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THE UNINTENDED CONSEQUENCES OF REGULATION: EVIDENCE FROM CHINA'S INTERBANK MARKETS

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The unintended consequences of regulation: Evidence from China's interbank market *

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Abstract

In this paper we use evidence from China's interbank market to examine the unanticipated consequences of regulation on the financial system. We find that banks tend to use newly introduced and lightly regulated financial instruments in the interbank market to get around regulation in the search for funds. Specifically, we find that banks which face greater competition have engaged more heavily in the issuance of interbank negotiable CDs and interbank wealth management products, especially when market rates are high. Moreover, these interbank activities are closely associated with banks' proprietary trading, suggesting the potential risk of contagion in the financial system.

Keywords: Interbank, Negotiable CDs, Interbank WMP, Proprietary trading
JEL classification: G20; G21; G28

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1. Introduction

Financial regulation can have unintended consequences. The literature shows that bank-like activities can take place outside of traditional deposit-taking financial institutions due to regulation changes (e.g., Adrian and Ashcraft, 2016; Buchak et al., 2018; Hachem and Song, 2017), which can further lead to contagion or to potential systemic risks in the financial sector (Allen and Gu, 2018). Understanding the channels that trigger such consequences is key to policy-making in the financial sector. Recent rapid growth in China's shadow banking and interbank markets serve as a unique environment for understanding how the banking sector responds to regulation changes and develops off-balance sheet activities driven by regulatory arbitrage, as well as how such effects can spill over to other subsectors of the financial system.

China's shadow banking sector has dramatically expanded since the 2008 global financial crisis. There are several components to China's shadow banking, including bank wealth management products (WMPs), entrusted loans, and trust products. From the end of 2013, banks have been allowed to issue interbank negotiable Certificate of Deposits (NCDs). Following the stock market crash in the summer of 2015 and the cutting of benchmark interest rates thereafter, banks were strongly motivated to issue interbank NCDs or interbank WMPs. Funds raised by issuing either interbank NCDs or interbank WMPs were further invested into the bond market, which was followed by the bond market boom and the subsequent crash due to the regulatory storm in the spring of 2017[2].

Reasons for the rapid rise of China's shadow banking sector have been the subject of much debate among policy makers and academics. For example, Hachem and Song (2017) argue that

[2] There is some anecdotal evidence of an intricate association between the bond market and shadow banking activities, e.g., an article from Reuters: https://www.reuters.com/article/us-china-markets-bonds/chinas-shadow-banking-crusade-risks-bond-market-crash-idUSKBN15A0EU. Figure 4 in the paper also shows the volatility of the Chinese bond market based on the aggregate index for 2013 to 2018.

shadow banking started to develop among small and medium-sized banks to evade higher liquidity standards, such as the loan-to-deposit ratio (LDR). Acharya, Qian and Yang (2017) document that bank competition and the four-trillion-yuan (US$586 billion) fiscal stimulus plan of 2008 contributed to significantly increased levels of shadow banking activity and, most notably, through the issuing of WMPs. Allen, et al. (2018b) document that the rise of shadow banking was partly driven by credit restrictions placed on the real estate sector, and note that the role of implicit guarantee in flattening pricing could further trigger financial risks. Buchak et al. (2018) examine counterparts in the US and classify US shadow banking into fintech and non-fintech sectors. Overall, they find consistently that shadow banks are significantly more likely to expand their market shares where traditional banks face more capital and regulatory constraints.

In this paper, we use China's recent fast-growing interbank NCD and interbank WMP markets to examine how regulations can generate arbitrage across different subsectors of the banking system and how such risks can be transmitted to capital markets, which can create contagion problems among different subsectors of the financial system. Unlike the wholesale funding markets of other countries (e.g., Perignon, Thesmar and Vuillemey, 2018), interbank NCDs have been adopted in China's interbank market since the end of 2013. In 2013 and 2014, authorities started to curb the recent rapid growth in shadow banking activities caused by the four-trillion-yuan fiscal stimulus plan in 2008, by imposing different regulations, including Doctrine 8 in 2013 and Doctrine 127 in 2014, through the China Banking Regulatory Commission (CBRC) (e.g., Allen, Qian and Gu, 2017a; Chen, He and Liu, 2017).[3] Following the introduction of these regulatory policies, interbank NCDs unexpectedly grew significantly in

[3] In Table A.2 we give a full list of regulation policies of shadow banking and interbank activities adopted in China from 2013 to 2018.

2015 and 2016.[4] Since then the issuance of interbank WMPs, which are sold to other banks on the interbank market, has also grown at a much higher rate, while the previously majority bank WMPs are invested in by other nonfinancial corporations and retail investors. Both interbank NCDs and interbank WMPs have been issued by banks as a supplement to bank deposits and original bank WMPs in recent years.

From evidence on China's interbank activities in recent years we present three sets of results in this paper. First, the launch of the interbank NCD market accompanied by other financial regulation policies has been utilised by banks for regulatory arbitrage across different subsectors in the financial system, and such effects are more significant for banks with tighter liquidity conditions. Specifically, we find that banks with higher LDR ratios are more likely to search for liquidity by issuing lightly regulated and newly introduced financial instruments such as interbank NCDs. Since the lifting of the upper limit of the floating range of deposit interest rates (through so-called "interest rate liberalisation"), smaller banks face greater competition from their peers and from the Big Four banks[5]. We use interest rate deregulation as a shock and our investigation confirms that banks that face more competition have been engaging more heavily in the issuance of interbank NCDs and WMPs, which can be both regarded as shadow-banking related activities; and that this association is stronger and more significant when liquidity conditions are tight in the interbank market.

Second, bank size has been considered in pricing initial yield spreads of interbank NCDs. Smaller banks (urban or rural commercial banks), as well as foreign banks, secure significantly

[4] The interbank NCD market was still growing fast in 2018. According to Bloomberg, the issuance of interbank NCDs by the largest five lenders in this market more than doubled toRMB 424 bn (US$68bn) in the first quarter from a previous record in September 2017: https://www.bloomberg.com/news/articles/2018-04-02/dearth-of-deposits-in-china-pushes-big-banks-to-short-term-debt.

[5] In China, the Big Four state-owned commercial banks are: the Industrial and Commercial Bank of China (ICBC), Bank of China (BOC), Agriculture Bank of China (ABC) and China Construction Bank (CCB).

higher prices for issued interbank NCDs, while Big Four banks secure significantly lower prices. Whether a bank is listed on the stock market does not seem to matter in terms of initial pricing. The rate of bank size growth has also been priced. Banks with a higher rate of total asset growth achieve higher yield spreads. Additionally, bank risk, in terms of liquidity mismatch and bankruptcy risk, does not seem to increase initial yield spreads.

Third, bank involvement in shadow-banking related interbank activities is highly correlated with banks' proprietary trading. Specifically, banks that have engaged more in interbank NCDs and WMPs have invested more in the bond market through proprietary trading. Such associations across different sectors of the financial system indicate the potential risk of financial contagion.

Our paper relates to and extends a broad literature on financial regulation and regulatory arbitrage in the financial system. For example, Boyer and Kempf (2018) recently documented that banks freely choose jurisdictions in which to locate their activities and have private information regarding their efficiency levels, and that financial integration is characterised by the inability of regulators to discriminate between banks of different efficiency levels. Boyson, Fahlenbrach and Stulz (2014) use trust preferred securities (TPS) to show that banks constrained by capital requirements issue TPS and engage in regulatory arbitrage, rendering these banks riskier than other banks with the same amount of regulatory capital but more adversely affected by the credit crisis. Buchak et al. (2018) show that both regulatory arbitrage in the banking system and technological advantages have contributed to the rise of shadow banking and, more specifically, to the shadow bank market's share of residential mortgage origination in the US. Hacham and Song (2016; 2017) document that regulatory arbitrage on liquidity rules in China's banking system in the late 2000s spurred the unprecedented credit boom that followed. Liu, Wang and Xu (2017) study the consequences of interest rate liberalisation for China and find that

liberalising interest rate controls improves capital allocation within each sector but exacerbates misallocations across sectors. Gao et al. (2018) use transactional level bank loan data to document that the deregulation of bank entry in 2009 led to higher screening standards, lower interest rates and lower loan delinquency rates among new entrant banks.

Our paper also relates to a growing literature on China's shadow banking and financial systems. Allen, Qian and Gu (2017a) provide an overview of the development of China's financial system over past decades. Wang et al. (2018) document that shadow banking affects aggregate profits via three channels: the capital channel, productivity channel and risk channel. Pareto improvement can only be achieved through dual-track interest rate liberalisation under reasonable assumptions. From micro evidence on bank WMPs, Acharya, Qian and Yang (2017) document that the swift rise of shadow banking activities in China seemed to be triggered by the fiscal stimulus plan in late 2008 and that the scale of WMP issuance is greater for banks more heavily constrained by on-balance sheet lending and facing more competition in the deposit market. Allen et al. (2018a) find that entrusted loans involve firms with privileged access to cheap capital channeling funds to less privileged firms and that these loans increase in value when credit is limited. The pricing of entrusted loans is affected by fundamental and informational risk. Allen et al. (2018b) examine the largest nonbanking sector (the trust industry) and find that the expectation of an implicit guarantee from an issuing trust company, bank or government flattens price sensitivity to risks and may further result in resource misallocation in the economy. Chen, He and Liu (2017) document that China's fiscal stimulus plan fuelled bank loans in 2009 and led to rapid growth in shadow banking after 2012.

The rest of this paper proceeds as follows. Section 2 describes the institutional background of China's interbank market with a focus on the recent development of interbank NCDs and

interbank WMPs. Section 3 describes the data, variables, and summary statistics that were used. Section 4 elaborates on our methodology and empirical results. Section 5 discusses NCD pricing, interbank activities and banks' proprietary trading. Section 6 concludes.

2. Institutional background: China's interbank market

China's national interbank lending market (National Interbank Funding Center) was established in 1984. Since November 2016, a total of 1,602 members (financial institutions) have participated in the interbank market (Allen, Qian and Gu, 2017a). Prior to the recent rapid rise in shadow banking activities, the China interbank market was dominated by traditional borrowing and lending activities and by an interbank bond market.[6] In December 2013, interbank NCDs were introduced by the People's Bank of China (PBoC) to provide additional baseline interest rates and to correspondingly improve the pricing mechanism in the market. All trading members of the National Interbank Funding Center can issue NCDs to raise funds in the interbank market. The market has grown dramatically in recent years, and since mid-2015, both nonfinancial corporations and individuals have been allowed to invest in NCDs. In other words, financial institutions are no longer the only investors in NCDs.

From 2014 to 2016 there was a rapid rise in interbank NCD issuance (Figure 1). The total issuance volume increased from RMB898.56bn in 2014 to RMB5,286.22bn in 2015 and further to RMB12,924bn in 2016. Meanwhile, the regulation of NCDs lagged. Doctrine 127 on interbank activities, announced jointly by the PBoC and CBRC in 2014, stipulated that interbank liabilities, including interbank deposits, interbank loans, and financial assets under repo/reverse

[6] The interbank NCD was first introduced into the Chinese interbank market in 1986 and was suspended in 1997 due to market turbulence. The interbank market was an illiquid market without a floating market interest rate system. The regulation proved unsuccessful, leading to the development of many illegal trading activities in the NCD market.

repo, could account for no more than one third of banks' total liabilities.[7] However, interbank NCDs were not included in total interbank liabilities on the balance sheet under Doctrine 127, which targeted only financial assets that had shown rapid growth under repo/reverse repo in the interbank market in recent years. As a result, the launch of the interbank NCD market allowed SMBs, and especially a number of city commercial banks (CCBs) and rural commercial banks (RCBs) with liquidity shortages, to issue high volumes of NCDs in the interbank market. They could also channel funds raised into other financial instruments (e.g., WMPs, NCDs issued by other banks with longer maturity periods or higher yields) in the interbank market. Figure 2 shows the monthly NCD issuance volume and due volume for different types of banks. It shows that the correlation between issuance and the due volume is higher for CCBs, RCBs and shareholding banks than it is for Big Four banks, suggesting that it is more likely that smaller banks issue interbank NCDs for liquidity purposes. An additional benefit of borrowing from and reinvesting in interbank NCDs or WMPs is to increase the total bank asset volume to satisfy quarterly examination by the authority.

[FIGURE 1]

[FIGURE 2]

3. Data and descriptive statistics

3.1 Sample construction

We compile data of both the bank level and transaction level. The bank-level dataset covers 312 banks that issued interbank NCD in China from 2013 to 2017, including the Big Four banks (ICBC, BOC, ABC and CCB), 13 shareholding commercial banks, and 295 city/rural

[7] Triggered by the four-trillion-yuan (US$586 billion) fiscal stimulus plan, shadow banking activities have been growing rapidly (Chen, He and Liu, 2017). One related activity of the interbank market involves the issuance of financial assets under repo/reverse repo, through which banks can continue lending to the real estate industry in co-operation with other banks or financial institutions (Allen et al., 2017b).

commercial banks.[8] We obtain our data from multiple sources. First, interbank activities (NCD and WMP issuance), bank financial data, and macroeconomic information are retrieved from WIND. We then match the interbank activity variables for year *t* with banks' financial and macroeconomic data for year *t-1*. Second, information on banks' proprietary trading in the bond market is obtained from iFIND. Both WIND and iFIND are leading Chinese financial terminals of the financial market and of institutions that are widely used in academic research. Third, bank branch information is extracted from the CBRC, including branch names, locations, affiliated headquarters, and ages. In this paper we only consider branches in operation before 2017. From the branch information we construct the competition measures as described in Section 3.2.

The transaction-level dataset consists of 60,206 NCDs issued from December 2013 to June 2018. We then match NCD characteristics for year *t* with issuer (bank) characteristics *Bank size, Bank size growth, LDR, type of bank* and *Z-score,* etc. for year *t-1*. NCD variables are extracted from the WIND database. Treasury bond yield information is extracted from China Bond.[9]

3.2 Bank-level variables

To measure interbank activities, we use five variables: *NCD/Total assets, NCD/Total liabilities, Bond to pay/Total assets, Interbank WMP/Total assets* and *Interbank activities ratio*. Since interbank NCDs and interbank WMPs were recently introduced as financial instruments in China, they were not required to be incorporated into banks' balance sheets before 2018.[10] We use two methods to estimate interbank NCD issuance. The first measure, *NCD*, is the aggregated issuance of NCD by year for each bank; the second measure, *Bond to pay*, is an item on banks'

[8] We exclude the Postal Saving Bank of China in our analysis due to limited information available on this bank.
[9] China Bond, affiliated with China Central Depository & Clearing Company, is an official institution that publishes price and trading information for China's bond market. The link to its website: http://www.chinabond.com.cn/d2s/engindex.html
[10] At the start of 2018, the PBoC decided to incorporate interbank NCDs into interbank liabilities for MPA (Macroprudential Assessment) examinations. However, before MPA examination was launched, neither of the two needed to be reflected in banks' balance sheets.

balance sheets. Due to its bond-alike characteristics, the issuance of interbank NCD has been recorded as *Bond to pay* on the balance sheet, since it was introduced at the end of 2013. We mainly use *Total assets* but also use *Total liabilities* as a scale for robustness checks.

For interbank WMPs, banks can record these under the following balance sheet items: *Financial assets available for sale, Held for trading financial assets, Due from banks* and *Investment receivables.* Therefore, we use the sum of these balance sheet items as a measure of total interbank WMP issuance. The *Interbank activities ratio* is calculated as the sum of the issuance of interbank NCDs and interbank WMPs scaled by total assets.

Our analyses cover an assortment of bank characteristics. *LDR* denotes total loans for a specific year *t* divided by total assets measured at the close of the same year *t*. The *Core capital ratio* denotes a commercial bank's core capital adequacy ratio and tier one capital for year *t* divided by risk weighted assets for the same year. *Bank size* is the natural logarithm of *total assets*. *Bond trading* denotes bank i's total level of bond trading in year *t*. *ROA* and the *NPL ratio* are used to measure bank performance. *ROA* denotes net earnings measured after dividends in year *t* to average assets at the close of year *t* and year *t-1*. The *NPL ratio* is calculated as all nonperforming loans for year *t* divided by total loans for the same year *t*. To measure bank probability of defaulting, we use the *Z-score* defined as ROA plus the equity-to-assets ratio divided by the standard deviation of ROA. We follow Acharya, Qian and Yang (2017) in constructing a measure for bank exposure to competition from other banks. *SMB_i* denotes bank i's exposure to competition from other SMBs. Definitions for these variables are provided in Appendix Table A.1.

3.3 Negotiable CD's transaction-level variables

Our main dependent variable for the transaction-level analysis is the *At-issue yield spread*

defined as the difference between *At-issue yield of NCD* and a *6-month treasury bond yield* matched on the date of issuance. We also consider key bond characteristics with *Maturity*, *Issuance volume* and the *Credit rating score*. *Log IssVol* is the natural logarithm of the issuance volume. The *credit rating score* is the numeric score of the issuer's credit rating at issuance, for example, AAA for 10, AAA- for 9, etc. We also control for issuer characteristics: *Bank size, Bank size growth, LDR, type of bank, Listed and Z-score. Bank size growth* is the rate of total bank asset growth. There are four main bank types: *Big 4, CityRural, Foreign* and *Shareholding* denote Big Four banks (the ICBC, BOC, ABC and CCB), city/rural commercial banks, foreign banks and shareholding commercial banks. *Shareholding* is used as a benchmark in the regressions. *Listed* denotes a listed bank. All variable definitions and data sources are reported in Appendix Table A.1.

3.4 Summary statistics

Table 1 presents summary statistics for bank and NCD characteristics for our sample. For the bank-level sample, both interbank activity and other bank performance vary considerably. *NCD/Total assets* range from 0 to 71.8%, with a sample mean of 7.9%. *NCD/Total liabilities* range from 0 to 77.8%, with an average of 8.5%. *Bond to pay/Total assets* range from 0 to 33.6%, with a sample mean of 6.2%. The *Interbank WMP/Total assets* ratio ranges from 0 to 76% and has a mean of 25.1%. The *Interbank activities ratio* ranges from 0 to 88.8%, with an average value of 16.6%. *Bond trading/Total assets* range from 0.1% to 6.285%, with a sample mean of 78.6% and a median of 58.3%. For other bank fundamental characteristics, the *Core capital ratio* ranges from 6.6% to 22.7% and has a sample mean of 12%. The *LDR* ranges from 0.162 to 25.88, with an average of 0.662. *Total assets* range from RMB3792mn to RMB26,100bn, with a sample mean of RMB693,962mn. *Bank size* ranges from RMB8.24mn to RMB17.08mn, with a sample

mean of RMB11.53mn. *ROA* has an average value of 1% and ranges from -6.1% to 3%. The *NPL ratio* ranges from 0 to 26.8% and has a sample mean of 1.6%. The *Z-score* ranges from 0.028 to 7.626 and has a mean of 0.378. The *SMB_i* ranges from 0.002 to 0.674, with a sample mean of 0.547.

For summary statistics on NCD characteristics, the *At-issue yield spread* ranges from -0.46% to 3.31% with a sample mean of 1.27%. *Maturity* ranges from 0.08 years to 3 years with a sample mean of 0.47 years. *Log IssVol* ranges from RMB2.30mn to RMB10.79mn with a sample mean of RMB5.99mn (US$ 0.88 million). *Bank size growth* ranges from 97.3% to 118.4% with a sample mean of 101.5%. Ranging from 3 to 10, the mean value for the *Credit rating score* is 8.89.

4. Methodology and empirical results

4.1 Methodology

We start by examining the determinants of interbank NCD issuance using Model (1) below:

$$\text{NCD issuance}_{i,t} \; or \; \text{Interbank WMP issuance}_{i,t} = \beta_0 + \beta_1 \cdot LDR_{i,t-1} \; or \; Cap\; ratio_{i,t-1} + \beta_2 \cdot (Bank\; characteristics)_{i,t-1} + \beta_3 \cdot (Year\; Dummies) \quad + \beta_4 \cdot (Bank\; dummies) \quad + \varepsilon_{i,t} \tag{1}$$

where *NCD issuance* is the dependent variable. We use *NCD/Total assets*, *NCD/Total liabilities*, *Bond to pay/Total assets* as measures of NCD issuance and *Interbank WMP/Total assets* as a measure of interbank WMP issuance. The key explanatory variable is the liquidity condition measured by the *LDR* or *Core capital ratio*. Acharya et al. (2016) document that the capital ratio and LDR play different roles where the capital ratio targets the asset side and controls bank size relative to its capital while the LDR targets both sides of the balance sheet and controls the loan balance relative to the deposit balance. In all of our regressions, we include year and bank fixed

effects to isolate time and bank heterogeneity. Robust standard errors clustered by banks are reported.

4.2 Baseline results

Table 2 reports the baseline results. In columns (1) to (6) we use three measures of NCD issuance, *NCD/Total assets*, *NCD/Total liabilities* and *Bond to pay/Total assets* to measure interbank NCD issuance by banks. As we document above, *NCD/Total assets* or *NCD/Total liabilities* are an accurate measure of bank NCD issuance scaled by bank total assets or total liabilities, respectively, whereas *Bond to pay/Total assets* covers both outstanding NCDs and bonds. In columns (7) and (8), we use *Interbank WMP/Total assets* rather than *NCD issuance* as the dependent variable to measure interbank WMP issuance. We find that the coefficients on *LDR* enter with significant (at the 1% level) and positive signs in all of the regressions, while the coefficients on *Core capital ratio* are less significant, suggesting that banks with higher LDRs tend to issue more interbank NCDs or interbank WMPs; however, the capital ratio does not seem to have a consistent and significant relationship with NCD issuance and WMP issuance in the interbank market. The impact of LDR is also economically meaningful. Estimations from column (1) show that a one-standard-deviation increase in the *LDR* increases *NCD/Total assets* by 1.58% (=0.831*0.0119), which, given average *NCD/Total assets* measured in the analysis, amounts to approximately 19.99% (=0.0158/0.079).

[TABLE 2]

We then divide our sample into Big Four banks and SMBs and investigate whether such a relationship varies between different types of banks. We use the same specification and include both year and bank fixed effects. In Table 3, columns (1) and (3) report the results for Big Four banks and columns (2) and (4) report the results for SMBs. We find that coefficients on the *LDR*

are only significant and positive for SMBs, suggesting that for SMBs, banks with a higher LDR tend to issue significantly more interbank NCDs, which is consistent with our hypotheses; however, such an association does not hold for Big Four banks. In terms of economic impact, estimations from column (2) suggest that for SMBs, an increase of one standard deviation in the LDR would increase NCD issuance levels by 11.26% (=0.831*0.0107/0.079). The *Chi-sq* tests show that the difference in economic impact is more significant for Bond to pay/total assets (with a P-value of 0.0000). SMBs have been facing more competition in the deposit market and thus are more likely to experience liquidity matching issues. The results indicate that NCD issuance is more sensitive to liquidity conditions for SMBs.

[TABLE 3]

In summary, evidence from baseline regressions supports our hypothesis that banks experiencing more loan-to-deposit mismatching and, therefore, facing more severe competition, are more likely to search for liquidity from the interbank market via NCD issuance and that such an effect is stronger for small and medium-sized banks.

4.3 Robustness and discussion

4.3.1 The impact of interest rate deregulation

We perform various tests to evaluate robustness. We consider two types of shocks. The first shock is interest rate deregulation. Before 2015, bank deposit interest rates were strictly controlled by the PBoC, for example, no banks were allowed to offer a deposit rate higher than a specified ceiling, through which the PBoC could affect liquidity conditions under different circumstances. Allen, Gu and Qian (2017b) document that interest rate regulation has been quite effective. Acharya, Qian and Yang (2017) suggest that under such a scheme banks have incentives to lend more than the market equilibrium level. As a result, the PBoC imposes

quantity regulations such as capital ratios and LDRs to prevent excessive liquidity and inflation.

Since the start of 2015 authorities have accelerated interest rate liberalisation. For example, in March [of that year?], the PBoC announced that the upper limit of the floating range of deposit rates was to be increased from 120% to 130%. [Five months later?] on August 26, the PBoC further increased the upper limit to 150%. And on October 24, the upper limit was finally lifted completely, indicating that interest rates had been liberalised.

We use interest rate deregulation as a shock to the commercial banking system and investigate how banks respond to such a shock through NCD issuance in the interbank market. We introduce the indicator *Post-deregulation*, which is defined as 1 starting in 2016 and as 0 otherwise, to identify regulation shocks and their interactions with the *LDR* in the regressions. Corresponding results are reported in Table 4. The dependent variable is NCD issuance scaled by bank total assets or bank total liabilities. As we introduce the time indicator into the regressions, we exclude year fixed effects for identification purposes. Bank fixed effects are still included in all specifications. First, we find that after interest rate deregulation NCD issuance tends to increase significantly overall. The estimation from column (1) suggests that holding all other factors constant, after interest rate deregulation NCD issuance is higher by 425% (0.336/0.079). Second, negative and significant coefficients of the interaction term (*Post-deregulation*LDR*) unexpectedly show that the increase is significantly lower for banks with higher levels of liquidity mismatching. We attribute this to the fact that after removing the LDR regulation of 2015, Big Four banks tend to have significantly higher LDRs than SMBs. Panel B of Table 1 also shows that in our sample period, on average the LDR for Big Four banks is 4.2% higher than that of SMBs.

[TABLE 4]

To further isolate the potential association between liquidity mismatching and bank size and to explore the impact of competition on interbank activities, we split our sample into SMBs and Big 4 banks and apply a competition variable, *SMB_i*. Following Acharya et al. (2017) we define *SMB_i* as bank i's exposure to competition from other SMBs calculated as the market share of this bank vs. other SMBs. We also incorporate the interaction of the post-deregulation indicator and *SMB_i* to identify how deregulation affects different banks in heterogenous ways. The results are reported in Table 5. We still use NCD issuance scaled by bank total assets or total liabilities as our dependent variables. First, our main results on the association between liquidity conditions and NCD issuance still holds with coefficients of the LDR being significant for the subsamples of SMBs and insignificant for the Big Four subsamples. However, after dividing the sample, we do not find strong average effects of deregulation on either SMBs or Big Four banks when holding all other factors constant. Second, the effect of interest rate deregulation is more significant for NCD issuance for SMBs that have faced more competition from other SMBs. In all of the regressions we control for provincial level GDP growth and inflation, as we assume that the interbank activities of regional small banks would be affected by local economic conditions.

[TABLE 5]

4.3.2 Special periods in the interbank market

We also investigate how interbank activities change during special periods when interbank market rates are high. Figure 3 plots SHIBOR overnight interest rates for 2014-2018.[11] From the start of 2017, interbank market rates started to become more volatile and remained at higher levels due to market expectations of stricter regulations on arbitrary activities in the interbank

[11] The SHIBOR (Shanghai Interbank Offered Rate) is the average interbank lending rate of accredited commercial banks in China released by the National Interbank Funding Center (in affiliation with the PBoC) daily. The SHIBOR is frequently used as the benchmark interest rate for the pricing of financial instruments.

market. For example, in March and April [2017?], the CBRC announced guidelines and different regulatory doctrines on interbank NCDs/WMPs and on banks' bond trading activities and ordered banks to estimate the total volume of their interbank "shadow activities" (not traditional interbank lending/borrowing activities). In turn, the market started to become very volatile and market interest rates increased correspondingly (resulting in the so-called "market turbulence" of 2017). During this period, it was expected that smaller banks would find it harder to obtain liquidity whereas the Big Four banks would be pressured less.[12] Therefore, we examine how market liquidity levels affect the NCD and WMP issuance during different episodes. Here, we only consider the period 2016-2018 for our estimations, as the interbank NCD was only introduced at the end of 2013 and from 2014 to 2015 the market was quite volatile due to a subsequent stock market run-up and crash. We define the years of 2017 and 2018 as high market rate periods in which the CBRC started to regulate interbank "shadow" activities. We also include interaction terms for the *High rate period* and *Big 4* to examine heterogenous effects. The results are reported in Table 6. We use NCD issuance as a dependent variable. The results suggest that overall, when market liquidity is more expensive, banks tend to issue more interbank NCD to raise funds. This effect is less strong for Big Four banks.

[FIGURE 3]

[TABLE 6]

4.4 Economic consequences of interbank NCD issuance

[12] For example, during the credit crunch of mid-2013, when overnight interbank market rates soared to roughly 13%, even though the PBoC wanted to punish overwhelmingly fast growing shadow banking activities in the Chinese banking system, the central bank finally injected liquidity into the Bank of China (one of the Big 4 banks) to stabilize the banking system and market expectations (see also Allen, et al., 2017). Due to their systemic importance, Big Four banks are expected to be less affected by market turbulence, as they are more likely to secure support from the government.

To further explore the economic consequences of the rise in interbank NCD, we investigate how the issuance of NCDs affects bank performance. We mainly consider two measures, *ROA* and the *NPL ratio*, for bank performance. The key explanatory variable is *NCD/Total assets.* Table 7 reports the results. In column (1) the coefficients of *NCD/Total assets* are negative and significant, suggesting that banks that have issued more NCDs tend to achieve lower levels of profitability holding all other factors constant. In column (2) the coefficients of NCD/Total assets are positive and significant at the 1% level, suggesting that banks borrowing more through NCDs have higher nonperforming loan ratios holding all other factors constant. Overall, the results indicate that the rise of interbank activities through the NCD market might worsen bank performance.

[TABLE 7]

5. Interbank NCD pricing, interbank "shadow" activities and banks' proprietary trading

5.1 Determinants of interbank NCD pricing

We also examine whether bank risks have been reflected in the initial pricing of interbank NCDs and how large and small banks are different in the risk sensitivity of NCD pricing. We include liquidity mismatching (LDR), bankruptcy risk (Z-score) and bank size growth in the regressions. The results are reported in Table 8. In columns (1) to (4), we use the full sample, while in columns (5) and (6), we use the subsamples of Big Four banks and SMBs instead. We find first that bank size growth presents significantly positive signs in the full sample tests, suggesting that banks showing at a higher rate of total asset growth tend to have higher at-issue NCD yield spreads. However, such an effect is only found for SMBs. Big Four banks that expand at a higher rate tend to have significantly lower yield spreads of NCD issuance consistent

with our hypothesis that a large number of banks have been engaging in these "shadow" interbank activities to expand their total bank size to meet criteria set by regulatory authorities. The *Chi-sq* test on *Bank size growth* suggests that such differences between Big 4 banks and SMBs are significant at the 5% level (with a P-value of 0.0103). Second, LDR values present significant and negative signs in columns (1) to (4) and opposite signs for Big Four banks and SMBs, suggesting that liquidity mismatching has only been considered in pricing for Big Four banks. Third, z-scores are not significant from the regressions, indicating that bank risk does not seem to matter for NCD initial pricing. Fourth, larger banks tend to have lower at-issue yield spreads on average. When using shareholding banks as a benchmark, Big Four banks tend to have significantly lower yield spreads while urban or rural commercial banks and foreign banks tend to have significantly higher yield spreads. Whether a bank is listed or not does not seem to matter for the at-issue yield spreads of interbank NCDs.

[TABLE 8]

5.3 Interbank activities and banks' proprietary trading

Finally, we investigate whether involvement in nontraditional interbank activities creates additional risks in terms of banks' proprietary trading. Specifically, we look at the relationship between aggregate interbank activities in the NCD and WMP market and banks' proprietary trading in the bond market. To manage bank assets and make profits, Chinese banks invest funds that they have raised through the interbank market into the bond market, which further triggers the volatility of domestic bond market performance. Figure 4 shows the growth of China's bond market from 2013 to 2018 based on the index developed and updated by China Bond. From late 2013 to late 2016, China's domestic bond market grew steadily, and especially after the stock market crash in the summer of 2015 bonds seemed to return to safe levels. However, from the

end of 2016 to 2017, the bond market experienced corrections and bond yields increased dramatically.

To examine relationships between interbank activities of recent years and banks' bond trading, we retrieve data from iFIND and create a bank-month panel dataset on banks' proprietary trading in bonds. We then aggregate bond trading by year and match these data with bank fundamental data. Table 9 reports the results on interbank activities and banks' bond trading. The dependent variable is banks' proprietary trading in the bond market scaled by total assets. In columns (1) to (3), the key explanatory variable is interbank activities including NCD and WMP issuances over bank total assets. In columns (4) to (6) we use *NCD/Total assets* as a dependent variable. We run regressions for both the full sample and for the subsamples of SMBs and Big Four banks. We find that both the *Interbank activities ratio* and *NCD/Total assets* enter with significant and positive signs in columns (1), (2), (4) and (5) but with insignificant and mixed signs in columns (3) and (6), suggesting that banks that have been engaging in more interbank activities tend to make more investments in bond market overall. However, such an effect is only significant for SMBs, consistent with our hypothesis that smaller banks have more incentives to earn yield spreads between bond investments and NCD issuance, driven by higher competition. Moreover, banks with a higher Tier1 capital ratio tend to invest less in the bond market, and such a relationship is more significant for SMBs than for Big Four banks. These results indicate that more interbank "shadow" activities may create additional risks in capital markets through banks' proprietary trading, which could further trigger systemic risks.

[TABLE 9]

6. Conclusions

Regulatory arbitrage has been discussed in different subsectors of the financial system. In

this paper, we examine how financial regulation can lead to unintended consequences using evidence from China's interbank market. China's wholesale funding market is dominated by traditional interbank borrowing and lending. However, we find that due to a recent regulation change aiming to control fast-growing shadow banking activities following the fiscal four-trillion-yuan (US$586 billion) stimulus plan of 2008, newly introduced and lightly regulated interbank NCDs have been used to search for liquidity. Since the deregulation of interest rates, banks that face more competition have engaged more heavily in the issuance of interbank NCDs and WMPs, which are both shadow-banking related activities, and such an association is stronger and more significant when there is a liquidity shortage. For the initial pricing of interbank NCDs, both bank size growth and bank type matters. However, bank risks do not seem to be considered in pricing. We also find evidence that bank engagement in such "shadow" interbank activities is closely associated with banks' proprietary trading. Such a relationship across different subsectors in the financial system might lead to systemic risks, which should be considered in current regulations.

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Table 1: Summary Statistics

Panel A: Characteristic Descriptions

This table reports descriptive statistics on the characteristics of bank and interbank NCDs.

Bank Characteristics (Bank level)

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
NCD/Total assets	1,086	0.079	0.011	0.122	0.000	0.718
NCD/Total liabilities	1,073	0.085	0.012	0.131	0.000	0.778
Bond to pay/Total assets	703	0.062	0.041	0.059	0.000	0.336
Interbank WMP/Total assets	1,086	0.251	0.247	0.135	0.000	0.760
Interbank activities ratio	1,086	0.166	0.131	0.152	0.000	0.888
Bond trading/Total assets	712	0.786	0.583	0.731	0.001	6.285
Core capital ratio	209	0.120	0.116	0.025	0.066	0.227
LDR	1,044	0.662	0.642	0.831	0.162	25.882
Total assets (mn RMB)	1,086	693,962	83,574	2,711,619	3,792	26,100,000
Bank size (mn RMB)	1,086	11.525	11.333	1.605	8.241	17.077
ROA	1,062	0.010	0.010	0.004	-0.061	0.030
NPL ratio	1,003	0.016	0.015	0.011	0.000	0.268
Z-score (in hundred)	1,061	0.378	0.318	0.359	0.028	7.626
SMB_i	1,526	0.547	0.552	0.080	0.002	0.674

Negotiable CD Characteristics (Transaction- level)

Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
At-issue yield spread (%)	60,206	1.273	1.31	0.423	-0.460	3.310
Maturity	60,206	0.465	0.496	0.352	0.077	3.003
Log IssVol (mn RMB)	60,054	5.989	6.174	1.210	2.303	10.785
Bank size growth	55,231	1.015	1.013	0.012	0.973	1.184
Credit rating score	60,107	8.887	9	1.232	3	10

Panel B: Differences in Interbank Activities and Bank Performance

This table reports differences in the interbank activities and bank performance of Big 4 banks and SMBs.

Interbank Activity Characteristics					
	Big 4		*SMBs*		*Difference*
	Mean	**Obs.**	**Mean**	**Obs.**	
NCD/Total assets	0.001	20	0.081	1,061	-0.079***
	(0.000)		(0.004)		(0.027)
NCD/Total liabilities	0.001	20	0.087	1,049	-0.086***
	(0.000)		(0.004)		(0.030)
Bond to pay/Total assets	0.020	20	0.064	683	-0.044***
	(0.001)		(0.002)		(0.013)
Interbank WMP/Total assets	0.129	20	0.253	1,061	-0.124***
	(0.005)		(0.004)		(0.030)
Interbank activities ratio	0.067	20	0.169	1,061	-0.102***
	(0.009)		(0.005)		(0.034)
Bank Performance Characteristics					
	Big 4		*SMBs*		*Difference*
	Mean	**Obs.**	**Mean**	**Obs.**	
NPL ratio	0.015	20	0.016	981	-0.001
	(0.001)		(0.000)		(0.003)
ROA	0.011	20	0.010	1,038	0.001
	(0.000)		(0.000)		(0.001)
LDR	0.703	20	0.661	1,020	0.042
	(0.013)		(0.026)		(0.188)
Core capital ratio	0.111	15	0.120	194	-0.009
	(0.003)		(0.002)		(0.007)

Table 2: Determinants of interbank NCD issuance

This table reports baseline results of regressions examining determinants of the issuance of interbank NCDs. Dependent variables include *NCD/Total assets*, *NCD/Total liabilities*, *Bond to pay/Total assets and Interbank WMP/Total assets*. The key variable is the *LDR* or *Core capital ratio*. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**NCD/Total assets**		**NCD/Total liabilities**		**Bond to pay/Total assets**		**Interbank WMP/Total assets**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LDR	0.0119***		0.0124***		0.186***		0.0176***	
	(0.00419)		(0.00443)		(0.0342)		(0.00486)	
Core capital ratio		0.186		0.199		-0.768**		-0.425
		(0.270)		(0.289)		(0.301)		(0.706)
Bank size	0.0594*	0.0842	0.0616*	0.0881	0.110***	0.195***	0.117***	0.146*
	(0.0319)	(0.0842)	(0.0338)	(0.0897)	(0.0183)	(0.0437)	(0.0300)	(0.0852)
Z-score	-0.0113	-0.359	-0.00509	-0.391	-0.0532*	0.220	-0.164***	0.0377
	(0.0516)	(0.218)	(0.0553)	(0.237)	(0.0298)	(0.137)	(0.0539)	(0.272)
Cons.	-0.672*	-0.878	-0.700*	-0.912	-1.373***	-2.484***	-1.068***	-1.496
	(0.362)	(1.009)	(0.384)	(1.077)	(0.224)	(0.591)	(0.344)	(1.027)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq	0.613	0.421	0.614	0.421	0.626	0.626	0.447	0.336
# of Obs.	1,044	209	1,044	209	699	125	1,044	209
Cluster	Bank	Bank	Bank	Bank	Bank	Bank	Bank	Bank

Table 3: Determinants of interbank NCD issuance: Big Four vs. SMBs

This table reports the results of regressions examining determinants of the issuance of interbank NCDs between Big Four banks and SMBs. The dependent variable is *NCD/Total assets* or *Bond to pay/Total assets*. The key variable is the *LDR*. Chi-sq tests are reported on the LDR. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**NCD/Total assets**		**Bond to pay/Total assets**	
	Big 4	*SMBs*	*Big 4*	*SMBs*
	(1)	(2)	(3)	(4)
LDR	0.0168	0.0107***	-0.0709***	0.178***
	(0.0350)	(0.00404)	(0.00974)	(0.0345)
Bank size	0.0718*	0.0460	-0.0694*	0.0978***
	(0.0280)	(0.0311)	(0.0256)	(0.0183)
Z-score	0.0503	0.00191	-0.0117	-0.0450
	(0.0301)	(0.0517)	(0.0131)	(0.0279)
Cons.	-1.236*	-0.521	1.222*	-1.221***
	(0.484)	(0.350)	(0.430)	(0.222)
Chi-sq (LDR)		0.03		65.30***
(P value)		0.8673		(0.0000)
Year FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
R-sq	0.565	0.625	0.868	0.635
# of Obs.	20	1,024	20	679
Cluster	Bank	Bank	Bank	Bank

Table 4: Determinants of interbank NCD issuance: the impact of deregulation

This table reports the results of regressions examining the impact of interest rate deregulation on NCD issuance. The dependent variable is *NCD/Total assets* or *NCD/Total liabilities*. Ley explanatory variables include *Post-deregulation*, *LDR,* and *the interaction between Post-deregulation* and *LDR*. *Post-deregulation* is equal to 1 when a period occurs after 2016 (the completion of interest rate liberalization) and is equal to zero otherwise. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**NCD/Total assets**	**NCD/Total liabilities**
	(1)	(2)
LDR	0.385***	0.405***
	(0.0922)	(0.0983)
Post-deregulation	0.336***	0.356***
	(0.0571)	(0.0605)
Post-deregulation*LDR	-0.195**	-0.201**
	(0.0843)	(0.0896)
Z-score	-0.0940	-0.0904
	(0.101)	(0.108)
GDP growth_pr	-0.189	-0.196
	(0.289)	(0.309)
CPI growth_pr	4.177***	4.507***
	(0.954)	(1.029)
Cons.	-0.293***	-0.315***
	(0.0842)	(0.0901)
Year FE	No	No
Bank FE	Yes	Yes
R-sq	0.612	0.612
# of Obs.	823	823
Cluster	Bank	Bank

Table 5: The impact of interest rate deregulation: subsamples

This table reports the results of regressions examining the impact of interest rate deregulation on NCD issuance for subsamples of SMBs and Big 4 banks. The dependent variable is *NCD/Total assets* or *NCD/Total liabilities*. Key explanatory variables include *Post-deregulation*, *SMB_i* and their interaction. *SMB_i* is defined as bank i's exposure to competition from other SMBs. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**NCD/Total assets**		**NCD/Total liabilities**	
	SMBs	*Big 4*	*SMBs*	*Big 4*
	(1)	(2)	(3)	(4)
LDR	0.235***	0.0938	0.250***	0.102
	(0.0696)	(0.133)	(0.0749)	(0.145)
Post-deregulation	0.0260	-0.469	0.0299	-0.514
	(0.0941)	(0.796)	(0.101)	(0.883)
SMB_i	0.907*	-1.854	0.973*	-2.026
	(0.495)	(2.395)	(0.530)	(2.647)
Post-deregulation*SMB_i	0.240*	-0.396	0.256*	-0.429
	(0.140)	(0.344)	(0.149)	(0.377)
Z-score	-0.0820	0.0450	-0.0772	0.0492
	(0.103)	(0.0346)	(0.111)	(0.0378)
GDP growth_pr	-0.186	-152.7	-0.185	-166.7
	(0.302)	(219.1)	(0.321)	(242.7)
CPI growth_pr	3.253***	31.30	3.526***	34.18
	(1.026)	(46.25)	(1.103)	(51.26)
Cons.	-0.649**	11.56	-0.701**	12.62
	(0.260)	(16.44)	(0.278)	(18.22)
Year FE	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes
R-sq	0.622	0.533	0.622	0.532
# of Obs.	804	16	804	16
Cluster	Bank	Bank	Bank	Bank

Table 6: Determinants of interbank NCD issuance: high vs. low market rate periods

This table reports the results of regressions examining determinants of the issuance of interbank NCDs. Dependent variables include *NCD/Total assets* and *NCD/Total liabilities*. Key explanatory variables include *High rate period*, *Big 4* and their interaction. *High rate period* is equal to 1 when a period occurs in 2017 (market liquidity crunch) and is equal to zero when a period occurs in 2016. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**NCD/Total assets**	**NCD/Total liabilities**
	(1)	(2)
LDR	-0.0138***	-0.0141***
	(0.00354)	(0.00389)
High rate period	0.0923***	0.0994***
	(0.0125)	(0.0134)
Big 4	-0.124***	-0.134***
	(0.0129)	(0.0136)
High rate period*Big 4	-0.0978***	-0.105***
	(0.0184)	(0.0197)
Z-score	-0.0367***	-0.0384***
	(0.0137)	(0.0140)
GDP growth_pr	0.508	0.559
	(0.363)	(0.385)
CPI growth_pr	-1.772	-1.894
	(1.774)	(1.906)
Cons.	0.161***	0.172***
	(0.0331)	(0.0352)
Year FE	No	No
Bank FE	No	No
R-sq.	0.285	0.285
# of Obs.	387	387
Cluster	Bank	Bank

Table 7: The effects of interbank activities on bank performance

This table reports the results of regressions examining bank performance. Dependent variables include *Net interest margin*, *ROA*, and the *NPL ratio*. The dependent variable is *NCD/Total assets*. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**ROA**	**NPL ratio**
	(1)	(2)
NCD/Total assets	-0.0181***	0.0210***
	(0.00628)	(0.00394)
LDR	-0.00205	0.0239***
	(0.00574)	(0.00885)
Core capital ratio	-0.00463	-0.0109
	(0.0177)	(0.0293)
Cons.	0.0133***	-0.000345
	(0.00472)	(0.00652)
Year FE	No	No
Bank FE	Yes	Yes
R-sq.	0.0559	0.166
# of Obs.	208	208
Cluster	Bank	Bank

Table 8: Determinants of the At-issue yield spread of interbank NCDs

This table reports the results of regressions examining determinants of the issuance of interbank NCDs. The dependent variable is *At-issue yield spreads* of interbank NCDs. Key explanatory variables include *LDR, bank size growth,* and a set of *bank type dummies*. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**At-issue yield spread**					
	Full sample				*Big 4*	*SMBs*
	(1)	(2)	(3)	(4)	(5)	(6)
Maturity	0.320***	0.316***	0.314***	0.319***	0.577**	0.314***
	(0.0177)	(0.0172)	(0.0173)	(0.0179)	(0.115)	(0.0171)
Log IssVol	0.0101***	0.00710***	0.00791***	0.00881***	0.0231	0.00661**
	(0.00300)	(0.00265)	(0.00271)	(0.00280)	(0.0122)	(0.00269)
Credit rating score	-0.0574***	-0.0854***	-0.0751***	-0.0807***	-0.0767***	-0.0849***
	(0.0117)	(0.00665)	(0.00661)	(0.00905)	(0.0121)	(0.00669)
Bank size growth	1.150**	1.267**	0.998*	1.323**	-36.20*	1.266**
	(0.556)	(0.566)	(0.551)	(0.565)	(11.49)	(0.567)
LDR	-0.0350***	-0.0407**	-0.0272**	-0.0383**	0.794*	-0.0409**
	(0.0125)	(0.0174)	(0.0111)	(0.0149)	(0.323)	(0.0176)
Z-score	-0.0211	-0.0251	-0.0190	-0.0439	-0.240	-0.0286
	(0.0269)	(0.0297)	(0.0316)	(0.0315)	(0.219)	(0.030)
Bank size	-0.0272***					
	(0.00914)					
Big Four		-0.212***	-0.197***			
		(0.0293)	(0.0276)			
CityRural			0.0769***			
			(0.0151)			
Foreign			0.116***			
			(0.0333)			
Listed				-0.0144		
				(0.0215)		
Cons.	0.714	0.549	0.683	0.383	37.42**	0.522
	(0.581)	(0.591)	(0.573)	(0.595)	(11.52)	(0.592)
Chi-sq (Bank size growth)						6.58**
(P value)						(0.0103)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No	No
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	0.398	0.400	0.403	0.397	0.329	0.398
# of Obs.	54,698	54,698	54,698	54,698	809	53,889
Cluster	Bank	Bank	Bank	Bank	Bank	Bank

Table 9: The effects of interbank activities on bank bond trading

This table reports the results of regressions examining banks' bond trading activities. The dependent variable is *Bond trading/Total assets*. The key explanatory variable is the *Interbank activities ratio* or *NCD/Total assets*. The *Interbank activities ratio* is defined as the sum of the issuance of interbank NCDs and interbank WMPs over bank total assets. All variables are defined in Appendix Table A.1. Robust standard errors clustered by bank are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Dep. Var	**Bond trading/Total assets**					
	Full Sample	*SMBs*	*Big 4*	*Full Sample*	*SMBs*	*Big 4*
	(1)	(2)	(3)	(4)	(5)	(6)
Interbank activities ratio	0.967**	0.968**	1.272			
	(0.428)	(0.433)	(1.262)			
NCD/Total assets				1.636***	1.642***	-5.305
				(0.391)	(0.389)	(10.08)
LDR	1.502*	1.484*	0.981	1.146	1.111	1.665
	(0.761)	(0.797)	(0.627)	(0.771)	(0.806)	(1.354)
Core capital ratio	-7.594***	-7.676***	-1.620	-6.333**	-6.408**	-3.537
	(2.815)	(2.839)	(5.228)	(2.840)	(2.864)	(4.718)
Cons.	0.296	0.367	-0.523*	0.482	0.561	-0.667
	(0.418)	(0.444)	(0.134)	(0.381)	(0.404)	(0.415)
Chi-sq			0.09			0.89
(P value)			(0.7677)			(0.3442)
Year FE	No	No	No	No	No	No
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	0.265	0.265	0.307	0.307	0.308	0.246
# of Obs.	162	147	15	162	147	15
Cluster	Bank	Bank	Bank	Bank	Bank	Bank

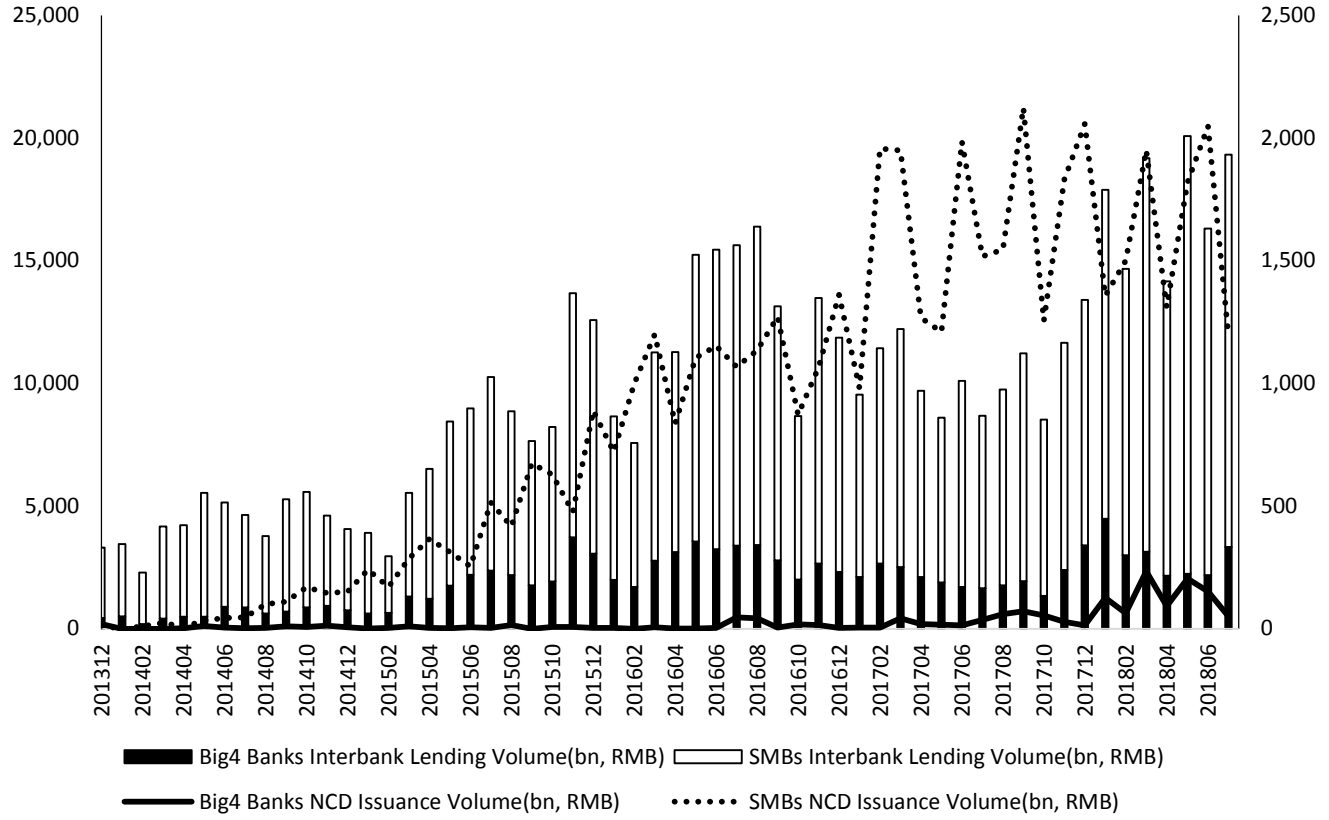

Figure 1: Interbank NCD issuance volume and Interbank lending volume by month: Big Four banks versus SMBs

This figure plots issuance volumes of interbank NCDs (Right-axis) and Interbank lending (Left-axis) for Big 4 banks vs. SMBs from the introduction of interbank NCDs in December 2013.

Source: WIND

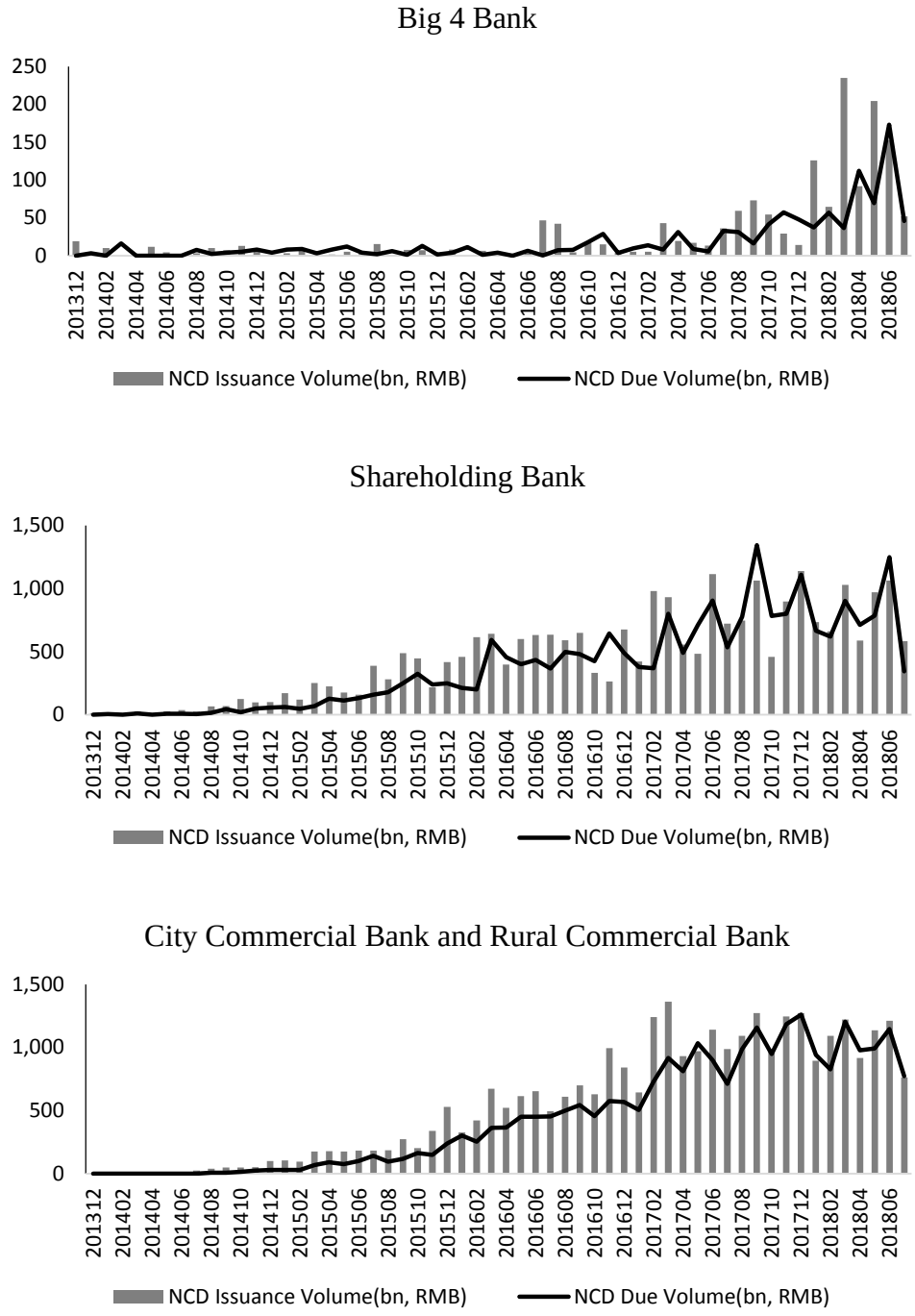

Figure 2: Interbank NCD issuance and due volumes for different bank types: 2013-2018

This figure plots the issuance and due volumes of interbank NCDs for different types of commercial banks by month from the launch of the interbank NCD market in December 2013.

Source: WIND

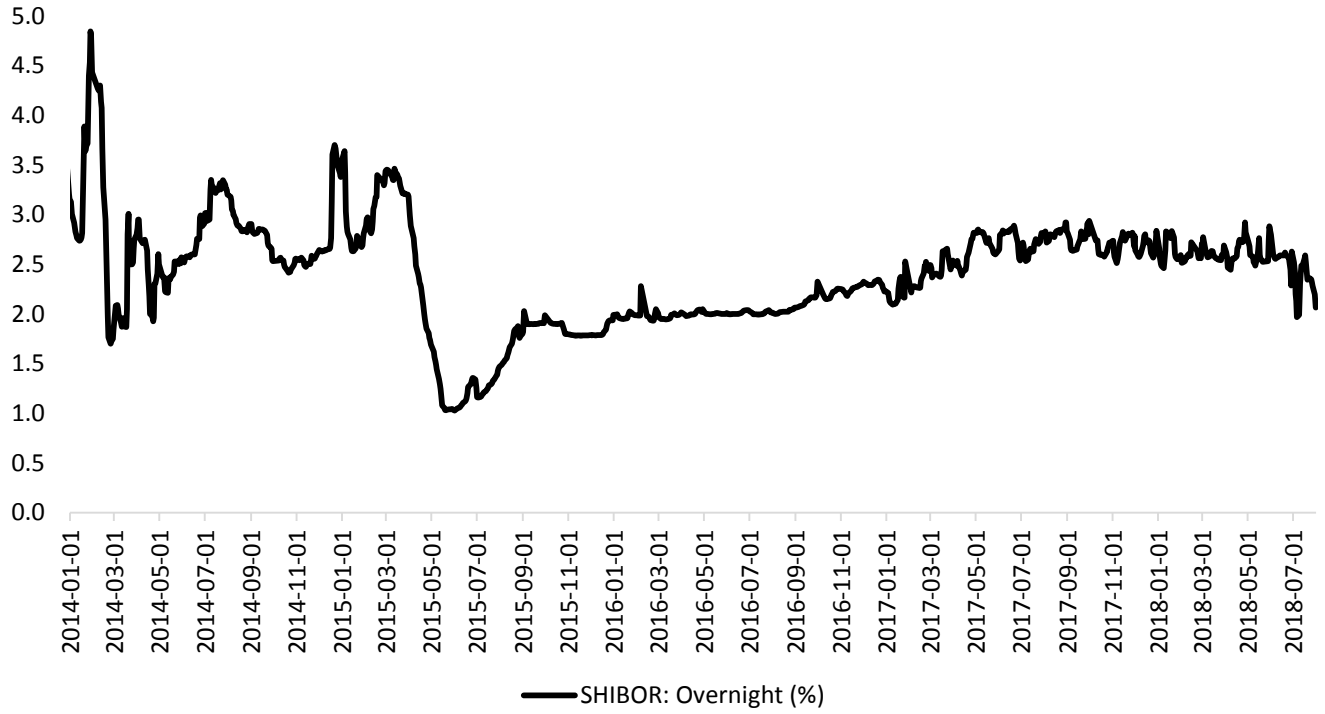

Figure 3: SHIBOR overnight interest rates: 2014-2018

This figure plots SHIBOR (Shanghai Interbank Offered Rate) overnight interest rates for 2014 to 2018. The SHIBOR records average lending rates of accredited commercial banks in China.

Source: National Interbank Funding Center

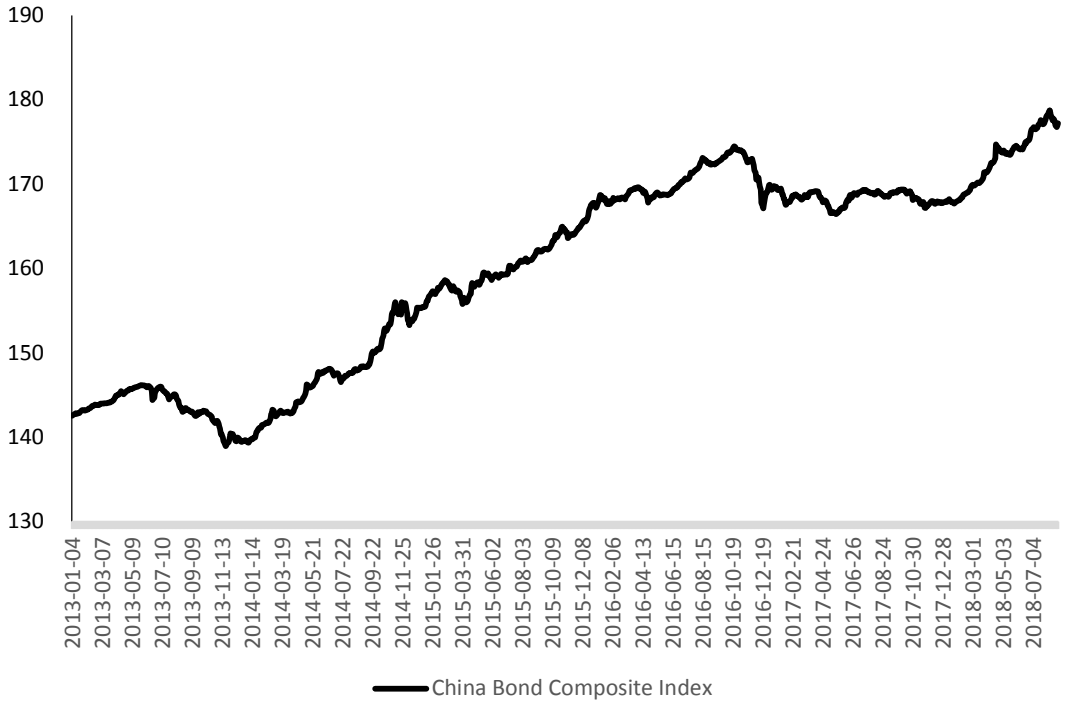

Figure 4: China's bond market index: 2013-2018

This figure plots trends of the Chinese bond index by month for 2013 to 2018. The index is developed and released by China Bond to measure the performance of China's domestic bond market. It is calculated from the prices of asset-backed securities, Eurodollar bonds, convertible bonds and all other bonds publicly issued in the China's bond market.

Source: China Bond (http://www.chinabond.com.cn)

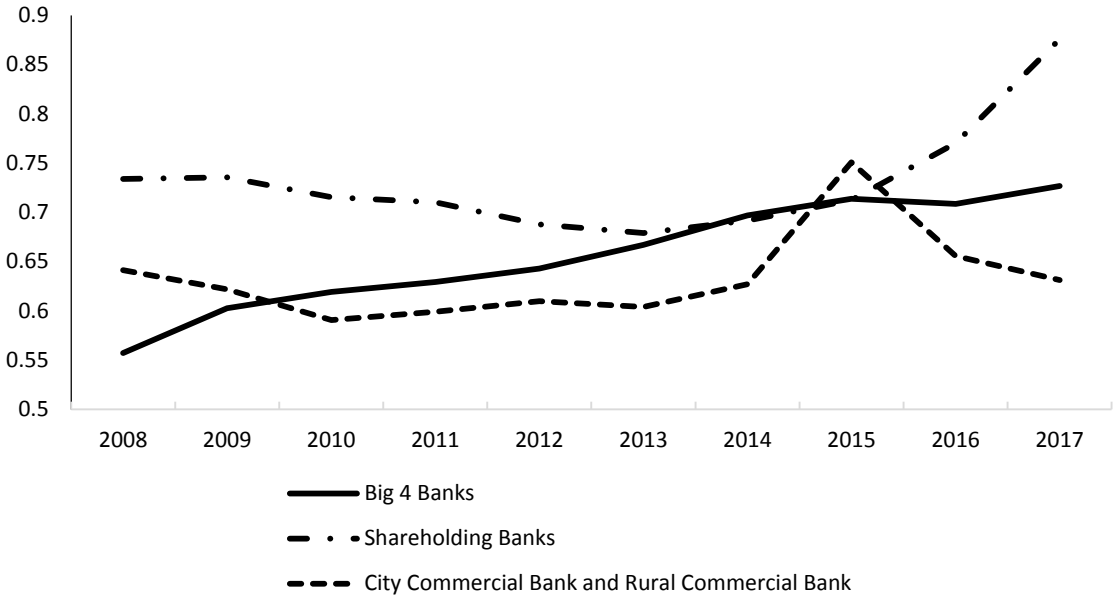

Figure 5: LDRs of different bank types: 2008-2017

This figure plots LDRs for different types of commercial banks by year for 2008 to 2017.

Source: WIND

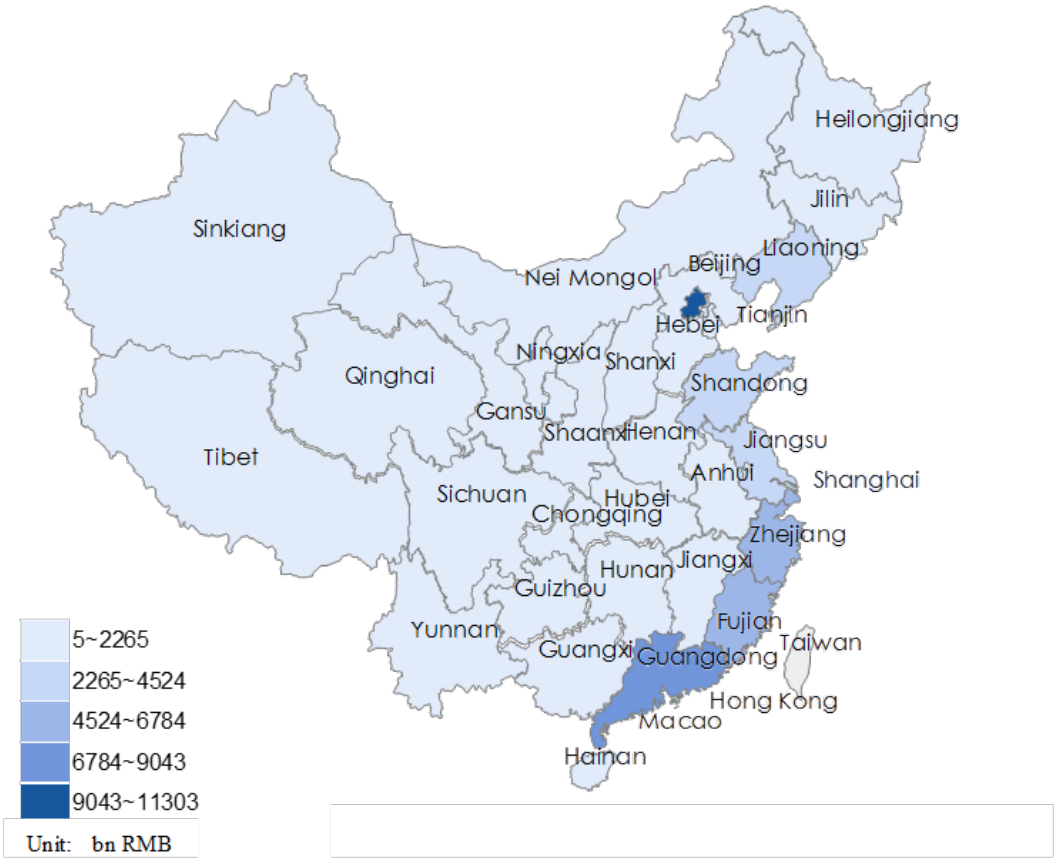

Figure 6: Distribution of interbank NCD issuance volume by province: 2013-2018

This figure plots the distribution of total issuance values of interbank NCDs by province (bank headquarters) for 2013 to 2018.

Appendix

Table A.1: Variables and Definitions

Variables	Definitions	Source
Interbank activities variables		
NCD/Total assets	Aggregate Negotiable CD issuance volume in year t over bank total assets of same year	WIND;Own calculations
NCD/Total liabilities	Aggregate Negotiable CD issuance volume in year t over bank total liabilities of same year	WIND;Own calculations
Bond to pay/Total assets	Bond to pay/Total assets	WIND
Interbank WMP/Total assets	Sum-up of Financial assets available for sale, Held for trading financial assets, Due from banks and Investment receivables over bank total assets	WIND;Own calculations
Interbank activities ratio	Sum-up of issuance of interbank NCDs and interbank WMPs over bank total assets	WIND;Own calculations
Bank variables		
Bank size	Natural logarithm of total assets	WIND
Bank size growth	Growth rate of total assets	Own
ROA	Net earnings after dividends in year t to the average of assets at the close of current year and lagged one year	WIND
CAR	Total Equities/ Total assets	Own
Z-score	(ROA+CAR)/Standard deviation of ROA	Own
Core capital ratio	Commercial bank's capital adequacy ratio, calculated as Tier one capital/ Risk weighted assets	WIND
LDR	Total loans/Total deposits	WIND;
NPL ratio	Total non-performing loans/Total loans	WIND
Bond trading/Total assets	Total amount of bond trading in year t over bank total assets of same year	iFIND; Own Calculation
SMB_i	Bank i's exposure to competition from other SMBs	CBRC; AQY (2017)
Big Four	=1 for ICBC, BOC, ABC and CCB; 0 otherwise	WIND
CityRural	=1 for city commercial banks or rural commercial banks; 0	WIND
Foreign	=1 for foreign banks; 0 otherwise	WIND
Shareholding	=1 for shareholding banks; 0 otherwise	WIND
Negotiable CD characteristics		
At-issue yield spread (%)	Difference between at-issue yield of NCD and 6-month treasury bond yield	WIND
Maturity	Negotiable CD maturity by year	WIND
Log IssVol	Natural logarithm of Negotiable CD issuance volume	WIND
Credit rating score	Numeric score of Negotiable CD issuer's credit rating, AAA equals 10, AA+ equals 9, etc. (from AAA to BBB-: 10 to 1)	WIND
Macro variables		
GDP growth	GDP growth rate of China	WIND
CPI growth	CPI growth rate of China	WIND
GDP growth_pr	GDP growth rate of province in China	WIND
CPI growth_pr	CPI growth rate of province in China	WIND
Post-deregulation	=1 after the deregulation of the lending/deposit interest rates (2016 and after); 0 otherwise	Own calculations
High rate period	=1 for 2017 and after; 0 otherwise	Own

Table A.2: Regulations on Shadow Banking and Interbank Activities: 2013-2018

Date	Authority	Order No.	Measures
25 Mar., 2013	CBRC	Order [2013] No.8	The CBRC stipulates a wealth management business that invests in nonstandardized credit assets.
7 Dec., 2013	PBoC	Order [2013] No.20	Negotiable certificates of deposit (NCDs) are allowed to be issued on the interbank market.
24 Apr, 2014	PBoC, CBRC, CIRC, CSRC and SAFE	Order [2014] No.127	The CBRC mainly stipulates that 1) the amount that banks borrow from their peers in the financial sector should not exceed one-third of total liabilities and 2) a bank's net volume of interbank lending to a single given financial institution should not exceed 50% of quality core capital following the deduction of assets with zero risk weighting.
8 May, 2014	CBRC	Order [2014] No.140	The CBRC enhances its supervision and risk control of the interbank activities sector.
22 Sep., 2015	CBRC	Order [2015] No.9	NCDs were included as interbank lending.
28 Apr., 2016	CBRC	Order [2016] No.82	The CBRC intensifies its oversight over the shadow banking sector and would evaluate the real volumes of nonperforming assets of commercial banks.
28 Mar., 2017	CBRC	Order [2017] No.45	The CBRC intensifies its targeted supervision of interbank activities, investment activities and wealth management products.
28 Mar., 2017	CBRC	Order [2017] No.46	The CBRC supervises when banks use funds from interbank lending (including NCDs) to purchase WMP supplied by their peers rather than channeling funds toward real economic activities.
6 Apr., 2017	CBRC	Order [2017] No.53	Banks should include NCDs as part of interbank lending and borrowing when reporting to regulators, instead of recording the instruments as bonds payable. The amount of interbank lending should not exceed one-third of total liabilities once NCDs is incorporated into interbank lending.
7 Apr., 2017	CBRC	Order [2017] No.6	The financing scale of interbank lending (including NCDs) should be reasonably controlled. The CBRC monitors banks with relatively high NCDs over interbank liabilities ratios.
10 Apr., 2017	CBRC	Order [2017] No.7	Banks with relatively high interbank lending ratios should disclose liquidity risk information.
12 May, 2017	PBoC	China Monetary Policy Report, First Quarter, 2017	Off-balance sheet wealth management products (WMPs) are included under the PBoC's risk-assessment framework (also known as the MPA assessment (short for Macro Prudential Assessment)).

11 Aug., 2017	PBoC	China Monetary Policy Report, Second Quarter, 2017	For financial institutions with assets of more than 500 billion RMB, NCDs are included in MPA assessments of the first quarter of 2018. Other financial institutions are evaluated but not judged by the same indicator.
31 Aug., 2017	PBoC	Order [2017] No.12	Financial institutions should not issue NCDs with a maturity level of more than one year from September 1, 2018.
6 Dec., 2017	CBRC		New requirements related to NCDs are announced in *Measures for the Liquidity Risk Management of Commercial Banks (for Revised Draft):* NCDs are included in interbank lending assessments.
11 May., 2018	PBoC	China Monetary Policy Report, First Quarter, 2018	For financial institutions with assets of more than 500 billion RMB, NCDs are included in MPA assessments. The same assessment is applied to financial institutions with assets of less than 500 billion RMB from the first quarter of 2019.
23 May, 2018	CBIRC	Order [2018] No.3	*Measures for the Liquidity Risk Management of Commercial Banks* takes effect from July 1, 2018.

Source: PBoC (People's Bank of China); CBRC (China Banking Regulatory Commission); CBIRC[13] (China Banking and Insurance Regulatory Commission)

[13] The CBIRC was created on 8 April 2018 with a sweeping government revamp that merged the previous CBRC with the China Insurance Regulatory Commission (CIRC).