened, BOC competed more aggressively than others for deposits. Using geographical exposure to BOC as an exogenous shock of deposit competition for various banks after 2010, we find that intensified deposit competition not only reduces bank deposit balance, increases deposit rates and reduces bank profits, but also leads to more reliance on WMPs and other liabilities. Finally, we document that this rapid growth imposed substantial rollover risks for the issuing banks, as reflected by higher yields on new WMPs, higher borrowing rates in the inter-bank market, and worse stock market performance during episodes of liquidity distress.

In terms of institutional setting, the banking sector in China is dominated by the Big Four banks, including the Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), Agricultural Bank of China (ABC), and BOC. In addition, there are many small- and medium-sized banks (SMBs), focusing their operation in a few regions. Bank deposits have historically been tightly regulated in China. During our sample period of 2007-2015, the People's Bank of China (PBC, China's central bank) set time-varying ceilings on bank deposit rates, which were almost always binding. Such ceilings limit banks' capability to adjust deposit rates. In practice, banks can partially circumvent these ceilings by offering small gifts to depositors which will not show up as interests. In addition, the loan-to-deposit ratio (LDR) requirement—loan balance *not* to exceed 75% of deposit balance—placed a cap on bank's (on-balance-sheet) lending activities.

WMPs are not subject to these on-balance-sheet regulations. For instance, investment projects financed by *principal-floating* WMPs[4] are recorded off banks' balance sheets and do *not* raise on-balance-sheet LDR. WMPs are not subject to any price restrictions, either, so that banks can offer WMPs at higher rates than regulated deposit rates to attract more savings. Moreover, banks can design the structure of WMPs—including the issuing amount and

[3] The exchange of export-related foreign currency deposits for domestic-currency (RMB) deposits was one of the main channels of M0 increase in China before the slowdown of net exports due to the GFC (Reuter report).

[4] Principal-floating WMPs are products whose principal is not explicitly guaranteed to be paid in full by the issuing bank, and principal-guaranteed WMPs are products with principal explicitly guaranteed to be paid in full. Principal-guaranteed products are usually recorded on the bank's balance sheet, while principal-floating products are always off the bank's balance sheet, and hence we emphasize the principal-floating products by more.

maturity—on a *product* basis to manage their liquidity needs. In contrast, the adjustment of deposit rates would apply to all the depositors, including those who are yield insensitive; and banks cannot arbitrarily set the deposit maturity as they wish due to regulation constraints.

In our first set of empirical tests, we link the jump in WMP issuance after 2010 to the massive fiscal stimulus and heightened deposit competition that ensued. To address the endogeneity of deposit competition, we begin by discussing why and how BOC differed from other big state-owned banks in its role during the GFC and the fiscal stimulus. On the one hand, the cross-border money inflows decreased dramatically in 2009 as China's export slumped due to the GFC, and it kept decreasing until 2015. While all banks' deposit growth was affected, BOC was hurt the most due to its dominant market share in international settlements and a much higher sensitivity of deposit growth to cross-border money inflows as compared to other big banks. On the other hand, BOC was much more supportive for the stimulus in terms credit expansion. From 2008 to 2010, loan balance increased by 77% for BOC, as compared to 60% for ABC, 48% for both the CCB and ICBC, and 59% for all banks as a whole. The combination of the contraction of foreign-currency deposits and unprecedented credit expansion of BOC led to the swift rising of its LDR, inching close to the 75% ceiling in 2010. Since 2011, as the monetary easing ended and the LDR regulation became more strictly enforced as part of the monetary tightening (Hachem and Song, 2021), BOC had to compete more aggressively for deposits. The average deposit rates it offered were close to those by the other three big banks before 2010, but exceeded the average rates offered by the other banks by 20 bps after 2010.

Since the bank deposit market in China is mostly local, in that banks operate local branches to source retail deposits, heightened deposit competition from BOC would have a larger impact on those SMBs with more branching overlap with BOC.[5] Accordingly, we use information of branch location of *all* the commercial banks to measure each SMB's exposure to BOC competition based on their branching overlap with BOC in 2010. We then examine whether exposure to BOC competition affects SMBs' deposit availability after 2010 with a "difference-in-differences" (DID) estimation strategy and study how banks respond to the exogenous shock of deposit availability induced by BOC competition after 2010.[6]

[5] SMBs likely also enjoy lower trust and expected safety net, limiting their ability to compete in deposit markets with the largest state-owned banks. Acharya et al. (2020) use a similar variation in competition from state-owned banks to document crowding out of private sector banks by state-owned banks in India.

[6] The identification assumption of our DID strategy is that SMBs, regardless of their exposure to BOC competition, should exhibit parallel trends if there were no such treatment. To support this assumption, we conduct an event study with 2010 as the base year and find no significant difference between banks with differential exposure to BOC competition before 2010 in terms of various bank characteristics, including deposit-to-assets ratio (DAR), WMP Balance/Assets, non-deposit liabilities-to-asset ratio (NDLAR), average deposit rates, average WMP yields, return on asset (ROA), loan-to-asset ratio (LAR), leverage and size (i.e., log(assets)). We also

We start by examining the first stage. Using the DID estimation strategy with bank fixed effects and province-year fixed effects, consistent with our conjecture, we find that branch overlap with BOC has a significant and negative impact on the SMBs' DAR (deposits-to-assets ratio) after 2010. In contrast, branch overlap with the other three big banks, regardless of it being measured individually or collectively, has no significant impact on the SMBs' DAR after 2010. We then use the exposure to BOC competition post-2010 as an instrument variable for SMBs' DAR, and find a significant causal impact of deposit availability on WMP issuance. In terms of magnitude, a one-dollar loss of deposits will lead to a one-dollar increase of WMP balance. When we decompose WMPs based on its yield type, we find the effect is mostly driven by the off-balance-sheet, principal-floating products.[7]

The effect of deposit competition goes beyond the issuance of WMPs. Regarding other sources of funding, intensified deposit competition is found to increase the banks' interbank borrowing and bond financing, but there is no significant effect on other passive liabilities from their business operation. In terms of magnitude, the loss of deposits induced by BOC competition is fully compensated with the increase of interbank borrowing and bond financing. As a result, we do not find any significant impact of deposit competition on the SMBs' on-balance-sheet assets, including loan-to-asset ratio, asset growth and average loan interest rates.

If the SMBs can fully make up the loss of deposits with other on-balance-sheet liabilities, why do they still issue WMPs? One explanation for the issuance of off-balance-sheet WMPs is similar to the practice of "reaching for yield" (Becker and Ivashina, 2015)—fund managers take on excessive *unmeasured* risks when the fund performance is evaluated based on measured risks. Similarly, banks are regulated and evaluated mostly based on their balance sheet, and the decrease in profits could force them to generate profits from off-balance-sheet activities. In this context, deposit competition is found to increase SMBs' average deposit rates and WMP yields, and the other on-balance-sheet liabilities, i.e., interbank borrowing and bond financing, are usually much costlier than deposits. As a result, banks' profitability is significantly and negatively impacted. When the exposure to BOC competition increases from the 10th to 90th

examine the exogeneity of BOC exposure—a stronger assumption than needed for the identification of DID estimation—by regressing all these bank characteristics (measured in 2010) on the banks' exposure to BOC competition. Only the coefficient for size is marginally significant. Moreover, branching overlap with BOC does not correlate with the SMBs' direct exposure to the slowdown of cross-border money net inflows, neither does the local market (branch) share of BOC correlate with the implementation of the fiscal stimulus across different places. Therefore, SMBs' branch overlap with BOC is not likely to capture some other major shocks that occurred around 2010 and directly affected SMBs thereafter.

[7] The Big Four banks also increased WMP issuance during the post-stimulus period. The deposit competition mechanism may also apply to these banks, although the magnitude is likely to differ due to their advantages in the deposit market.

percentile, the average ROA decreases by 0.2% (the sample mean during 2011-2015 was 0.9%) and ROE decreases by 3.0% (the mean during 2011-2015 was 12.5%). Profits from off-balance-sheet activities partially make up the profit loss. On average, off-balance-sheet commissions and fees can make up one quarter of the profit loss due to more fierce deposit competition. The short-term profit-seeking motive of banks is also consistent with the findings of several recent papers. For example, Meiselman et al. (2023) find that higher ROE of banks can indicate profit-seeking at the cost of greater exposure to tail risks, and Acharya et al. (2023b) find that taking on liquidity risk by banks may be a form of searching for yield or gambling for resurrection.

We provide complementary tests on two alternative hypotheses about the nature of the branch overlap with BOC. The first concern about the BOC competition measure is that it may capture unobserved local demand shock occurred after the fiscal stimulus which led to an increase in BOC and SMBs' demand for funding. To rule out this hypothesis, we explore *within*-bank variations of branch expansions across different cities. The bank-by-year fixed effect controls for any bank-level shocks and the cross-city variation of branch expansion can only be driven by local factors. The demand shock hypothesis should predict more new branches by SMBs in places with more BOC branches. However, we find that for a given SMB, the number of new branches decreased by more after 2010 in cities with more BOC branches in 2010, consistent with the deposit competition and against the demand shock hypothesis.

The second alternative hypothesis stipulates that *local demand* for WMPs happened to be positively correlated with BOC's branch presence. For instance, BOC has stronger presence in the coastal areas, which are more economically developed and the local demand for WMPs may be higher. To examine this hypothesis, we explore within-city variations of WMP offering across different banks. The key explanatory variable is the bank's branch overlap with BOC in *other* cities in 2010. With the city-by-year fixed effect to control for local WMP demand, we find that in a *given* city, the number of WMPs offered by a bank increased by more after 2010 if the bank has more branching overlap with BOC in *other* cities, consistent with the deposit competition hypothesis, as against the local WMP demand hypothesis.

The next set of questions relates to the implications for the issuing banks and the financial markets of the shift from deposit to WMP financing. Meiselman et al. (2023) show with empirical evidence that the short-term profit-seeking strategy of banks is in general associated with greater realization of tail risks. In our context, the short-term profit seeking motives for issuing WMPs can expose banks to greater rollover risks. Deposits provide a stable source of funding for banks, while WMPs need to be frequently rolled over due to their shorter maturities

(typically three to six months) and much longer horizons of the underlying investment projects.[8] Thus, banks face inherently greater maturity mismatch risk when they switch from deposits to WMPs. As the scale of WMPs grows, the rollover risks of WMPs also grow, with potential spillovers in funding stress to other banks. We present three pieces of suggestive evidence consistent with the emergence of such financial fragility.

First, we show that at the WMP level, when there is a greater amount of WMPs due in a quarter, banks offer significantly higher yields on the individual *new* products in excess of the deposit rate ceilings to attract new investors and meet redemption of the maturing products. These results hold for both large banks and SMBs, and both principal-floating and guaranteed WMPs. The magnitude of the effect is larger for WMPs of shorter maturities. At the aggregate level, the average WMP yield spread over the deposit rate ceiling closely tracks the amount of WMPs to roll over for the Big Four banks as well as for the SMBs.

Secondly, WMPs also affect banks' behavior in the interbank market. At the bank-level, the Big Four banks and the next ten largest banks that submit SHIBOR (Shanghai Inter-bank Offer Rate) quotes, will ask for significantly higher quotes when they have more WMPs approaching maturity. At the aggregate level, the one-week SHIBOR rises sharply after 2010, closely tracking the aggregate amount of maturing WMPs issued by the Big Four banks. This result suggests that the frequent rollovers of WMPs impose pressure on (interbank) market liquidity.

Finally, to show that investors appear to 'price' the banks' rollover risks, we examine the stock market's response during episodes of 'credit crunches,' i.e., when the cost of interbank funds unexpectedly rises as measured by incidence of above-threshold level increases of SHIBOR quotes. We find that stock prices drop more for banks with more WMPs maturing in the short run during these episodes of interbank liquidity stress, indicating that investors and the market are indeed concerned about the extent of banks' rollover risks.

The rest of the paper is organized as follows. In Section II, we review related literature, and in Section III we describe China's banking sector and the regulatory framework. We present our sample of WMPs and their issuing banks, and link the rise of WMPs to the 4-trillion stimulus plan and bank competition in Section IV. In Section V, we study the rollover risk of WMPs and their issuing banks. We conclude in Section VI.

[8] One reason for the short maturities is to help banks conduct 'window dressing' before regulatory actions. Regulators monitor LDRs at the quarter end; when WMPs mature, issuing banks can transfer the funds from the investors' WMP accounts to their deposit accounts, which temporarily boosts deposit levels and lowers the LDR. We find that the maturity date of WMPs clusters immediately before the end of a quarter, consistent with this window dressing hypothesis.

II. RELATED LITERATURE

To the best of our knowledge, this is the first paper to show that *fiscal stimulus*—a supply-side shock to bank lending – interacting with bank competition and regulation in unintended ways – can spur the growth of shadow banking and engender financial fragility.

Our work extends the recent literature on the role of bank deposits as a transmission channel of macroeconomic policies. Recently, Drechsler et al. (2017, 2018) show that tightening *monetary* policies can trigger loan contraction due to the market power of large banks in the deposit markets. Xiao (2020) finds that some of the deposit outflow will feed the shadow banking sector during periods of tightening monetary policies; specifically, "shadow banks" in the US, including money market funds, raise interest rates more than commercial banks, leading to a shift of deposits from commercial banks to shadow banks. In the context of the residential mortgage market in the US, Buchak et al. (2018) and Gopal and Schnabl (2020) show that the aftermath of the global financial crisis and a tightening of bank regulations led to a contraction of bank credit, and shadow banks, including online, "fintech" lenders, partially filled the gap. Credit contraction in the form of mortgage loans can be substituted by riskier, privately funded credit, which appears to have in part fueled the housing market boom in the US prior to the GFC (Drechsler et al., 2021). Relatedly, Sarto and Wang (2023) argue that persistent low interest rates make banking business less profitable, contracting their investments to maintain deposit branches as well as lending activity, and spurring shadow-banking growth (in areas with adversely-affected banks).

In contrast to these papers, we show that large *fiscal* stimulus, and the induced lending by banks, can (also) trigger heightened deposit competition (even when it is not accompanied with monetary easing), which in turn leads to the growth of shadow banking and more fragility of the financial system. This role of fiscal stimulus has not been examined hitherto, even though fiscal or housing stimulus policies have coincided with the settings explored in these prior studies of shadow banking growth.

Our study also contributes to the literature on the formation and risks of shadow-banking products in the pre-GFC period. As the WMPs in China are offered directly by commercial banks and there is recourse to their balance-sheets, they resemble those products packaged with bank loans and sold to investors in the pre-GFC "originate and distribute" model of intermediation in the developed economies. For instance, after financial institutions sold the loans and other (unpackaged) debt products to the underwriters, there remained some

connection between the structured products and the originating institutions in the U.S. In this sense, the growth of WMPs in China closely resembles the growth and collapse in the issuance of asset-backed commercial paper in the U.S. due to regulatory arbitrage that led to securitization without risk transfer (see Acharya et al., 2013b, and Borst, 2013, among others).

A growing strand of literature studies the rise of shadow banking in China. Allen et al. (2019) and Chen et al. (2018) study a large component of the shadow banking sector, i.e., entrusted loans extended by non-bank financial institutions and firms to other firms. Allen et al. (2023) show that the scale of trust products issued by trust companies—the largest nonbank institutions, began to take off in 2010, with most of the capital raised going to real estate sectors and local government debt.[9] Other papers look at the credit allocation during and the rise of shadow-banking products around the large stimulus. For example, Cong et al. (2019) showed that during 2009-2010 stimulus, bank credit disproportionally favored state-owned enterprises (SOEs), which were less productive than private firms. In contrast to these papers, we focus on the role of deposit competition and WMPs' rollover risks. Chen et al. (2020) show that local governments financed investment projects through stimulus bank loans in 2009 and then switched to nonbank "shadow banking" debt financing after 2012 when faced with rollover pressure from bank loans coming due.

Finally, Hachem and Song (2021) show – including theoretically – that when there is a tightening in liquidity regulations (on the ratio of long-term lending and short-term funding), a large price-setting bank can boost its deposit levels, while smaller price-taking banks turn to off-balance-sheet activities to raise funds such as via the WMPs, fueling the growth of the shadow banking sector. In contrast, our identification strategy (DID) that tracks how small- and medium-sized banks responded to the unexpectedly intensified deposit competition from local branches of the stimulus-implementing but export-sector-hit large state-owned bank (BOC), allows us to trace the channel from the fiscal stimulus to the growth in WMPs via frictions in deposit markets (competition and regulations). Our results also indicate that the swift rise of WMPs as shadow banking finance increased the overall banking system's fragility due to spillover of rollover risk to the general liquidity conditions.

III. INSTITUTIONAL BACKGROUND AND DATA

III.1 Banking System and Regulations

[9] Ehlers et al. (2018) and Hachem (2018), among others, provide comprehensive description of the background and evolution of shadow banking in China.

There are mainly five categories of banks in China. The first category is the Big Four banks—in addition to Bank of China, they are the Industrial and Commercial Bank of China (ICBC), China Construction Bank (CCB), and Agricultural Bank of China (ABC). The State Council, the highest branch of the government, directly appoints presidents of these banks. In addition to pursuing for-profit strategies as other commercial banks, these banks also serve certain policy goals—typically through lending. The second category is state-owned *policy* banks which do not take deposits and mainly serve policy goals through lending. The third category is joint-equity commercial banks, which include 13 members, whose average size is about 15% of that of the Big Four banks.[10] The fourth category is urban commercial banks, which are typically founded and mostly controlled by local governments and whose size ranges between 0.1% and 1.5% of that of the Big Four banks. The last category is rural commercial banks, which mainly serve the rural area and agriculture sector, and their size is even smaller than a typical urban commercial bank. Unlike the first three categories, the urban and rural commercial banks concentrate their business in a limited number of cities.

China tightly regulates bank deposit rates as part of the macroeconomic policy tool kit (e.g., Song et al., 2011). Prior to June 2012, there was only one official rate for each maturity across all banks, and starting from June 8, 2012, the central bank (i.e., PBC) introduced both upper and lower bounds within which banks can set their deposit rates. The lower bounds on deposit rates were non-binding and lifted gradually. The upper bounds on deposit rates, however, were almost always binding and not lifted until the end of 2015. In addition, PBC monitors and sets limits on total bank lending through tools including capital ratio requirements and the loan-to-deposit ratio (LDR) ceilings. The capital ratios of almost all commercial banks have been well above the lower bound. The limit on the LDR prohibits banks from lending more than 75% of their total deposits, and this upper bound was binding for many SMBs.

III.2 The Rise of Shadow Banking

Products such as WMPs can help banks circumvent on-balance-sheet regulations, such as the LDR and deposit rate ceilings. On the asset side, loans originated by the bank or packaged by other financial institutions are recorded off the bank's balance-sheet if they are financed with principal-floating WMPs. Credit supply with principal-floating WMPs hence can help banks circumvent on-balance-sheet regulations including the LDR requirement. On the liability side, WMPs can serve as a substitute for deposits without 'price control:' the deposit rates are

[10] The largest one of the group, Bank of Communications, has been recently classified as a "big bank," but its size is only half of the Big Four banks, and hence we still classify it as an SMB in the paper.

capped by the regulatory ceiling, while the WMP yields face no such restrictions. While principal-guaranteed WMPs are usually required to be recorded on the balance sheet, just like deposits, principal-floating WMPs are treated as off-balance-sheet liabilities, and so their maturity structure can be devised to help issuing banks manage LDR requirements. In short, WMPs can help the banks to arbitrage deposit-related regulations.

Despite their differences from the issuing banks' perspective, both deposits and WMPs have effectively been safe assets from the standpoint of households/savers. Deposit insurance was formally introduced on May 1, 2015; before that, only two commercial banks went bankrupt during the past 25 years and in both cases the depositors were paid in full. Although there is no such insurance for WMPs, the principal of WMPs has always been paid in full in practice, no matter whether the products are labeled as principal-guaranteed or principal-floating.[11] Furthermore, WMPs also offer more flexibility (than deposits) for the issuing banks to manage liabilities. Banks can strategically design the properties of WMPs, including the issuing amount and maturities, and adjust these dynamically based on market conditions. In contrast, it is much more difficult for the banks to 'discriminate' against different groups of depositors: for instance, an increase of deposit rates will have to apply to both new depositors and all the existing depositors, including yield-insensitive ones. Banks typically cannot reject new deposits even after if they have excessive amounts of liquidity; they cannot set or alter a particular maturity structure either.

While our focus is on WMPs, a broad definition of "shadow banking" refers to all investment products that are not on banks' balance sheets. Examples include entrusted loans and the loans offered by trust companies (Allen et al., 2019; Allen et al., 2023), both of which are important components of China's shadow banking sector. For comparison, in 2015 the total bank WMP balance is about 20 trillion RMB in 2015, the total asset of the trust industry is about 16 trillion RMB in 2015 (Allen et al., 2023), and the total amount of entrusted loans during 2004-2013 is 0.7 trillion RMB (Allen et al., 2019). With the rise of shadow banking, there is a dual-track system of intermediation in China's financial system (Wang et al., 2019; Chen and Lin, 2019). While interest rates on deposits are capped and on-balance-sheet lending is regulated by the capital ratio and LDR, the shadow banking sector is exempt from such

[11] Hainan Development Bank went bankrupt in 1998 (the depositors were paid in full), and more recently, Baoshang Bank was taken over by the regulators and emerged from bankruptcy in 2020. During our sample period, none of the WMPs issued by the 135 sample banks defaulted, and there was no news about possible failure (in the operation) of any of the banks. A new set of regulations on wealth management industry, "Regulating the Asset Management Business of Financial Institutions," was announced in April 2018, according to which banks can no longer offer principal-guaranteed products after 2020. The regulators also took steps to specifically tackle the maturity-mismatching risks of the bank WMP sector.

requirements. The regulators are aware of both the nature and the scale of bank WMPs and other shadow-banking products, and to sustain the effectiveness of the on-balance-sheet regulations, the inevitable "cat and mouse" game between the regulators (including China Banking Regulatory Committee, CBRC) and the banks has been evolving along with the expansion of the shadow banking sector. In this process, the regulators gradually tightened the restrictions on the targeted assets in which the WMP funds can be invested in, and banks invited more financial institutions to join the credit 'supply chain' among banks, other institutions, and firms, and packaged the loans in different forms.

III.3 Data and Summary Statistics

We focus on the Big Four banks, the 13 joint-equity commercial banks, and the 118 urban commercial banks in our empirical tests. We classify all the 131 non-Big Four banks as small- and medium-sized banks (SMBs). Our WMP data comes from multiple sources. We first surveyed the largest 25 banks, including the Big Four banks, 13 joint-equity commercial banks, and the 8 largest urban commercial banks, and asked for their quarterly Wealth Management Activity Statements of Commercial Banks that they submitted to CBRC from 2007 Q1 to 2014 Q4. We also collected year-end WMP balances for publicly listed and bond-issuing banks from their financial reports. To supplement the dataset, we download individual WMP information from WIND database for all the sample banks and add up the actual issuing and maturing amount (or the targeted amount if actual amount is not available) of all the individual WMPs for each bank. The final sample is an annual panel of WMP balance and quarterly panel of WMP matured for all the 135 banks from 2007-2015.[12]

We downloaded the annual financial statements for the 131 SMBs from WIND. Though less than half of the sample banks are publicly listed, most of them have issued public debt (e.g., Negotiable Certificate of Deposits), and hence disclosed their financial reports. We end up with an unbalanced annual panel for these SMBs from 2007 to 2015. For the Big Four banks, we collected their financial statements and detailed information such as deposit rates, deposit maturity structure, loan rates at quarterly frequency from their annual reports from 2006Q1 to

[12] As our measure of WMP balances for *most* urban commercial banks is based on aggregating individual products, we also obtained the total WMP balances of *all* the urban commercial banks from CBRC. Figure IA1.1 in the Internet Appendix compares WMP balances for our sample of banks versus actual WMP balances (from CBRC): the two lines closely track each other, confirming that our measure is accurate at the aggregate level. Figure IA1.2 compares our sample WMP balances of the Big Four and joint-equity commercial banks with the total bank WMP balances in the CBRC reports, *minus* the balances of all urban commercial banks. Note that the latter includes products issued by the *rural* commercial banks in addition to those issued by the Big Four and joint-equity commercial banks, which explains the small gap between the two lines.

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To measure local bank competition, we collect branching information for all the commercial banks (including those that are *not* in our sample) from the CBRC website. Each branch of any bank must acquire a license from CBRC before operating. Starting from November 2007, CBRC has been publishing information on all bank branch licenses, including the opening date, the closing date (if applicable), address, and affiliation. Finally, we obtained market interest rates (SHIBOR), each participating bank's submitted quotes to the interbank market from the SHIBOR website, and the stock prices of listed banks from WIND.

Table 2 Panel A reports the summary statistics of bank characteristics. We group the banks into the Big Four banks and SMBs. The Big Four banks are much larger than the average SMB. The fraction of asset financed by deposits is also higher for Big Four banks than for the SMBs (79.2% vs 75.4%), plausibly due to the Big Four banks' wide branching network and advantages in attracting deposits. Between 2007 and 2015, the average WMP balance for the Big Four banks is about 4.6% of their assets. The ratio is slightly lower for the 131 SMBs, which is about 3.0%. On average, 75.4% of the SMBs' asset base is financed by deposits, 12.7% by interbank borrowing, and 1.3% by bonds. On the asset side, SMBs allocate about 46.6% of their assets in loans and have an average leverage ratio of 0.93. In terms of profitability, the average loan rates charged by SMBs is about 7.9%, much higher than the average deposit rates of 2.1%. The average WMP yield is about 4.8%, more than double the average deposit rates. The average ROA of these SMBs is about 1.0%, and is about 0.8% if we exclude the commissions and fees from off-balance-sheet activities.

IV. Deposit Competition and the Growth of WMPs

In this section, we first show the timeline of important events leading up to the rise of WMPs. We then introduce the identification strategy and examine the reasons behind the rise of WMPs issued by SMBs. Finally, we conduct robustness checks to examine alternative hypotheses.

IV.1 Aggregate Timeline

Figure 1 presents the timeline of main events. As a result of the GFC and abrupt fall in demand for exported goods and services, China's export sectors went into a slump, leading to a sharp slowdown of deposit increase from cross-border money inflows since 2009. Meanwhile, the State Council initiated a large scale of fiscal stimulus package and commercial banks,

especially the Big Four banks, significantly increased lending during 2009-2010 as part of the stimulus. To support banks' credit expansion, loose monetary policy was implemented for 2009-2010. At the end of the stimulus period, PBC began to tighten monetary policy to cool off overheated sectors (e.g., real estate) and control rising levels of debt. Without monetary easing, the combination of the slowdown of deposit growth and the unprecedented scale of credit expansion led to tight liquidity and fierce deposit competition since 2011. We hypothesize and confirm that WMP issuance took off as a result of these developments.

Figure 2 plots the two aggregate shocks. First, Figure 2.1 shows the quarterly cross-border net receipts (i.e., receipts minus payments) of the non-banking sector processed through domestic banks.[13] The GFC hit China's export sector heavily. Total exports fell from US $136.7 billion in September 2008 to $64.86 billion in February 2009. Accordingly, prior to the GFC, cross-border net receipts had been rising rapidly, and the rising trend stopped in 2009 Q1. After 2010, although the total size of trade slowly recovered, the net receipts associated with trade continued to decrease until 2015 Q4, and, as a result, total cross-border net money inflows continued to decrease and the trend only reverted after 2015. Second, Figure 2.2. shows the annual growth of bank loan balance. Before the GFC, bank loan balance was growing at an annual rate of about 15%; it witnessed a sharp increase to more than 30% in 2009, and went back to previous levels after 2010.

The combination of the slowdown of money inflows and the unprecedented credit expansion to implement fiscal stimulus led to a shortage of funding and more fierce deposit competition among banks. To ensure the credit expansion would not be constrained by the availability of funding, the monetary policy was largely loosened during 2009-2010. Figure 3.1 shows the required bank reserve ratios, which took a significant dip during 2009-2010. A lower reserve ratio leads to higher money multiplier and supports a faster growth of loans. As a result of monetary easing, the market interest rates dropped. As shown in Figure 3.2, the interbank borrowing rate, SHIBOR, decreased by nearly 4% at the beginning of 2009 and continued to stay at about 2%.

However, after 2010, the post-stimulus period arrived and monetary easing was reverted. As shown in Figure 3.1, the required bank reserve ratio not only went back to previous levels but kept increasing. A higher reserve ratio increases the demand for deposits among banks. As part of the monetary tightening, LDR regulation also began to be strictly implemented (Hachem

[13] The cross-border receipts and payments capture the entirety of cross-border money flows that would affect the banks' financial statements, including the trade of goods and services involving domestic bank accounts (which does not necessarily go through China's Customs) and money flows under the capital and financial accounts.

and Song, 2021), leading to further demand for deposits among banks. Figure 3.2 shows a sharp increase of the interbank borrowing rates, SHIBOR, upon entering 2011. It also shows the evolution of the average WMP yields (which are targeted returns specified at issuance) and the 3-month deposit rate ceilings (we pick the 3-month rates because the average maturity of WMPs is around three months).[14] The average WMP yield was well above the official deposit rate ceilings over the sample period, and closely tracked the three-month SHIBORs.

Given this reversal of monetary easing, deposits soon became of short supply and deposit competition among banks intensified. Figure 4 shows that the proportion of assets financed by deposits decreased for all banks, especially SMBs. At the same time, banks' issuance of WMPs started to take off. Was this intensified deposit competition a *causal* factor for the rise of WMPs? We answer this question by exploring cross-section differences in the changes of deposit competition.

IV.2 Hypothesis Development and Identification Strategy

While all banks were exposed to the slowdown of cross-border money inflow and the credit expansion, BOC stood out in terms of exposure to these shocks. In this section, we will first document the uniqueness of BOC as being more affected by these shocks and hence competing for deposits much more aggressively than all the other large banks. We will then utilize this differential behavior of BOC, and use the branching overlap of an SMB with BOC as exogenous variation of deposit competition facing that SMB to study (in panel data) how the intensified deposit competition caused SMBs to issue WMPs in the shadow banking sector.

A. Slowdown of Cross-border Money Flow and Deposit Loss

BOC was established in 1912 and since 1949 when the People's Republic of China was founded, it was positioned to handle cross-border transactions and settlements, and remained the most dominant player in the foreign exchange market now. For instance, BOC's market share of the net exchange of foreign-currency deposits was 45.4% in 2008, 54.1% in 2009 and 42.6% in 2010, much higher than that of the other three big banks. If we look at the components of deposits, 23.0% of BOC's deposits are in foreign currencies in 2010, while the ratio is only 3.7% for ICBC, 2.7% for CCB, 1.1% for ABC, and even smaller for the average SMBs. The cross-border money inflow, whether exchanged for local currency or not, will increase domestic banks' deposit balance. Therefore, BOC benefited the most from cross-border money

[14] Huang et al. (2023) show that the realized return equals the target return for 72% of the products, and the average realized return is only 16 basis points below the average target return.

inflows before 2008, when the volume of China's total export grew substantially; when the export sectors went into a slump in 2009, BOC's deposit base was adversely affected. In an interview with the Economic Observer in early 2011, Mr. Gang Xiao, the President of BOC, admitted that the sluggish increase in foreign exchange deposits in recent years (at that point) had been an important reason for the tight liquidity situation facing the bank.

To examine whether the deposit growth of BOC is more sensitive to the fluctuation of cross-border flows than that of any other big banks, consider the following specification:

$$d_{i,t} = \alpha_i + \theta_t + \beta \cdot \mathcal{I}_{i=BOC} \cdot cbf_t + \varepsilon_{i,t}\ , \tag{1}$$

where $d_{i,t} = \frac{\Delta Deposit_{i,t}}{Deposit_{i,08}}$ is the percentage increase of deposits of bank i in quarter t scaled by its deposit balance in 2008, and $cbf_t = \frac{CBF_t}{\sum_i Deposit_{i,08}}$ is quarterly cross-border net inflow (receipts minus payments) scaled by the Big Four banks' total deposit in 2008. The time fixed effect, θ_t, controls for any macroeconomic shocks that affect the deposit growth of all big banks, and β captures how BOC differs from other big banks in terms of the sensitivity of deposit growth to cross-border flows. To show what kind of variation drives β, we take the first difference of $d_{i,t}$ (to get rid of α_i) and plot the difference of $\Delta d_{i,t}$ between BOC and the other big banks (to get rid of $\Delta\theta_t$) against Δcbf_t.

$$\Delta d_{BOC,t} - \tfrac{1}{3}\textstyle\sum_{i\neq BOC} \Delta d_{i,t} = \beta \cdot \Delta cbf_t + \Delta\varepsilon_{BOC,t} - \tfrac{1}{3}\textstyle\sum_{i\neq BOC} \Delta\varepsilon_{i,t} \tag{2}$$

Figure 5 shows a strong positive relationship: in periods when the cross-border flow increases more, BOC's deposit growth also increases by more as compared to other big banks. The regression analysis reports a significantly positive estimate of β. In terms of magnitude, when the cross-border net inflow is enough to increase all Big Four banks' deposit by 1%, BOC's deposit growth will increase more than that of other three big banks by 2%.

To confirm that BOC differs from each of the other three big banks, we estimate Eq. (2) with each of the four components on the left separately:

$$\Delta d_{i,t} = \alpha_i + \beta_i \cdot \Delta cbf_t + \Delta\varepsilon_{i,t}, \tag{3}$$

Table 3, Panel A shows that only BOC's deposit growth is significantly positively correlated with cross-border flow. The sensitivity estimate happens to be quantitatively large for ABC as compared to the other two big banks, but is nevertheless statistically insignificant which is unsurprising as ABC is much less concentrated in the coastal areas compared to any other big banks and much less exposed to cross-border money flows.

Finally, in Table 3 Panel B, we conduct some back-of-the-envelope calculations to gauge

how much the contraction in cross-border money flows contributed to BOC's rising loan-to-deposit ratio (LDR) in 2009, which is also affected by BOC's credit expansion as we show in the next section. Cross border receipts and payments processed through banks will lead to a net inflow of foreign-currency deposits.[15] Note that after depositing the funds (in foreign currencies), the depositors can either keep it in foreign currencies or exchange it for domestic currency (RMB), and so the following equation holds:

Net inflow of foreign-currency deposits = Change of foreign-currency deposit balance + net exchange of foreign-currency deposits by customers

The change in the balances of foreign-currency deposits is taken from BOC's balance sheet, and we obtained BOC's net exchange of foreign-currency deposits by customers in 2008, 2009, and 2010. We then calculate the net inflow of foreign-currency deposits as the summation of the two. Compared to 2008, BOC's net inflow of foreign-currency deposits decreased dramatically by US$ 43.99 billion in 2009 and by US$ 35.01 billion in 2010.

What would BOC's LDR be without the negative shock to exports in 2009-2010? If the annual net foreign-currency deposit inflow during 2009-2010 had remained the same as in 2008, the counterfactual LDR would be 69.1% in 2009 and 66.8% in 2010, down by 4.1% and 6.0% compared to the actual figures, respectively. Hence, the slump in total exports and cross-border money flows had a quantitatively important effect on the deposit growth of BOC, exacerbated BOC's position of LDR, and together with the bank's expansion of loan supply, led to more aggressive deposit competition by BOC after 2010.

B. The RMB 4 trillion Stimulus and Credit Expansion

The Chinese government responded to the export slump and sharp decline in GDP growth by introducing the RMB 4-trillion stimulus plan. The implementation of the stimulus package involved multiple parties.

First, the central government would invest RMB 1.18 trillion from fiscal incomes during 2009-2010 in infrastructure, housing, public health, etc.

Second, local governments, through state-owned City Infrastructure Investment Corporations (CIICs), also made investments. These CIICs raise funds from bank loans and by issuing bonds against local governments' land assets (Bai et al., 2016).

[15] By looking at foreign-currency deposits only, we will miss cross-border transactions using domestic currency. However, during 2009-2010, the amount of international wire transfer and settlements using RMB was quite limited: according to the report from PBC, this amount in 2010 is about RMB 600 billion, or US$ 90 billion, while total cross-border payments and receipts in 2010 is about US$ 3.4 trillion.

Third, banks, especially the Big Four banks, played a crucial role by providing the lion's share of the funds for the investment projects associated with the stimulus. This led to a large credit expansion in the economy. Many investment projects were medium and long-term in nature and financed by medium and long-term loans. From January 2009 to December 2010, Big Four banks' medium and long-term loan balances increased by RMB 5.80 trillion (a 66% increase), while their short-term loan balances increased by RMB 1.26 trillion (a 31% increase). In contrast, SMBs' medium and long-term loan balances increased by 1.27 trillion RMB (25%) and short-term loan balances increased by 0.82 trillion RMB (18%) during the same period.

While all four banks announced large credit expansion in support of the stimulus, the scales of their expansion were different. Figure 6.1 shows the total loan balances of the Big Four banks: for ease of comparison, we normalize the bank's loan balance to be one at the end of 2008, right before the stimulus plan. From 2006 Q4 to 2008 Q4, except for ABC in 2008 Q4, they exhibited similar paths in loan growth.[16] However, the paths of the loan growth began to diverge in 2009, as BOC exhibited a much steeper growth path than the other three banks: from 2009 Q1 to 2010 Q4, its total loan balance increased by 77%, compared to an increase of 60% by ABC, and 48% by both the CCB and ICBC.[17]

Figure 6.2 presents the evolution of total deposit balance of the Big Four banks. Like Figure 6.1, we normalize each bank's deposit balance to be one at the end of 2008. From 2006 Q4 to 2008 Q4, all four banks were on similar growth paths for deposits. Starting in 2009, the growth rates of all four banks' deposit balances rose as compared to the earlier period. BOC also stood out in terms of deposit growth, although not that dramatic as compared to its loan growth. As we have argued that BOC's deposit growth was hurt the most by the slowdown of cross-border money flows, there must be other reasons that helped with BOC's deposit growth during 2009-2010. Competing more aggressively for retail deposits is likely not the reason because, as we show in Figure 7, the average deposit rates offered by BOC is almost the same

[16] ABC went public in July 2010 (the last initial public offering (IPO) of the Big Four banks). To prepare for the IPO, capital was injected and non-performing loans were removed from its balance-sheet (see Allen et al., 2012, for more details). As in Figure 6.1, its loan balance exhibits two jumps leading up to the IPO.

[17] We do not take a stand as to why BOC was more supportive for the stimulus than the other large banks. One hypothesis is that, as reflected in various talks by the executives, supporting the stimulus was regarded by BOC as an opportunity to catch up with the other big banks, as it ranked last among the four banks in terms of both asset size and profitability in 2008 (See Figure IA2 in the Internet Appendix). Executives' career concerns may be another reason. Executives of the Big Four banks are appointed by the Organization Department of the Central Committee of the Chinese Communist Party (CCP), and they need to balance between political career paths and the banks' commercial goals. The President of BOC at the time was Mr. Xiao Gang. In 2012, among the four top executives of the Big Four banks, Xiao was the only one to become a member of the Central Committee of the CCP. He was further promoted to Chairman of the China Securities Regulatory Commission, a minister-level position. Market observers linked his promotion to his career experience and strong support for PBC's call during the stimulus; also see Deng et al. (2015) for bank executives' career concerns and their policy implications.

as other big banks during 2009-2010.

An alternative reason is deposit creation through loan supply. Firms that received large credit supply would experience an increase of their deposit balance if the immediate marginal propensity of spending is smaller than one. In Table IA1 of the Internet Appendix, we show that for the same bank, more loan supply to firms relative to households leads to higher deposit growth by firms relative to households. Based on this within-bank estimation of deposit creation of loan supply, we calculate that if the banks' loan supply did not change from 2008 to 2010, the deposit growth for BOC would be 6.4%, much smaller than 19.6% for ABC, 12.3% for ICBC, and 17% for CCB. This is consistent with BOC's deposit growth hit more by the slowdown of cross-border money flows.

Another reason behind BOC's faster deposit growth is attracting non-retail depositors (such as non-bank financial institutions). Much of BOC's extra deposit growth from 2008 to 2010 as compared to other big banks can be attributed to the increase of non-retail deposits. Specifically, total deposit growth of BOC from 2008 to 2010 is higher than the average of the other big banks by 16.8%, and the difference is only 10.0% if we look at retail deposits only (from households and firms).

The large-scale expansion of credit, along with the losses of deposits from cross-border money flows, led to a spike in the loan-to-deposit ratio (LDR) for BOC. In Figure 6.3, none of these Big Four banks' LDR exceeded 65% at the end of 2008 Q4, way below the limit of 75%. Starting from 2009, however, BOC's LDR increased dramatically and touched the 75% threshold by the end of 2009 and remained high during 2010, while the LDR of the other three banks decreased slightly during 2009-2010.

C. Deposit Competition from BOC

The high level of its LDR, however, did not lead to an immediate increase of deposit competition from BOC until 2011 when the monetary policy was tightened and the LDR regulation was strictly enforced. Thereafter, BOC started to compete much more aggressively than other banks. In Figure 7, we show how the average deposit rates offered by BOC differ from those offered by other big banks over time. To control for difference in their deposit maturity structure, we look at the average deposit rates minus the maturity-weighted average rates. Denote $r_{i,t}$ as the average deposit rate of bank i in year t, $Deposit_{i,g,t}$ as the deposit balance of bank i for maturity g in year t, $r_{g,t}$ as the deposit rates for maturity g in year t posted on the Big Four banks' websites (which turn out to be the same for the Big Four banks). The deposit rate premium is than defined as:

$$\hat{r}_{i,t} = r_{i,t} - \frac{\sum_g Deposit_{i,g,t} \times r_{g,t}}{\sum_g Deposit_{i,g,t}} \quad (4)$$

Figure 7 shows $\hat{r}_{i,t}$ for each big bank over time. Although the deposit rates were regulated before 2012 and only partially relaxed since 2012, the premium $\hat{r}_{i,t}$ are positive and differ across the big banks. This is because $r_{i,t}$ includes not only the regulated deposit interests but also additional fees and expenses paid to attract depositors, and local branches have discretion on how much benefit to offer to customers in addition to the official deposit rates.[18]

Figure 7 reveals two important facts. First, there was no difference in terms of deposit competition between BOC and other big banks before 2010. After 2010, however, although the other three big banks continued to offer similar premium, the average deposit rate premium offered by BOC was significantly higher by about 0.2%, consistent with our hypothesis that BOC started to compete more aggressively for deposits after 2010. Second, the premium was increasing for all the banks during 2010-2015, consistent with our hypothesis that in the aggregate, deposit competition intensified after 2010.[19]

D. Measurement of Exposure to BOC Competition

We argue that the increased deposit competition by BOC led to an exogenous shock to SMBs. We measure an SMB's exposure to BOC's deposit competition after 2010 based on their branch overlap at the end of 2010. The hypothesis is that deposit competition is at the local level, and greater branch overlap with each other implies more direct competition between the two.

The BOC competition measure is constructed in two steps. First, we calculate the market share of BOC in each city. Denote $N_{i,j}$ as the number of bank *i*'s branches in city *j* at the end of 2010, and then define the market share of BOC in city *j* as its share of branches:

$$MktShare_{BOC,j} = N_{BOC,j} / \sum_i N_{i,j} \quad (5)$$

Second, we calculate the exposure of bank *i* to the deposit competition from BOC as follows:

$$BOCExp_i = \sum_j N_{i,j} \times MktShare_{BOC,j} / \sum_j N_{i,j} \quad (6)$$

The variable $BOCExp_i$ measures the degree to which the bank *i*'s branches overlap with those of BOC. It is the weighted average of BOC's market share ($MktShare_{BOC,j}$) across cities,

[18] One example of such fees and expenses is gifts offered to attract depositors, such as cash, gold, and cooking oil. It also includes other administrative costs directly related to attracting deposits. See a collection of news reports here: http://finance.qq.com/zt2010/banklc/.

[19] We find similar divergence in average deposit rates after 2010 between BOC and the other three big banks.

using the number of bank i's branches in the cities as the weight. To highlight the special role of BOC as compared to the other three big banks, we also construct $ABCExp_i$, $ICBCExp_i$, and $CCBExp_i$ in the same manner and define $Big3Exp_i = ABCExp_i + ICBCExp_i + CCBExp_i$.

The variation of $BOCExp_i$ depends on the branching networks of both the SMBs and BOC. If all SMBs proportionally allocate their branches across all cities, or if BOC equally allocates its branches across cities, i.e., $MktShare_{BOC,j}$ does not vary with j, then there will be no variation in $BOCExp_i$ for different SMBs. First, the SMBs usually concentrate their businesses in certain regions. The urban commercial banks are regional, i.e., they only operate in one or a few neighboring provinces. For example, Bank of Chongqing operates in four provinces (Chongqing, Ningxia, Sichuan, and Guizhou), and Huishang Bank operates in only two provinces (Jiangsu and Anhui). These two banks are relatively large, and most urban commercial banks only operate within one province. The joint-equity commercial banks can operate nationwide but they usually concentrate their activities where they were founded. For instance, at the end of 2010, the Guangdong Development Bank locates about 60% of its branches in Guangdong Province, where the bank was founded.

Second, while the BOC and the other three big banks have branches in all the provinces, their network intensities vary. As shown in Table 2, Panel B, the average share of BOC's branches across all cities is 6.4% with a standard deviation of 3.3%. The average branch share of the other three big banks as a whole is about 40%, half of which is contributed by ABC who has widespread branching network in the rural areas, with a standard deviation of 13.4%. Figure IA3 of the Internet Appendix shows that ABC has most of its branches in the western areas, ICBC concentrates in the northern and southern regions, CCB focuses on central China, while BOC has its most presence in the coastal and northern parts of the country. Hence, the two facts that most SMBs are regional and BOC has more presence in some regions than in others provide variations in the exposure to BOC competition across different SMBs. As Table 2 Panel B also shows, the average exposure to BOC competition across our sample SMBs is about 7.1% with a standard deviation of 2.1%, and to the other big three banks as a whole is about 36.9% with a standard deviation of 8.2%.

E. Identification Strategy

We saw from Figure 7 that only after 2010 did BOC become more aggressive in competing for deposits. This inspires a "difference-in-differences" (DID) estimation strategy to link the SMBs' deposit availability to their exposure to increased deposit competition from BOC after 2010. With this first stage, we can then examine how banks adjust WMP issuance based on

their deposit availability in the second stage. Note that in Eq. (5), we measure the market share of BOC relative to all banks. Hence, the *relevance condition* is that, after 2010 BOC increased competition for deposits more than ALL the other banks as a whole (including the other three big banks and all the SMBs), and hence greater more branch overlap with BOC relative to others leads to more fierce deposit competition after 2010. The *exclusion restriction* is that the SMBs should experience parallel trends in terms of the outcomes that we examine if BOC hadn't competed aggressively for deposits after 2010, regardless of the extent of their geographic exposure to BOC.

To test the assumption of parallel trends, we first conduct an event study of BOC competition on various bank variables in each year, using 2010 as the base year. That is, we estimate the following specification:

$$y_{it} = \sum_{\tau \neq 2010} \beta_\tau \cdot BOCExp_i \times 1_{y=\tau} + \alpha_{\mathrm{i}} + \theta_{\mathrm{t}} + \varepsilon_{it}, \quad (7)$$

where y_{it} is the outcome variable of interest, α_{i} captures time-invariant bank fixed effect, θ_{t} the time fixed effect, and ε_{it} is the stochastic error term. We consider six most relevant bank variables for y_{it}, i.e., deposit-to-assets ratio (DAR), WMP/Assets, non-deposit liability-to-assets ratio (NDLAR), Deposit rates, WMP yields, and return on assets (ROA). These variables together capture the banks' access to deposit funding, alternative sources of capital, cost of funding, and profitability. Figure 8 plots the 95% confidence interval of β_τ for each outcome variable. The parallel-trend assumption holds in all the six dimensions before 2010, which lends support to our identification assumption.[20] Figure IA5 in the Internet Appendix shows that the parallel-trend assumption also holds for the leverage ratio, loan-to-assets ratio (LAR) and size (i.e., log(asset)). Figure 8 also illustrates the estimated treatment effect. Banks with greater exposure to BOC competition experienced lower DAR, issued more WMPs, used more on-balance-sheet non-deposit liabilities, offered higher deposit rates, and had lower ROA, all consistent with the hypothesis that greater branching overlap with BOC implies more exposure to deposit competition.

In addition to presenting parallel trends graphically, we also examine the exogeneity of the treatment, a stronger assumption than needed for the DID estimation. To see if the treatment is correlated with certain bank characteristics, we regress all the nine variables (the six bank

[20] The BOC competition seems to have already affected DAR and NDLAR in 2010. In the second half of 2010, the monetary policy started to be tightened and BOC might have taken some measures (not by offering higher deposit rates) to compete for deposits. Therefore, treating 2011 as the start of BOC competition may lead to downward bias to our estimates. Nonetheless, we stick to 2011 as our choice for the DID threshold since the monetary policy was only partially tightened in 2010.

variables plus leverage, LAR, and size) measured in 2010 on the banks' exposure to BOC competition. As reported in Table IA2 in the Internet Appendix, only the coefficients for size are marginally significant (with a partial correlation of 0.19). These results assure us that banks would have shown parallel trends regardless of their exposure to BOC competition, if BOC had not become more aggressive in the deposit markets.[21]

We now move on to our main two-stage least square specification:

$$DAR_{it} = \beta \cdot BOCExp_i \times 1_{t>2010} + \alpha'_{\mathrm{i}} + \theta'_{k(i)\mathrm{t}} + \epsilon_{it} \tag{8}$$

$$\frac{WMP_{it}}{Asset_{it}} = \gamma \cdot DAR_{it} + \alpha_{\mathrm{i}} + \theta_{k(i)\mathrm{t}} + \varepsilon_{it} \tag{9}$$

In Eq. (8) and (9), *i* denotes the bank, *t* is the year, and *k(i)* denotes the province where the SMB *i* is headquartered. In addition to the standard DID specifications, we allow the year fixed effects to vary across different provinces; we are essentially comparing banks headquartered in the same province and subject to the *same* set of province-specific shocks. Eq. (8) is the first stage. It describes the causal effect of exposure to intensified BOC competition since 2010 on the bank's deposit availability. Eq. (9) is the second stage where DAR_{it} is instrumented by $BOCExp_i \times 1_{t>2010}$. The parameter γ captures the causal effect of deposit availability on the bank's WMP issuance.

We verify the relevance condition in the next section. For the exclusion restriction, the identification assumption for the γ estimate to be unbiased is:

$$\mathbb{E}\left[BOCExp_i \cdot \varepsilon_{it} \middle| \alpha_{\mathrm{i}}, \theta_{k(i)\mathrm{t}}, t > 2010\right] = 0 \tag{10}$$

The fact that SMBs with differential $BOCExp_i$ exhibited parallel trends in various characteristics before 2010 lends some support to this assumption. One concern is that, although the pre-2010 shocks were not correlated with $BOCExp_i$, there might be some other shocks during 2009-2010, which were correlated with $BOCExp_i$ and had persistent effects on the banks after 2010. The identification assumption will be violated only if these shocks can affect the banks' WMP issuance and other characteristics through channels independent of

[21] For most of the urban commercial banks, we estimate their WMP balances by adding up either the actual or the target issuing amounts of all outstanding WMPs. Measurement error in this variable could therefore jeopardize our identification assumption, if the error term does *not* exhibit parallel trends during the sample period for banks with different degrees of exposure to BOC competition. We select the observations with true WMP balances, i.e., the values reported in our surveys or disclosed in the banks' financial statements, and calculate the measurement error as the difference between estimated WMP balance (i.e., sum of either the actual or the target issuing amounts of individual WMPs) and the true WMP balances scaled by the bank assets. We then calculate the mean and the median of the measurement error for the high-exposure and low-exposure banks over time. Figure IA6 of the Internet Appendix shows that, for years before 2015, the two groups did show parallel trends (using both mean and median values).

DAR_{it}. Note that when exposure to these unobserved shocks affects banks' activities only through the deposit channel, the 2SLS estimate of γ is still unbiased and only the effect of BOC competition per se is biased.

In terms of potential candidates for these unobserved shocks, would the cross-border money flow and the implementation of the stimulus also affect SMBs' operation through non-deposit channels and could the banks' exposure to these shocks be correlated with their branch overlap with BOC? If BOC had more branches in places with greater stimulus investment, the higher demand for loan financing could lead to increasing issuance of WMPs by the local banks. Similarly, if BOC operated more branches in places more exposed to the cross-border money flows, the slowdown of cross-border money inflow might have unknown effects on the banks' activities independent of the deposit channel.

To mitigate this important concern, we show below that within each province, neither the exposure to cross-border money flows or the implementation of the stimulus was geographically correlated with the local presence of BOC branches. Both BOC's exposure to the cross-border money flows and its support for the stimulus were a result of BOC's central strategy rather than responses to local market conditions. Firstly, for the cross-border money flows, we check at the bank level, whether the bank's exposure to cross-border flows (proxied by their foreign-currency deposit share) in 2010 correlates with $BOCExp_i$, the bank's exposure to BOC competition. We then check, at the city level, whether the detrended deposit growth from 2008 to 2010, reflecting the effect of the slowdown of cross-border money inflows, is correlated with $MktShare_{BOC,j}$, the branch share of BOC in 2010. To calculate the detrended deposit growth, we fit a city-specific linear trend to the city's deposit balance during 2003-2008 and predict the city's deposit balance in 2010 by assuming the trend continued. We then calculate the difference between actual and predicted deposit balance scaled by predicted balance in 2010. Table 4 Panel A shows that for both measures, the correlation is both insignificant and close to zero after controlling for province fixed effect.

Secondly, we measure the intensity of stimulus implementation at the city-level by looking at the stimulus loan and investment, i.e., the detrended increase of bank loan balance and fixed capital investment from 2008 to 2010. Bank loan balance describes the financing side of the stimulus as most of the investment projects were financed by bank credit, and the fixed capital investment is a direct result of the stimulus. We calculate the detrended increases using the same approach as in calculating the detrended deposit growth. In Table 4 Panel B, we regress the estimated stimulus loan and investment on $MktShare_{BOC,j}$. We do not find any significant

correlation after controlling for the province fixed effect. Without the province fixed effect, the stimulus investment is negatively correlated with the presence of BOC, which is opposite to what the loan demand hypothesis conjectures. Therefore, the correlation between BOC branch presence and exposure to cross-border flows or the implementation of the stimulus cannot make our identification assumption violated.

The exclusion restriction, of course, cannot be proved formally. The discussion on the underlying triggers for BOC's deposit competition since 2010, the parallel trends of SMBs with differential exposure to BOC competition along a rich set of characteristics, and the small correlation between the exposure to BOC competition and bank characteristics (as well as their exposure to other aggregate shocks) lend a strong support for the identification assumption.

IV.3 Empirical Results

A. Baseline Regression Results

We report regression results of Eq. (8) and (9) in Table 5. In Column (1), the OLS coefficient estimate of DAR in explaining WMP/Assets is negative but statistically insignificant. In Column (2), we apply the DID estimation of Eq. (8). The treatment effect of $BOCExp_i$ on DAR is negative and significant, demonstrating the effect of BOC deposit competition on SMBs after 2010. Recall that $BOCExp_i$ captures the exposure to intensified BOC competition relative to competition from all other banks as a whole. To see if the effect is driven by the difference of competition between BOC and other big banks or between BOC and other non-big banks, in Column (3) we also include the interaction term between the post-stimulus indicator and the exposure to competition from the other three big banks. With the inclusion of such an interaction term, we are essentially employing as regressors the SMBs' exposure to BOC and to the other three big banks, in both cases relative to all the other non-big banks as a whole. The coefficient estimate of the interaction term between $BOCExp_i$ and the post-2010 dummy barely changes, and the coefficient estimate of the interaction term between $Big3Exp_i$ and the post-2010 dummy is insignificant, and its magnitude is small.[22] Both facts suggest that on average, the three big banks other than BOC did not change their deposit competition differently from all the non-big-four banks as a whole. Hence, it makes little difference whether to measure exposure to BOC competition relative to all other banks or to all non-big banks.

[22] We unbundled the Big3 exposure variable, and added branch overlap with each of the other three big banks separately into the regressions. Table IA3 of the Internet Appendix shows that an SMB's branch overlaps with any of the other big 3 banks have no significant treatment effect on the SMBs' DAR or WMP/Asset.

In Column (4) of Table 5, we report the second stage results of the 2SLS estimation. The estimated coefficient of DAR_{it} in affecting WMP issuance is significantly negative, with the magnitude of the coefficient much larger than the OLS estimate in Column (1). This result supports the negative and *causal* effect of deposit availability on the SMBs' WMP issuance; that is, banks with less access to deposits will issue more WMPs. The contrast between the 2SLS estimate and the OLS estimate implies a positive correlation between DAR_{it} and the regression error term ε_{it}. Possible reasons for this positive correlation include better customer services and/or reputation, which can help an SMB to attract both more depositors and more WMP investors.

In Column (5), we report results from a 'reduced-form' regression model, which is the treatment effect of BOC competition on banks' WMP issuance. The coefficient estimate is significantly positive, meaning that banks more exposed to BOC competition in the local deposit markets issue more WMPs after 2010. In Column (6), we include the interaction term between the post-stimulus indicator and the exposure to competition from the other three big banks. Similar to Column (3), the coefficient estimate of the treatment effect of BOC competition barely changes and the coefficient estimate of the competition from other big banks is insignificant and close to zero.

B. Other Responses and Mechanisms

Before we discuss potential mechanisms via which BOC competition drives WMP issuance of SMBs, we continue to explore the effects of deposit shortfall on the other dimensions of SMBs' operation. To this end, we estimate Eq. (8) with alternative dependent variables and report the results in Table 6.

First, in Panel A, we examine how the exposure to BOC competition affects SMBs' use of other on-balance-sheet funding. Greater exposure to BOC competition after the stimulus leads to significantly greater use of interbank borrowing and bond financing, but not of other liabilities and paid-in capital. Interbank borrowing and bond issuance represent active debt management while other liabilities are more a result of business operation and hence passive debt. The results suggest that deposit shortage leads to not only more issuance of off-balance-sheet WMPs but also greater use of alternative on-balance-sheet liabilities.

The three alternative sources of funding, i.e., WMPs, interbank borrowing and bonds, are costlier than deposits. WMPs offer much higher yields than the official deposit ceiling as shown in Figure 3. For the other two sources, take Nanjing Urban Commercial Bank for example. In 2014, the average cost of deposits was 2.48%, while it was 5.56% for interbank borrowing and

4.97% for bond financing.

If the alternative sources of funding are costlier on average, why did the banks not simply respond with higher deposit rates? While they did increase the average deposit rates as shown in Table 6 Panel C, the capability of increasing deposit rates is limited due to the official ceiling on deposit rates. Another, potentially more important, explanation is that, although the average cost of these alternative sources is higher, the marginal cost may be lower. This is because the increase of deposit rates would have to apply to not only the incremental deposits but *all* the existing deposits. In contrast, for the non-deposit alternatives, banks simply offer higher return on the incremental part. In addition, these alternatives offer better control over the amount to raise and the maturity.

The increase of interbank borrowing and bond issuance seems to fully make up the loss of deposits. To see this, note that in Table 5 Column (2), the estimated treatment effect of BOC competition on DAR is -0.703, and in Table 6 Panel A, the total estimated treatment effect of BOC competition on interbank borrowing and bond financing is 0.843. This suggests that when facing more fierce deposit competition, banks actively seek other on-balance-sheet liabilities so as to keep the total size of on-balance-sheet liabilities unaffected. This is consistent with what we find on the asset side of the SMBs. As reported in Table 6 Panel B, there is no significant effect of BOC competition on the SMBs' loan supply, asset growth and average loan interest rates. No effect on the asset side should be expected as the total size of on-balance-sheet liabilities was not impacted.

If the SMBs can fully make up the loss of deposits with other on-balance-sheet liabilities, why do they still issue WMPs? As shown in Column (7)-(8) of Table 5, when we decompose the WMPs into principal-floating and principal-guaranteed products, more than 80% of the effect is contributed by principal-floating WMPs. so, the effect on WMP issuance is mostly driven by those off-balance-sheet products.

Given this, we propose that one explanation for the issuance of off-balance-sheet WMPs is similar to the practice of "reaching for yield" (Becker and Ivashina, 2015) - fund managers take on excessive unmeasured risks when the fund performance is evaluated based on measured risks. Similarly, banks are regulated and evaluated mostly based on their balance sheet performance, and the decrease of accounting profits would encourage them to make more profits from off-balance-sheet activities. In this context, although the size of the banks' balance sheet was not affected by BOC deposit competition, their profitability was negatively impacted.

On the extensive margin, the non-deposit liabilities are costlier than deposits as we discuss above. On the intensive margin, banks also need to offer higher deposit rates and WMP yields

to compete for deposits. In Panel C, Columns (1) and (2), we find a significant and positive treatment effect of BOC competition on the average deposit rates and WMP yields offered by SMBs. In terms of magnitude, when the exposure to BOC competition increases from the 10th to the 90th percentile, the average deposit rates increase by 0.63% (its mean during 2011-2015 was 1.067%), and the average WMP yield increases by 1.7% (its mean during 2011-2015 was 5.02%).[23] As a result of both the reshuffle to costlier funding sources and higher deposit rates and WMP yield, the ROA of the SMBs (excluding off-balance-sheet commissions and fees) was significantly and negatively impacted, as shown in Panel C Column (3). When the exposure to BOC competition increases from the 10th to the 90th percentile, the average ROA decreases by 0.2% (its mean during 2011-2015 was 0.877%). Importantly, the profits from off-balance-sheet activities do partially make up the loss. In Column (4) when we include the commissions and fees from off-balance-sheet activities, the effect on total ROA is still significant and negative but quantitatively smaller. We find off-balance-sheet commissions and fees roughly make up one quarter of the profit loss due to more fierce deposit competition. In Columns (5) and (6), we consider ROE which is what the shareholders care about and the key variable to capture exposure to tail risks used in Meiselman et al. (2023). Similar to the result with ROA, exposure to BOC competition had a significantly negative effect on the SMBs' ROE, and the effect is partially mitigated by the bankers' profit-seeking from the off-balance-sheet activities.

To summarize, in response to fierce deposit competition in the form of exposure to BOC branches, banks not only increase their deposit rates to compete for deposits but also turn to other alternative sources of funding, i.e., WMPs, interbank borrowing and bond financing. These alternative sources of funding do require a higher return rate than deposits, but the marginal cost can be lower because unlike these alternatives, the increase of deposit rates would have to apply to not only the incremental but also all the existing deposits. To make up for the loss of profits, banks raise more from these alternative sources of funding than the loss of deposits and in particular, conduct more off-balance-sheet activities that are not subject to balance sheet regulations or add on-balance-sheet risks. Yet still, this is not enough to fully make up for the loss of profits and their total profits decrease.

There are two main alternative hypotheses for the findings of greater deposit competition

[23] In the regressions on SMBs' WMP yields (Panel C, Column 2), we weigh each observation with the number of WMPs used to calculate the average WMP yield at the bank-year level. This weighting scheme is justified by the fact that in the data, the number of WMPs used to calculate the WMP yield is strongly negatively correlated with the measure error of WMP yield estimates.

leading to greater WMP issuance. First, there may be some local shocks to loan demand (beyond what we capture with the stimulus loan supply and fixed capital investment) that caused both BOC and SMBs to expand on the asset side and to compete on the liability side, and the measure $BOCExp_i$ happens to capture SMBs' exposure to these shocks. Second, there may be some regional shocks to WMP demand that is correlated with the measure $BOCExp_i$. We examine these alternative hypotheses in the next two sections.

IV.4 Investment Opportunities and Within-Bank Estimation

Relating to the concern that our results may be driven by possible correlations between BOC branch presence and shocks to the availability of investment opportunities, such as loan demand, rather than deposit competition, note that if these loans were included on the bank's balance sheet, we should see the direct effect on the bank's LAR, loan interest rate and asset growth, which is not found in Table 6 Panel B. Even if these loans were written off the bank's balance sheet (which is inconsistent with the aggregate increase of bank loan balances following the stimulus) and did not affect the bank's assets on the balance sheet, it cannot explain the effect on the bank's DAR. We have tried to address this concern by including the province-year fixed effects and confirming that within each province, the BOC presence is not correlated with loan demand resulting from the stimulus across different cities.

We now provide additional evidence that BOC presence is associated with greater deposit competition rather than more investment opportunities by exploring the *within-bank* variations of branching expansion across different cities. Besides adjusting deposit rates and seeking alternative funding sources, banks can also close existing, or open new, branches in response to market conditions. If deposit competition from BOC is the force behind the effect of $BOCExp_i$, then to avoid direct competition from this large bank, SMBs would prefer to operate fewer branches in cities with more BOC presence. In contrast, if greater presence of BOC branches in a city is associated with *more* investment opportunities, we should expect to see the same or even *more* SMB branches as these banks try to capture these opportunities. To control for any unobserved bank-level characteristics that may affect the banks' branching strategy, we study the branching expansion decisions across cities within the same bank.

Adjustments of branch networks require the approval of the local bureaus of CBRC. In general, banks are discouraged from expansion on the 'extensive margin'—establishing branches in cities with *no* pre-existing branches, as compared to expansion on the 'intensive margin'—setting up new branches in cities with pre-existing branches (Geo et al., 2019; Lai et

al., 2023). [24] As shown in Table IA4 in the Internet Appendix, during 2007-2015, about 90% of the new branches of joint-equity and urban commercial banks are expansion on the intensive margin.

Hence, we study the effect of BOC exposure on branch adjustments by SMBs on the intensive margin.[25] Specifically, we consider bank-city pairs such that the bank operates at least one branch in that city at the end of 2007. For all these bank-city pairs, we calculate the number of new bank branches established by the bank in the city in each year during 2007-2015. We then conduct the following *within-bank* DID estimation:

$$BranchN_{ijt} = \gamma \cdot MktShare_{BOC,j} \times 1_{t>2010} + \theta_{it} + \alpha_{ij} + \varepsilon_{ijt} \quad (11)$$

In Eq. (11), the dependent variable $BranchN_{ijt}$ is the number of new branches established by bank i in city j and year t, θ_{it} is the time-varying bank fixed effect, α_{ij} is the bank-city fixed effect, and $MktShare_{BOC,j}$ is the percentage of BOC branches in city j at the end of 2010. This specification estimates for a given bank, whether the bank establishes a greater or smaller number of branches in cities with higher BOC branch presence after 2010.

Table 7 reports the regression results. In the first column, we find a significant and negative effect of BOC's branch share on the SMBs' new branch establishment. To test the parallel trend assumption as well as to examine the timing of the treatment effect, in Column (2), we estimate the effect of BOC's branch share year-by-year using 2007 as the base year. There is no significant difference between different cities prior to 2010. After 2010, the effect becomes much larger in 2014 and statistically significant in 2015 (but not before). The finding that the effect is much stronger in 2014 and 2015 is because restrictions on the SMBs' branch expansion were relaxed and in response there was a large increase of new branch establishment in 2014 and 2015. As Figure IA7 in the Internet Appendix shows, the total number of new branch establishment by our sample SMBs was only around 2,000 in 2013 and jumped to more than 5,000 in both 2014 and 2015.

Since new branch establishment is a major decision, banks may not adjust their branching expansion strategy if the increase of deposit competition is only modest. It is likely that only

[24] In February 2006, CBRC issued "Urban Commercial Bank Nonlocal Branching Management Act," which laid out the regulatory principles and necessary conditions on branch expansion on the extensive margin; for intensive margin, branch expansion is subject to the "Commercial Bank Local Branching Management Act." Table IA4 of the Internet Appendix reports the number of new branches of the joint-equity and urban commercial banks based on the cities where the branches are located.

[25] To study branch expansion on the extensive margin, one may pair each bank with all the cities; but since most banks only operate in a few cities, the matrix will be sparse ($BranchN_{ijt}$ is zero for more than 98% of the observations). Nevertheless, the result survives if we estimate Eq. (11) on all the bank-city pairs.

in cities with substantial presence of BOC will the bank consider cutting branching expansion to avoid competition. Figure IA7 also provides visual evidence that indeed, the number of new branch establishment in 2015 is stable when BOC's branch share increases from 0.04 to 0.08, and decreases when BOC's branch share increases beyond 0.08. In Columns (3) and (4), we restrict the sample to cities where BOC's branch share exceeds the 25th percentile and find a much larger and significant effect of BOC's branch share on the SMBs' new branch establishment. In terms of the magnitude of the effect, based on the estimate in Column (4), if the BOC market share increases by 10%, banks will establish 6 fewer branches in the city in 2015. As a comparison, the mean and standard deviation of new branch establishment in 2015 is 4.9 and 7.5.

To summarize, a greater exposure to BOC branches does not seem to capture better investment opportunities, as SMBs establish *fewer* new branches after 2010 in cities with greater BOC exposure.

IV.5 WMP Demand and Within-City Estimation

The second concern about our interpretation of the results on WMP issuance is that they may be driven by the positive correlation between BOC branch presence and the local demand for WMPs—that is, in places with more BOC presence, the demand for WMPs happens to be higher after 2010 and banks respond by issuing more WMPs and reducing deposit financing. However, this hypothesis would predict a negative effect of BOC branch overlap on the use of non-deposit liabilities and a non-positive effect on the deposit rates and WMP yields, which is opposite to what we find in Table 6. In this section, we provide additional evidence against the "WMP demand" hypothesis by exploring *within-city* variations of WMP offerings across different banks. The within-city estimation controls for local WMP demand and links the banks' issuance of WMPs in a given city to its exposure to BOC deposit competition in other cities.

When a bank offers a new WMP, it does not have to make the product available in all of its branches. We collect information on the list of cities that an individual WMP is offered from WIND. Among all the WMPs in the dataset, about 80% of them are offered in all the issuing bank's branches, and the rest are only available in a limited number of cities or provinces. Under the deposit competition hypothesis, the local branch should offer more WMPs when the bank faces more BOC competition in other cities as the competition shall affect *all* the branches through the bank's internal capital market, regardless of the status of deposit competition faced

by the branch in its local market or the local WMP demand.[26] Under the WMP demand hypothesis, however, the issuance of WMPs should mostly depend on local factors. If there is any spillover effect across branches through the bank's internal capital market, the effect should be *negative*. This is because more WMP demand from investors in other cities increases the WMP issuance by the branches in other cities, lowers the marginal return of funds for all branches, and, therefore, reduces the branch's issuance of WMPs.

To differentiate between these two hypotheses, we examine the effect of the bank's exposure to BOC competition in the *other* cities on the bank's WMP issuance in a given city. Specifically, we estimate the following specification:

$$WMPN_{ijt} = \beta \cdot BOCExp_{i,-j} \cdot 1_{t>2010} + \theta_{\mathrm{jt}} + \alpha_{\mathrm{ji}} + \varepsilon_{ij} \quad (12)$$

In Eq. (12), the dependent variable is the number of WMPs offered by bank *i* in city *j* in year *t*. We do not use the issuance amount as the dependent variable because the information on this variable is not available at the product-city level. The key independent variable, $BOCExp_{i,-j}$, is bank *i*'s exposure to BOC competition in all cities except *j*:

$$BOCExp_{i,-j} = \frac{\sum_{j' \neq j} N_{i,j'} \times MktShare_{BOC,j'}}{\sum_{j' \neq j} N_{i,j'}} \quad (13)$$

We include the city-by-year fixed effect to control for the time-varying local market conditions and the city-by-bank fixed effect to control for the bank-city specific time-invariant characteristics. With the city-by-year and city-by-bank fixed effects, Eq. (12) examines that within a given city, whether banks experience different paths of WMP offering due to their exposure to BOC competition anywhere else after 2010.

The total number of WMPs in the WIND database was 4,080 in 2008, and rose to 55,910 in 2015 (there were only 1,170 WMPs in 2007 and less than 500 annually before 2007). Therefore, we choose the sample period to be 2008-2015. We construct bank-city pairs such that the bank operated at least one branch in the city at the beginning of 2008. We then count the number of WMPs offered by the bank in the city in each year during 2008-2015. There are altogether 1,845 bank-city pairs. Among 52% of the bank-city-year observations, no single WMP was offered; and among the rest, the mean and the standard deviation of $WMPN_{ijt}$ are 696 and 1,191, respectively.

[26] There may be some heterogeneity in WMP supply across branches in response to the local deposit market competition. In unreported results of DID estimation controlling for bank-by-year and bank-by-city fixed effects, we do find that the same bank offers significantly more WMPs in cities with more BOC competition after 2010, although the magnitude of the effect is small.

Table 8 reports the results. In the first two columns, we include all the banks in the estimation. To verify the parallel-trend assumption, we use year 2008 as the base year and report the estimated effect year-by-year. Column (1) shows that the parallel-trend assumption holds; that is, in a given city, there is no significant difference in the growth of WMP offering between banks with differential exposure to BOC competition before 2010. The effect becomes statistically significant starting in 2011. In Column (2), we pool the post-treatment years together and obtain an average treatment effect estimate. In terms of the magnitude of the effect, moving $BOCExp_{i,-j}$ from the 25th percentile to the 75th percentile, the predicted number of WMPs offered annually would increase by 306, which is economically important compared to the mean of 285 and standard deviation of 885 (see Table 1 Panel A). Recall that the WMP demand hypothesis would predict no or a negative effect of branch overlap with BOC in other cities on local WMP offering. Therefore, these results are consistent with the deposit competition hypothesis and against the WMP demand hypothesis.

Another concern is that, if banks respond to the overall demand of WMPs in cities where they operate, but offer WMPs uniformly across all the branches, then under the WMP demand hypothesis, we would still find a positive significant effect of exposure to BOC competition anywhere else on the local WMP offering. To check if the results are driven by the banks that uniformly offer WMPs in all branches, in Columns (3) and (4), we only include those banks that do not offer all the WMPs in all the branches. The parallel-trend assumption still holds, and the estimated treatment effect remains positive and significant, and the magnitude of the coefficients barely changes compared to Columns (1) and (2). This result too supports the deposit competition hypothesis, and is inconsistent with the WMP demand hypothesis.

To summarize the results from this section, our key hypothesis is that when the fiscal stimulus is supported by credit expansion (*without* monetary easing), it can lead to intensified deposit competition, which in turn leads to the rise of shadow banking activities. We exploited the unique role played by BOC in the import-export market and during China's RMB 4-trillion stimulus to develop our identification strategy, and find supporting evidence.

V. ROLLOVER RISKS OF WMPS

What are the consequences of the shift from deposit funding to WMP funding on the issuing banks and the banking sector? Meiselman et al. (2023) shows with empirical evidence that in general, the short-term profit-seeking strategy of banks measured with their ROE is associated with greater realization of tail risks. Our context provides a particular scenario where

the short-term profit seeking motives for issuing WMPs can expose banks to greater risks. There are at least two types of risks associated with WMP financing as compared to deposit financing. First, WMPs need to be rolled over frequently due to their shorter maturities, which imposes challenges to banks' liquidity management. Second, while banks offer explicit guarantees on deposits, they only offer implicit (and non-binding) guarantees on WMPs. Failure to honor the guarantees may hurt investors' confidence in the bank's ability and/or willingness to honor the guarantees in the future and lead to a significant freeze of the banks' ability to issue new WMPs (Huang et al., 2023).

In this section, we focus on the first type of risk, viz., rollover risk, and provide some suggestive evidence on how the rollover of WMPs affects the banks' behavior in pricing of their own WMPs as well as in the inter-bank market, and next how it affects the pricing of banks in the stock markets (which may reflect in part also the second type of risk).

In particular, we study the WMP rollover of both the Big Four banks and the SMBs whereas the analysis from the previous section focused on the SMBs only.

V.1 Maturity Mismatches of WMPs

While a large fraction of the assets financed by the WMPs are long-term, WMPs usually have short maturities (the average maturity is 3-4 months). One reason for setting short maturities is to boost the issuing banks' deposit balances at the time of the regulatory inspection, e.g., of the LDR requirement. When WMPs mature, banks transfer funds from the investors' WMP accounts to their savings or deposit accounts at the bank, temporarily boosting the bank's deposit balance. The inspection of LDR is conducted by the CBRC at the end of each quarter. By setting the maturity dates close to quarter end, banks can boost total deposit balances on days when LDR inspections are performed.[27]

To examine the strategic timing of the WMP maturity dates, we collect information on individual WMPs from the WIND database and count the number of WMPs that mature on each day within a quarter. Figure 9 shows the total number of WMPs issued by the SMBs and the Big Four banks that mature on each day of the quarter. There is significant clustering of WMPs maturing exactly on the last day of the quarter, but no such strong clustering of maturity dates near the end of the first two months of the quarter. This pattern supports the notion that banks use maturing WMPs to manage deposit-related requirements such as the LDR regulation.

[27] The motivation and implementation are akin to the use of "Repo 105" transactions by Lehman Brothers in window-dressing its balance-sheet leverage ratio at quarter ends (Jeffers, 2011).

V.2 Yields on New WMPs

The resulting short maturities of WMPs introduce rollover risks for the issuing banks, in that when a large amount of WMPs mature on a particular day, banks will need to raise capital within a short time window to meet redemption of funds. One way to refinance the maturing WMPs is to issue new products. However, with the increasing scale of these products to roll over, banks would have to offer higher yields on new WMPs in excess of the deposit rates so as to attract enough investors within a short time window.

To examine this channel, we calculate at product-level WMP yield spread, $YieldSpread$, as the difference between the annualized target yield of the WMP product of the bank and the bank's deposit-rate ceiling of the same maturity in the same year. We relate this WMP yield spread to $WMPdue$, which is the amount of WMPs due in a quarter over bank assets at the end of the previous year, focusing on a bank's own *WMPdue* as well as that of Big Four banks and SMBs as a whole. We focus on short time windows (quarters) to match the typical maturity of WMPs. As shown in Table 2 Panel A, on average, Big Four banks needed to roll over WMPs amounting to 7.2% of their assets and SMBs needed to roll over WMPs of about 3.7% of their assets, more than two thirds of which was of principal-floating WMPs.

Formally, we study the effect of $WMPdue$ on the WMP yield spread with the following specification:

$$YieldSpread_{ikt} = \beta_1 \cdot WMPdue_{it} + \beta_2 \cdot WMPdue_{SMB\backslash i,t} + \beta_3 \cdot WMPdue_{Big\backslash i,t} + bank_i + YieldType_k + Maturity_k + e_{ikt} \quad (14)$$

There are three key explanatory variables. The first is bank i's own maturing WMPs to roll over in quarter t. For regressions on principal-floating (guaranteed) WMPs, $WMPdue$ is calculated based on principal-floating (guaranteed) products only. To capture the 'equilibrium effect' of $WMPdue$, we calculate the leave-one-out *average* $WMPdue$ of the Big Four banks and the SMBs. That is, $WMPdue_{SMB\backslash i,t}$ is the average $WMPdue_{it}$ of all SMBs except i if i is an SMB and $WMPdue_{Big\backslash i,t}$ is the average $WMPdue_{it}$ except i if i is a Big Four bank. The coefficients $(\beta_1, \beta_2, \beta_3)$ capture how the need to roll over maturing WMPs affects the WMP yield beyond the regulatory deposit rates. We also control for bank, WMP yield type and maturity fixed effects. We do not include quarter fixed effects as otherwise coefficients on $WMPdue_{SMB}$ and $WMPdue_{Big}$ would not be identified because of collinearity.

Table 9 presents the results. In Column (1), we report the coefficient estimates of the three key explanatory variables. All three variables have a positive and significant effect on the WMP

yield spread: when an issuing bank has more WMPs to roll over or when the aggregate amount of WMPs to roll over is large, the bank will offer a higher WMP yield (spread). In terms of the magnitude, one-standard-deviation increase of $WMPdue$, $WMPdue_{SMB}$ and $WMPdue_{Big}$ will increase the WMP yield spread by 10, 40, and 20 bps, respectively, as compared to the standard deviation of WMP yield spread of 130 bps (see Table 1 Panel A).

To explore the heterogenous effects of these variables on different WMPs, we first interact ($WMPdue, WMPdue_{SMB}, WMPdue_{Big}$) with the bank type. We find similar effects on WMPs issued by SMBs and Big Four banks (Columns under (2)). We then interact with the WMP types and also find similar effects on principal-guaranteed and floating products (Columns under (3)). Lastly, we look at WMP maturities (Columns under (4)). All three variables have greater effects on shorter-term products (0-3 months maturity), with robust evidence of diminishing effect as product maturity lengthens beyond 1 year, which is consistent with the hypothesis that banks issue short-term WMPs to manage liquidity and balance-sheet metrics at quarter ends, but incur rollover risk by doing so.

It can be seen visually too that in aggregate, the WMP yield spread strongly comoves with the amount of WMPs to roll over. As shown in Figure 10.1, the average WMP yield spread strongly comoves with the average $WMPdue$ especially $WMPdue_{Big}$ since 2010. The strong positive correlation between WMP yield spread and the maturing WMPs to roll over is consistent with an outward shift of the supply curve. That is, with more WMPs to roll over, banks supply more WMPs, and as a result the equilibrium WMP yield spread increases.

V.3 The Interbank Market Rates

If the rollover of WMPs and associated costs affect bank liquidity, they could also affect banks' behavior in the interbank market. Our hypothesis is that if a bank has more WMPs approaching maturity and hence to roll over, and if there is greater quantity of WMPs due in the aggregate, the bank should submit a higher ask rate at which it is willing to lend and a higher bid rate at which it is willing to borrow in the interbank market. In other words, more maturing WMPs increase the banks' marginal value of funding liquidity. To examine this hypothesis, we focus on the banks' SHIBOR ask rate by estimating the following specification:

$$ShiborAsk_{it} = \beta_1 \cdot WMPdue_{it} + \beta_2 \cdot WMPdue_{SMB\backslash i,t} + \beta_3 \cdot WMPdue_{Big\backslash i,t} + bank_i + e_{it} \quad (15)$$

In Eq. (15), the dependent variable is a SHIBOR-participating bank's average ask quotes within quarter *t*. As in Eq. (14), we include the bank's own liquidity condition and the aggregate market's liquidity condition resulting from the rollover of WMPs in the regressions. We also

include bank fixed effects but not time fixed effects because otherwise, $WMPdue_{SMB}$ and $WMPdue_{Big}$ cannot be identified due to collinearity. We use quarterly observations of banks that participate in the SHIBOR bid and ask processes from 2008 Q1 to 2015 Q4 and estimate the Eq. (11) for the Big Four banks and SMBs separately.

Table 10 reports the results. The liquidity condition of the Big Four banks is a much more important determinant of the market liquidity than that of the SMBs. The coefficient of $WMPdue_{SMB}$ is statistically insignificant in all the regressions, while the coefficient of $WMPdue_{Big}$ is positive and significant for both the Big Four banks and SMBs. Moreover, the Big Four banks will ask for a higher rate if their own $WMPdue$ is higher, but the SMBs do not. The size of the effect is economically important. A one standard deviation increase in $WMPdue_{Big}$ increases the big bank's ask rates for the overnight SHIBOR by 43 bps (Panel A Column (1)), and the participating SMB's ask rates for the overnight SHIBOR by 56 bps (Panel B Column (1)). Other columns in both panels show that the magnitude of these effects does not vary much across different maturities but appears to be the greatest for the 1-month SHIBOR.

The asymmetric effects of the liquidity condition between the Big Four banks and the SMBs are in line with the fact that the Big Four banks are the main liquidity providers and the price setters in the interbank market, while SMBs are typically net borrowers and price takers (Hachem and Song, 2021). When large banks have more maturing WMPs, SMBs are induced too to submit higher ask quotes given the greater aggregate demand for rollover of short-term WMPs. To see this visually, in Figure 10.2, we plot $WMPdue_{SMB}$ and $WMPdue_{Big}$ against the one-week SHIBOR. We can see a clear rising trend in the one-week SHIBOR over our sample period, and it closely tracks the average $WMPdue$ of the Big Four banks. In contrast, the average $WMPdue$ of the SMBs has a weaker relationship with SHIBOR.

Overall, the greater rollover pressure of WMPs, especially those issued by the Big Four banks, tightens the interbank liquidity and leads to higher interbank interest rates.

V.4 The Stock Market's Response to Rollover Risk

Finally, we look at the stock market response to an unexpected shock of funding costs for the 17 listed banks during 2009-2015. Since banks tap the interbank market for liquidity when their WMPs mature, a sudden increase in SHIBOR would increase their funding cost if they have large amounts of WMPs to roll over. This should be reflected in changes of their stock prices if investors are aware of the rollover risks.

To identify unexpected shock to funding costs, we calculate the daily changes in the overnight and one-week SHIBORs and regard the changes as unexpected if changes in both

the overnight and one-week rates are high. A large increase in SHIBOR should be unexpected because otherwise, banks could arbitrage by borrowing one day in advance and lending on the next day when the rate increases. The SHIBOR is announced at 11:30am (9:30am starting from 08/01/2014) everyday; if the announced rates are much higher than those on the previous day, the stock prices could incorporate this negative shock before trading ends that day. To test this prediction, we estimate the following specification on days with unexpected shock of funding costs:

$$return_{it} = \alpha + \beta \times WMPdue_{it} + \theta_t + \varepsilon_{it} \quad (16)$$

The dependent variable $return_{it}$ is the end-of-day stock return of the WMP issuing bank from the previous trading day to the current day. We choose days when the changes in both the overnight and one-week SHIBOR are above a certain threshold which we vary across estimations. The independent variable $WMPdue_{it}$ is the amount of WMPs that mature in the current *month t*, scaled by the issuing bank's equity at the end of the previous quarter. In the previous subsection, we use the amount of WMPs maturing in a quarter as the regressor. But what is more relevant here is the amount of WMPs needed to be rolled over within a short time window around the date when SHIBOR increases unexpectedly, as the SHIBOR event affects the short-term funding cost the most. Therefore, we use the amount of WMPs maturing in the current month. We scale WMP amount due by (book) equity instead of total assets because the dependent variable in Eq. (16) is the (market) return on equity. The coefficient β is expected to be negative for dates with sufficiently large changes in the SHIBORs.

Table 11 reports the results. We choose four different thresholds to classify the SHIBOR change as unexpectedly high, with the largest one to be c = 1% (100 basis points). During our sample period, there were nine trading days on which both the overnight and one-week SHIBOR jumped by more than 1%. The second, third, and fourth thresholds are 0.8%, 0.6% and 0.4% with 15, 24, and 47 trading days, respectively. The first row in Table 11 reports estimation results using raw returns on the bank stocks. Consistent with our hypothesis, the coefficient estimate of $WMPdue$ is negative and statistically significant when the threshold is no less than 0.6%.[28] In terms of the economic magnitude of the effect: a one standard deviation increase in $WMPdue$ leads to a drop in raw returns by 0.17% during the trading days when the SHIBOR spiked by 1% or higher.

We also use three risk-adjusted stock returns as the dependent variable in Table 11: raw

[28] Figure IA9 in the Internet Appendix presents the scatter plot of raw returns against *wmpdue* with c = 1%; a negative relationship between bank stock prices and *wmpdue* emerges.

daily return minus the market return (second row), the residual from a linear projection of raw daily returns on market returns for the past 60 trading days (third row), and the residual from a CAPM model (with the 3-month SHIBOR as the risk-free rate) using observations for the past 60 trading days (fourth row). The results are robust to all these alternative measures of stock returns.

To summarize, the results in this section showed that the rollover risks of WMPs put pressure on banks' liquidity management and increase their funding cost. In particular, the amount of maturing WMPs to roll over, especially those issued by the Big Four banks, is an important determinant of the interbank market rates and stock prices of banks facing rollover risks, with the potential to induce financial fragility.

VI. CONCLUSION

Much attention has been paid to the rise of shadow banking as a result of "regulatory arbitrage" by financial institutions and its impact on the stability of the overall financial system. However, there is little academic research on how shadow banking arises in emerging markets. In this study, we examine one of the largest components of China's shadow banking sector—Wealth Management Products (WMPs) issued by banks, which can be regarded as short-maturity, off-balance-sheet substitutes for deposits. We first link the rapid rise in the scale of WMPs after 2010 to intensified deposit competition, which is triggered by the combination of fiscal expansion and slowdown of cross-border money flows, both a result of the 2008-2009 Global Financial Crisis. We demonstrate that the effect of deposit competition on smaller banks to be causal by exploiting the special role of one large state-owned bank, viz., BOC (Bank of China), which was much more exposed to both shocks and competed much more aggressively than other banks for deposits, leading to cross-sectional difference in the increase of deposit competition after 2010.

We then study the rollover risk of the WMPs by studying issuing banks' activities when these products mature and in the context of the interbank market as well as bank stock prices.

Overall, our tests and results shed light on how deposit competition can arise and matter in unexpected ways to increase bank reliance on fragile deposit-like substitutes in shadow banking. Such migration can be the result of a fiscal stimulus even without monetary easing, with consequences for fragility of the financial system.

References

1. Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge, 2023. "When should you adjust standard errors for clustering?." The *Quarterly Journal of Economics* 138.1: 1-35.
2. Acharya, Viral, Abhiman Das, Nirupama Kulkarni, Prachi Mishra, and N.R. Prabhala, 2020, "Government Guarantees and Bank Vulnerability during a crisis: Evidence from an Emerging Market," Working paper, NYU Stern School of Business.
3. Acharya, Viral, Nicola Cetorelli and Bruce Tuckman, 2023a, "Where Do Banks End and NBFIs Begin?" Working Paper, NYU Stern School of Business.
4. Acharya, Viral, Rahul Singh Chauhan, Raghuram Rajan and Sascha Steffen, 2023b, "Liquidity Dependence and the Waxing and Waning of Central Bank Balance Sheets," Working Paper, NYU Stern School of Business.
5. Acharya, Viral, and Sabri Oncu, 2013a, "A Proposal for the Resolution of Systemically Important Assets and Liabilities: The Case of the Repo Market," *International Journal of Central Banking* 9 (1), 291-350.
6. Acharya, Viral, Philipp Schnabl and Gustavo Suarez, 2013b. "Securitization without Risk Transfer," *Journal of Financial Economics* 107, 515-536.
7. Allen, Franklin, Jun Qian, Chenyu Shan, and Mengxin Zhao, 2014. "The IPO of Industrial and Commercial Bank of China and the 'Chinese Model' of Privatizing Large Financial Institutions," *European Journal of Finance* 20, 599-624.
8. Allen, Franklin, Jun Qian, Chenying Zhang, and Mengxin Zhao, 2012. "China's Financial System: Opportunities and Challenges," Chapter 2 in *Capitalizing China*, Joseph Fan and Randall Morck, eds. University of Chicago Press.
9. Allen, Franklin, Yiming Qian, Guoqian Tu, and Frank Yu, 2019. "Entrusted Loans: A Close Look at China's Shadow Banking System," *Journal of Financial Economics* 133, 18-41.
10. Allen, Franklin, Xian Gu, Wei Li, Jun Qian, and Yiming Qian, 2023. "Implicit Guarantees and the Rise of Shadow Banking: The Case of Trust Products," *Journal of Financial Economics* 149, 115-141.
11. Bai, Chong-En, Chang-Tai Hsieh, and Zheng Michael Song, 2016. "The Long Shadow of A Fiscal Expansion," *Brookings Papers on Economic Activity*, Fall 2016.
12. Becker, Bo, and Victoria Ivashina, 2015. "Reaching for yield in the bond market," *The Journal of Finance* 70.5: 1863-1902.
13. Borst, Nicholas, 2013. "Shadow Deposits as a Source of Financial Instability: Lessons from the American Experience for China," *Policy Brief Peterson Institute for International Economics* 13.
14. Buchak, Greg, Gregor Matvos, Tomasz Piskorski, Amit Seru, 2018. "Fintech, regulatory arbitrage, and the rise of shadow banks," *Journal of Financial Economics* 130 (3), 453-483.

15. Chen, Kaiji, Jue Ren, and Tao Zha, 2018. “The Nexus of Monetary Policy and Shadow Banking in China,” *American Economic Review* 108, 3891-3936.
16. Chen, Zhuo, Zhiguo He, and Chun Liu, 2020. “The Financing of Local Government in China: Stimulus Loan Wanes and Shadow Banking Waxes,” *Journal of Financial Economics* 137, 42-71.
17. Chen, Shiyi, and Bin Lin, 2019. “Dual-track Interest Rates and Capital Misallocation,” *China Economic Review* 57, 301-338.
18. Cong, Lin William, Haoyu Gao, Jacopo Ponticelli, and Xiaoguang Yang, 2019. “Credit Allocation under Economic Stimulus: Evidence from China,” *Review of Financial Studies* 32, 3412-3460.
19. Deng, Yongheng, Randall Morck, Jing Wu, and Bernard Yeung, 2015. “China’s Pseudo-monetary Policy,” *Review of Finance* 19, 55-93.
20. Drechsler, Itamar, Alexi Savov, and Philipp Schnabl, 2017. “The deposits channel of monetary policy,” *Quarterly Journal of Economics* 132, 1819-1876.
21. Drechsler, Itamar, Alexi Savov, and Philipp Schnabl, 2018. “Liquidity, Risk Premia, and the Financial Transmission of Monetary Policy,” *Annual Review of Financial Economics* 10, 309-328.
22. Drechsler, Itamar, Alexi Savov, and Philipp Schnabl, 2021. “How Monetary Policy Shaped the Housing Boom,” *Journal of Financial Economics*, forthcoming.
23. Egan, Mark, Ali Hortaçsu, and Gregor Matvos, 2017. “Deposit competition and financial fragility: Evidence from the US banking sector,” *American Economic Review* 107.1: 169-216.
24. Ehlers, Torsten, Steven Kong, and Feng Zhu, 2018. “Mapping Shadow Banking in China: Structure and Dynamics,” BIS Working Paper No. 701.
25. Gao, Haoyu, Hong Ru, Robert Townsend, and Xaioguang Yang, 2019. “Rise of bank competition: Evidence from banking deregulation in China,” No. w25795. National Bureau of Economic Research.
26. Garcia-Herrero, Alicia, Jinghan Cai, Fengyun Li, and Le Xia, 2019. “Regulatory Arbitrage and Window-dressing in Shadow Banking: The Example of Chinese Wealth Management,” *Available at SSRN 3420552*.
27. Gopal, Manasa, Philipp Schnabl, 2022. “The Rise of Finance Companies and FinTech Lenders in Small Business Lending,” Review of Financial Studies.
28. Hachem, Kinda, 2018. “Shadow Banking in China,” *Annual Review of Financial Economics* 10, 287-308.
29. Hachem, Kinda, and Zheng Song, 2021. “Liquidity Rules and Credit Booms,” *Journal of Political Economy* 129, 2721-2765.
30. Huang, Ji, Zongbo Huang, and Xiang Shao, 2023. "The risk of implicit guarantees: Evidence from shadow banks in China." *Review of Finance* 27.4: 1521-1544.
31. International Monetary Fund, 2014. “Risk Taking, Liquidity, and Shadow Banking: Curbing Excess While Promoting Growth,” Global Financial Stability Report.

32. Jeffers, Agatha, 2011. "How Lehman Brothers used Repo 105 to manipulate their financial statements." *Journal of Leadership, Accountability and Ethics*.
33. Lai, Shaojie, Lihan Chen, Qing Sophie Wang, and Hamish D. Anderson, 2023. "Bank competition and corporate employment: Evidence from the geographic distribution of bank branches in China." Journal of Banking & Finance 154: 106964.
34. Meiselman, Ben S., Stefan Nagel, and Amiyatosh Purnanandam, 2023. "Judging banks' risk by the profits they report". No. w31635. National Bureau of Economic Research.
35. Qian, Jun, Phil Strahan, and Zhishu Yang, 2015. "The Impact of Incentives and Communication Costs on Information Production and Use: Evidence from Bank Lending," *Journal of Finance* 70, 1457-1493.
36. Sarto, Andres and Olivier Wang, 2023. "The Secular Decline in Interest Rates and the Rise of Shadow Banks," Working Paper, NYU Stern School of Business.
37. Song, Michael, Jetil Storesletten, and Fabrizio Zilibotti, 2011. "Growing like China," *American Economic Review* 101, 196–233.
38. Wang, Hao, Honglin Wang, Lisheng Wang, and Hao Zhou, 2019. "Shadow Banking: China's Dual-track Interest Rate Liberalization," *Available at SSRN 2606081*.
39. Xiao, Kairong, 2020. "Monetary transmission through shadow banks," *Review of Financial Studies*, 33(6), 2379-2420.

Table 1 Definition of Variables

Variable	Definition
Asset, Billion RMB	the bank's total assets at year end.
Deposit, Billion RMB	the bank's deposit balance at year/quarter end.
Loan, Billion RMB	the bank's loan balance at year/quarter end.
LDR	Loan/Deposit ratio.
DAR	the bank's total deposit balance over assets at year end.
WMP	the bank's total WMP balance at year end. It is first based on our survey data and then on the banks' financial reports, and finally complemented by adding up either the actual or the target issuing amounts of individual WMPs available in WIND; WMP^f (WMP^g) refers to principal-floating (-guaranteed) products.
NDLAR	the bank's non-deposit liability (i.e., total liability-deposit) over asset at year end.
Interbank, Bil. RMB	the bank's interbank borrowing (repo + interbank deposits) at year end.
Bond, Billion RMB	the bank's bonds payable at year end.
Other Lia., Bil. RMB	the bank's total on-balance-sheet liability - Deposit - Interbank – Bond.
Paid-in Capital, Bil. RMB	the bank's total paid-in capital at year end.
Leverage	the bank's total on-balance-sheet liability over asset at year end.
LAR	the bank's total loan balance over asset at year end.
Loan Rate, %	banks average loan rates, calculated as interest incomes/(loan balance + reverse repo + deposits in other banks).
Deposit Rate, %	banks average deposit rates, for Big Four it is reported and for SMBs it is calculated as (net interest income – Net Interest Margin × Assets)/Deposits.
WMPYield, %	the average annualized target yield of WMPs weighted by the amount raised at the bank-year level.
ROA_nofee, %	the bank's annual return-on-asset excluding the commissions and fees.
ROA, %	the bank's annual return-on-asset including all the sources of profits.
ROE_nofee, %	the bank's annual return-on-equity excluding the commissions and fees.
ROE, %	the bank's annual return-on-equity including all the sources of profits.
BranchN	the number of new branches established by the bank in the city in a given year.
WMPN	the number of WMPs offered by the bank in the city in a given year.
$WMPdue^f$	the amount of principal-*floating* WMPs matured in the quarter over the bank's asset at the previous year end.
$WMPdue^g$	the amount of principal-*guaranteed* WMPs matured in the quarter over the bank's asset at the previous year end.
WMPdue	$WMPdue^f + WMPdue^g$.
YieldSpread, %	the annualized target yield of the WMPs minus the bank deposit rate ceiling of the same maturity.
SHIBOR Ask, %	quarterly average SHIBOR ask rates of the SHIBOR-participating banks.
$MktShare_{BOC}$	the market share using the number of branches of BOC in the city in 2010.
$MktShare_{Big3}$	the market share using the number of branches of ABC, CCB and ICBC as a whole in the city in 2010.
BOCExp	the average $MktShare_{BOC}$ using the bank's number of branches in the city in 2010 as the weight.
Big3Exp	the average $MktShare_{Big3}$ using the bank's number of branches in the city in 2010 as the weight.
CBF, Billion US dollars	quarterly cross-border money net inflow, which is all receipts minus payments processed through domestic banks.
SHIBOR, %	quarterly average Shanghai Interbank Offered Rates.

Table 2 Summary Statistics

Panel A provides summary statistics of bank characteristics for the Big Four banks and SMBs separately. Panel B gives the summary of the market (branch) share of BOC and the other three big banks in 2010, as well as the competition exposure of our sample SMBs to these big banks. Panel C provides statistics for some other economic variables used in this paper. Table 1 provides definition for all variables.

Panel A. Bank Characteristics

	Mean	Median	St. Dev.	Obs
Big Four banks:				
Asset, B RMB	1.27e+04	1.25e+04	4328.177	36
Deposit, B RMB	13162.991	12970.740	6297.993	276
Loan, B RMB	5301.436	5134.002	2099.428	148
DAR	0.792	0.793	0.058	36
WMP/Asset	0.046	0.051	0.032	36
LDR	0.627	0.618	0.057	148
Deposit Rate, %	1.723	1.680	0.261	67
WMPdue[f]	0.048	0.060	0.034	128
WMPdue[g]	0.023	0.011	0.032	128
WMPdue	0.072	0.080	0.053	128
YieldSpread, %	2.952	2.900	1.310	51178
SHIBOR Ask, 1-week, %	3.033	3.246	1.017	128
SMBs:				
Asset, B RMB	307.326	60.422	799.608	1043
DAR	0.754	0.767	0.111	1032
WMP/Asset	0.03	0.001	0.06	1043
NDLAR	0.177	0.165	0.113	1030
Interbank/Asset	0.127	0.109	0.103	1030
Bond/Asset	0.013	0.001	0.025	1030
Other Lia. /Asset	0.036	0.031	0.037	1030
Paid-in Capital/Asset	0.044	0.039	0.031	1030
Leverage	0.93	0.935	0.031	1040
LAR	0.466	0.476	0.106	1009
Loan Rate, %	7.927	7.585	2.409	999
Deposit Rate, %	2.127	1.884	1.683	904
WMPYield, %	4.785	4.938	0.934	670
ROA_nofee, %	0.872	0.835	0.432	1026
ROA, %	1.035	1.016	0.402	1026
ROE_nofee, %	13.192	12.565	6.680	1025
ROE, %	15.813	15.503	6.448	1025
Foreign deposit share	0.042	0.006	0.114	56
BranchN	2.201	1.000	4.927	4680
WMPN	285.321	0.000	885.493	14760
WMPdue[f]	0.026	0.000	0.124	3452
WMPdue[g]	0.011	0.000	0.038	3452
WMPdue	0.037	0.001	0.147	3452
YieldSpread, %	3.183	2.950	1.304	164223
SHIBORAsk, 1-week, %	3.054	3.253	1.013	311

Panel B. Big Four Market Share and Competition

	Mean	Median	St. Dev.	Obs
$MktShare_{BOC}$	0.064	0.061	0.033	339
$MktShare_{Big3}$	0.400	0.381	0.134	339
BOCExp	0.071	0.071	0.021	131
Big3Exp	0.369	0.368	0.082	131

Panel C. City Economic Variables

	Mean	Median	St. Dev.	Obs
CBF (Cross-Border Net Flows), B dollar	30.213	27.955	52.595	88
Bank Loan Balance, B RMB	83.475	25.444	212.383	2494
Fixed Capital Invest., B RMB	46.304	23.940	65.103	2355
Bank Deposit Balance, B RMB	124.505	44.801	338.806	2492
SHIBOR, 1-week, %	3.042	3.245	1.033	32

Table 3 Cross-border Money Inflow and Big Four Deposit Growth

Panel A. Sensitivity of Deposit Growth to Cross-border Money Inflow

This table reports the sensitivity of the big banks' deposit increase to the cross-border money flow. △d is change of deposit increase scaled by the bank's deposit balance in 2008 and △cbf is change of CBF (cross-border net money inflow) scaled by total deposit balance of the four big banks in 2008. Sample period is from 2006Q1 to 2022Q4.

Bank	BOC	ABC	CCB	ICBC
Dep Var: △d	(1)	(2)	(3)	(4)
△cbf	3.110**	2.103	1.339	-0.00626
	(2.016)	(1.391)	(0.921)	(-0.00549)
Observations	66	66	66	66
R-squared	0.074	0.044	0.020	0.000

Panel B. Counterfactual Analysis on BOC

This table reports to what extent the decline of net foreign-currency deposit inflow contributed to the rising LDR of BOC. Net foreign-currency deposit inflow leads to: (1) the net exchange of foreign currency for RMB deposits (second row); (2) an increase of foreign-currency deposit balance if not exchanged for RMB deposit (third row). So, the first row equals the sum of the second and third row. The counterfactual total deposit balance and LDR are calculated by assuming BOC's net foreign-currency deposit inflow in 2009 (X-43.99) and 2010 (X-35.01) remained the same as in 2008 (X+7.76). We conceal the values with X due to data confidentiality. All numbers are in billion USD.

Year		2008	2009	2010
Net foreign-currency deposit inflow		X+7.76	X-43.99	X-35.01
Net Exchange of Foreign currency for RMB deposits		X	X-64.54	X-37.90
Increase of Foreign-currency deposit balance		7.76	20.56	2.89
Actual:	Total Loan Balance		644.91	769.34
	Total Deposit Balance		881.46	1056.69
	LDR		73.2%	72.8%
Counterfactual:	Total Loan Balance		644.91	769.34
	Total Deposit Balance		933.21	1151.21
	LDR		69.1%	66.8%

Table 4 Local Exposure to Shocks and BOC Branch Presence

This table examines whether the SMBs' own direct exposure to the cross-border money inflow shock (Panel A) and the stimulus shock (Panel B) is correlated with their exposure to BOC competition. In Panel A, Column (1)-(2) show the correlation between the SMBs' exposure to BOC competition and the share of their deposits in foreign currency in 2010; Column (3)-(4) show the correlation between BOC market (branch) share and the detrended deposit growth from 2008 to 2010 across cities, which is calculated by first fitting a city-specific linear trend to the city's deposit balance during 2003-2008 and then calculating the ratio between the actual and predicted balance in 2010. In Panel B, we check whether BOC market (branch) share is correlated with the implementation of local stimulus across cities, measured by the supply of stimulus loans and the stimulus investment in fixed capital which are calculated similarly to the detrended deposit growth. Robust *t*-statistics are shown in the parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Panel A. Direct Exposure to the Shock of Cross-border Money Inflow

Dep Var:	Foreign deposit share		Detrended deposit growth	
	(1)	(2)	(3)	(4)
$MktShare_{BOC}$			0.0987	-0.0172
			(0.268)	(-0.0673)
BOCExp	0.960	0.0317		
	(1.646)	(0.0211)		
Province FE	No	Yes	No	Yes
Observations	52	42	295	291
R-squared	0.024	0.207	0.001	0.297

Panel B. Local Implementation of Fiscal Stimulus

Dep Var:	stimulus loan		stimulus investment	
	(1)	(2)	(3)	(4)
$MktShare_{BOC}$	0.157	-0.272	-2.118***	-0.810
	(0.252)	(-0.582)	(-3.060)	(-1.272)
Province FE	No	Yes	No	Yes
Observations	295	291	289	284
R-squared	0.000	0.300	0.036	0.430

Table 5 BOC Competition, Deposit Availability and WMP Balance

This table shows the treatment effect of exposure to BOC competition on the SMBs' deposit availability (DAR) and WMP issuance (WMP/Asset) after 2010 with the DID specification, and the causal effect of DAR on WMP/Asset where DAR is instrumented by the SMB's exposure to BOC competition after 2010 with the 2SLS specification. We conduct the estimation using annual observations of all SMBs from 2007 to 2015. All the standard errors are clustered by bank. Robust *t*-statistics are shown in the parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep Var:	WMP/Asset	DAR	DAR	WMP/Asset	WMP/Asset	WMP/Asset	WMP^f/Asset	WMP^g/Asset
DAR	-0.0244			-1.119*				
	(-0.764)			(-1.791)				
BOCExp*1(t>2010)		-0.703***	-0.809***		0.787**	0.960**	0.647*	0.140**
		(-2.805)	(-2.839)		(2.104)	(2.130)	(1.734)	(2.021)
Big3Exp*1(t>2010)			0.0722			-0.117		
			(0.568)			(-1.254)		
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	979	979	979	979	991	991	991	991
R-squared	0.693	0.824	0.824	-2.307	0.701	0.703	0.688	0.637
Spec	OLS	First Stage		Second Stage	Reduced Form			
N of banks	126	126	126	126	126	126	126	126
F-stat				7.866				

Table 6 Effects of BOC Competition on SMBs' Other Activities

This table shows the treatment effect of exposure to BOC competition on the SMBs' other on-balance-sheet funding sources, asset growth, loan supply, deposit rates and profitability after 2010. We conduct the estimation using annual observations of all SMBs from 2007 to 2015. Standard errors are clustered by bank. Robust *t*-statistics are shown in the parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Panel A. Other on-balance-sheet Funding Sources

	(1)	(2)	(3)	(4)
Dep. Variable	Interbank/Asset	Bond/Asset	Other Lia./Asset	Paid-in Capital/Asset
BOCExp*1(t>2010)	0.455*	0.388***	0.0112	-0.0338
	(1.765)	(4.668)	(0.0907)	(-0.393)
Bank FE	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes
Observations	977	977	977	977
R-squared	0.759	0.697	0.504	0.636
N of banks	126	126	126	126

Panel B. Asset Growth and Loan Supply

	(1)	(2)	(3)
Dep. Variable	LAR	log(Asset)	Loan Rate
BOCExp*1(t>2010)	0.0554	0.374	3.095
	(0.159)	(0.234)	(0.304)
Bank FE	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes
Observations	953	939	942
R-squared	0.826	0.991	0.672
N of banks	123	119	123

Panel C. Deposit Rates and Profitability

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Deposit Rate	WMPYield	ROA_nofee	ROA	ROE_nofee	ROE
BOCExp*1(t>2010)	12.53**	33.36*	-4.196***	-3.394**	-58.82*	-46.52
	(2.060)	(1.858)	(-2.705)	(-2.243)	(-1.831)	(-1.401)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Province-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	843	567	975	975	974	974
R-squared	0.711	0.86	0.745	0.706	0.673	0.631
N of banks	123	108	126	126	126	126

Table 7 Within-Bank Estimation of New Branch Opening

This table examines for a given bank, whether its branching expansion decision in a given city is affected by the local competition from BOC after 2010. The dependent variable, BranchN, is the number of branches established by the SMB in a given city in each year. We choose bank-city pairs such that the bank operated at least one branch at the end of 2007 in the city. The sample goes from 2007 to 2015. "High" exposure to BOC competition means that $MarSha_{BOC}$ is above the 25th percentile. Standard errors are clustered by both bank and city. Robust *t*-statistics are shown in the parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Exposure to BOC Competition		All	All	High	High
Dep Var: BranchN		(1)	(2)	(3)	(4)
$MktShare_{BOC}$*	1(t>2010)	-11.06*		-24.68**	
		(-1.699)		(-2.232)	
	1(t=2008)		-14.57		-19.73
			(-1.199)		(-1.351)
	1(t=2009)		-12.81		-14.70
			(-1.019)		(-0.934)
	1(t=2010)		-14.52		-20.87
			(-1.197)		(-1.412)
	1(t=2011)		-12.69		-15.64
			(-1.045)		(-1.084)
	1(t=2012)		-9.978		-12.71
			(-0.803)		(-0.863)
	1(t=2013)		-11.87		-14.42
			(-0.921)		(-0.923)
	1(t=2014)		-45.92		-89.71**
			(-1.627)		(-2.170)
	1(t=2015)		-27.26*		-60.06***
			(-1.725)		(-2.851)
Observations		3,960	3,960	3,051	3,051
R-squared		0.552	0.554	0.559	0.566
Bank-Year FE		Yes	Yes	Yes	Yes
Bank-City FE		Yes	Yes	Yes	Yes
#City		145	145	94	94
#Bank		44	44	33	33

Table 8 Within-City Estimation of Local WMP Offering

This table examines within a city, whether banks offer a greater number of WMPs after 2010 when they have more branching overlap with BOC in *other* cities. The dependent variable, WMPN, is the number of WMPs offered by the bank in that city in each year. We choose bank-city pairs such that the bank operated at least one branch at the end of 2007 in the city. The sample goes from 2008 to 2015. In Column (1)-(2) we consider all banks while in Column (3)-(4) we include only those banks that do not offer all WMPs in all their branches. Standard errors are clustered by both bank and city. Robust *t*-statistics are shown in the parentheses. *** p<0.01, ** p<0.05, and * p<0.1.

Dep Var: WMPN		(1)	(2)	(3)	(4)
BOCExp'*	1(year=2009)	2,986		246.6	
		(1.403)		(0.421)	
	1(year=2010)	6,486		1,255	
		(1.532)		(0.993)	
	1(year=2011)	10,816*		3,882	
		(1.895)		(1.406)	
	1(year=2012)	11,846**		10,914	
		(2.507)		(1.542)	
	1(year=2013)	27,917***		33,485**	
		(2.819)		(2.333)	
	1(year=2014)	48,190***		49,315***	
		(2.667)		(3.083)	
	1(year=2015)	51,074*		22,244**	
		(1.885)		(2.236)	
	1(year>2010)		26,811**		23,468***
			(2.577)		(3.103)
Observations		7,832	7,832	2,928	2,928
R-squared		0.653	0.639	0.677	0.658
City-Year FE		Yes	Yes	Yes	Yes
City-Bank FE		Yes	Yes	Yes	Yes
#City		187	187	63	63
#Bank		150	150	52	52

Table 9 WMP Rollover Risks and WMPs' Yield Spread

This table reports the effect of the bank's own matured WMPs to roll over (WMPdue) and the average rollover need of other SMBs ($WMPdue_{SMB}$) and big banks ($WMPdue_{Big}$) on the individual WMP *YieldSpread*, which is the annualized target yield minus the bank deposit rate ceiling of the same maturity at the issuing date. To explore the heterogeneity of the effects, we interact (WMPdue, $WMPdue_{SMB,}$ $WMPdue_{Big}$) with the issuer bank types in Column (2), the WMP yield types in Column (3) and maturities in Column (4). For regressions on principal-floating (guaranteed) products, WMPdue is calculated using principal-floating (guaranteed) products only. All regressions include WMP yield type, maturity and bank fixed effects. The sample includes all the WMPs issued by the Big Four banks and the SMBs from 2008 to 2015. Standard errors are clustered by banks and quarters.[29] Robust t-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)		(3)		(4)			
	All	Bank Type		WMP Yield Type		Maturity			
Dep Var: YieldSpread, %		SMB	Big4	Guarantee	Floating	0-3months	3-6months	6-12months	1y-
WMPdue	0.356***	0.347***	1.597*	1.135**	0.322***	0.424***	0.351***	0.179***	0.158
	(13.48)	(7.571)	(1.697)	(2.348)	(10.21)	(7.937)	(6.387)	(4.793)	(1.469)
$WMPdue_{SMB}$	17.40***	17.72***	16.16***	15.46***	18.04***	22.41***	15.27***	10.27***	1.209
	(7.560)	(7.177)	(4.531)	(5.984)	(8.325)	(7.665)	(7.556)	(7.499)	(0.464)
$WMPdue_{Big}$	5.153***	4.702***	6.363***	6.700***	4.254***	9.674***	1.135	1.420	0.545
	(4.675)	(3.966)	(4.960)	(4.048)	(2.971)	(7.871)	(0.827)	(1.222)	(0.364)

[29] Following Abadie et al. (2023), we should cluster at the level at which at the treatment is assigned. We cluster at the bank level as WMPdue is assigned at the bank level for all the WMPs issued by the bank in that quarter, and we cluster at the quarter level because $WMPdue_{SMB}$ and $WMPdue_{Big}$, after a linear transformation with WMPdue, is assigned at the quarter level.

Table 10 WMP Rollover Risks and SHIBOR Quoted Rates

This table reports the effect of the bank's own matured WMPs to roll over (WMPdue) and the average rollover need of other SMBs ($WMPdue_{SMB}$) and big banks ($WMPdue_{Big}$) on the bank's SHIBOR quoted rates from 2008 Q1 to 2015 Q4. All regressions control for bank fixed effect. Standard errors are clustered by quarters. Robust t-statistics are shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Panel A. Big Four Banks

	o/n	1wk	2wks	1mth	3mths	6mths
Dep Var: SHIBOR Ask, %	(1)	(2)	(3)	(4)	(5)	(6)
WMPdue	0.211***	0.256***	0.293***	0.362***	0.284**	0.237**
	(3.446)	(3.336)	(3.355)	(3.468)	(2.565)	(2.429)
$WMPdue_{SMB}$	0.0570	0.0894	0.0929	0.0517	0.126	0.207
	(0.406)	(0.549)	(0.518)	(0.246)	(0.600)	(1.153)
$WMPdue_{Big}$	0.614***	0.696***	0.784***	0.988***	0.828**	0.612**
	(3.371)	(3.086)	(3.060)	(3.228)	(2.520)	(2.089)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	No
Observations	128	128	128	128	128	128
R-squared	0.571	0.554	0.557	0.588	0.481	0.462

Panel B. SMBs

	o/n	1wk	2wks	1mth	3mths	6mths
Dep Var: SHIBOR Ask, %	(1)	(2)	(3)	(4)	(5)	(6)
WMPdue	0.00811	0.00965	0.0111	0.00532	0.0170	0.0255
	(0.772)	(0.768)	(0.788)	(0.325)	(0.985)	(1.662)
$WMPdue_{SMB}$	0.0577	0.0855	0.0895	0.0509	0.148	0.200
	(0.444)	(0.558)	(0.522)	(0.257)	(0.774)	(1.182)
$WMPdue_{Big}$	0.795***	0.933***	1.067***	1.345***	1.005**	0.761*
	(3.269)	(3.062)	(3.068)	(3.276)	(2.281)	(1.891)
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	No
Observations	311	311	311	311	311	311
R-squared	0.559	0.545	0.553	0.587	0.467	0.439

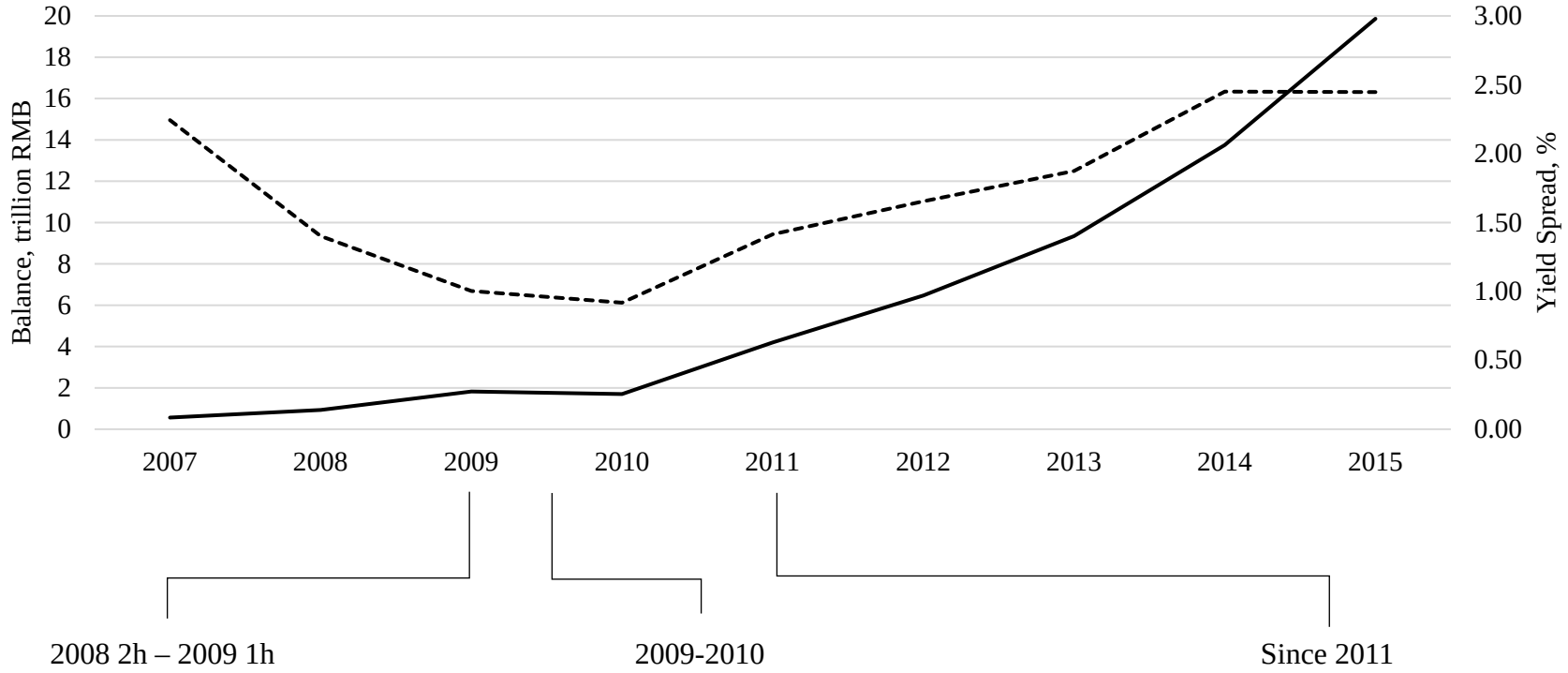
Table 11 WMP Rollover Risks and the Stock Market's Response

The table reports the correlation between stock return and the bank's WMP rollover need during days with large unexpected funding shocks. The sample includes daily observations of stock return from 2009 to 2015 for the 16 listed banks. We choose the trading days when both the changes in the one-week and overnight SHIBOR are above a specified threshold c. For these days, we regress the individual stock returns on WMP amount due in the current month over its (book) equity, after controlling for the trading date fixed effect, and report the coefficient in each cell in the table. The first row uses raw returns and the second row uses stock returns minus market returns. In the third row, we apply a linear projection of raw daily returns on market returns for the past 60 days and use the estimated residual return as the dependent variable. In the fourth row, we estimate CAPM using observations for the past 60 trading days and use the estimated residual return as the dependent variable. Standard errors are clustered by trading date[30]. 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	-0.244**	-0.169*	-0.190**	-0.104
	(-2.583)	(-1.841)	(-2.420)	(-1.176)
Deduct market	-0.244**	-0.169*	-0.190**	-0.104
	(-2.583)	(-1.841)	(-2.420)	(-1.176)
Projection	-0.203**	-0.133	-0.196**	-0.125
	(-2.461)	(-1.550)	(-2.376)	(-1.332)
CAPM	-0.203**	-0.133	-0.196**	-0.125
	(-2.458)	(-1.549)	(-2.375)	(-1.331)
Obs	144	238	382	750

[30] We cluster at the trading date level because stock returns are usually thought to be uncorrelated over time but can be correlated across stocks at the same time. Adjusting standard errors using the Fama-Macbeth approach delivers largely similar results.

Figure 1 Timeline of Events



US and European crises
=> Cross-border money net inflow fell sharply, which slowed down deposit growth.

China initiated a large-scale fiscal stimulus
=> Commercial banks issued large volumes of new loans to support the stimulus.
=> People's Bank of China (PBC) conducted monetary easing.

PBC tightened monetary policies since 2011
=> Bank deposit competition intensified, and WMP started to take off.

=> BOC was hit more than other big banks due to its traditional focus on international settlement.

=> BOC was most aggressive in increasing credit supply.

=> BOC increased deposit rates and competed for deposits much more aggressively than other big banks.

Figure 2 Cross-Border Money Net Inflow and Credit Expansion

The first figure plots the cross-border money net inflow (receipts minus payments) of the non-banking sector processed through banks. Data is from State Administration of Foreign Exchange. The second figure plots the annual growth of total bank loan balance. Data is from the People's Bank of China.

Figure 2.1: Cross-border Money Net Inflows

Figure 2.2: Annual Growth of Bank Loan Balance

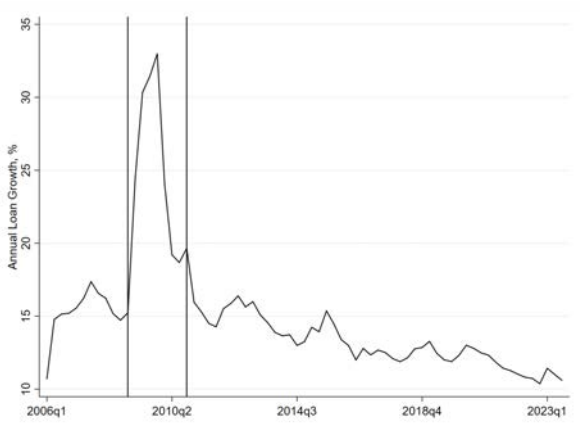


Figure 3 Monetary Policy during 2007-2015

The first figure plots the required bank reserve ratio. The second figure plots the three-month SHIBOR, three-month deposit rate ceilings, and the average target yield of WMPs for each month during 2007-2015. Data on the target returns of all WMPs is from WIND.

Figure 3.1: Bank Reserve Ratio

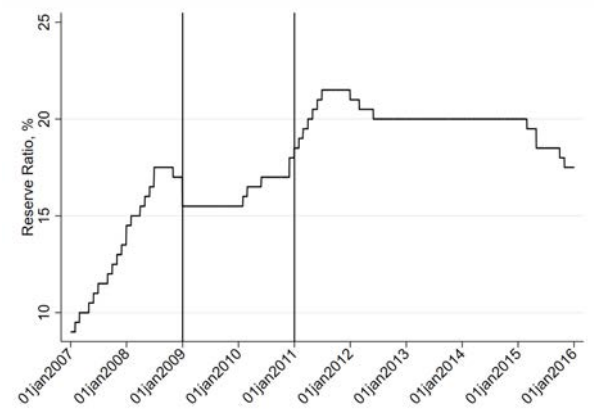


Figure 3.2: Market Rates

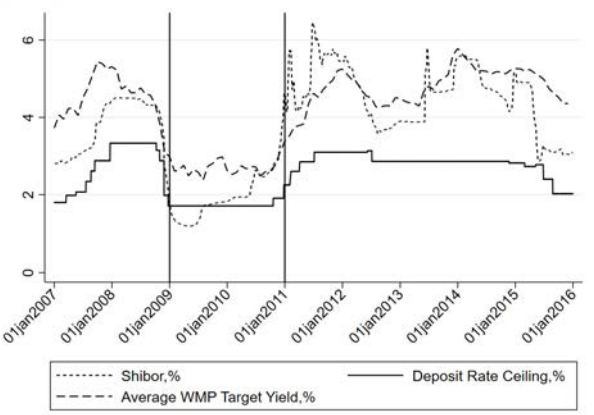


Figure 4 WMPs vs Deposits

This figure plots the average WMP/Asset and DAR (i.e., deposit/asset) for the 131 SMBs and Big Four banks from 2007 to 2015, separately.

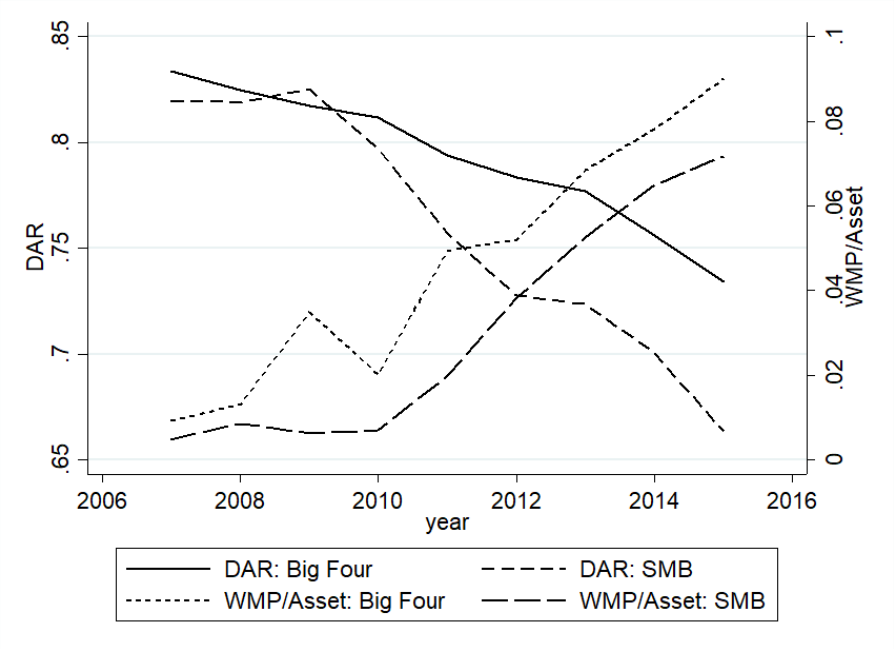


Figure 5 Sensitivity of BOC's Deposit Growth to Cross-border Money Net Inflow

This figure plots the difference of the change of deposit growth between BOC and other three big banks against the change of cross-border money net inflows processed by domestic banks. We use quarterly observations from 2006q1 to 2022q4.

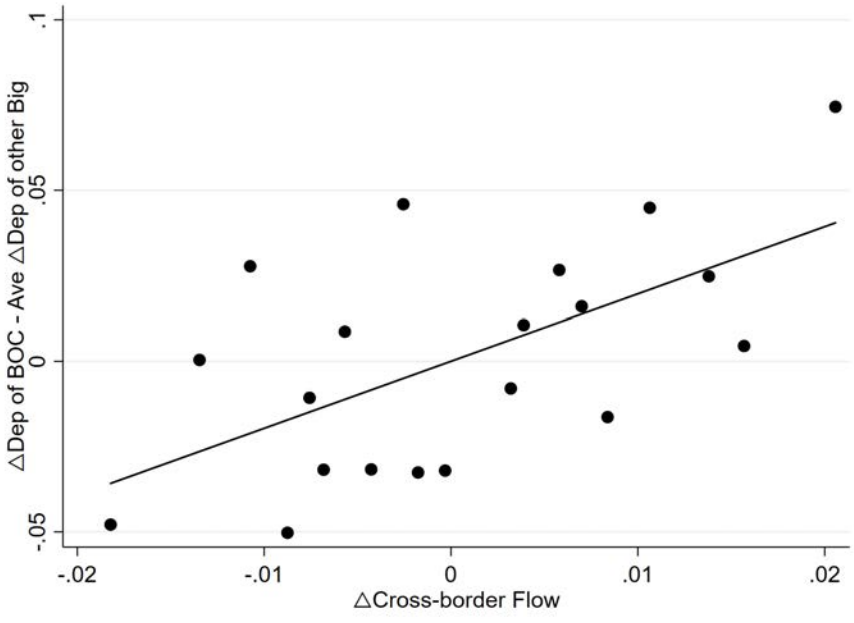


Figure 6 Credit Expansion of BOC during the Stimulus

Figure 6.1 presents the total loan balances and Figure 6.2 presents the total deposit balances of the Big Four banks, all normalized to be one for 2008 Q4. Figure 6.3 plots the loan-to-deposit ratio (LDR) of the Big Four Banks.

Figure 6.1: Total Loan Balances of the Big Four Banks

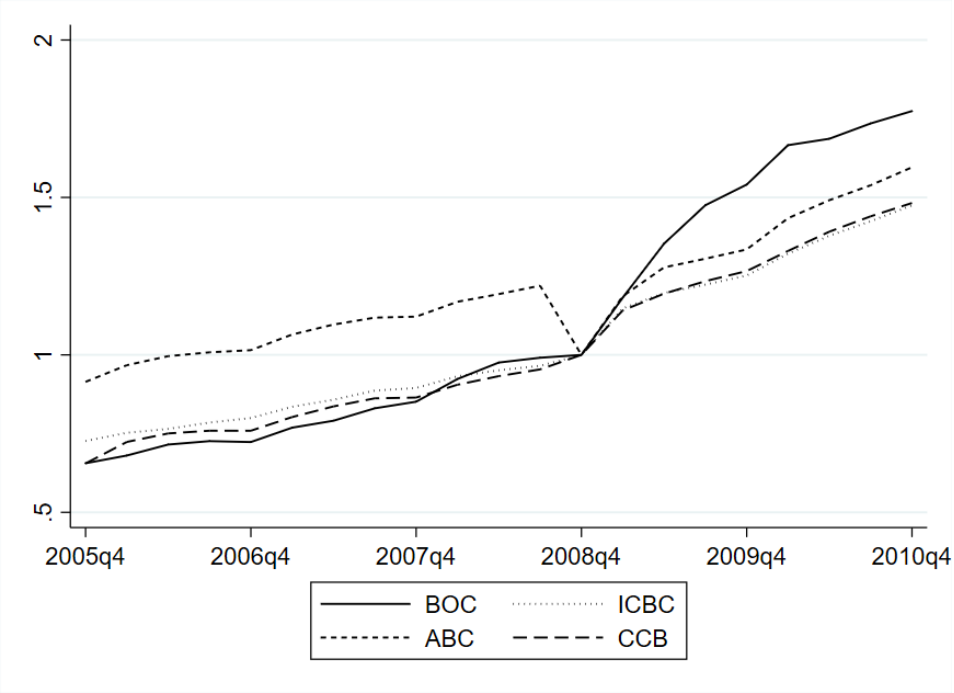


Figure 6.2: Total Deposit Balances of the Big Four Banks

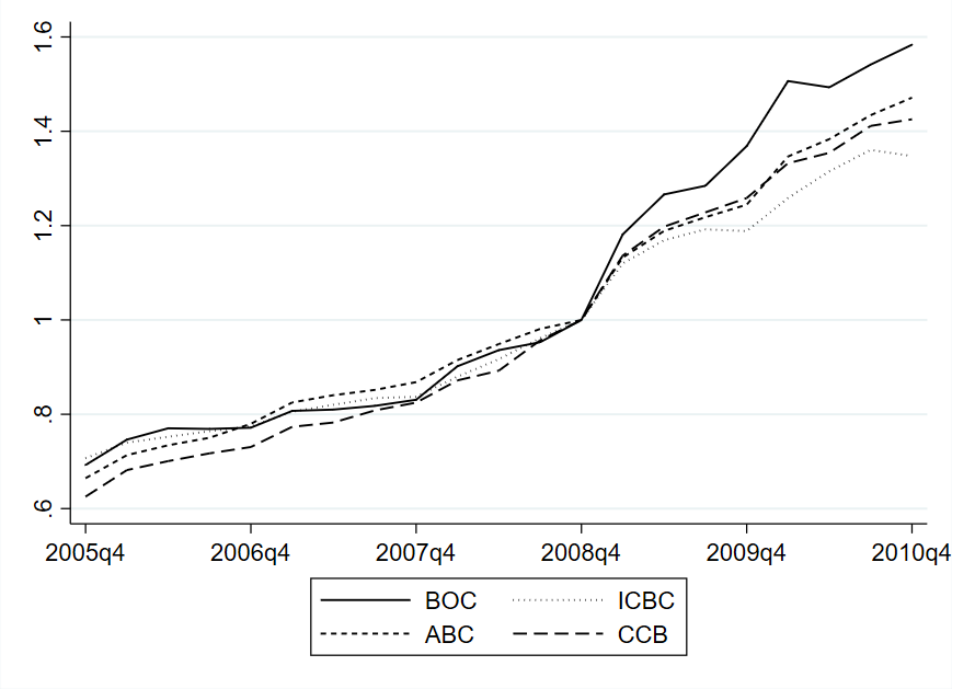


Figure 6.3: LDRs of the Big Four Banks

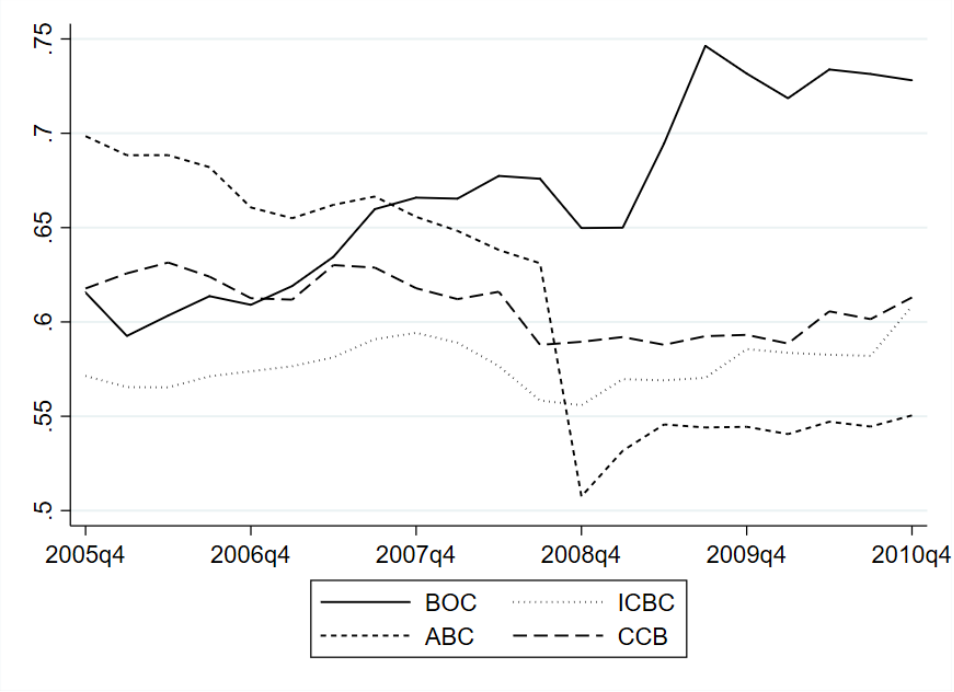


Figure 7 Deposit Rate Premia of BOC and the Other 3 Big Banks

This figure plots the deposit rate premium of the Big Four banks, which is the average deposit rates minus the maturity weighted average deposit rates posted on the banks' website.

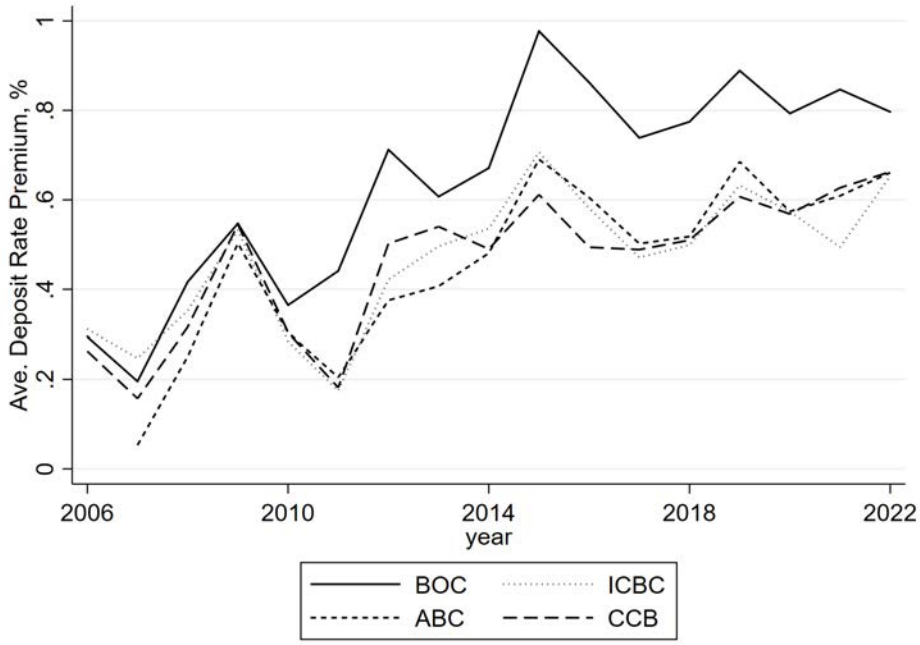


Figure 8 Parallel Trends between SMBs with Different Exposure to BOC Competition

The graphs below plot the 95% confidence interval for the coefficient estimates of the treatment effect of BOC competition on the corresponding bank variables in each year (using 2010 as the base year). The sample includes all SMBs with data available in 2010. Standard errors are clustered by bank.

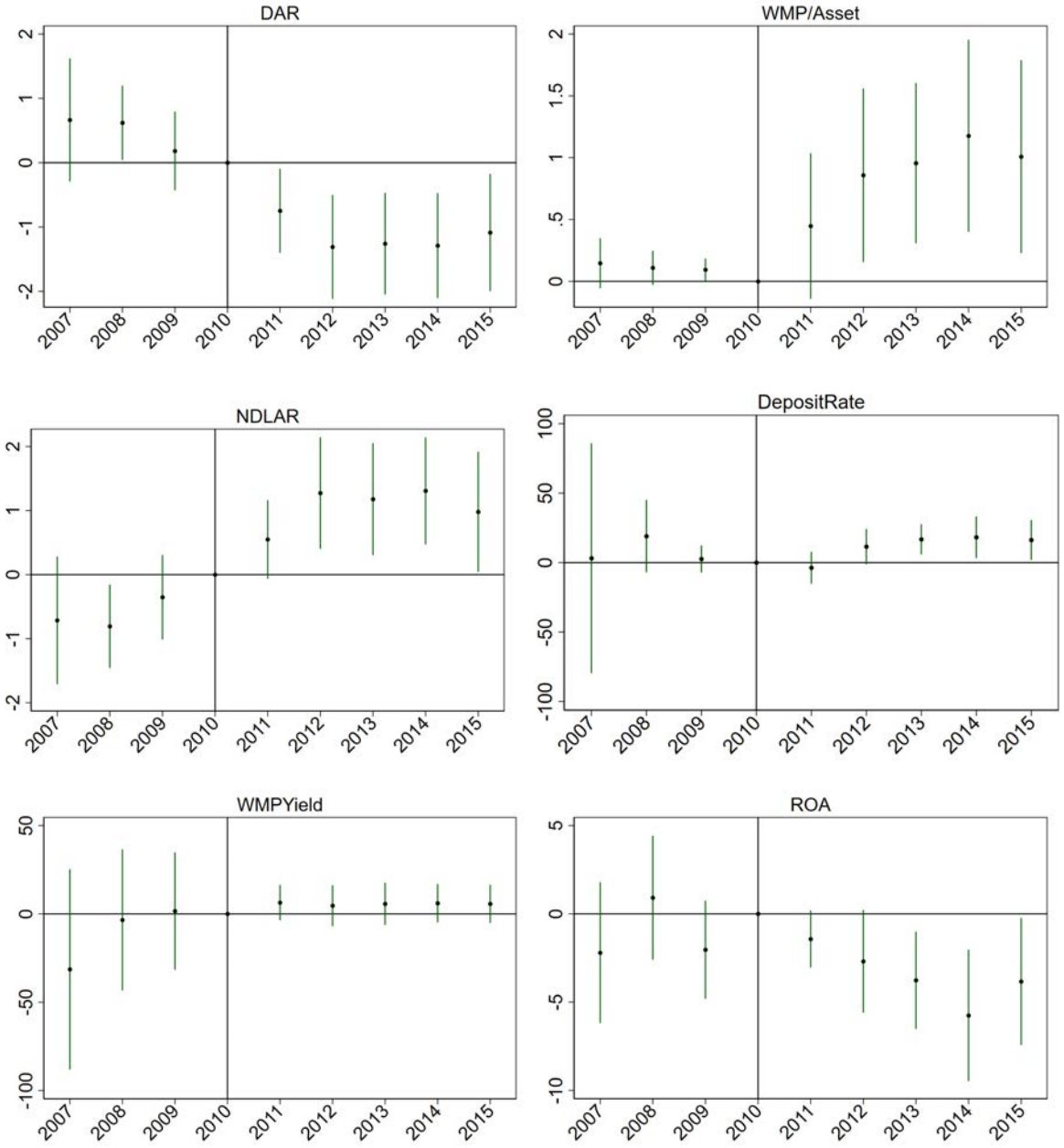


Figure 9 Distribution of WMP Maturity Dates within a Quarter

This figure plots the total number of WMPs issued by the SMBs and the Big Four banks maturing on each day of a quarter; we label the last day of each quarter as the 90th day and label the other days backwards. Data of individual WMPs is collected from WIND.

Figure 9.1: SMBs

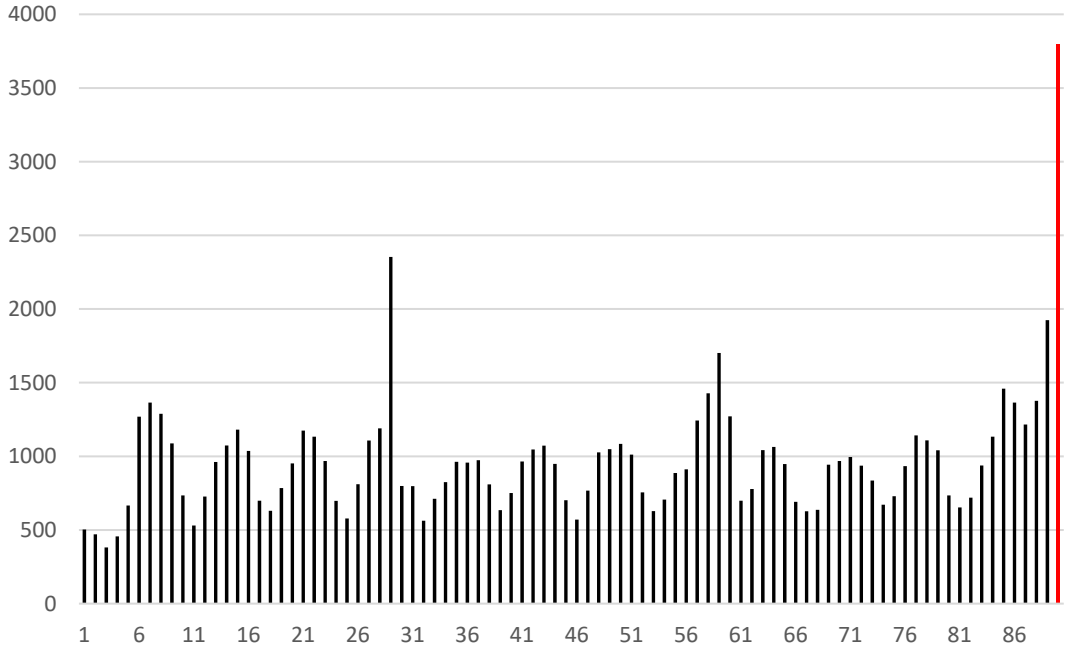


Figure 9.2: Big Four Banks

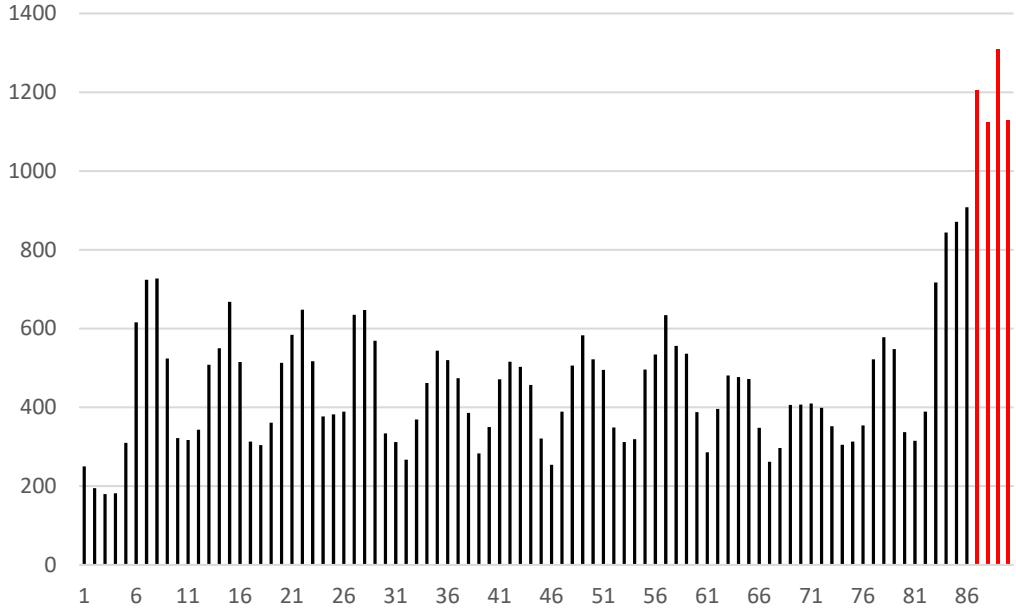


Figure 10 WMP Rollover, WMP Yield Premium and the One-week SHIBOR

This figure plots the average *WMPdue* of the Big Four banks and the sample SMBs versus the average WMP yield spread and one-week SHIBOR for each quarter over time.

Figure 10.1: WMP Yield Spread, %

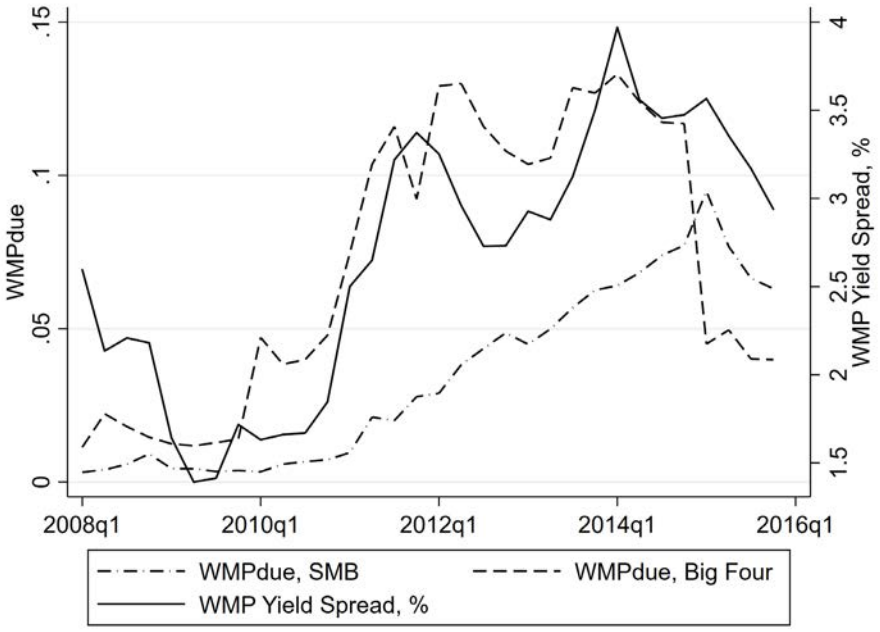


Figure 10.2: 1-week SHIBOR, %