China's Shadow Banking: 2020-2022

——In the Long Shadow of Strengthened Regulation

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June 1, 2023

ABSTRACT

This paper researches into development of China's shadow banking during 2020-2022, a special period marked by COVID-19 and strengthened global regulation on Non-Bank Financial Intermediation (NBFI). Research focus includes balance sheet evolvement, growth dynamics, and relation with macro-finance. Its business model surprisingly resembles western peers. They both fund underserved sectors and have similar exposure to balance sheet mismatch. Massive holding of bond investment (36.6% of total asset) is funded by uninsured interbank fund and wealth management product, which makes it more closely related with banks' balance sheet and risk contagion from NBFI to traditional commercial banks more easily. This paper then re-summarizes growth dynamics of China's shadow banking in a "Pull-Push" framework, and proposes concept of reintermediation in respective to disintermediation. Consecutive regulation on NBFI and real estate sector kept dragging on growth of shadow banking, and rendered it in liquidity surplus, which is invested into interbank market. This paper also provides empirical evidence on relation of China's shadow banking with macro-finance, and notes several empirical breakdowns of pre-

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COVID relations among economic and financial indicators. Most important breakdown is the non-functionality of monetary policy transmission channel. Besides, it continued to twist de facto financial regulatory indicators, however with fading impact.

JEL Codes: E44, E65, G23, G28, N15

Keywords: Shadow Banking; Monetary Policy; Financial Regulation; Balance Sheet; Risk Contagion

1. Introduction

SHADOW BANKING HAS RECEIVED CONTINUOUS attention from both academia and broad public. As the most apparent driving force behind 2008 Global Financial Crisis (GFC), it came under elaborate scrutiny by global financial regulators. With announcement of Basel III in 2010/2011 (Basel Committee on Banking Supervision (2011)), as well as other strict financial regulations (such as Dodd-Frank Act in the U.S.), development of shadow banking, which has been one very important supplicant to traditional commercial banks, seems to be slowing across the globe.

Does shadow banking subdue into background as a result of the strengthen regulation? Two banking crises in 2023 remind us this is not the case. One is signified by Silicon Valley Bank (SVB) in the U.S., which basically mismatched heavy weighted bond investment portfolio with unstable large-amount corporate deposits. The other is Credit Suisse in Switzerland, which was involved in several high-profile risky trade and investment, and self-exposed internal control risk. It maintained investment bank-styled business portfolio and became inundated in scandals and litigations(Wallace and Brown (2023)). Both Silicon Valley Bank and Credit Suisse operate in close resemblance to modus operandi of shadow banking. Asset-liability mismatch, risk-oriented investment strategy, and lack of internal control all contributed to imploding of U.S. shadow banking in 2007-2008, and directly doomed last remanence of investment banks, e.g., Lehman Brother, Bear Stearns, etc. These elements yet contributed again to the demise of not-so-systematically-important SVB and G-SIFI Credit Suisse. The tricky part here

is that SVB and Credit Suisse both incorporate as banking institutions and follows strict banking regulation, including full evolving set of Basel III. The off-balance sheet shadow banking activities before 2008 exhibits itself again on the balance sheet of traditional commercial banks. This could be considered both coincidence and irony. Not the least, Foroohar (2023) recently claimed shadow bank funded commercial real estate market should feel more strained in not-so-distant future, which will put pressure on non-banks, and in turn small regional banks which hold chunk of claims to the sector. As early as 2020, Sengupta and Xue (2020) noted that as a result of no access to deposit guarantee as well as central bank liquidity backstop, shadow banking will be vulnerable in time of financial distress. It turns out even banks operating resemble to shadow banking become vulnerable in distressful time too.

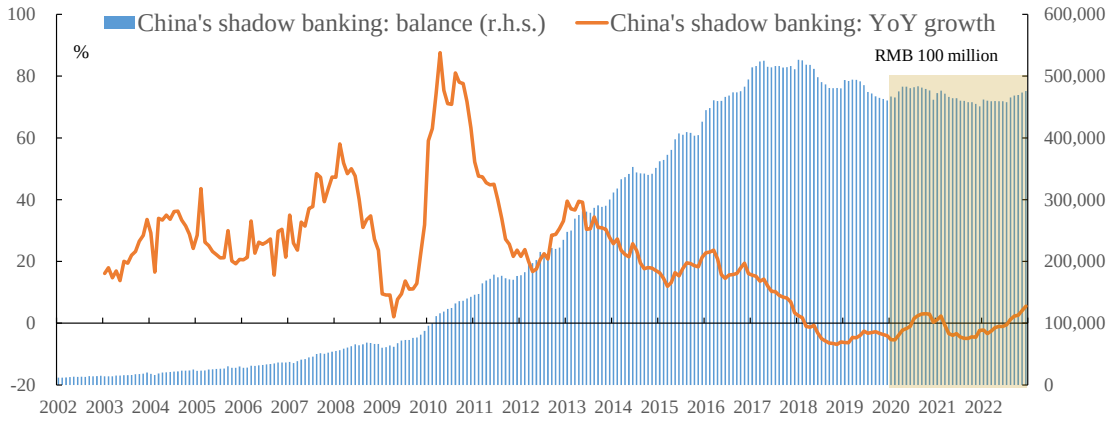


Figure 1 China's Shadow Banking: Growth in 2002-2022

Note: Data compiled by methodology from Li (2019) and updated to 2022.

The above rationale warrants further research attention on shadow banking, even after adoption of Basel III. This paper looks into China's shadow banking, a special case of the global phenomena, and its development during 2020-2022. China's shadow banking stood at RMB 47.6 trillion yuan (equivalent USD 6.8 trillion) by end-2022. It

broadly follows the same global trend. According to data compiled by Li (2019), in September 2008, the month Lehman Brother's demise stirred global financial turmoil, China's shadow banking reached its pre-GFC peak at RMB 6.9 trillion yuan (equivalent USD 1 trillion) (Figure 1). The average annual growth rate in 2003-2008 was 28%, highest year-over-year (YoY) growth reached around 60%. This fast growth came to halt in the height of GFC, with monthly YoY growth slowed to near nil in April 2009. Later that year, China's shadow banking began a second round of exponential growth. In 2009-2017, average annual growth rate was 25%, highest-ever YoY growth reached around 80% (Li (2021)). The outstanding balance reached RMB 52 trillion yuan (equivalent USD 8 trillion) in 2017. During this period, shadow banking exerted significance on effectiveness of China's monetary policy and financial stability. Since 2018, growth of China's shadow banking has plateaued. In 2018-2019, it shrank by 10%. Then in 2020-2022, it stabilized and accumulated expansion of only 3%. Vis-à-vis narrow measure of global shadow banking (Financial Stability Board (2023)), the highest percentage was 15.8% in 2016, with the latest available figure 10.4% in 2021.

Several major pieces about shadow banking in general were published in last several years. One branch of research focus on liquidity and credit transformation of shadow banking as rationale for its growth relative to traditional banking. Gennaioli, Shleifer and Vishny (2013) builds a model in which intermediaries create riskless debt for retail investors, in the process improve welfare in the case of rational expectations, however vulnerable to crisis. Sunderam (2015) builds both theoretical model and empirical evidence that investors' demand for money-like claims as shadow banking's debt drove

shadow banking growth in the U.S. before GFC. Moreira and Savov (2017) builds macrofinance model in which shadow banking creates money-like claims for investors and economize on collateral, resulting vulnerability in distressful times. Other researchers claim regulation on traditional banking as the reason for shadow banking's growth, and detailed its impact on financial stability. Farhi and Tirole (2021) researched into theoretical design of banking regulation. Increased regulation reduced moral hazard, but needs to be balanced with benefit to banks from deposit insurance, lender of last resort, and others, in order that banks not turn to shadow sector for funding. Irani, Iyer, Meisenzahl and Peydro (2021) utilizes U.S. data to point out that loan migration from capital-intense traditional banks into shadowy non-banks increases fragility of financial system and also price volatility of relevant assets. Gebauer and Mazelis (2023) build theoretical model that capital-based regulation on traditional banks will help drive growth of shadow banking. Lyonnet and Chretien (2023) documents about traditional bank and shadow banking's coexist and regulation-evasion based relation in the U.S., who uses money market mutual funds (MMMF) as proxy for shadow banking. Monetary policy also plays a role besides financial regulation. Xiao (2020) observes monetary tightening signified by rate hiking actually push deposits into shadow banking liabilities in the U.S and increase financial stability risk.

These papers echo with research on China's shadow banking in particular. One branch of research note beneficial effect of China's shadow banking. Zhu (2021) states that China's shadow banking dated back to 1980s, and separates shadow banking into bank-initiated, and local government and state-owned enterprises (SOEs) initiated, with

former one beneficial to improving allocation efficiency. Chen, He and Liu (2020) that one unexpected consequence of China's shadow banking is development of China's corporate bond market. However, fast development of China's shadow banking seems to be directed mostly to local government and real estate investment. Allen, Qian, Tu and Yu (2019) uses corporate-level micro-data of entrusted loan as proxy variable for shadow banking to find that these loans are directed to real estate investment before 2014. Zhu (2021), Li (2021) and Chen, He and Liu (2020) broadly reach the same conclusion. Monetary tightening is recognized as one major factor behind fast development of shadow banking. Chen, Ren and Zha (2018) states that quantity based monetary policy framework drives shadow banking growth when loan growth is restricted by the central bank, which also echoes finding in Li (2021). As a result, before 2019, shadow banking exerted a significant influence on China's monetary policy transmission and decreased monetary policy effectiveness(Chen, Ren and Zha (2018); Li (2020)). Cheng and Wang (2022) uses bank-level WMP issuance data and provide evidence that shadow banking supplement banks' liquidity management as additional funding source, reduces responses of banks' loans to monetary policy change and dampens monetary policy efficiency. Li (2020) takes one step further into financial stability, and simulated effect of shadow banking's development on pushing up real estate price, and its twisting of financial regulatory indicators, both of which increases financial stability risk. Li (2019) gives an estimation of scale of China's shadow banking which compliments one possible shortfall of previous research. As there's no available high-frequency, macro-level, aggregate estimation of shadow banking, most

scholars use proxy variables, such as provincial data, corporate data, partial shadow banking business (entrusted loans, etc.), to simulate as shadow banking. The proxy data for most time might be enough, but is also susceptible to double accounting, partial data in place of aggregates, and other issues. Li (2019) conducts monthly estimation dating back to 2002, and gives balance sheet of China's shadow banking. By listing individually of asset and liability items, it avoids possible double accounting issue. This paper is widely cited in Chinese literature.

The current paper will utilize detailed balance sheet data from Li (2019), and specifically researched into several facets of China's shadow banking during 2020-2022, including balance sheet evolvement, growth dynamics and relevant empirical test, relation with macro-finance.

This paper's main contributions to the current literature include:

First, its research into China's shadow banking helps deepen understanding of current banking crises in the U.S. and Switzerland. Business model of China's shadow banking surprisingly resembles that of SVB and Credit Suisse, as well as shadow banking activities in the U.S. Two similarities stand out.

1. Similar clientele profile. They both fund underserved sectors in the economy. SVB is well known to provide banking service to innovative enterprises, who found it hard to obtain traditional banking service from large commercial banks. China's shadow banking provides off-balance sheet loan and trust financing to infrastructure investment (through local government financial vehicles, LGFV) and real estate enterprises.

Traditional commercial banks have been reluctant to provide these financing due to restraining industrial regulation.

2. Similar exposure to balance sheet mismatch. By end-2022, out of its USD 212 billion total asset, SVB held 55% in bond investment. At the same time, China's shadow banking held 36.6% of total asset in bond investment. Bond holding of the latter expanded 48% during 2020-2022, and might reach that of SVB in not-so-distant future. However, they both have highly unstable funding source from liability-side perspective. China's shadow banking is funded by inter-bank loans and unstable wealth management product, both uninsured, in similarity to uninsured corporate deposits of SVB. This mismatch is likely to subject respective entities to substantial interest rate risk, just as in SVB's collapse.

Second, this paper brings attention to reintermediation in respective to disintermediation. If we define financial "***Disintermediation***" as financing activities move out of balance sheet of traditional banks, and into financing channels of shadow banks (or Non-Banking Financial Intermediation, NBFI), then we could safely call what happened in the U.S. financial sector before 2008 GFC and in China before 2017 as such. Then what we observe in the U.S. after 2008 and in China after 2017-2018 could be called financial "***Reintermediation***", that shadow banking financing activities are moving back onto balance sheet of traditional commercial banks, and shadow banking increases bond investment at the expense of non-standardized products. We re-summarize this disintermediation and reintermediation process in a "Pull-Push"

framework for growth dynamics of China's shadow banking and provide empirical evidence.

Third, this paper sheds light on several empirical breakdowns of pre-COVID relations among economic and financial indicators in China during 2020-2022. In the 3 years, several factors contribute to dynamics of China's shadow banking: continuously announced financial regulations on shadow banking related sectors, broad crack down on real estate sector, and last not the least, the COVID-19. These factors constituted one very complex and interactive economic system, and might have caused these breakdowns. First breakdown is positive correlation between RMB loans growth and shadow banking growth, rather than competition relation before 2019. Shadow banks and traditional banks plays hand in hand. Second, quasi operational target of monetary policy, i.e., interbank funding interest rate, stops transmission to RMB loans, which is intermediate target of monetary policy. Third, money supply as intermediate target no longer transmits to ultimate targets, i.e., industrial production and inflation. The most important intermediate target of monetary policy no longer severs as leading indicator for economic activities. Fourth, RMB loans stop transmission to CPI-indicated inflation as well. However, we still observe twisting of financial regulatory indicator brought by shadow banking, which was also the case before 2019.

This paper goes as follows. Section 2 discusses evolving balance sheet composition of China's shadow banking in 2020-2022. Section 3 explores behind-the-scene growth factors. Section 4 conducts empirical test of shadow banking's development in the 3 years. Section 5 discusses its relations with financial system. Section 6 concludes.

2. Balance Sheet Composition

Li (2019) defines China's shadow banking from functional perspective as *"those financial businesses that rely on banks' creditworthiness, conduct banking business, but without strict banking regulation. Specifically, they refer to financial businesses beyond banks' traditional on-balance sheet loans and bond investment, which at the same time have complete function of credit transformation, maturity transformation, and liquidity transformation"*. The wording 'functional' here means posting systemic impact on monetary policy and financial stability. The core characteristic is that traditional commercial banks' funds and creditworthiness are utilized in shadow banking. The three transformations were meant to be conducted in traditional commercial banking, but due to regulation restriction and arbitrage incentives, these businesses were moved off banks' balance sheet or out of loan/bond investment items, while still dependable mostly on banks' operations. Li (2019) also constructs balance sheet of China's shadow banking in accordance to above definition, and publishes yearly data from 2002 to 2018, with monthly data shown in figure and reproduced in Figure 1 of this paper. This section updates the data to 2022, and gives a brief explanation of major items. Itemized balance sheet of China shadow banking from 2020 to 2022 is displayed in Table I.

Table I China's Shadow Banking: Balance Sheet in 2020-2022

Unit: RMB 100 million yuan

Asset item/Year	2019	2020	2021	2022	2020-2022 expansion	2022 share
Undiscounted bankers'	33,299	35,100	30,100	26,600	-20.1%	5.6%
Entrusted loans	114,400	110,600	108,700	112,400	-1.7%	23.6%
Trust loans	74,500	63,400	43,600	37,500	-49.7%	7.9%
Bond investment	117,763	142,541	169,245	174,305	48.0%	36.6%

Asset item/Year	2019	2020	2021	2022	2020-2022 expansion	2022 share
Other assets	120,670	110,223	99,350	125,141	3.7%	26.3%
Total asset	**460,632**	**461,864**	**450,995**	**475,946**	3.3%	100.0%

Liability item/Year	2019	2020	2021	2022	2020-2022 expansion	2022 share
Undiscounted bankers'	33,299	35,100	30,100	26,600	-20.1%	5.6%
Inter-bank quasi loans	157,263	166,416	171,559	196,101	24.7%	41.2%
Layered investment	270,070	260,348	249,336	253,244	-6.2%	53.2%
Of which:						
bank funds	174,543	172,356	172,318	177,440	1.7%	37.3%
off B/S WMP[2]	95,527	87,992	77,018	75,804	-20.6%	15.9%
Total liability	**460,632**	**461,864**	**450,995**	**475,946**	3.3%	100.0%

Note1: Data compiled by methodology from Li (2019). Foundational data from PBOC, China Central Depository & Clearing, Shanghai Clearing House, China's Banking Wealth Management Product Registry and Depository Center, and Wind.

Note2: "off B/S WMP" is abbreviation for off balance sheet wealth management products.

2.1 Asset Composition

Bond investment, entrusted loans, and other assets are the 3 most important asset-side items, share of which standing at 36.6%, 23.6% and 26.3% respectively. Bond investment contains standard bond products issued in China's interbank bond market, which is subject to strict regulation by financial regulators and also actively traded by market participants. The total outstanding bond in China at 2022 was RMB 144.8 trillion yuan, of which 12% was held by shadow banking entities. Entrusted loans are loans initiated by an enterprise, and serviced by the entrusted entity, usually a commercial bank, with another enterprise as the debtor. Other assets include funds utilization not listed, such as trust investment other than trust loans, unused cash reserve, which are not listed individually mainly due to data availability issues.

From 3-year growth perspective, bond investment expanded in 2020-2022 at the expense of trust loans. As the total asset stabilized and even grew by 3.3%, bond

investment expanded a hobbling 48%. Its share in total asset stood at 36.6% by end-2022, 11 percentage points higher than end-2019. Trust loans shrank by 49.7%, with its share at only 7.9% by end-2022, 8 percentage points lower than end-2019. Percentage shrinkage of undiscounted bankers' acceptances is somewhat high at 20%, but rather limited in RMB amount.

2.2 Liability Composition

The analytic focus of China's shadow banking is its liability side items. By business type, it includes undiscounted bankers' acceptances, inter-bank quasi loans, and layered investment.

Inter-bank quasi loans are de facto bank loans to enterprises, but through back-channel guarantee agreement and/or common understanding from another bank, it has been moved out of loan category, and re-categorized as inter-bank funding (e.g., repo). This re-categorization not only excludes the business from loan quota calculation, but also much subject it to more loosely regulation compared with traditional bank loans. These loans are essentially bank loans, and wrongfully categorized. In 2020-2022, inter-bank quasi loans expanded by 24.7%, with its share in total liability standing at 41.2%, 7 percentage points higher than end-2019.

Layered investment are those financial products nested layer upon layer. For example, bank-issued wealth management product could invest in trust product, which in turn loan this money out to an enterprise through asset management program of security company (alias of investment bank in China). These long and multi-channel investment were designed to circumvent financial regulation in different sub-financial industries.

In 2020-2022, layered investment actually shrank by 6.2%, but still accounting for over half of all shadow banking funding source, though 5 percentage points lower than end-2019. To eliminate double accounting as much as possible, outstanding balance of layered investment doesn't equal to simple sum of all investment channels, but by tracing to end-investors, i.e., banks and retail investors, cutting all middle nodes. Within 25.3 RMB trillion layered investment by end-2022, 17.7 trillion was held by banks themselves, roughly 70%, only 30% was held by retail investors through the so-called off balance sheet wealth management products (off B/S WMP). According to China's banking regulation, those WMP with bank-guaranteed principal payment or interest return will be categorized as banks' on-balance sheet deposits, and subject to strict regulation. So, these WMP included in shadow banking calculation are only seemingly non-guaranteed products, which are subject to lesser regulation and individualistic self-discipline. In practice, bank-issued WMP rarely default on principal or interest payment, and market participants call it as "implicit guarantee" or "rigid payment". Retail investors purchase off B/S WMP simply because of the expectation of implicit guarantee by commercial banks. As there's no direct and timely source to calculate balance of off B/S WMP, we rely on historical wealth management industry report to reach estimation. Figure 2 compares our estimation for layer investment (off B/S WMP) with off B/S WMP issuance number since 2010. To be noticed, the latter is only products number, not outstanding balance, but this is the closest resemble available to public. We can see that two data series move very closely, as our estimation captures the overall trend, zenith, and trough of the latter. It seems that product fund balance per

issuance is quite stable since 2010, a little bit higher than RMB 1 billion yuan, but this amount has grown larger to around 2 billion since 2020, which in turn night be the result of recent regulatory change.

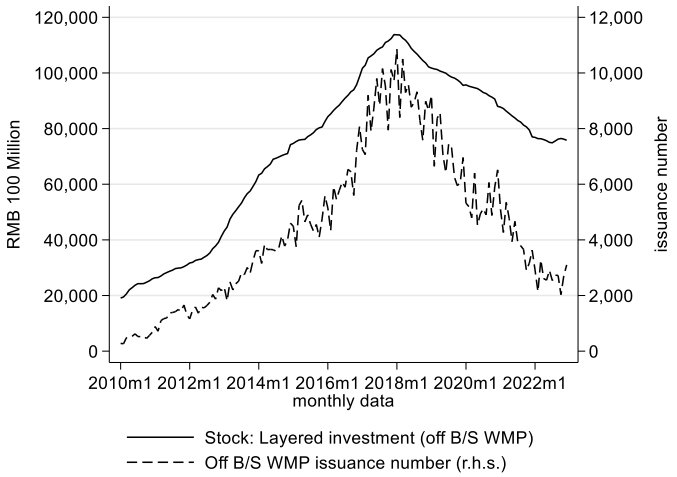


Figure 2 Layered Investment (off B/S WMP) and WMP Issuance

Source: author calculation and data provider Wind.

Liability is the key to understand China's shadow banking. All the major liability items are either de facto banks' liability themselves, i.e., undiscounted bankers' acceptances and inter-bank quasi loans, or off-balance-sheet quasi-deposit (off B/S WMP) implicitly guaranteed by banks' creditworthiness. On the one hand, this direct link differentiated China's shadow banking from western ones. On the other hand, it makes China's shadow banking more closely related with banks' balance sheet and risk contagion from non-bank financial intermediation (NBFI) to traditional commercial banks more easily.

Balance sheet data of China's shadow banking provides direct empirical evidence to Gennaioli, Shleifer and Vishny (2013), in that shadow banking intermediaries provides seemingly riskless debt to investors by pooling loans and securitization, however the difference here is that shadow banking entities in China create these riskless debt mostly

by utilization of implicit guarantee from traditional commercial banks, and also by pooling loans to certain extent.

To summarize more blatantly, the de facto deciding power in shadow banking business lies in the hands of commercial banks themselves. NBFI and related institutions are simply utilized by commercial banks as financing channels, rather than independent decision makers. Facing financing demand from enterprises, commercial banks have to make two decisions. The first is choice of financing channels to meet this demand, by traditional on-balance-sheet loans and bond investment, or by shadow banking? They have to take into account relative interest rate difference of the two, as well as regulatory cost incurred during business. The second one is choice of funding source, if they choose shadow banking in first decision. They could simply use on-balance-sheet bank funds, or by issuing WMP to retail investors.

One might ask what about those financial assets without bank funds or bank vouch? One quick answer is that there are not much such assets. By the end of 2022, total asset of China's financial institutions amounted to RMB 419.64 trillion yuan (equivalent USD 60 trillion)[1], of which 90% is from other depository corporations, i.e., banks, rural credit cooperatives and financial companies. The data reveals that there are only limited investment channels other than bank-provided ones. Besides, Chinese retail investor are quite risk-averse, and putting most confidence and trust in traditional commercial banks. These are the two reasons why retail investors mostly invest either in deposit at banks, or in wealth management products issued by banks and wealth management

[1] Data available at PBOC: http://www.pbc.gov.cn/diaochatongjisi/116219/116225/4820197/index.html.

subsidiaries of banks. For other financial assets not related to banks at all, they act as money transfer channel, and don't pose significant macro-impact on monetary policy or systemic financial stability risk. So, Li (2019) and this paper excludes these assets in shadow banking calculation.

3. Growth Dynamics

3.1 Institutional Background

Growth of China's shadow banking is summarized in a supply-demand model in Li (2021). Based on that, this paper re-models and illustrates rationale behind development of China's shadow banking in a "Pull-Push" framework as in Figure 3. Pull factors include infrastructure investment and real estate investment, which are underserved by traditional commercial banks in financing activities due to restrictive regulation. These two are the most important usage of shadow banking funds and constitute main demand of it. Zhu (2021) also found before 2017 that shadow banking funds were directed to real estate investment by local government and SOEs. Financial regulation acts as push-back factor. When regulatory authority perceives that shadow banking develops too fast and may exert significant influence on monetary policy and financial stability, they will patch up regulatory loophole which made fast expansion of shadow banking possible and increase inspection pressure on relevant financial businesses. Regulation would affect both demand and supply of shadow banking funds. Before 2019, China's financial regulatory authorities rolled out 3 waves of nuclear-bomb-level regulations on shadow banking, in 2011 against repo of bankers' acceptances, 2014 against interbank

business, and 2017-2018 against layered investment and arbitrage respectively (Li (2021)). At last, there is role of commercial banks. As the supply side of shadow banking funds, banks use shadow banking as channel to reduce cost of financial regulation and manage its liquidity. Regulatory cost results from monetary policy, capital adequacy based micro-prudential regulation, and interest rate regulation, most important of which is RMB loan balance closely watched by respective authority. Li (2021) states that shadow banking serves as funds conduit vis-à-vis traditional RMB loans. When monetary policy tightens, banks will provide financing support to infrastructure and real estate investment projects through shadow banking, instead of traditional loans. Interbank market serves as tool of commercial banks to manage liquidity for shadow banking. When there is funds surplus after meeting demands of infrastructure and real estate investment, extra funds will be invested in interbank market, and interest rate in the interbank market is indicator of invest return, which is the case before 2009. When there is deficit, interest rate in the interbank market will serve as the additional financing source for shadow banking, which is the case during 2009-2018. The “Pull-Push” framework in this paper contrasts with Sunderam (2015) in that financing demand driven in China and money-like claim driven in the U.S. provide interesting comparative perspective.

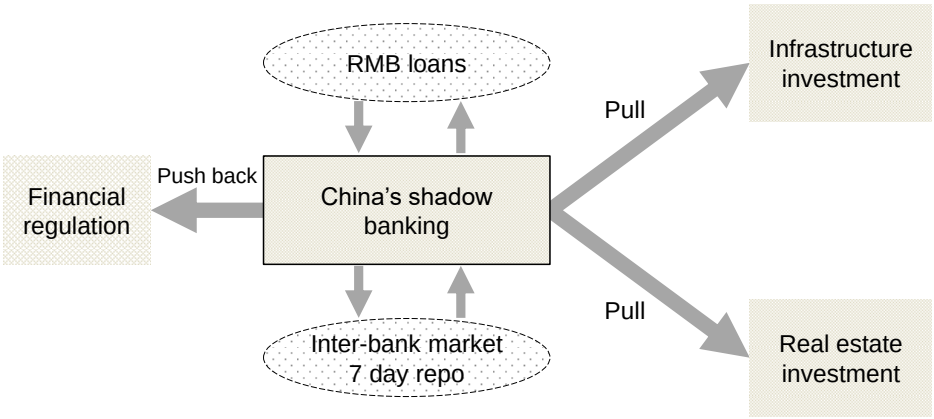


Figure 3 China's Shadow Banking: an "Pull-Push" Illustration

Source: modification based on Li (2021).

This analytic framework for development of China's shadow banking, i.e., "Pull-Push" model, also fits well in 2020-2022. There are several points to be made in the remaining of this section in relevance to the 3 years' development dynamics.

3.2 Consecutive Regulation

Two kinds of regulation should be noted here.

One is financial regulation targeting NBFI and shadow banking sector. "Guiding opinions on regulating asset management business" published in April 2018 is the latest major regulation on shadow banking. Market institutions calls it New Regulation on Asset Management (NRAM). This regulation basically forbids financial institutions utilizing shadow banking channels to circumvent regulatory restriction, such as multi-layer investment, investment in areas not supported by policy, etc. It was so powerful that financial regulatory authorities published in July 2018 a clarification, to mitigate market concerns regarding too much steep decline of shadow bank financing, as well as total social financing (TSF). Since 2020, financial regulatory authorities have been unstoppable at publishing new regulations. We went through public websites of these authorities, including the People's Bank of China (PBOC), China Banking and

Insurance Regulatory Commission (CBIRC), etc., and found at least 11 financial regulations relevant to shadow banking sector during 2020-2022, with additional one (F12) announced in November 2022 and effective in 2023, and another one (F13) both announced and effective in March 2023. Of all the 13 financial regulations listed in Figure 4, 10 mention NRAM, 3 target WMP and wealth management companies, 4 target insurance companies, 2 target trust companies, one targets financial asset investment corporation, one targets off balance sheet business of commercial banks, and 2 are broad market regulation targeting NBFI. These regulations are mainly follow-up to NRAM, and put ongoing suppressive pressure on shadow banking sector. Detailed regulation list (including date, title, department and mail elements) could be found in appendix table.

Figure 4 China's Shadow Banking and Regulations since 2020

Note: Regulations marked with F refer to financial regulation, and those with R refer to real estate regulation. Detailed regulation list could be found in appendix table.

Source: Websites of NDRC, MOF, MOHURD, PBOC, CBIRC, CSRC, SAFE, see appendix table for abbreviations.

The second series is real estate regulation specifically targeting real estate sector. Numerous regulations were published since 2020 from central to provincial, and down to local government level. These regulations affect operations of real estate enterprises,

as well as restricting their financing channels. The collective result is that monthly year-over-year real estate investment turned negative in third quarter of 2021, and has remained so most of the time since then. We only list 4 real estate regulations issued by central government departments targeting financing activities of real estate enterprises. 3 regulations were issued during August 2020 to March 2021. The first one establishes rules for real estate enterprises to monitor funds and manage financing activities; the second one states banks should not concentrate loans in real estate sector; the third one forbids loans of operational purpose to flow into real estate sector. Interestingly, in November 2022, China's regulators announced sixteen measures (R4) to support stable and healthy development of real estate market. Pressure on real estate sector soothed to certain extent. These regulation list could also be found in appendix.

3.3 Reintermediation onto Banks' Balance Sheet

This is the common trend across the globe. If we define "***Intermediation***" as financing through traditional banking business, then fast development of shadow banking could be called "***Disintermediation***", which refers that NBFI provide financial services to real economy instead of traditional commercial banks. This development would reveal itself in that some business portfolio moves from traditional loans and bond investment on banks' balance sheet to that of balance sheet of shadow banking. Since global financial crisis in 2007-2008 casts shadow banking on focus, and global financial regulators established new regulatory authority and new capital rules to correct misbehavior of shadow banking, the tide should reverse. However, the financing needs of previously underserve sector have to be met anyway, and this is a simple binary

choice between commercial banks and shadow banking. Then we expect to see relatively faster development of traditional banking business in comparison with shadow banking. We could call this reverse process ***Reintermediation***. SVB and Credit Suisse were both conducting shadow banking business in "before 2008" sense on a commercial bank's balance sheet. They ran now into trouble. This is the trouble of reintermediation, and deserve regulatory attention.

Reintermediation is also the case in China, traditional banking business expands at the expense of shadow banking. In 2009-2016, before the latest round regulatory crackdown on shadow banking in 2017, total new RMB loans amounted to RMB 76 trillion yuan, while total new shadow banking financing amounted to wobbling 43 trillion, and the latter eclipsed over half of the former. In 2020-2022, the tide reversed vehemently, with the former amounted to 61 trillion, the latter only 1.5 trillion. New shadow banking financing only compared with 2.5% of total new RMB loans. The trend is clearer in Figure 5. We use China's yearly nominal GDP as the common denominator, and calculated ratio of respective outstanding balance of each financing channel to the denominator. Shadow banking as a percentage to nominal GDP reached its historical high in 2016, at 66%, 30 percentage points higher than 2011, while RMB Loans and banks' bond investment only increased by 29 and 13 percentage points. In 2022, shadow banking's ratio shrank 7 percentage points from 2019, while that of loans and bond investment expanded by 22 and 7 points respectively. In comparison with 2016, shadow banking's shrinkage is a much higher 27 percentage points.

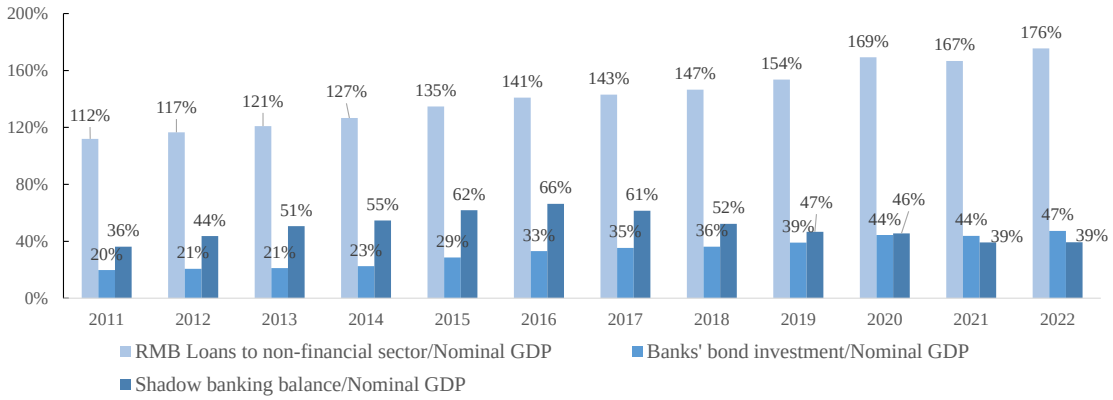


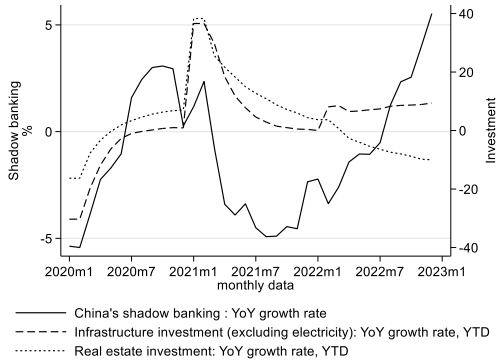
Figure 5 Traditional Banking vs. Shadow Banking as Percentage of GDP

Source: PBOC, Wind and author calculation.

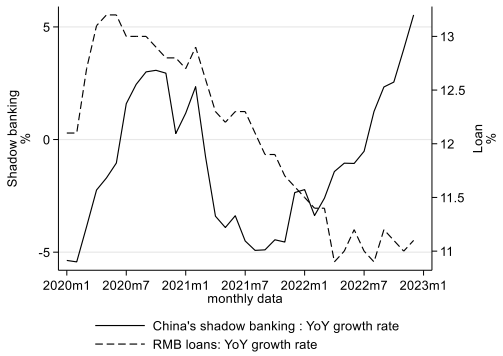
There is second-tier meaning of reintermediation of China's shadow banking, i.e., bond investment eclipsing trust loan and other financing channels. Shadow banking competes for financing support to infrastructure and real estate investment mainly through trust loans, entrust loans, and other trust-like financing channels. These are more customized and direct money transfer to the borrowers. On the other hand, bonds are publicly traded and standardized financial products, and could not provide comparable customized financing support to enterprises. However, NRAM encourages standardized bond investment, and discourages multi-layer non-standardized opaque financial products. We deduct bond investment from shadow banking expansion, and find something interesting. During 2017-2021, non-bond asset allocation of shadow banking decreased RMB 15 trillion yuan, while bond investment increased by 11 trillion. During 2020-2022, the trend continued, and the two numbers are decreasing 4 trillion and increasing 6 trillion respectively.

3.4 Stifled Demand, Resulting Seemingly Unused Funds

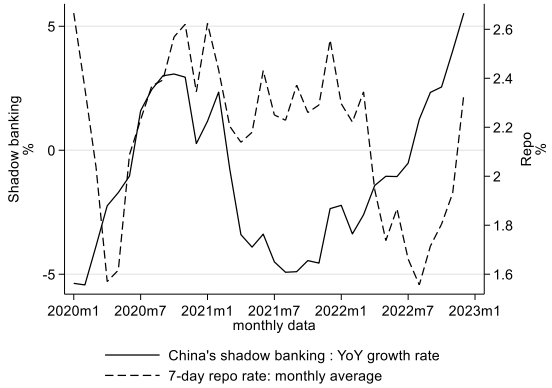
Many pre-COVID-19 observations regarding shadow banking broke down after 2020.



a. Vis-à-vis investment



b. Vis-à-vis RMB loans



c. Vis-à-vis interbank repo interest rate

Figure 6 China's Shadow Banking and Economic & Financial indicators

Note: YTD is abbreviation for year to date, which refers to accumulated amount in the year.
Source: National Bureau of Statistics (NBS), PBOC, Wind and author calculation.

First, demand for shadow banking funding from infrastructure investment and real estate investment had been lukewarm, half due to shock from COVID-19, half due to stringent regulation in 2020-2022. 3-year arithmetic average growth rates for the two are only 5% and 0.5% respectively, while being 18% and 6% during 2013-2016. Figure 6a exhibits that infrastructure investment still moves in tandem with shadow banking, but real estate investment reversed previous trend in that after 2021, real estate investment slowed down with somehow stabilized shadow banking growth. Second, RMB loans moved in tandem with shadow banking during height of COVID. In previous years, shadow banking competes with loans for investment projects, but from 2020 to 2021H1, year-over-year growth rate chart of the two moves surprising close

with each other (Figure 6b). Third, interbank market interest rate (represented by 7-day repo rate in Figure 6c) also moves in tandem with shadow banking most of the time. With muted demand, interbank market no longer serves as additional financing source, but rather investment avenue for extra unused funds.

4. Empirical Test

4.1 Model

To further illustrate growth dynamics of China's shadow banking during 2020-2022, we build the following empirical model:

$$sshadowyoy_t = \alpha + \beta_1 infnoeyoyytd_t + \beta_2 reinvyoyytd_t + \beta_3 loanyoy_t + \beta_4 repo7drate_t + \varepsilon_t$$

Dependent variable, i.e., sshadowyoy, is year-over-year (hereafter: YoY) growth rate of outstanding balance of China's shadow banking. Independent variables include YoY growth rate of infrastructure investment (excluding electricity), YoY growth rate of real estate investment, YoY growth rate of RMB loans, and 7-day repo rate. Table II gives summary statistics of variables in the model.

Table II Summary Statistics of Variables in Empirical Model

Unit: %

Variable	Variable name	Obs. no.	Mean	Std	Min	Max
sshadowyoy	shadow banking: YoY growth rate	36	-1.01	3.07	-5.43	5.53
infnoeyoyytd	infrastructure investment (excluding electricity): YoY growth rate, YTD	36	3.90	13.85	-30.30	36.60
reinvyoyytd	real estate investment: YoY growth rate, YTD	36	4.01	12.89	-16.30	38.30
loanyoy	RMB loans: YoY growth rate	36	12.06	0.78	10.90	13.20
repo7drate	7-day repo rate: monthly average	36	2.17	0.31	1.56	2.67

Note: Obs. no. is abbreviation for observation number. Std is abbreviation for standard error.

4.2 Variable Selection and Relevant Pre-tests

First, demand side. Two investment variables are included. Shadow banking meets financing demand of the two when they are underserved by traditional commercial banks. For both variables, we use growth of accumulated year-to-date quantity (hereafter: YTD), to avoid too much turbulence in growth of monthly quantity.

Second, RMB loans is included to illustrate decision making of commercial banks in choosing between traditional banking business and shadow banking to meet enterprises' demand. If monetary policy is being tightened, or regulatory cost for on-balance-sheet financing channels becomes high, they might well choose shadow banking. However, in different historical period, commercial banks might balance different rationale to make their supply decision.

Third, interbank interest rate stands for interbank market liquidity. Commercial banks mainly use interbank market to adjust their liquidity position. During 2020-2022 (see Figure 6c) and before 2008, which were marked by poor demand for shadow banking funds, commercial banks have excessive funds, either from shadow banking channels or traditional banking business, and they invest the extra liquidity in interbank bond market or money market. 7-day repo rate might well stand for investment return for the extra liquidity. But in first 10 years after 2008 GFC, when demand for shadow banking was plentiful, commercial banks are facing liquidity deficit for shadow banking financing channels, and have to make up by absorbing additional liquidity from interbank market, which renders 7-day repo rate an indicator of additional financing cost. Different rationale means different sign mark of variable repo7drate.

4.2.1 Data Period

January 2020 to December 2022, 36 months in all.

4.2.2 Stationarity Test

We test stationarity of variables in Table II by ADF (Augmented Dicky-Fuller), Phillips-Perron, DF-GLS, and KPSS. For ADF and DF-GLS tests, 4 variables but 7-day repo rate are non-stationary. For Phillips-Perron, all 5 variables are non-stationary. The results suggest it's necessary to conduct further co-integration test.

4.2.3 Co-integration Test

Result of co-integration test rely on choice of lag periods. We first use Likelihood test and Information Criterion (AIC, HQIC, SIC) to decide lag periods, and use trace test and maximum eigenvalue test to further look into co-integration rank. Significance level is 5%. Test results couldn't reject that these variables in Table II have at least 3 co-integration relation during 2020-2022.

4.3 Empirical Methodology

For the time series model in subsection 4.1, we need to consider two issues in empirical test. The first one is endogeneity caused by simultaneous equations and omitted variables. This may render inconsistency of coefficient estimation. We address this issue by utilizing various instrumental variable method, specifically, Two-stage Least Squares (2SLS), Limited Information Maximum Likelihood (LIML), and Generalized Method of Moments (GMM). The second one is possible autocorrelation and heteroscedasticity of the error term ε_t. In this case OLS isn't the most efficient estimation method, and usual t-test and F-test become unreliable. To address issue, in 2SLS, LIML and GMM estimation, we use Heteroskedasticity and autocorrelation-

consistent (HAC) standard error by specifying *nwest* option (Newey-West) in program. To better compare results from different estimation methods, we also conduct OLS with Heteroskedasticity-consistent (HC, White) standard error and HAC (Newey-West) standard error.

4.4 Instrumental Variables Selection

Table III Summary Statistics of Instrumental Variables

Unit: % for growth rates

Variable	Variable name	Obs. no.	Mean	Std	Min	Max
estatesalesytdyoy	real estate sales: YoY growth rate, YTD	36	5.28	43.27	-35.90	133.40
manuinvyoyytd	manufacture investment: YoY growth rate, YTD	36	6.57	17.27	-31.50	37.30
indyoyytd	industrial production (value-added): YoY growth rate, YTD	36	6.47	9.78	-13.50	35.10
eleyoyytd	electricity production: YoY growth rate, YTD	36	3.95	7.22	-8.20	19.50
bondindex	China bond index	36	128.22	1.73	125.32	131.19
rmbindex	RMB: nominal effective interest rate	36	104.98	4.37	98.27	112.31

Table III lists instrumental variables for infrastructure investment growth, real estate investment growth and 7-day repo rate. Growth rate of RMB loans is left alone because it is more affected by monetary policy stance of the central bank, and less likely to be correlated with the error term. Real estate sales is included due to its close correlation with real estate investment, while not that correlated with shadow banking financing. Manufacture investment, industrial production, and electricity production, i.e., 3 variables representing the broad economy, are expected to be correlated with infrastructure and real estate investment, while only weakly correlated with shadow banking financing. Bond index and RMB nominal effective exchange rate are included to instrument 7-day repo rate, and these two are also expected to be weakly correlated

with shadow banking financing. Besides, we also include one-period lag of 3 endogenous variables as additional instrumental variables.

We conduct three tests for instrumental variables. First is endogeneity test of 3 supposedly endogenous variables (two investments and 7-day repo rate) as listed in Table IV. Based on HAC score, we couldn't reject the 3 variables are exogenous, while F statistics reject null hypothesis that they are exogenous at significance level of 1%. The contradictory result supports we both list results of IV and original OLS in the paper. The second test is overidentification test. Hansen's J statistic[2] shows we couldn't reject the null hypothesis that all instrument variables are exogeneous. The third one is weak instrumental variables test. Kleibergen-Paap rk Wald F statistic[3] is higher than 5% threshold value. Our selected IV passes the test.

Table IV Test Related to Instrumental Variables

Indicator	Value
HAC score chi2(3)	3.69
p-value	0.297
HAC regression F(3,28)	5.59
p-value	0.004
Hansan's J statistic	2.88
p-value	0.824
Kleibergen-Paap rk Wald F statistic	65.27
5% maximal IV relative bias	16.10
10% maximal IV relative bias	9.37
20% maximal IV relative bias	5.78

[2] We report Hansen's J statistic here instead of commonly known Sargan statistic, because we apply HAC restriction to the error term. ivreg2 program within Stata in this case will report Hansen's J.

[3] We report Kleibergen-Paap rk Wald F statistic here instead of commonly known Cragg-Donald Wald F statistics, because we apply HAC restriction to the error term. ivreg2 program within Stata in this case will report Kleibergen-Paap rk Wald F.

4.5 Test Results and Discussion

We list empirical test results in Table V. Most of results in Table V further corroborate analysis in section 3. Li (2019) reports empirical results before 2019. Interested readers could reference for comparison.

Table V Estimation Result for Growth of China's Shadow Banking

	(1) OLS+HC	(2) OLS+HAC	(3) 2SLS	(4) LIML	(5) GMM
infnoeyoyytd	0.47***	0.47***	0.52***	0.54***	0.53***
	(13.69)	(11.38)	(16.15)	(15.71)	(27.73)
reinvyoyytd	-0.53***	-0.53***	-0.60***	-0.62***	-0.60***
	(-13.20)	(-10.25)	(-13.22)	(-12.98)	(-24.45)
repo7drate	4.22***	4.22***	5.83***	6.22***	1.88***
	(8.25)	(7.68)	(4.50)	(4.61)	(2.83)
loanyoy	4.34***	4.34***	4.66***	4.76***	6.19***
	(5.13)	(4.01)	(14.10)	(14.16)	(31.09)
constant	-61.05***	-61.05***	-69.50***	-71.50***	-78.87***
	(-9.21)	(-7.72)	(-10.87)	(-11.08)	(-27.92)
observations	36	36	36	36	36
Adjusted R-squared	0.80		0.78	0.77	0.57

Note1: we conduct empirical test with Stata software. For each cell in table, upper number without parentheses is coefficient estimation. For variables in column (1), robust t-statistics is in parentheses; in (2), t-statistics is in parentheses; in column (3)-(5), z-statistics is in parentheses.
Note2: *** p<0.01, ** p<0.05, * p<0.1.

During 2020-2022, one percentage point growth of infrastructure investment correlates with around 0.5 percentage point growth of shadow banking. Infrastructure investment still plays the role of demand for shadow banking funding. One percentage point growth of real estate investment surprisingly correlates with around 0.5-0.6 percentage point shrinkage of shadow banking. With consecutive regulation, real estate no longer serves as the main demand side for shadow banking funding. When real estate investment growth slows, GDP growth will suffer too. Newly rolled-out policy mix will support GDP growth in this case, and increase demand for shadow banking funds

indirectly. This might give an explanation to the opposite relation between real estate investment and shadow banking. One percentage point 7-day repo rate increase correlates with around 4 percentage points growth of shadow banking. This result goes similarly with that before 2008. Without excessive demand from infrastructure investment and real estate investment after 2009, unused shadow banking funds (or liquidity surplus) have nowhere to go, but investing in interbank market, either as bond investment, or as interbank lending to other financial institutions. 7-day repo rate in this case signifies broad interest rate level across the market, and serves as an indicator of investment return. Higher rate solicits more shadow banking funds. Besides, financial regulation these years targeted non-standardized asset in NRAM, and encouraged standard interbank money market and bond market investment. WMP issuing institutions increase interbank investment due to these regulations, and this serves as another explanation to the positive correlation between 7-day repo rate and shadow banking growth.

The most striking result is the positive correlation between RMB loans growth and shadow banking growth. This stands for one of the major empirical breakdowns of pre-COVID relations among financial indicators. Section 5 will discuss several further breakdown relations. One possible explanation for the positive correlation is that RMB loans and shadow banking no longer compete as funding source, rather they act supplementary to each other. When infrastructure investment project need money, some of it will come from RMB loans, and some from standardized shadow banking form financing (due to NRAM). But considering that shadow banking growth has been quite

low since 2020, this is not a very strong convincing argument, and could very well be a collateral development of low growth by shadow banking. A high negative value for constant term could also be explained by slow growth of shadow banking. Non-quite-rigorously speaking, from adjust R-squared, our model could explain around 80% of shadow banking growth movement during 2020-2022.

5. Relation with Macro-Finance

From the perspective of macro-financial management, we focus effort on monetary policy transmission and financial regulation.

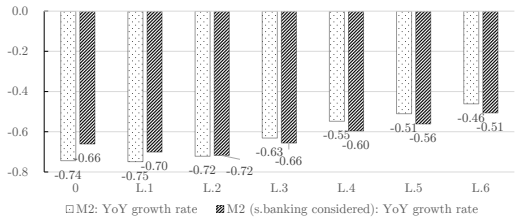
5.1 With Monetary Policy Transmission

Monetary policy transmission follows the paths: operational target to intermediate targets, and then to ultimate targets (or monetary policy objectives). We select 7-day repo rate among depository institutions[4] as quasi operational target of monetary policy. RMB loans and money supply are the most common intermediate targets. Industrial production and CPI are treated as ultimate target variables. During 2020-2022, we observe several new phenomena.

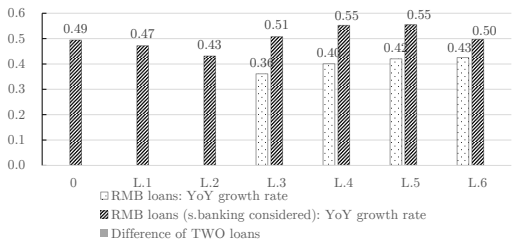
First, operational target of monetary policy stops transmission to RMB loans. Correlation between 7-day repo rate among depository institutions and RMB loans growth are insignificant at 5% significance level from same period up to 6-months lead. This is direct contrary to result before 2019. We could still observe negative correlation

[4] 7-day repo rate in previous sections refer to that among all interbank market participants, not only depository institutions.

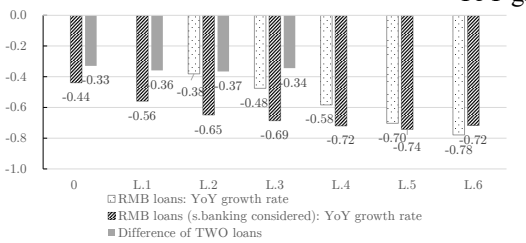
between operational target and money supply growth, but the difference between money supply and money supply (shadow banking considered[5]) is quite small (Figure 7a).



a. Correlation between operational target and M2 growth



b. Correlation between two RMB loans growth and industrial production (value-added): YoY growth rate



c. Correlation between two RMB loans growth and CPI: YoY growth rate

Figure 7 Correlation of Financial Indicators and Economic Indicators during 2020-2022

Note: Correlation is calculated by Stata, with significance level at 5% for listed values.

Second, money supply as intermediate target no longer transmits to ultimate targets. Correlation between M2 growth (either original or with shadow banking considered) and industrial production are insignificant at 5% significance level from same period up to 6-months lead. Correlation between M2 growth and CPI growth are again insignificant at 5% significance level from same period up to 4-months lead.

[5] Calculation method for RMB loans (s.banking considered) and M2 (s.banking considered) follows Li, Wenzhe, 2020, Economics of china's shadow banking: Impact on monetary policy, *China Economic Studies (in Chinese)* 322(05), 55-70.. We arrive at these data by considering shadow banking's impact on respective variables. For example, all outstanding balance of shadow banking is added onto RMB loans to get RMB loans (s.banking considered), and those shadow banking balance not included in current definition of M2 by PBOC is added to current M2 to get M2 (s.banking considered).

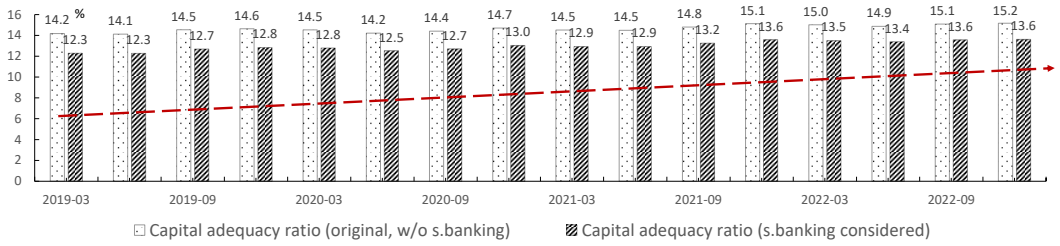
Third, RMB loans as intermediate target still transmits to industrial production, but its relation with CPI-indicated inflation broke down. We observe positive correlation between RMB loans and industrial production, but the difference between RMB loans and RMB loans (shadow banking considered) is no longer significant, in contrast with before 2019 (Figure 7b). Negative correlation between RMB loans (either original or with shadow banking considered) and CPI growth, which is quite shocking result to us (Figure 7c).

These new phenomena are quite thought provoking and shocking to economic audience. One possible explanation is structural economic change resulting from COVID-19 shock. COVID-19 not only influences mass economic entities through medical channels, but also exert impact on their social and economic behavior by ways of draconian social distancing restriction, life-style change of working from home (WFH) arrangement, prevalent off-site home-education instead of on-site school education. Another possible explanation is higher degree of government intervention in economic life. In pandemic crisis of such scale, Chinese government stepped in supporting the economy and ensuring steady basic and medical supplies. Brunnermeier, Sockin and Xiong (2022) builds a theoretical model in describing rationale of China's government to intervene financial market: more intervention leads to financial stability, but at the expense of market pricing efficiency. The same line applies here too. More policy support stabilized economic output during 2020-2022, in the form of much more mobilized fiscal expenditure, heightened RMB loans to strategic sectors and medical supply, and etc. This support ended less in the hand of consumers, and as a result

reflected less in inflation indicators. In the process, previous commonly held and market-oriented economic and financial relations broke down. Facing COVID-19, government agencies again chose economic and social stability against market efficiency, just like other economies would do.

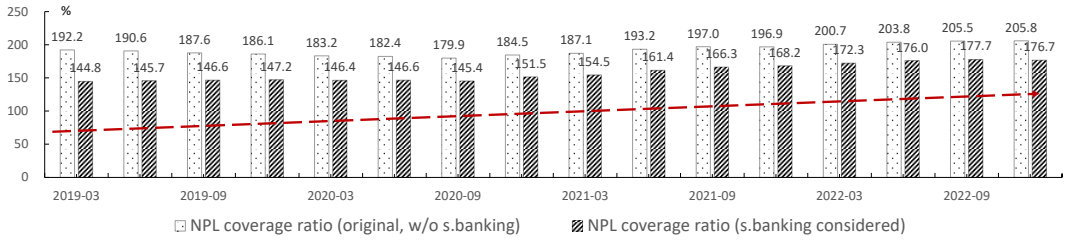
5.2 With Financial Regulatory Indicators

From previous analysis both in Li (2020) and in section 2, China's shadow banking relied heavily on creditworthiness of traditional commercial banks. Rather we should say, shadow banking is the second balance sheet or second financing channel of traditional commercial banks. This makes reported regulatory indicators of banking institutions unreliable after considering existence of large scale of shadow banking. We list both original regulatory indicators of China's banking industry, and those indicators with shadow banking considered in Figure 8[6]. Selected indicators include capital adequacy ratio, NPL coverage ratio, and loan to deposit ratio.

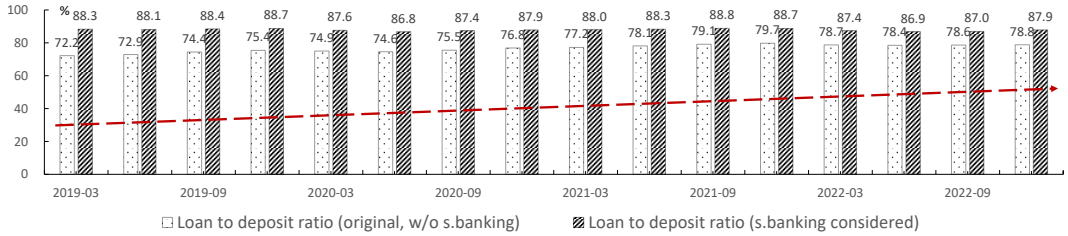


a. Capital adequacy ratio

[6] Calculation method for financial regulatory indicators with shadow banking considered follows Li, Wenzhe, 2020, Economics of china's shadow banking: Impact on financial stability, *Financial Regulation Research (in Chinese)* 101(05), 31-47.. We arrive at these data by considering shadow banking's impact on respective variables. For example, those shadow banking balance not included in risk-weighted asset calculation is included to risk-weighted asset to arrive at recovered capital adequacy ratio with the same original capital as numerator. Shadow-banking generated NPL is added to original NPL data of banks to calculate recovered NPL coverage ratio. All shadow banking asset is added to loans and part of liability items are added to deposit to calculate recovered loan to deposit ratio.



b. NPL coverage ratio



c. Loan to deposit ratio

Figure 8 China's Banking Regulatory Ratios during 2020-2022

We could make three points here based on charts and data in Figure 8. First, COVID-19 didn't make a jump on these financial regulatory indicators. To verify this, we specifically include data dated back to first quarter of 2019. These indicators barely moved around beginning of 2020, and later data broadly followed pre-COVID time series trend. Second, shadow banking still twists de facto financial regulatory indicators during 2020-2022. We could see that capital adequacy ratio with shadow banking considered was lower than the original one, averaging 1.6 percentage points lower. NPL coverage ratio with shadow banking considered was 31 percentage points lower than the original one on average. Loan to deposit ratio with shadow banking considered was 10 percentage points higher than the original one on average. Third, due to near to null growth of China's shadow banking during 2020-2022, its twisting to regulatory indicators seemed to be fading, while overall indicators were improving broadly. For example, by the end of 2019, capital adequacy ratio of the whole banking industry was 14.6%, and 12.8% after recovering shadow banking impact, i.e., 1.8 percentage point difference. By the end of 2022, the original ratio and recovered ration both improved

to 15.2% and 13.6% respectively, and the difference is 0.6 percentage point. At the same time, NPL coverage ratio has improved from 186.1% to 205.8%, by 19.7 percentage points, while recovered ratio has improved from 146.6% to 176.7%, by a higher 30.1 percentage points.

6. Concluding Remarks

This paper pushes understanding about shadow banking in several fronts.

First, we give complete balance sheet data of China's shadow banking during 2020-2022. China's shadow banking stood at RMB 47.6 trillion yuan (equivalent USD 6.8 trillion) by end-2022, expanding 3.3% in last 3 years. Bond investment expanded 48%, and took the largest share of total asset, i.e., 36.6% by end-2022, while trust loans shrunk by 49.7%. On the liability side, layered investment took the largest share, i.e., 53%, while inter-bank quasi loans came the second, and took 41.2%. Liability is the key to understand China's shadow banking. All the major liability items are either de facto banks' liability themselves, i.e., undiscounted bankers' acceptances and inter-bank quasi loans, or off-balance-sheet quasi-deposit (off B/S WMP) implicitly guaranteed by banks' creditworthiness. This makes China's shadow banking more closely related with banks' balance sheet and risk contagion from NBFI to traditional commercial banks more easily.

Second, we re-summarize growth dynamics of China's shadow banking in a "Pull-Push" framework, and propose concept of reintermediation in respective to disintermediation. During 2020-2022, infrastructure investment still counted as main

demand for shadow banking funds, however, real estate investment no longer served as demand indicator. Consecutive regulation on NBFI and real estate sector kept dragging on growth of shadow banking, including New Regulation on Asset Management (NRAM) and 13 subsequent financial regulations, as well as 4 real estate regulations. In the process, we note reintermediation of banking business, i.e., reverse process of disintermediation, which refers that NBFI provide financial services to real economy instead of traditional commercial banks, and vice versa. Muted demand from real estate sector, and heightened regulatory pressure on NBFI both made shadow banking funds excessive, or in liquidity surplus, and being invested into interbank market. In the process, interbank rate serves as indicator for investment return, no longer as funding cost as before 2017. We conduct empirical tests using various instrumental variable methods. Results echoes our analysis in the "Pull-Push" framework.

Third, we provide empirical evidence on relation of China's shadow banking with macro-finance, specifically monetary policy transmission and financial regulation, and note several empirical breakdowns of pre-COVID relations among economic and financial indicators in China during 2020-2022. Most important breakdown is the non-functionality or monetary policy transmission channel. Two possible explanations are structural economic change resulting from COVID-19 shock, and higher degree of government intervention in economic life. In pandemic crisis of such scale, Chinese government stepped in supporting the economy and ensuring steady basic and medical supplies, resulting that previous market-oriented economic and financial relations broke down. From financial regulation perspective, COVID-19 didn't make a jump on these

financial regulatory indicators. However, it still twists de facto financial regulatory indicators during 2020-2022, rendering them less reliable. Due to near to null growth of China's shadow banking during 2020-2022, its twisting to regulatory indicators seemed to be fading.

What lies ahead for China's shadow banking sector? One possibility is that with gradual opening up after lift of COVID-19 restrictions and economic life back to normal, stories and analytic framework of shadow banking will resume its pre-COVID19 state. Relations between shadow banking and economic/financial indicators, as well as monetary policy transmission efficiency will recover. However, there is also another nonnegligible possibility, the "good old days" won't come back, as the economy and financial system might suffer from "long COVID". In this case, policy makers will have to try new policy mix to resume or increase monetary policy transmission efficiency, and push forward market-oriented financial reform and necessary adjustment.

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Appendix Table: Partial Collection of China's Regulation on Shadow Banking related Sectors and Real Estate Sector since 20201

Mark	Date[2]	Regulation title	Department[3]	Main elements
Financial regulation on shadow banking related sectors				
F1	April 16, 2020	Notice to financial asset investment corporations on asset management businesses	CBIRC (CBIRC[2020]12)	Development of market-oriented debt-equity swap asset management business of financial asset investment corporations in accordance to NRAM.
F2	May 1, 2020	Temporary regulation on Insurance asset management product	CBIRC (CBIRC Ordinance[2020]5)	Insurance asset management institutions to conduct asset management business in accordance to NRAM and other regulations.
F3	June 23, 2020	Notice to banking and insurance industry on retrospection of market arbitrage correction	CBIRC (CBIRC[2020]27)	Marco-policy implementation; equity and corporate governance; credit and loan management; shadow banking and cross-sector financial business; innovative business; accountability; insurance fund utilization; financial and business data; financing trust business; NBFI subsidiary management, etc. Implementation of NRAM.
F4	July 31, 2020	Adjusting the transitional period of the "Guiding opinions on regulating asset management business"	PBOC, NDRC, MOF, CBIRC, SAFE	Extend the transitional period of the NRAM for 1 year to the end of 2021.
F5	September 7, 2020	Notice on 3 regulations of portfolio insurance asset management product implementation	CBIRC (CBIRC GA[2020]85)	Insurance asset management institutions to conduct portfolio insurance asset management product business in accordance to NRAM and other regulations and strengthen risk control.
F6	May 27, 2021	Regulatory notice on cash management WMP	CBIRC PBOC (CBIRC[2021]20)	Cash management WMP invests only in money market, and are purchasable and redeemable daily. Covers investment ratio respective to asset type, information disclosure, risk control, duration, etc in accordance to NRAM and other regulations.
F7	July 21, 2021	Notice on regulating trust companies in non-financial subsidiary businesses	CBIRC (CBIRC GA[2021]85)	Prevent regulatory arbitrage by trust companies through non-financial subsidiaries.
F8	April 24, 2022	Notice on financial product investment by insurance funds	CBIRC (CBIRC Regulation[2022]7)	Insurance companies should invest in financial products (including WMP, trust, ABS, etc.) in accordance with its liability characteristics, risk preference and other constrains.

Mark	Date[2]	Regulation title	Department[3]	Main elements
F9	May 10, 2022	Regulation on liquidity risk management of wealth management products issued by wealth management companies	CBIRC (CBIRC Ordinance[2021]14)	Effective liquidity risk management of WMP in accordance to NRAM and other regulations.
F11	August 22, 2022	Regulation on internal control of wealth management companies	CBIRC (CBIRC Ordinance[2022]4)	For wealth management companies to prevent and dispose risk, ensure compliance, stable operation in accordance to NRAM and other regulations.
F10	September 1, 2022	Regulation on insurance asset management corporations	CBIRC (CBIRC Ordinance[2022]2)	Strengthen regulatory oversight on insurance asset management corporations, protect investor right, and prevent risk in accordance to NRAM and other regulations.
F12	January 1, 2023	Regulation on off balance sheet risk management of commercial banks	CBIRC (CBIRC Regulation[2022]20)	Strengthen off balance sheet risk management of commercial banks, including guarantee business, sale and purchase agreement, etc.
F13	March 20, 2023	Regulation to trust companies on trust business categorization	CBIRC (CBIRC Regulation[2023]1)	Clarify trust business boundary and service content, prevent risk and avoid overlap among different trust business types. Asset management business should be compliant to NRAM as other domestic institutions.
Regulation in real estate sector				
R1	August 20, 2020	Regulatory conversation with real estate enterprises	MOHURD, PBOC	Rule for major real estate enterprises on funds monitoring and financing management. Conducive for real estate to form stable expectations on financial policy, as well as to arrange operating and financing activities reasonably.
R2	December 28, 2020	Regulation to banking financial institutions on concentration management of real estate loans	PBOC, CBIRC (PBOC[2020]322)	Strengthen ability of banking financial institutions to fend against possible real estate market turbulence, and prevent potential systemic financial risk from high concentration of real estate loans by financial system. Ratio of real estate loans to total loan portfolio, and of personal mortgage to total loan portfolio, should not exceed upper limit calculated by PBOC and CBIRC.
R3	March 26, 2021	Notice on preempt loans of operational purpose to flow into real estate sector against regulations	CBIRC, MOHURD, PBOC (CBIRC GA[2021]39)	Loans earmarked for operational purpose should only be invested into daily operation of enterprises, with proper debtor qualification examination, maturity and collateral management.

Mark	Date[2]	Regulation title	Department[3]	Main elements
R4	November 11, 2022	Notice to financial sector on better supporting stable and healthy development of real estate market	PBOC, CBIRC (PBOC[2022]254)	Sixteen measures to ensure stable and orderly real estate financing, better financial support on completing current real estate projects, active participation in risk disposal of troubled real estate enterprises, temporarily extend transitional arrangement of concentration management of real estate loans, etc.

Note 1: These are only partial collection of all regulations during this period. All regulations in the table are available to public at respective department websites.

Note 2: For most cases, "Date" column refers to the day on which the respective regulation goes into effective. If not specified explicitly, then it refers to the signature date of the regulation. If both dates are unavailable, then it refers to the date on which the regulation is released on department websites.

Note 3: abbreviations of government departments in the table are as follows, NDRC: National Development and Reform Commission, MOF: Ministry of Finance, MOHURD: Ministry of Housing and Urban-Rural Development, PBOC: The People's Bank of China, CBIRC: China Banking and Insurance Regulatory Commission, CSRC: China Securities Regulatory Commission, SAFE: State Administration of Foreign Exchange. GA stands for general administration office within respective department.