# The Macroeconomics of Shadow Banking: Financial Liberalisation and Structural Transformation

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**Abstract.** Shadow banking has been the most significant financial development in China over the past decade. However, the macroeconomic implications of the emergence of shadow banking are understudied. Existing literature stresses the risk of financial instability caused by the shadow banking system. In contrast, this paper presents evidence pointing to a positive welfare effect, as shadow banking partially liberalises the repressed financial environment. Both macro and micro evidence indicate that shadow banking improves the financial condition of private firms that are underfunded by the state-owned banking system. This implies a transition towards a more favourable economic structure that is less reliant on state-led investment.

**JEL:** E44, E51, G21, G23, G28, P34, P44
**Keywords:** Shadow banking in China, financial intermediation, financial liberalisation, wealth management products

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# 1. Introduction

Shadow banking has emerged as a major component of China's financial system in the past decade. Generally understood as the borrowing and lending activities outside of the traditional banking system, the presence of shadow banking has contributed to financial liberalisation and increased credit provision, particularly for the under-funded private sector. However, the nature of regulatory arbitrage associated with shadow banking also poses challenges to financial stability and has raised serious concerns among policymakers.

In the wake of the turmoil of the 2008 Global Financial Crisis, the macroeconomic impact of shadow banking has been a major focus of study in the literature (Adrian and Ashcraft, 2016; Gorton et al., 2010; Pozsar et al., 2010). Research generally highlights the trade-off between stability and growth. On the one hand, shadow banking improves capital efficiency, increases liquidity provision and boosts growth. On the other hand, it also contributes to a more fragile and unstable system due to lower collateral requirements, neglect of tail risks, and regulatory evasion.

Shadow banking in China bears resemblance to that of developed countries as both extend credit to the real sector, especially to borrowers with low creditworthiness, and create saving vehicles (seemingly safe asset) as an alternative to bank deposits. However, given the drastically different institutional settings, shadow banking in China has more to do with banks' efforts to evade regulation in an environment of financial repression, rather than with securitisation and financial engineering as seen in the developed world.

The current research on Chinese shadow banking has been primarily focused on explaining its emergence (Allen et al., 2023; Acharya et al., 2020; Chen et al., 2020; Hachem, 2018). There has been only limited investigation into the impact of shadow banking on the broader economy (Wang et al., 2016).

Various articles have highlighted the stability concerns associated with the growing shadow banking sector, which often involves non-standard credit instruments, maturity mismatches, implicit guarantees, and insufficient capital reserves. Experts are concerned that such operations could undermine credit and monetary policies, spurring over-investment and asset bubbles, and ultimately exacerbating financial instability. For instance, the New York Times reported: "But experts worry that untrammeled shadow lending could lead to ticking time bombs that could threaten the financial system of the world's second-largest economy... much of the lending appears to represent a speculative frenzy, often involving residential real estate, that has become of increasing concern to some Chinese officials, bankers and economists." (Bradsher, 2017)

While these concerns are legitimate, they overlook the positive side of shadow banking. In an environment of financial repression, financial innovations which serve to liberalise the financial conditions can also improve the efficiency of capital allocation. China has historically implemented financial repression policies that direct bank credit towards state-owned enterprises, thereby leaving private firms deprived of financial resources. Households have only limited options for saving, with only regulated deposit accounts with poor interest rates. Shadow banking partially liberalises the system by providing credit to those who are in need and offering households higher yields on their savings.

This study presents evidence that aligns with the financial liberalisation story, showing that shadow banking extends credit to the private sector, improving the vitality of private firms, increasing household wealth, and promoting a transition towards an economic structure that is less reliant on state-led investment. Wang et al. (2016) showed that shadow banking as a dual-track interest rate liberalisation process which is Pareto improving. The current study expands on this literature and presents additional evidence to support the claim.

I rationalise this idea with a dual-sector, dual-asset model, where a bank can lend either in traditional loans or in shadow products. Shadow products have lower capital requirements than traditional loans. There are two types of firms in the economy, one of which receives the majority of bank loans, forcing the other to borrow in shadow products. The simple model illustrates the substitution between traditional loans and shadow finance. When monetary policy tightens, banks, under the incentive to economise on capital reserves, optimally substitute shadow products for traditional loans. This in turn induces a production structure that is more favourable to private firms.

I provide both macro and micro evidence to support this argument. At the macro level, I estimate a Bayesian SVAR model that encompasses a wide range of macro variables and various measures of shadow banking. The impulse response analysis shows a clear pattern of contrasting behaviour between traditional loans and shadow lending. While traditional bank lending drives investment by state-owned enterprises, shadow banking spurs private investment. When monetary conditions tighten, shadow banking activities pick up despite traditional bank lending declines.

At the micro level, I collect all wealth management products issued by each bank as a proxy for shadow banking activities. I compute the exposure of each city to shadow banking by mapping the branch network of banks. I then relate the city-level shadow banking measures to the city's economic outcomes. The results show that higher levels of shadow banking activities (more wealth management product issuance) are associated with higher consumption, lower fixed-asset investment, higher household savings

and more newly registered firms, after controlling for a rich set of fixed effects of city characteristics. These results withstand various robustness tests — subsampling, additional controls and instrumental variable estimation. Both the macro- and micro-level evidence support the financial liberalisation argument and demonstrates the positive welfare effects of shadow banking.

This paper contributes to the growing literature on China's shadow banking system. Chen et al. (2018) point out that contractionary monetary policy causes the expansion of shadow banking business. Acharya et al. (2020) explain the growth of shadow banking products with deposit competition from state-owned banks. Allen et al. (2019) conduct a detailed transaction-level study of entrust loans. Hachem and Song (2016) find that liquidity regulation is a key factor explaining shadow activities. Chen et al. (2020) link the development of shadow banking to the refinancing needs resulting from the 4 trillion yuan stimulus package. Wang et al. (2016) find shadow banking as a dual-track interest rate liberalisation process. Gabrieli et al. (2018) and Cheng and Wang (2020) study the impact of shadow banking on monetary policy transmission. Ehlers et al. (2018), Hachem (2018), Sun (2019) and Allen and Gu (2021) provide excellent overviews of the shadow banking system.

The findings of this paper are broadly consistent with the existing literature on shadow banking theories in developed markets (Gennaioli et al., 2013; Plantin, 2015; Moreira and Savov, 2017; Fève et al., 2019). Despite the different institutional arrangements, the conclusions are similar. Shadow banking on both sides extends credit to risky borrowers and generates seemingly safe assets for investors. While this may be Pareto-improving in good times, the failure of banks to internalise aggregate tail risk means greater fragility for the system as a whole. The paper also echoes the broader literature on financial liberalisation (McKinnon, 1973; Shaw, 1973; Levine, 2005), who argues that financial liberalisation deepens capital and improves the efficiency of resource allocation, which is ultimately beneficial for economic growth.

The rest of the paper is structured as follows. Section 2 provides a brief historical background and lays the essential conceptual foundations for understanding China's shadow banking system. Section 3 presents a stylised model. Section 4 conducts a Bayesian VAR analysis to investigate the macro impact of shadow banking at the aggregate-level. Section 5 provides cross-sectional evidence using city-level panel data. Section 6 concludes.

# 2. Conceptual Groundwork

## 2.1. Banking and Shadow Banking in General

Banking is the intermediation of credit between savers and borrowers. Banks engage in credit, maturity and liquidity transformation during intermediation — transforming risky, long-term and illiquid investments into relatively safe, short-term and liquid assets (deposits) that can be conveniently held by households and firms. Banks profit from the management of risk in the intermediation process. If a bank correctly assesses the risk and return of its investment, it makes a profit from the spread between the higher interest rates it charges to borrowers and the lower interest rates it pays to savers. If the risk and return are unfavourable, the bank absorbs the loss because it promises to pay savers their deposits at par. The promise to always pay deposits at par makes them money — which is widely used as a means of payment and as a store of value. Bank failures are often associated with systemic meltdowns of the economy. For this reason, governments usually impose heavy regulations on banks and provide backstop to ensure the stability of the financial system.

Shadow banking undertakes credit, maturity, and liquidity transformations without being regulated as a bank. The sector has flourished over the decades and currently surpasses traditional banking in size. At its height in 2007, the liabilities of traditional banks were approximated to be 14 trillion dollars in the United States, whereas the shadow banking liabilities, measured grossly, were over 22 trillion dollars (Pozsar et al., 2010).

In developed economies, such as the United States, the shadow banking system is a vertical specialisation along the lending process. Unlike traditional banking, a single bank no longer carries out all lending activities. Instead, various market entities with diverse incentives and risk preferences specialise in specific phases of the funding chain. Typically, the process involves the origination of loans by a bank, off-balance-sheet pooling and securitisation, and tranching of the pools to engineer safe pieces of assets. Large institutions are typically the ultimate creditors in the chain, holding shares of money market funds instead of deposits in a bank. The procedure frees a bank from the responsibility of holding a loan for its entire duration, along with the required capital reserves associated with it, therefore improving the capital efficiency and profitability of the bank. Shadow banking therefore transforms the nature of banking "from a credit-risk intensive, deposit-funded, spread-based process, to a less credit-risk intensive, but more market-risk intensive, wholesale funded, fee-based process." (Pozsar et al., 2010)

The proliferation of shadow banking activities comes with both benefits and costs.

Specialisation in the lending process brings efficiency gains, thereby reducing the cost of credit and increasing public access to finance. However, as most of these activities are off-balance sheet and have no formal access to the lender of last resort or other government guarantees, they compromise the stability of the financial system. Moreover, reliance on short-term money market instruments to finance long-term debts also make them vulnerable to runs during crises when cash holders refuse to roll over their funding (Gorton and Metrick, 2012). It remains a pressing challenge for regulators to extend the functionality of the lender of last resort to the realm of shadow banking and safeguard the financial system in extreme times.

## 2.2. Shadow Banking in China

The shadow banking system in China shares commonalities with the systems found in developed countries, as they both complicate the lending process and raising regulatory challenges. However, China's unique regulatory framework, including loan-to-deposit ratios and interest rate regulations, gives rise to distinctive features to its shadow banking system. In short, China's shadow banking is not so much about securitisation and specialisation, but more about banks' tactics to evade regulation and bypass financial repression.

### 2.2.1. The Origin of Shadow Financing

Multiple explanations have been proposed for the emergence and the subsequent rapid expansion of the shadow banking sector. Chen et al. (2020) link the emergence of shadow financing to the 4 trillion yuan stimulus package introduced in 2009. The Chinese government implemented this plan together with ultra-easing monetary policies during the Global Financial Crisis (GFC) to counter the economic downturn. Local authorities aggressively expanded their balance sheet via local government financing vehicles (LGFVs) to invest in infrastructure and heavy industries. As the monetary policy became more stringent in 2010, local authorities faced a significant funding shortfall to refinance their debts. As traditional lending channels became restricted, local governments resorted to shadow funds to refinance their debts, ultimately spurring the expansion of the shadow banking industry.

Wang et al. (2016) demonstrate that shadow banking activities are reactions to financially repressive regulations. In particular, the shadow banking system redirects credit from state-owned enterprises (SOEs) favoured by banks to more productive, yet underserved private businesses through non-bank lending channels. Shadow banks also issue

off-balance-sheet wealth management products (WMPs), which offer higher returns compared to interest-rate-regulated bank deposits. Therefore, the shadow banking system is essentially a process of interest rate liberalisation, which potentially improves Pareto efficiency.

Acharya et al. (2020) provides an explanation for the emergence of shadow banking from the perspective of competitions with state-owned banks. The study suggests that a bank is likely to issue more WMPs to source funding when it faces increased competition from a state-owned bank.

Hachem and Song (2016) argues that the rise of shadow banking in China is mainly due to regulatory arbitrage over liquidity regulations. The regulators tightened the liquidity rules, specifically the loan-to-deposit ratio, between 2007 and 2010. Banks initially responded with window dressing, but then began to issue off-balance-sheet WMPs to circumvent the regulation.

Allen et al. (2023) highlights how a lack of funding in certain industries, such as real estate, contributes to the prevalence of shadow financing. The government has implemented strict credit policies for developers and investors in order to restrain excessive speculation in the real estate market. The high demand for real estate and the limited credit from banks has led to the growth of shadow banking, as an effort to circumvent credit restrictions.

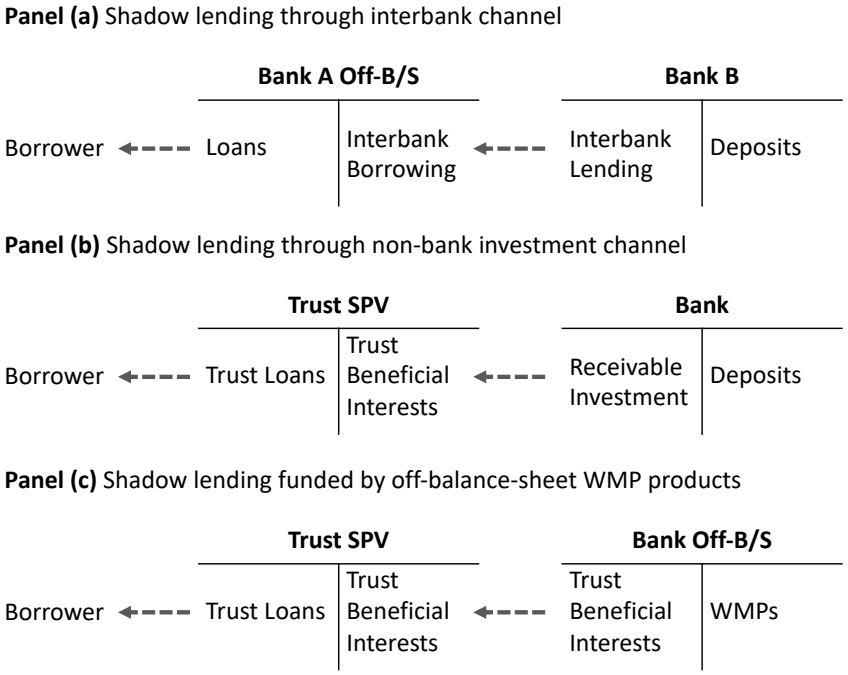
### 2.2.2. The Mechanism

There is a notable difference in China's shadow banking system compared to its developed counterparts. China's shadow banking practices are largely dominated by banks, unlike the securitised market-based lending activities found in developed markets. Banks engage in shadow activities such as reclassifying assets, cooperating with non-bank financial institutions, or issuing off-balance-sheet products to reduce regulatory burdens. Ehlers et al. (2018) presents a comprehensive summary of the system with stylised maps.

To briefly illustrate, Figure 1 shows three typical shadow banking operations. Panel (a) shows shadow lending through the interbank channel. If a borrower seeks to borrow from Bank B, rather than issuing the loan directly and recording it on its balance sheet (which would be subject to regulations and require capital reserves to support it), Bank B engages in interbank lending with Bank A. Bank A then lends the funds to the borrower, committing to repaying all principal and interest to Bank B. As Bank A is not liable to the loss of the loan, the lending is recorded off Bank A's balance sheet. Bank A charges a fee for being an agent but is not subject to any credit loss. For Bank B, hiding the lending within interbank payments lowers the risk weight of the lending.

As per regulations, interbank claims have a risk weight of 25%, significantly lower than the 100% risk weight of standard loans. The operation thus improves the bank's capital efficiency.

**Figure 1: The Mechanism of China's Shadow Banking System**




Notes: This figure shows examples of shadow banking activities in China. Panel (a) demonstrates an interbank channel where Bank A acts as an agent for Bank B and the borrower. Bank B lends funds to Bank A through the interbank channel, and Bank A records the lending off its balance sheet as it commits to repayment of the principal and interest to Bank B. Panel (b) demonstrates shadow lending through bank-trust cooperation. The bank extends credit to a trust SPV and records the trust beneficial interests as receivable investments on its balance sheet. This approach avoids the lending being regulated as a loan. Panel (c) illustrates the shadow funding using WMP products. Banks pool the funds raised through the issuance of WMPs and lend the money through channelling operations. WMP products without explicit guarantees on principal or interest are held off the bank's balance sheet, although banks may provide implicit guarantees to investors.

A bank may also conceal its lending by co-operating with non-bank financial institutions and classifying the assets as "receivables investments" or "available-for-sale financial assets". Panel (b) demonstrates the process. The bank collaborates with a trust company to channel the funds to a trust SPV and lends to the borrower. The bank retains the beneficial interests in the trust as "receivables investments" on its balance sheet. The bank improves capital efficiency because lending to financial institutions also has a lower risk weight than standard business loans. Similarly, banks can also chan-

nel funds through bank-security cooperation, bank-insurance cooperation or bank-fund cooperation. In all these cases, the bank is the primary lender, while the funds are routed through other financial institutions. Simultaneously, deposits are created as a liability of the bank, which expands the total money supply as measured by M1 or M2. Reclassifying assets to conserve capital allows banks to expand their balance sheets and increase money supply beyond regulated thresholds.

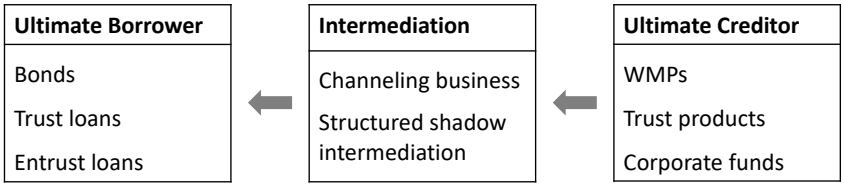
The situation is different in panel (c), where the bank offers off-balance-sheet WMPs to fund shadow lending. WMPs are short-term store-of-value products that provide higher returns to investors as an alternative to deposits. Since there are no explicit guarantees on principles or returns, banks classify these WMPs as off-balance-sheet items. However, investors usually assume that WMPs are implicitly guaranteed by banks. In practice, banks often pool the funds raised by WMPs and invest them in bonds or non-standard debt instruments such as trust beneficiary rights. However, this procedure entails maturity and liquidity mismatches due to the significantly shorter terms of WMPs compared to the invested claims. Consequently, banks face considerable roll-over pressure when WMPs reach maturity. Any funding shortfall would have to be met by borrowing from the money market. This means that WMP-issuing banks would be frequently subject to unstable demand for liquidity. In addition, banks may use the cash pool to cover any investment losses, which obscures the true risks of the investments and may even be susceptible to Ponzi schemes.

The entire shadow banking system can be summarised in three stages (Figure 2). The ultimate creditors are households and corporations that hold claims through WMPs or trust products. Additionally, corporates can engage in entrust loans, which are loans between non-financial companies utilising banks as serving agents. The funds then pass through the shadow intermediation process as outlined above and ultimately flow to the end borrowers (LGFVs, real estate developers, private enterprises, etc.) via bonds, trust loans, or entrust loans. To quantify the portion of funds channelled through shadow banking, it is estimated that at its peak in 2016, 25% of all outstanding bonds were financed by WMPs, 62% of municipal corporate bonds (issued by LGFVs) were financed by WMPs, and 70% of trust funds were channelled through bank-trust cooperations (Sun, 2019).

### 2.2.3. The Measurement

Different methods have been used in the literature to measure the size of the shadow banking sector. It can be measured from either the lending side or the funding side. From the borrowers' perspective, the size of shadow lending equals to the sum of all

**Figure 2: The Three Stages of Shadow Intermediation**




Notes: This diagram provides an overview of the three stages involved in the shadow intermediation process. At the ultimate creditor stage, funding is secured through the issuance of WMPs or trust products. Meanwhile, corporates have an additional option of lending their idle funds through entrust loans. In the intermediation stage, interbank payments, bank-trust or bank-security cooperation are used to channel funds to the borrowers without the loans being classified as loans on banks' balance sheets. At the final borrowing stage, borrowers such as LGFVs and real estate developers obtain funds through bonds, trust loans, or entrust loans.

bonds, trust loans and entrust loans issued via shadow banking channels, excluding those financed by direct investment. There is no exact statistics on this account. But it is common practise to add up trust loans, entrusted loans, and bankers' acceptance bills in the total social financing account to approximate the magnitude of shadow lending.[1] Bond or equity financing is considered direct financing and therefore not included. Using this measure, shadow lending reached its height in 2016, accounting for 32.9% of the total social financing (Allen and Gu, 2021).

Another approach, from the creditors' perspective, involves monitoring the flow of WMPs, trust, and entrust funds directed towards the shadow banking system. There are two challenges associated with this approach. First, not all WMPs or trust products involve shadow banking. Second, there is a possibility of double accounting, as WMPs may also invest in trust products. In this regard, there is no perfect measure for this approach either. Literature typically uses the size of WMPs to approximate the magnitude the shadow funds. In 2006, the total outstanding WMPs was about 22% of the money supply (M2) or 31% of GDP (author's calculation).

A more precise measure, based on the shadow intermediation mechanism, was proposed by Sun (2019) to estimate the size of shadow banking using a balance sheet deduction method. This approach involves deducting the value of "non-shadow assets" from the total money-like claims generated by the banking system. The exact formula is given by

$$S = M_2 + W + D_G + K - (L + B + FX),$$

[1] Total social financing, defined by the People's Bank of China (PBOC), refers to the overall funding the real economy receives from the financial system, including both banks and non-bank financial institutions.

where $S$ represents the measure of shadow banking, $M_2$ denotes the broad money supply, $W$ stands for WMP products, $D_G$ represents government deposits, $K$ represents the banks' capital, $L$ denotes standard bank loans, $B$ represents corporate bonds held by banks, and $FX$ denotes foreign exchanges held by banks.

This approach effectively captures the credit produced by banks but hidden through non-standard accounting practices. However, this method is not flawless either as non-loan assets do not always involve shadow banking — for example, interbank payments, which may or may not involve shadow lending activities.

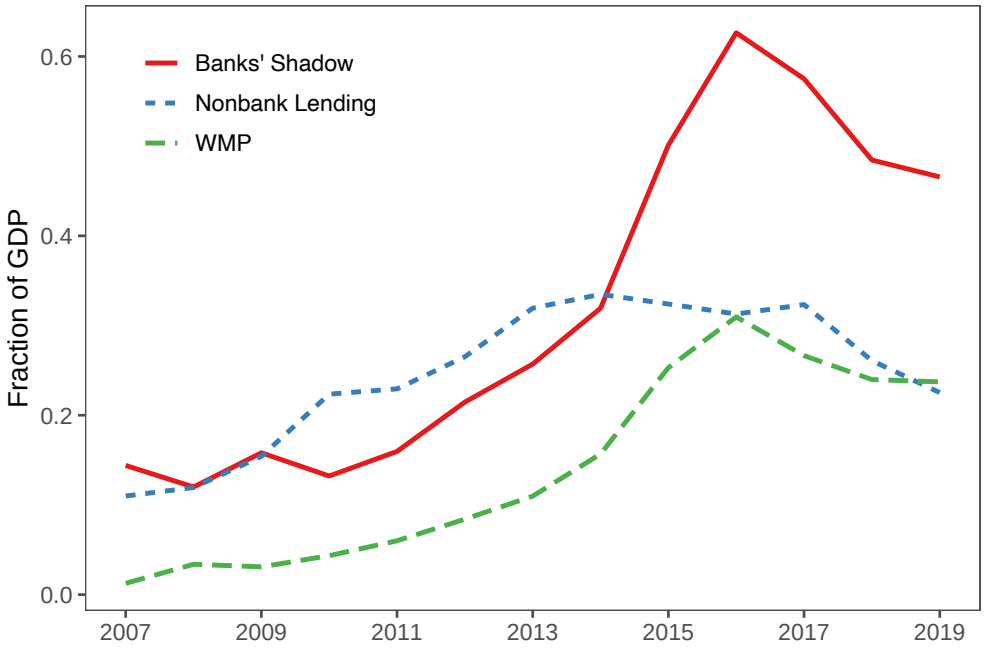
Since shadow activities in China are primarily used by banks to evade regulations and create claims off the balance sheet, Sun (2019) believes it is more appropriate to refer to it as the "Banks' Shadow", as opposed to the "shadow banking" in developed markets. This paper follows Sun's terminology, using "Banks' Shadow" for the measure produced by the deduction method and "Nonbank Lending" for the aforementioned measure derived from total social financing.

Figure 3 shows a comparison of the three measures. The Banks' Shadow method provides the most generous estimate, amounting to 62.6% of GDP at its peak. The WMP measure exhibits similar trends as the Banks' Shadow, albeit at a lower magnitude. This is because it does not account for shadow lending financed by bank deposits. The non-bank lending broadly coincides with the deduction method until 2014, after which the two approaches diverge. The divergence is mainly related to regulatory changes. In 2013, the China Banking Regulatory Commission (CBRC) administrated that WMPs could invest at most 35% in "non-standard assets".[2] This redirected the funds acquired from WMPs away from investing in trust products, bankers' acceptances, or other non-standard assets towards standard traded bonds or stocks.

In this paper, I use different measures in different scenarios depending on data availability and the purpose of the study. For instance, the Banks' Shadow cannot be calculated at the sub-national level, where I opt to use WMP issuance as an approximation. At the national level, where all aggregate measures are available, I employ all of them. It would be helpful to view the different measures as capturing different aspects of the shadow banking system, rather than one being more accurate than the other. For example, the non-bank lending reflects the credit supply beyond conventional loans, while the Banks' Shadow captures banks' disguised lending through non-standard accounting practices.

[2] Non-standard assets refer to any securities or instruments that are not-standardised for trading on the bond or stock markets.

**Figure 3: Measures of China's Shadow Banking Business**




Notes: This graph illustrates three measures of the shadow banking sector as fractions of GDP. Banks' Shadow is the total amount of money claims minus traditional assets found in banks' balance sheets. Non-bank Lending refers to the combined sum of trust loans, entrusted loans, and undiscounted bankers' acceptances. WMP refers to the size of all wealth management products issued. Source: CEIC, Sun (2019), Author's calculation.

### 2.2.4. The Risk and Reward

In the context of financial repression, shadow banking serves as a partial liberalisation of the financial system that could potentially improve the efficiency of capital allocation. Wang et al. (2016) note that the shadow banking system improves the financial condition for private firms, which are underfunded in a system dominated by state-owned banks favouring state-owned enterprises. Moreover, WMPs offer savers higher yields than bank deposits, liberalising interest rates to better reflect the return opportunities offered by economic reality.

However, shadow banking also exposes the system to higher risks. These activities often involve non-standard and opaque accounting practices, disguising the true risks associated with the underlying investments. It also increases banks' leverage ratios, with insufficient capital reserves to cover the credit risks. In addition, the WMPs issued by banks often involve severe maturity mismatches, which increase the banks' vulnerability to liquidity risks, particularly when high volumes of WMPs come due. Last but not least, the effectiveness of monetary policies is undermined by shadow banking as banks can bypass regulatory requirements. It particularly weakens regulations designed to control the supply of credit. For instance, the shadow banking system directs credit towards real estate investors, despite facing regulatory headwinds, and potentially fuels the speculative bubble in the market.

## 2.3. Shadow Banking and Money Creation

It is helpful to understand shadow banking from the perspective of money creation in order to understand its impact on the macroeconomy. The nature of money has evolved with each significant financial advancement. With the advent of banking, money ceased to be a commodity and existed as a liability of banks. The emergence of shadow banking necessitates a redefinition of money, as the financial system nowadays generates various quasi-money claims that obscure the differences between money and non-money.

Throughout this paper, I adhere to the "credit first" or "financing through money creation" (FMC) view on banking, which contradicts the mainstream economic theory. Specifically, banks do not act as passive intermediaries reallocating real resources between savers and borrowers. Instead, banks fund their loan and investment portfolios by issuing liabilities that serve as a commonly accepted means of payment, namely deposits. In other words, banks have the extraordinary right to credit their borrowers at will, and creating money *ex nihilo* without the need to accumulate savings beforehand (Jakab and Kumhof, 2015; Kumhof et al., 2014; Werner, 2014; Turner, 2013; Disyatat, 2011).

The question at hand is whether shadow banking, which imitates traditional banking functions but operates differently, generates liabilities akin to deposits when granting loans, and if so, whether these liabilities are considered money.

The answer to the first part of the question is clear. The "deposits" for shadow banks are the NAV shares in wealth management products or money market funds as they serve as the ultimate funding sources for the chain of shadow credit intermediation. However, the precise nature of these shadow deposits remains unclear. Are they generated by shadow loans or do they require pre-existing funds (e.g. deposits) to be funded? Should they themselves be considered as money, contributing to the overall money supply, or are they of a different nature?

Opinions vary among scholars on this issue. Michell (2017) contends "...the traditional banking system may obtain securities by issuing its own liabilities and providing them to sellers of securities. This is not the case for 'shadow' institutions which fund themselves by issuing liabilities which cannot be used for settlement purposes." Therefore, he concludes, "these claims are not money because they cannot be used as final means of settlement."

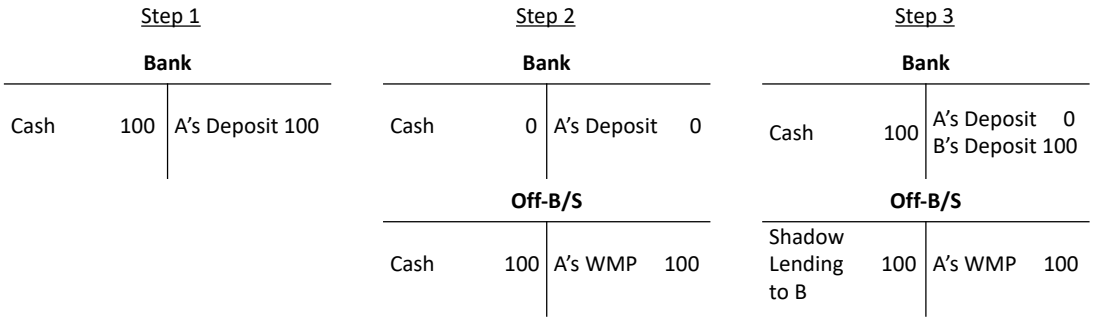
Mehrling (2013) and Pozsar (2014) present different perspectives. The authors argue that shadow claims such as repos and NAV shares can be viewed as money because "they promise to trade at par on demand." On the other hand, they acknowledge that shadow money is an inferior form of currency. "Unlike demand deposits, they cannot be used for settlement purposes. But they are still considered money because they can be traded for a demand deposit at par on demand."

Sun (2019) also rejects the notion that shadow banking creates money: "the credit creation of non-financial institutions is done via money transfer, which neither creates deposits to increase money nor shifts deposits out of the banking system... the purchase of WMPs leads only to changes in deposit accounts, shifting deposits off-balance sheet rather than transferring them to the deposits of [corporates]... WMPs neither create credit (or money) nor serve as credit intermediaries."

To shed some light on the discussion, it is helpful to visualise the creation of shadow claims in a balance sheet approach. Figure 4 illustrates this process using the example of off-balance sheet WMPs. Suppose A has deposits in a bank and uses the money to purchase the WMP issued by the bank. After the purchase, his deposit moves off the balance sheet. Suppose B wants to borrow money from the shadow banking system. Assuming that he obtains funding from a bank-trust cooperation, the bank funds the trust loan with the money raised from the WMP. When the loan is finalised, B receives the funds as a deposit from the bank (assuming it is the same bank, since we are

considering the banking system as a whole). The off-balance-sheet vehicle holds the trust beneficiary rights as an asset. Shadow banking leaves the bank's balance sheet unchanged from its initial position. Therefore, the money supply (measured by M1 or M2) remains the same. But the off-balance sheet items expand. On the surface, the process simply shifts the deposit from A's account to B's account. But the assets and liabilities of the economy expand — A and B now both hold claims on money. The total amount of cash claims is doubled.

**Figure 4: Shadow Banking and Money Creation**




Notes: The figure illustrates the link between shadow banking (with WMP issuance) and money creation. In step 1, A deposits his cash in a bank as an initial position. In Step 2, the bank provides WMP products as alternatives to deposits, which A purchases and withdraws his deposits. Consequently, the cash moves off the balance sheet. In Step 3, assuming B requires a loan from the bank. The bank provides lending to B through shadow channels, such as bank-trust partnerships, and records the claim off the balance sheet. B obtains the fund from trust loans and deposits it on the bank's balance sheet. The bank's balance sheet remains unchanged in size from the initial position, but the off-balance-sheet items expand.

If WMP shares can be used as a means of payment, there would be no question that shadow banks create money. Off-balance sheet vehicles can issue new shares, which the public can spend just like cash. However, in reality, WMP shares must be converted into bank deposits before they can be used for payments. In this respect, bank deposits are unique because banks have the privilege of handling the payment system. Shadow claims only become money if they promise to pay (directly or indirectly) on par with bank deposits.

Despite the fact that shadow claims are not accepted as a means of payment, we cannot simply exclude them from our definition of money for a number of reasons. In the first place, shadow banking is undeniably an important part of the modern financial system. The size of the sector is too large to be ignored. In China, where banks still dominate, shadow claims account for 22% of broad money. In the United States, according to Pozsar (2014), shadow money (including uninsured deposits, private repos and NAV shares) was estimated at 3.2 trillion dollars in 2013, compared with 1.4 trillion

dollars in demand deposits. Excluding shadow claims from the definition of money means ignoring a major class of money-like assets. As the shadow banking sector grows, the quantity of money (measured by deposits) becomes increasingly disconnected from economic reality (Schularick and Taylor, 2012). We could imagine a hypothetical scenario in which deposits were completely redundant. All households and firms would hold their savings in shadow products. No one would ever prefer to hold wealth in low-yield deposits, and conversions between deposits and shadow products were seamless. Deposits were only created when paying out, and were converted back into shadow assets immediately after being paid. In such an economy, it makes little sense to measure deposits as the only form of money. The decline of deposits does not imply the cessation of the need for money and invalidates all monetary theories. The inclusion of shadow claims in the definition of money becomes a mandate.

Secondly, although shadow money cannot be used directly as a means of payment, it does act as a store of value. As a result of either financial liberalisation or efficiency gains, shadow money tends to offer better returns than bank deposits. It is increasingly becoming the dominant form of short-term store of value. This shift is not trivial, as we are witnessing the decoupling of the different functions of money — the separation of the store of value from the means of payment.

Finally, from a money creation perspective, it is true that shadow banking does not have the same degree of autonomy as traditional banks to freely create readily accepted money. Whether it is securitised banking or Chinese-style shadow lending, it is a bank that originates the loans. Banks are not constrained by their deposits to lend, at least in theory. Shadow financing somewhat depends on the liquidity preference of the public. The more willing the public is to hold shadow assets compared to deposits, the greater the funds available to the shadow banking sector. Nevertheless, shadow banking aids credit expansion and expands the balance sheet of the entire financial system. Real economic activities are also impacted by the vicissitudes in the shadow banking sector. If the primary concern is the interconnection between finance and the real economy, it is essential to consider the total size of assets and liabilities generated by the financial system, not just traditional banks.

In summary, the FMC view places banks at the centre of resource allocation in an economy. Different banking structures would imply different real economic outcomes. A monopolised financial structure that directs credit to designated sectors would imply an unbalanced economic structure, while a more liberalised financial structure would allocate credit according to customers' demand and the actual return on investment. This claim will be further developed in the rest of this paper.

# 3. The Model

To quantitatively rationalise the financial liberalisation narrative, this section presents a stylised model featuring a financial sector with dual assets to demonstrate how shadow banking transforms the production structure and how monetary policy induces such transformation. There is an extensive literature on incorporating the financial sector into macroeconomic models (Kiyotaki and Moore, 1997; Bernanke et al., 1999; Gertler and Karadi, 2011; He and Krishnamurthy, 2012). The presented model in this sector deviates from other literature in that the impact of financial intermediaries on the real economy is not derived from financial market frictions, borrowing constraints or information asymmetries. Instead, in line with the FMC perspective, I highlight the central role of banks in creating purchasing power, allocating resources to specific sectors and shaping economic outcomes. Banks' decision to expand credit is subject to regulatory constraints rather than real savings from households. Banks create liabilities (deposits or shadow assets) when they lend, which households hold passively as wealth. Full details of the model are given in Appendix A. In this section, I provide a brief overview of the key elements that motivate the empirical work that follows.

**Banks** There is a representative monopolistic bank that has both a traditional banking branch and a shadow banking branch. The two branches offer different lending and saving products and are subject to different regulatory requirements. The bank's balance sheet is represented by the equation

$$L_t + B_t + G_t = D_t + S_t + K_t.$$

On the asset side, $L_t$ denotes loans provided by the traditional banking branch, $B_t$ denotes bonds, which are the shadow lending products, $G_t$ is the reserves required by the authority. On the liability side, $D_t$ represents traditional bank deposits, $S_t$ refers to shadow assets, and $K_t$ is the bank's capital. The bank profits from the spread between its assets and liabilities, net of the cost of lending,

$$\Pi_t = R^L_{t-1}L_{t-1} + R^B_{t-1}B_{t-1} - R^D_{t-1}D_{t-1} - R^S_{t-1}S_{t-1} - \Psi^L_{t-1} - \Psi^B_{t-1},$$

where $R^I_t$ is the gross interest rate for asset type $I$, $I \in \{L, B, D, S\}$. $\Psi^L_t$ and $\Psi^B_t$ are the costs associated with traditional loans and shadow lending respectively. Following

Karmelavičius and Ramanauskas (2019), the cost function is specified as

$$\Psi^I(I_t, G_t) = -\nu \ln\left(\frac{G_t}{\omega_I I_t} - \mu_I\right) I_t,$$

where $I \in \{L, B\}$. $\omega_I$ is the average risk weight of asset $I$ and $\mu_I$ is the capital requirement for the asset. It is assumed that $\mu_L > \mu_B$, since traditional lending requires higher reserves than shadow lending. $\nu$ is a cost scaling parameter. This cost function nicely reflects the reality of banking operations. If the bank has enough capital reserves above the required ratio, $\frac{G_t}{\omega_I I_t} \gg \mu_I$, the cost curve is almost flat; as the reserve ratio approaches the regulatory requirement $\mu_I$, the cost function imposes infinite cost on the bank. Therefore, the bank's optimal capital ratio is always above the regulatory threshold.

The bank pays out part of the profit as dividends and accumulates the rest as capital,

$$K_t = (1-\delta)K_{t-1} + \Pi_t - d_t,$$

where $\delta$ is the capital depreciation rate and $d_t$ is the dividend payout. The bank seeks to maximise its expected dividend payout stream, $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta_b^t \ln(d_t)$.

For simplicity, assume that traditional loans are fully funded by deposits, $L_t = D_t$; shadow lending is fully funded by shadow assets, $B_t = S_t$; and the bank pledges all its capital as reserves, $G_t = K_t$. The bank's budget constraint is therefore reduced to a single equation

$$(R^L_{t-1} - R^D_{t-1})L_{t-1} + (R^B_{t-1} - R^S_{t-1})B_{t-1} = G_t - (1-\delta)G_{t-1} + \Psi^L_{t-1} + \Psi^B_{t-1} + d_t.$$

The representative bank maximises its profit by setting the optimal level of bank loans $L_t$, shadow loans $B_t$, capital reserves $G_t$ and dividend payout $d_t$. It is emphasised that it is the bank's decision that determines the capital available to the economy, and hence the level of output, irrespective of the saving decisions of households or firms.

The first-order conditions are given by the following set of equations:

$$\begin{aligned} R^L_t - R^D_t &= \Psi^L_L(L_t, G_t), \\ R^B_t - R^S_t &= \Psi^B_B(B_t, G_t), \\ (1-\delta) - \Psi^L_G(L_t, G_t) - \Psi^B_G(B_t, G_t) &= \frac{1}{\beta_b}\mathbb{E}_t\left[\frac{d_{t+1}}{d_t}\right]. \end{aligned}$$

The first two equations equate marginal revenue (the spread between borrowing and

lending rates) to marginal cost. The third equation relates the marginal cost of adjusting capital to the expected future dividend payout. Note that if $[G^*, L^*, B^*, d^*]$ is a solution to the above equations, then $c[G^*, L^*, B^*, d^*]$ is also a solution. This means that all first-order conditions and budget constraints still hold if the bank's capital and assets grow at the same pace. This gives a steady growth path as the bank accumulates capital and assets over time.

**Firms and households** There are two representative perfectly competitive firms: $k$-firm and $c$-firm. The $k$-firm secures the majority of bank loans and specialises in producing capital goods $Y_k$, functioning similarly to state-owned enterprises in reality. The $c$-firm, which corresponds to private enterprises, has limited access to bank credit, relies on funds from shadow banks and specialises in the production of consumer goods $Y_c$.

The production function of the $k$-firm is $Y_{k,t} = K_{k,t}^{\alpha} N_{k,t}^{1-\alpha}$, where $K_{k,t}$ and $N_{k,t}$ are capital and labour inputs. Assume that all of the $k$-firm's capital is financed by bank loans, $K_{k,t} = L_{k,t}$. Therefore, the $k$-firm's optimisation problem is given by

$$\max_{L_t, N_t} \; q_t Y_{k,t} - r_t^L L_{k,t} - w_t N_{k,t} - \Upsilon(K_{k,t}, K_{k,t-1}),$$

where $q_t$ is the relative price of capital to consumption, $r_t^L$ is the interest on loans, $w_t$ is the wage rate, $\Upsilon$ is the cost of adjusting capital (Christiano et al., 2005).

Similarly, the $c$-firm has a production function $Y_{c,t} = K_{c,t}^{\gamma} N_{c,t}^{1-\gamma}$. Assuming that the production capital of $c$-firm is financed by both traditional loans and shadow funds, $K_{c,t} = L_{c,t} + B_{c,t}$. Assume further that there is a loan quota: $L_{c,t} \leq \theta L_t$, where $\theta$ governs the maximum amount of credit available to the $c$-firm, which is assumed to be a small fraction of total available loans. The optimisation problem of $c$-firm is therefore

$$\max_{L_t, B_t, N_t} \; Y_{c,t} - r_t^L L_{c,t} - r_t^B B_t - w_t N_{c,t} - \Upsilon(K_{c,t}, K_{c,t-1})$$

subject to $L_{c,t} \leq \theta L_t$.

The representative household derives utility from both consumption goods $C_t$ (produced by the $c$-firm) and capital goods $H_t$ (produced by the $k$-firm), and suffers disutility by offering labour $N_t$. The household saves both in bank deposits $D_t$ and shadow assets $S_t$. The household's problem can be described as

$$\max_{\{C_t, H_t, N_t\}} \; \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_h^t \left[ \ln C_t + \omega \ln H_t - \frac{\psi}{2} N_t^2 \right]$$

subject to

$$C_t + q_t H_t + D_t + S_t = R^D_{t-1} D_{t-1} + R^S_{t-1} S_{t-1} + w_t N_t + d_t + T_t.$$

Note that the household takes $\{D_t, S_t\}$ as given and chooses $\{C_t, H_t, N_t\}$ to maximise its utility. Because it is not the household's saving decision that determines the funds available to the bank, but it is the bank that determines the financial wealth available to the household. $d_t$ is the dividend received as the shareholder of the bank. $T_t$ is a lump sum transfer to the household. There is a single monetary policy rule that sets the deposit rate exogenously, $r^d_t = \bar{r} + \epsilon_{r,t}$. The other interest rates are determined endogenously.

**Model implications** The full details of the model are discussed in Appendix A. It should be noted that the model is a simplified version and does not capture many features found in reality. For example, I abstract from the price behaviour and assume that everything is expressed in real terms. This will miss out an important transmission channel from the financial sector to the real sector, as banks only create nominal purchasing power which influences the real economy through inflated prices. Nevertheless, the model illustrates the mechanism by which the structure of the output is shaped by banking or shadow banking operations, and demonstrates how this is subject to the influence of regulations imposed by the authority. The simulation of the model reveals several key implications.

1. When the bank faces tighter capital requirement on loans, it substitutes traditional loans with shadow lending to conserve capital.

2. As the bank provides additional shadow lending, the underfunded $c$-firm gains access to more production capital, resulting in increased output of the consumption goods. In the meanwhile, the output of the $k$-firm declines.

3. As the production structure shifts towards more output from the $c$-firm, the household enjoys higher levels of consumer goods, lower levels of capital goods and higher levels of total wealth, as shadow assets accumulate faster than bank deposits shrink.

4. A tightening of monetary policy has a similar effect, as raising the deposit rate reduces the spread over traditional loans and the bank optimally switches to shadow lending for higher profits.

The following sections provide empirical tests of these theoretical predictions.

# 4. Time Series Evidence

This section utilises national-level time series data and a Bayesian SVAR model to investigate the impact of shadow banking on the macroeconomy. First, I outline the data and empirical framework. Then I compare the responses to shocks from conventional lending versus shadow lending in investment, prices, as well as the housing market. Finally, I address the impact of monetary policy on shadow banking dynamics.

## 4.1. The Time Series Data

Aggregate time series data have the advantage of allowing us to construct different measures of shadow banking at the national level, which is not feasible at the micro level. Table B.1 provides a detailed account of the data source and the method of construction for each series. Here I provide a brief summary of the main variables. I have included both the *Banks' Shadow* and *Nonbank Lending* in the analysis. As discussed in Section 2.2.3, the different measures do not coincide, but capture different aspects of the shadow banking system. Banks' Shadow captures the non-standard accounting practices of banks to circumvent regulations, while Nonbank Lending measures the funding from non-bank financial institutions. These shadow financing variables are compared with traditional bank loans in terms of their impact on other macroeconomic variables.

Regarding macroeconomic indicators, I categorize fixed asset investment (FAI) into SEO investment and Non-SOE investment to investigate the heterogeneous responses of SOEs and private enterprises to different funding shocks. For price levels, I include both the consumer price index (CPI) and the producer price index (PPI). The former is primarily indicative of consumer demand, while the latter reflects the dynamics of industrial supply and demand. Various interest rates are included to control for different channels of monetary policy transmission (Chen et al., 2016). China has a multifaceted monetary policy framework aiming to control both the quantity and price of money, using a range of instruments that include both open market operations and administrative credit controls (Jones and Bowman, 2019). Specifically, the 7-day interbank repo rate represents interbank liquidity condition, to which the shadow banks are highly sensitive due to roll-over pressures. I also include the benchmark lending and deposit rates, from which the actual loan or deposit rates can only deviate within a certain limit set by the central bank. Although benchmark rates have been reformed to the more recent LPR framework, they are nevertheless included as they have been the indicators for policy rates over a long period of time.

Two exogenous variables are also incorporated. One is the average number of COVID

cases, as our quarterly series spans from 2000Q1 to 2021Q4, covering the pandemic period. The other variable is the US GDP, which is needed to address the impact of global economic shocks such as the GFC. Most series are sourced from CEIC and are seasonally adjusted using the X-13 procedure. I also make use of the seasonally adjusted series from Higgins and Zha (2015) for some variables. All variables except interest rates are log-transformed.

## 4.2. The Bayesian SVAR Model

The structural vector autoregression model is specified as follows,

$$A_0 y_t = \Sigma_{l=1}^{p} A_1 y_{t-l} + C z_t + \epsilon_t,$$

where $y_t$ is an $n \times 1$ vector of endogenous variables, and $z_t$ is an $m \times 1$ vector of exogenous variables including constant. $\{A_0, A_1, \ldots, A_p, C\}$ are parameter matrices with $A_0$ invertible. $p$ denotes the number of lags. $\epsilon_t \sim \mathcal{N}(0, I_n)$ is the vector of structural shocks. The reduced-form representation of the model is

$$y_t = \sum_{l=1}^{p} B_l y_{t-l} + D z_t + u_t,$$

where $B_l = A_0^{-1} A_l$, $D = A_0^{-1} C$, $u_t = A_0^{-1} \epsilon_t$, $u_t \sim \mathcal{N}(0, \Sigma)$, $\Sigma = \mathbb{E}[u_t u_t'] = (A_0' A_0)^{-1}$. The matrices $B$ and $\Sigma$ are reduced-form parameters estimated by regressions. Structural parameters $\{A_0, \ldots, A_p, C\}$ can be recovered by specifying matrix $A_0$.

**Identification** The baseline model includes 14 endogenous variables as listed in Table B.1. The identification of structural shocks is achieved by ordering the endogenous variables recursively so that monetary policy (interest rates) responds to prices and real variables (investment and consumption) contemporaneously, but prices and real variables respond to interest rates with a lag; financial variables (bank loans or shadow financing) respond to interest rates contemporaneously, but not vice versa. The identification assumption is that all information relevant to banks' lending decisions, such as macroeconomic conditions and monetary policy, are included in the model so that the residuals from bank loans or shadow financing can be interpreted as financing shocks originating from banks. The model is estimated with four lags, as higher order lags do not appear to change the results.

**Priors** For Bayesian inference, I adopt the Minnesota prior over the parameters $(B, D)$, which is a standard choice in the Bayesian VAR literature. The prior provides adequate shrinkage over lags and cross-variable correlations, since the model involves a large number of endogenous variables but a relatively short time period. More specifically, the prior for the coefficient on the endogenous variables is characterised by

$$\mathbb{E}[(B_s)_{ij}|\Sigma] = \begin{cases} 1 & \text{if } i = j \text{ and } s = 1 \\ 0 & \text{otherwise} \end{cases}$$

$$\text{Var}[(B_s)_{ij}|\Sigma] = \begin{cases} \frac{\lambda_1^2}{s^{\lambda_3}} & \text{if } i = j \\ \frac{\lambda_1^2 \lambda_2^2}{s^{\lambda_3}} \frac{\sigma_{ii}}{\sigma_{jj}} & \text{if } i \neq j \end{cases},$$

where $\lambda_1$ governs the overall tightness, $\lambda_2$ controls the variance of the cross-variable coefficients, $\lambda_3$ controls the rate at which the coefficients shrink on lags. $\Sigma$ is assumed to be a known matrix, with diagonal entries $\sigma_{ii}$ equal to the residual variance of individual AR models run on each variable in the VAR.

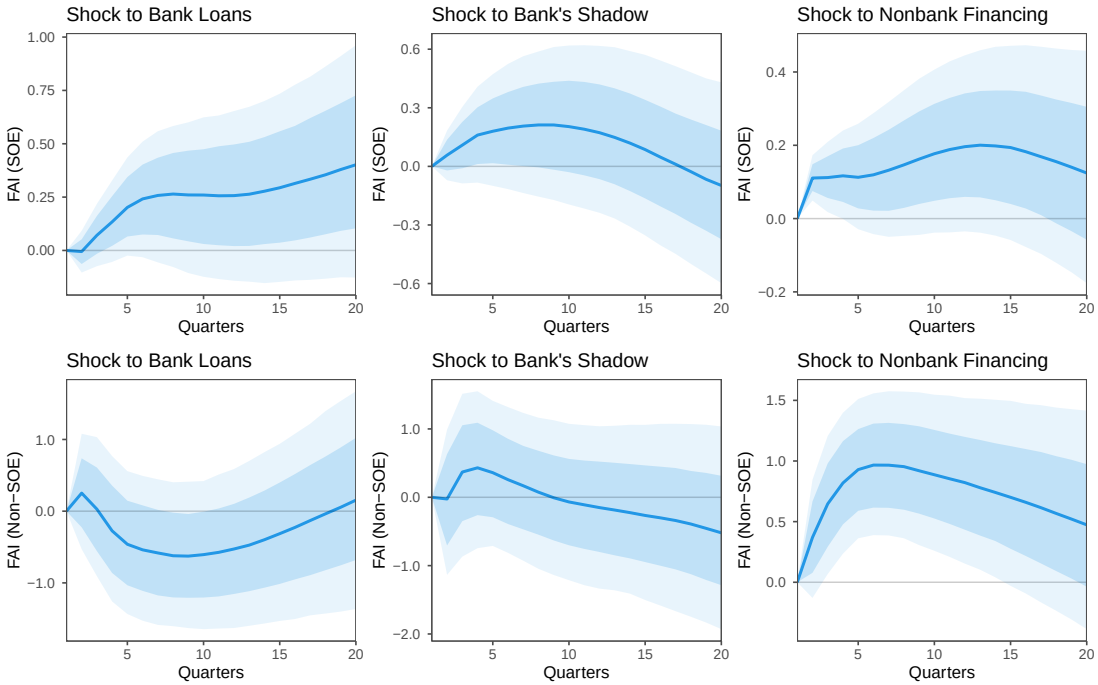
In the baseline estimation, I set $\lambda_1 = 0.1$, $\lambda_2 = 0.5$, and $\lambda_3 = 2$. Appendix B probes the sensitivity of the results to different prior value settings. This section reports the baseline results with the standard Minnesota prior. Additionally, Appendix B estimates the model with "initial dummy observations" which is designed to be consistent with unit root and cointegration processes (Sims, 1993). The robustness checks ensure that the primary findings in this section are not undermined by different prior settings.

## 4.3. Impulse Response Analysis

**The impact on investment** The impact of financing shocks on fixed-asset investment (both SOE and non-SOE) is displayed in Figure 5. The result identifies a remarkable disparity in the impact of bank loans on SOE and non-SOE investments — while the former is significantly positive, the latter in slightly negative. Nonbank Lending, however, emerges as a prominent stimulus for non-SOE investment. The outcome aligns with the findings in other literature. As mentioned by Chen et al. (2016), the transmission of monetary policy to the real economy largely results from the disproportionate allocation of credit to infrastructure and heavy industry rather than to light industry. Geng and Pan (2019) show that credit tightening results in the reduction of funding to non-SOEs rather than SOEs. Lardy (2019) reports that, as of 2016, SOEs received 83% of bank loans, with only 11% allocated to private enterprises. These findings reflect the institutional facts of the Chinese financial system. The national banking system prioritizes allocating

financial resources to serve national goals instead of funding market-driven consumer demand. Consequently, the more efficient and profitable private sector is under-funded from the formal banking system and has to rely on shadow financing or other informal lending channels. The results here reinforce this view.

**Figure 5: Response of Investment to Financing Shocks**




Notes: This figure shows the dynamic responses of fixed-asset investment of State-Owned Enterprises (SOEs) and Non-SOEs to 1 SD positive shock to bank loans, Banks' Shadow, and Nonbank Lending, respectively. Solid lines represent the median responses; shaded areas represent the 68% and 90% credible bands. Vertical axes are in percentage points.

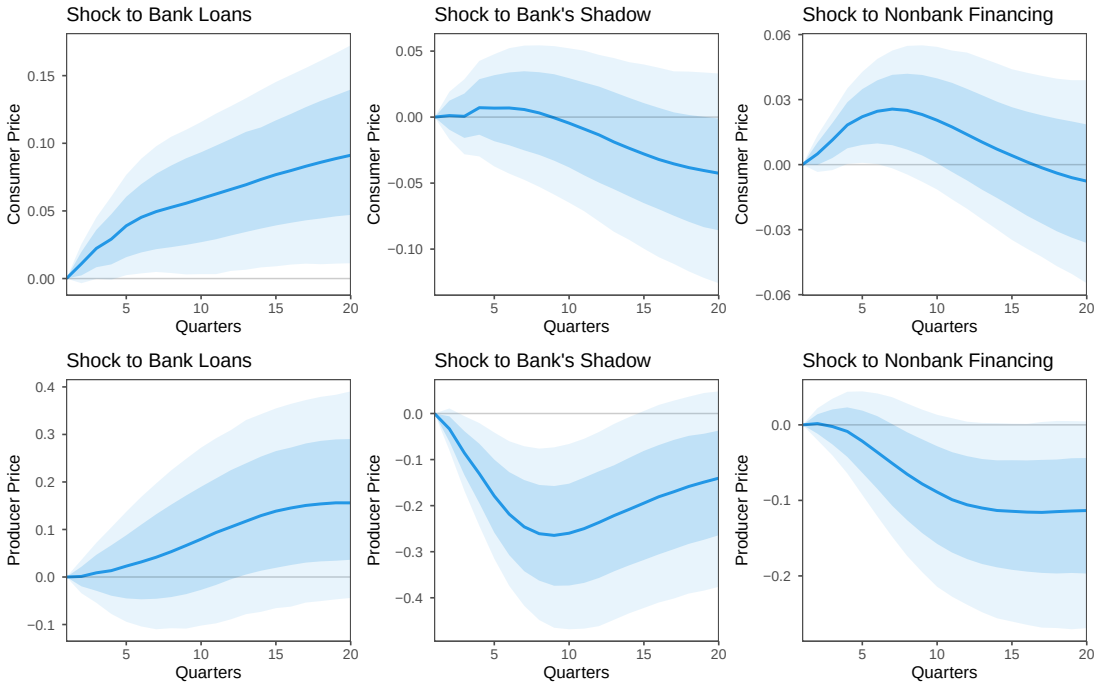
The differences between Banks' Shadow and Nonbank Lending are also worth noting. Nonbank Lending tends to have a more pronounced effect on investment than Banks' Shadow. Although the reason for this is not entirely clear, some tentative explanations can be offered. First, Nonbank Lending includes entrusted loans, while Banks' Shadow does not. Entrusted loans are loans between enterprises with banks as middle agents. Entrusted loans have been found to reallocate funds from firms with access to cheap credit to those with limited access to credit (Allen et al., 2019). Thus, entrusted loans provide vital support to small and medium-sized firms. The Bank's Shadow, however, does not capture this. Second, Nonbank Lending is a measure from the lending side, while Banks' Shadow is more of a measure from the funding side, which is closely related to WMP issuance (Figure 3). Thus, Nonbank Lending has a more direct link to investment.

Banks' Shadow, which grows with the accumulation of shadow assets, has only an indirect link. Third, as shown in Figure B.3, Nonbank Lending is more sensitive to the benchmark lending rate, while the Banks' Shadow is more sensitive to the interbank repo rate and the benchmark deposit rate. As investment is mainly regulated by the lending rate, it is more likely to be correlated with Nonbank Lending. A closer investigation reveals that, when monetary policy tightens, the investments that are deterred from accessing bank loans would resort to nonbank lending. Thus, nonbank lending serves as a counter-regulatory financing channel for underfunded firms.

**The impact on price levels** The argument made above can be reaffirmed by looking at the behaviour of prices. Figure 6 investigates the responses of both the consumer price index (CPI) and producer price index (PPI). While the CPI is driven by consumer demand, the PPI is driven by demand from the industrial sector, particularly heavy industries that consume significant amounts of industrial goods and raw materials. It is unsurprising that bank loans support both price indices. Expansionary monetary policies, transmitted mainly through bank loans, have positive impacts across the board. Banks' Shadow and Nonbank Lending, however, imply contrasting trends for consumer and producer prices — they are associated with higher CPI, but lower PPI. The divergent price responses are consistent with the findings on investment. Since shadow banking mostly funds non-SOEs, which specialise in light industries and consumer goods production, it is more likely to drive the price dynamics of consumer goods. On the other hand, bank loans which mainly finance heavy industry stimulate the demand for industrial goods and thus drive up the PPI.

**The impact on the real estate market** The impact of shadow banking on the real estate market deserves particular attention, as many commentators believe that large portions of shadow funds flow towards the real estate sector, contributing to a housing bubble (Bradsher, 2017; Allen et al., 2019). The impact of shadow banking on the real estate market is analysed in Figure 7. The evidence, however, indicates minimal endorsement for this view. It is predominantly the traditional loans provided by banks that stimulate real estate investment and drive up property prices. The shadow banking, if measured by Banks' Shadow, does not have a significant impact on real estate investment at all. The Nonbank Lending has a slightly positive effect on investment, but the magnitude is not comparable to bank loans. In terms of property prices, only traditional loans have a positive effect. The response of the house price to shadow financing is negative. This is not surprising, as households' property purchases are mainly financed by mortgages,

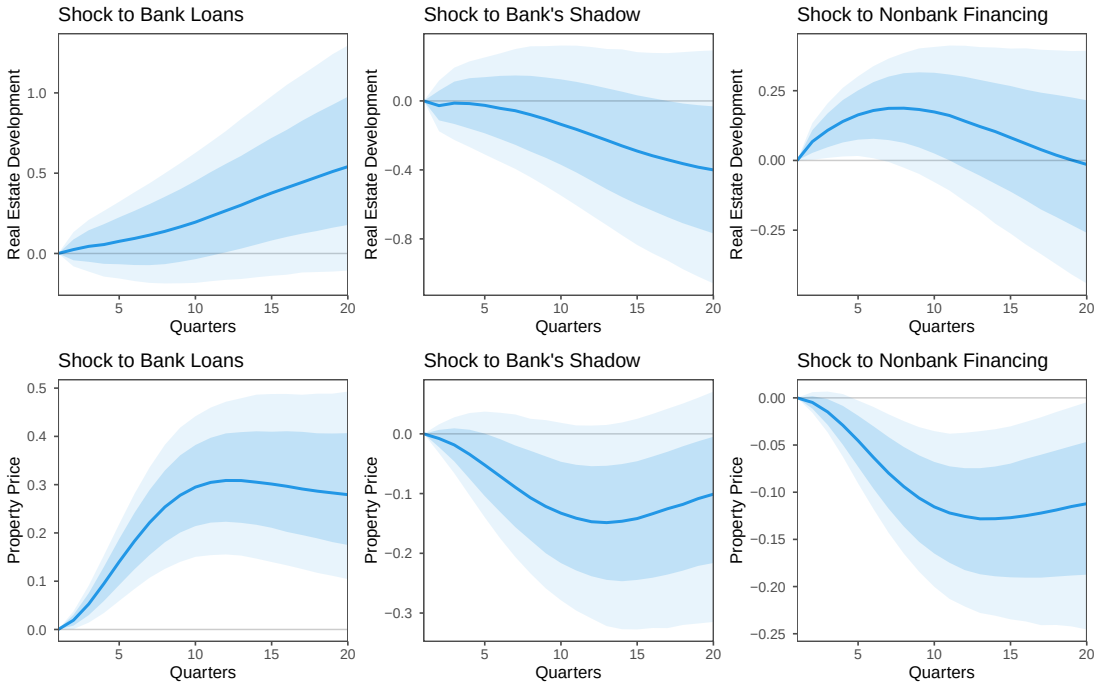
## Figure 6: Response of Price Levels to Financing Shocks




Notes: This figure shows the dynamic responses of consumer price index and producer price index to 1 SD positive shock to bank loans, Banks' Shadow, and Nonbank Lending, respectively. Solid lines represent the median responses; shaded areas represent the 68% and 90% credible bands. Vertical axes are in percentage points.

which are only available from banks. In short, the available evidence does not support the claim that shadow banking has contributed to the housing market bubble.

**Figure 7: Response of Real Estate Market to Financing Shocks**

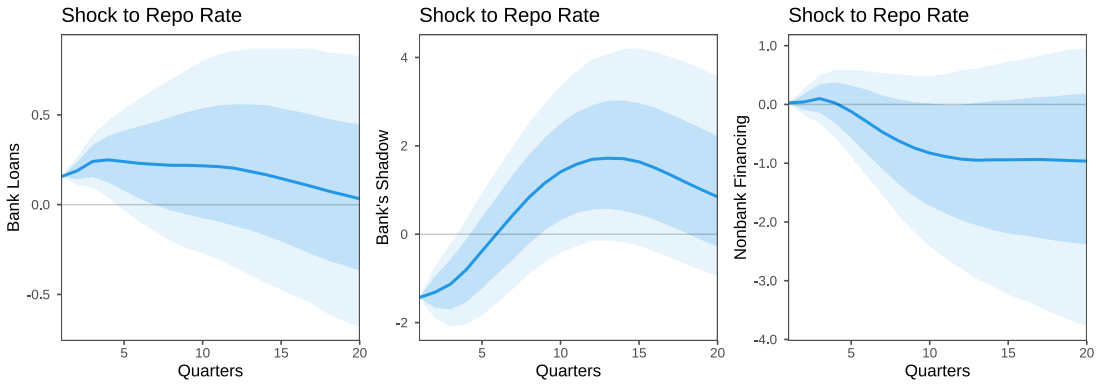



Notes: This figure shows the dynamic responses of real estate developing investment and residential property price index to 1 SD positive shock to bank loans, Banks' Shadow, and Nonbank Lending, respectively. Solid lines represent the median responses; shaded areas represent the 68% and 90% credible bands. Vertical axes are in percentage points.

**Sensitivity to interest rate shocks** Finally, I examine the lending behaviour of banks, whether through traditional loans or shadow products, in response to monetary policy shocks. China's monetary authority does not have a singular policy rate. This section focuses on the interbank repo rate (R007), which reflects the interbank liquidity condition and is increasingly becoming the target rate of the monetary authority. Results for other interest rates are provided in Figure B.3. Note that the model controls for both benchmark lending and deposit rates, thus isolating the effect of the interbank channel in the transmission of monetary policy. There is a notable divergence in the responses of conventional loans and Banks' Shadow to a tightening of liquidity conditions (Figure 8). The rise in interbank lending rates has led to a gradual decline in conventional loans. The Banks' Shadow, despite contracting initially, rebounds to higher levels eventually. It is not surprising that bank loans respond slowly to the interbank repo rate as they are

primarily governed by the benchmark lending rate. The behaviour of the Banks' Shadow is consistent with the discussion in Section 2. Banks that finance shadow investments with short-term funds acquired from WMPs highly rely on borrowing from the interbank market to fulfil liquidity needs when large numbers of WMPs mature. As a result, tightening interbank liquidity conditions initially shrink the size of the Banks' Shadow. However, as conventional lending becomes more restrictive, banks are turning to shadow lending over time.

**Figure 8: Response of Loans and Shadow Lending to Interest Rate Shocks**




Notes: This figure shows the dynamic responses of bank loans, Banks' Shadow, and Nonbank Lending to 1 SD positive shock to the interbank repo rate (R007). Solid lines represent the median responses; shaded areas represent the 68% and 90% credible bands. Vertical axes are in percentage points.

**Summary** In short, the findings from the impulse response analysis support the view that shadow banking channels funds to non-SOEs, in contrast to bank loans, which mainly finance SOEs. There is limited evidence to suggest that shadow banking contributes to real estate speculation or bubbles. The results are consistent with the theoretical predictions, that banks substitute shadow lending for traditional lending when monetary policy tightens.

Whether shadow banking improves the overall welfare remains contentious. My findings are in support of the claim that shadow banking improves the financing conditions for private firms. Given the well-known structural imbalance in the Chinese economy, which is heavily dependent on investment by state-owned enterprises, reallocating credit to private enterprises could improve efficiency. Nonetheless, this claim necessitates a caveat, as the potential risks associated with shadow banking have not been factored in. The unregulated shadow banking sector could expose the financial system to increased liquidity and credit risks that mostly fall outside the regulatory framework. It also un-

dermines the regulators' efforts to deleverage the economy and contain systemic risks. However, it is difficult to estimate how much of this risk is attributable to the shadow banking sector. Despite its rapid growth over the past decade, the size of the sector is moderate compared to developed economies. A simple correlation analysis shows that bank loans remain the main source of leverage (correlation: 0.48, measured by debt-to-GDP ratio), ahead of non-bank lending (correlation: 0.14) and Banks' Shadow (correlation: 0.07). This indicates that conventional bank loans are the primary cause of the high debt ratio, whereas the contribution of shadow banking is relatively minor.

# 5. Cross-Sectional Evidence

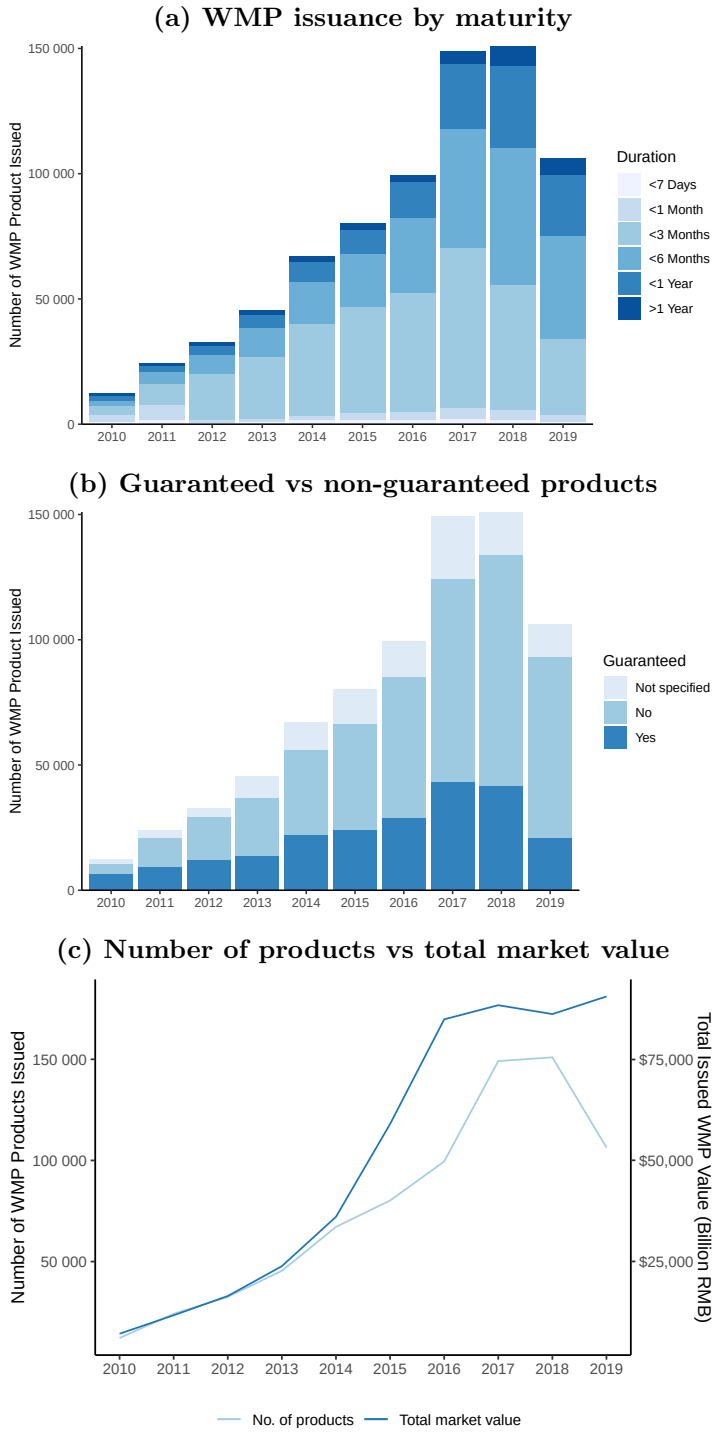
This section zeros in on analysing the impact of shadow banking at the micro level. A panel dataset is constructed with prefectural cities as observation units. Then I estimate a regression model to investigate how the local economic structure is affected by its exposure to shadow banking activities. The evidence offers further support to the financial liberalization hypothesis, showing that higher shadow banking exposure of a city leads to increased consumption, reduced investment, and a more vibrant private sector.

## 5.1. City-level Shadow Banking Exposure

There is no direct statistical data on shadow banking available at the prefectural city level. To construct cross-sectional variations of shadow banking exposure, I compute a "shift-share" measure for each city based on the banking industry's trend of WMP issuance, following the same methodology used by Bartik (1991) and Autor et al. (2013). WMP issuance serves as an approximation for shadow banking activities. Although not all shadow lending involves the issuance of WMPs, nor are all WMP issuances channelled to shadow banking, WMPs are nonetheless at the core of the shadow banking industry and constitute its most essential part. The approximation is the best estimate possible given the available data.

**The WMP data** I manually gathered data from WIND on WMP issuance from every bank between 2010 and 2019. A total of 770,255 WMPs were recorded during this period. Figure 9 characterises the WMP dataset. The majority of WMPs have a short-term maturity; almost 50% of them have a maturity period of less than 3 months, 80% have a maturity period of less than 6 months. Two-thirds of the WMPs offered neither return nor principal guarantees. Banks that offer guaranteed WMPs must record them on their

**Figure 9: WMP Issuance by Maturity and Guarantee Status**




Notes: The total number of Wealth Management Products (WMPs) is calculated from the WIND dataset of bank-level WMP issuances. The market value of outstanding WMPs is sourced from CBIRC's *Annual Report on China's Banking Wealth Management Market*.

balance sheets, as they are liable for the principal or returns. Non-guaranteed WMPs, on the other hand, can be recorded off the balance sheets. Therefore, banks have an incentive to provide non-guaranteed WMPs, even though investors often perceive these products as implicitly guaranteed by banks. The dataset does not provide information on the monetary value of each WMP issuance. Only the number of products issued during a specific period can be computed. Panel (c) compares the market value of all outstanding WMPs (reported by CBIRC, national aggregates) with the number of issuances (computed from the WIND dataset) each year. The trends mostly coincide before 2014, indicating a stable average size of WMPs during the period. However, the two trends diverge after 2014, suggesting that the size per WMP issuance is increasing. Although the value of WMPs in monetary terms would provide a more suitable measure, the data constraints only allow us to rely on the quantity of issued WMPs as a suboptimal choice.

The data for WMPs are recorded at the bank level. I calculate a city's exposure to WMP by utilizing the number of branches of every bank in that city. Let $k$ indicate the index of a bank, and $\text{WMP}_{kt}$ denote the number of WMPs issued by bank $k$ in year $t$. Assuming $B_{ik}$ is the number of branches of bank $k$ in city $i$, and $B_i = \sum_k B_{ik}$ is the total number of branches of all banks in the city. Then the shadow banking exposure of a city $i$ in a given year $t$ can be calculated as the following:

$$S_{it} = \sum_k \frac{B_{ik}}{B_i} \times \text{WMP}_{kt}.$$

In other words, a city's exposure to shadow banking activities increases in proportion to the amount of WMP issued by a particular bank, as well as the city's exposure to that bank.

The shadow banking exposure is then matched with other economic indicators at the city level, such as population, real output, fixed-asset investment,[3] retail consumption, household savings, etc. Most of the required data can be obtained from the local statistics bureau. To eliminate the disproportionate effects of outliers, I remove the extreme values falling below the 0.1 percentile and above the 99.9 percentile. The sample also excludes Xinjiang and Tibet as they are not comparable. Descriptive statistics for the dataset are reported in Table C.2.

[3]The NBS has ceased to publish the levels for fixed-asset investments since 2017, but keeps publishing the year-over-year growth rate. I derive the missing values from previous observations by using the growth rate.

## 5.2. Baseline Estimates: Finance and Economic Dynamism

I estimate the following regression model to explore the impact of banking and shadow banking activities on city-level economic dynamics:

$$\Delta Y_{it} = \alpha \Delta L_{it} + \beta \Delta S_{it} + X'_{it}\gamma + \delta_t + u_{it}.$$

Both dependent and independent variables are expressed as log-differences. To smooth out unpredictable yearly fluctuations, I group the sample into three-year periods (2011-2013, 2014-2016, 2017-2019), and compute the difference over a span of three years. Specifically, $\Delta Y_{it} = \frac{100}{3}[\ln(Y_{it}) - \ln(Y_{it-2})]$, which is expressed as annualised percentage growth. The key coefficient of interest is $\beta$, which captures the effect of a change in shadow banking exposure $S_{it}$. For comparison, the effect of shadow banking is contrasted with traditional bank loans $L_{it}$. Additionally, $X_{it}$ contains a rich set of city characteristics measured in the pre-sample period (2007-2009) interacted with the time fixed effects. In particular, I include the initial GDP per capita to account for the effect of varying economic development levels; population size to reflect the scale of the economy; distance to the coast, as coastal cities have more accessible transportation and foreign investment opportunities compared to inland cities; and the total number of bank branches, which serves as an indicator of the city's financial connectivity. By interacting these variables with the time fixed effect, the model accounts for fairly rich heterogeneities in economic trends across cities. $\delta_t$ is the time fixed effect. As the model is estimated in differences, it is not necessary to include the city fixed effect. The standard errors are clustered by province.

The baseline estimate is presented in Table 1. The dependent variables are, from left to right, real output, fixed asset investment, retail consumption, household savings, the number of medium-to-large industrial enterprises,[4] and the number of newly registered firms. I am particularly interested in the issue of "structural imbalance", that is, the dynamics of investment versus consumption, and the performance of large industrial enterprises versus private enterprises.

The result shows a clear contrast between the effects of conventional loans and shadow banking. There is a strong positive correlation between bank loans and fixed-asset investment, with a 1-percentage-point increase in bank loans driving up investment by 0.4 percentage points. However, an increase in shadow banking activity has only an insignificant and negative effect on investment. Both bank loans and shadow banking

[4]Specifically, medium-to-large industrial enterprises refer to those with annual turnover above 20 million RMB ($\approx$ 2.7 million USD).

**Table 1: Impact of Shadow Banking on City-Level Economic Dynamics**

| | $\Delta Y$ | $\Delta I$ | $\Delta C$ | $\Delta S$ | $\Delta N^{ind}$ | $\Delta N^{new}$ |
|---|---|---|---|---|---|---|
| $\Delta$Loan | 0.350*** | 0.383*** | 0.233 | 0.098*** | 0.486*** | 0.073 |
| | (0.089) | (0.098) | (0.143) | (0.020) | (0.114) | (0.096) |
| $\Delta$WMP | -0.015 | -0.196 | 0.128 | 0.128*** | -0.352** | 0.168* |
| | (0.136) | (0.135) | (0.136) | (0.021) | (0.147) | (0.102) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Control $\times$ Year | Yes | Yes | Yes | Yes | Yes | Yes |
| Num.Obs. | 768 | 768 | 768 | 768 | 768 | 768 |
| R2 Adj. | 0.240 | 0.375 | 0.126 | 0.526 | 0.264 | 0.180 |

Notes: This table shows the impact of changes in conventional loans and shadow financing available to a city on its economic outcomes. Dependent variables include output, fixed-asset investment, retail consumption, household savings, number of medium to large industrial firms, and number of newly registered firms. Changes are evaluated over three-year periods (2011-2013, 2014-2016, 2017-2019). Control variables include urban characteristics such as population, per capita income, coastal proximity, and the number of bank branches, all measured in the pre-sample period (2007-2009 average). Standard errors are clustered at the provincial level and reported in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

are positively correlated with consumption, with elasticities between 0.1 and 0.3, though neither of which is statistically significant. Bank loans and WMP issuance both contribute to household savings, with an estimated elasticity of around 0.1. This is in line with the FMC view. Notably, WMP issuance has a more sizeable impact on savings, underscoring the prominent role of WMPs as a high-yield saving option for households in lieu of traditional deposits. The contrasting dynamics between medium-to-large industrial enterprises (MLIEs for brevity) and newly registered firms are also striking. While increased bank lending is associated with more MLIEs — a 1-percentage-point increase in bank loans predicts almost 0.5-percentage-point increase in the number of MLIEs — it has no significant effect on new firms, which is a measure of small business dynamism. On the contrary, a higher level of shadow banking activity is negatively associated with the number of MLIEs, but it predicts a significantly higher number of newly registered firms — a 1-percentage-point increase in shadow banking activity predicts a 0.17-percentage-point increase in the number of newly registered firms. This evidence further confirms that shadow banking improves the financial condition of small, privately owned firms.

## 5.3. Robustness Checks and 2SLS Estimation

I probe the robustness of the result from various angles. The results are summarised in Figure 10 and more details are given in Appendix C.

The model assumes that all heterogeneities across cities have been controlled for, so that the difference in economic outcomes can only be attributed to differences in financing structure and idiosyncratic errors. However, it can be questioned whether the conditional set is comprehensive enough. For example, political influence is not factored in. The central government would introduce specific subsidies for extremely poor regions.

To address this concern, I re-estimate the model using a subsample of cities with relatively comparable levels of GDP per capita. Specifically, I retain only those observations with per capita income between 20,000 and 70,000 RMB. This results in a reduction of 30% of the original sample, focusing only on the central mass of the distribution. The subsample consists mainly of moderately prosperous cities. Consequently, we can reasonably expect similar levels of political support and other relevant aspects in these cities. The estimated coefficients, albeit slightly lower than the baseline, do not challenge the main conclusion.

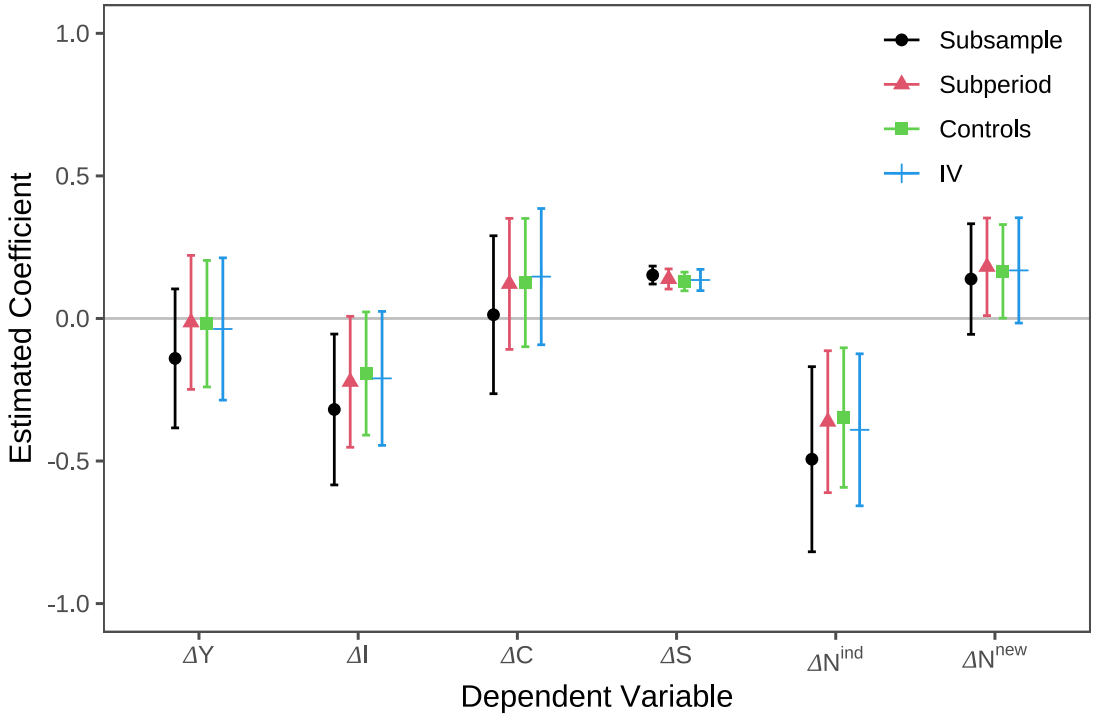
On the regulatory front, the first round of regulatory tightening targeting WMPs took place between 2013 and 2014. A further round of tightening was implemented in 2017. Therefore, there is a concern that observations before and after the regulatory changes are not comparable. To address this, I remove the early observations from the sample and keep only the more recent observations from 2014 to 2019. The estimates show no discernible changes, suggesting that the results are not biased by particular sample periods.

In the baseline, the possible business cycle dynamics are assumed to be fully captured by the time-fixed effect and the interaction terms, so there is no need to control for other time-varying variables. As a robustness check, I also include city-level changes in registered unemployment and the urbanisation rate. This reduces concerns about omitted variables that simultaneously affect the outcomes. The result shows that the inclusion of these additional controls does not significantly change the results.

Reverse causality is another potential concern. It is possible that a particular economic structure necessitates financing from shadow banks, rather than shadow banking activity influencing economic structure. To partially alleviate this concern, regressions can be done on lagged explanatory variables, which was found to not alter the result.

This concern can be further mitigated by using an instrumental variable. Research indicates that cities with ambitious investment plans in 2009, during the counter-GFC stimulus period, encountered difficulties in refinancing when monetary policies became

**Figure 10: Impact of Shadow Banking under Various Model Specifications**




Notes: This figure presents coefficients of shadow banking exposure $\beta$ estimated using different model specifications. The *Subsample* estimates are based on cities with GDP per capita between RMB 20,000 and 70,000. The *Subperiod* estimates focus on more recent periods (2013-2016 and 2017-2019). The *Controls* include spontaneous control variables such as changes in unemployment and urbanization. *IV* reports coefficients estimated using the predicted refinancing difficulty as an instrument. Standard errors are clustered at the provincial level. Bars represent 90% confidence intervals.

tighter in subsequent years (Chen et al., 2020). Based on this insight, I construct an instrument with a city's investment ratio in 2009 multiplied by the current interest rate,

$$\text{IV}_{it} = \frac{\text{FAI}_{i,2009}}{\text{GDP}_{i,2009}} \times r_t.$$

I use the 10-year treasury yield as a benchmark for the long-term borrowing rate. The IV is thus an indicator of the potential refinancing difficulty faced by city $i$ at time $t$. According to Chen et al. (2020), municipalities with more refinancing difficulties are more likely to resort to shadow banking. Therefore, this instrument correlates with the shadow banking measure $S_{it}$. Because the investment in 2009 is pre-determined and the interest rate is set nationally independently of local economic conditions, the instrument is orthogonal to $u_{it}$.

I do not claim the exclusion restriction though. When a municipality faces refinancing difficulty, resorting to shadow banking is only one of the many possible consequences. The local government may also reduce spending in response. However, other channels correlated with the instrument, if they have any effect on the outcome variables, would most likely have a negative impact. Therefore, estimating the model using the IV would provide us with a lower-bound estimate of the impact of shadow banking activity. The instrumental variable estimation turns out to be similar to the baseline, indicating the resilience of the baseline results.

In conclusion, the findings remain robust under different model specifications, including sub-sampling, additional controls, and the use of instrumental variables. Across all these specifications, greater shadow banking exposure corresponds to lowered fixed-asset investment, increased consumption, higher household savings and a more dynamic small business sector as measured by the number of newly registered firms. The results are consistent with the analysis in Sections 3 and 4 and provide additional support for the financial liberalisation hypothesis.

## 6. Conclusion

This paper analyses the mechanism of shadow banking in China, and provides various levels of evidence on its macroeconomic impact. It is demonstrated that shadow banking generally supports private investment and improves the dynamism of small and medium enterprises, as it mitigates the financing gap caused by the national policy of prioritising investment in state-owned enterprises and heavy industries.

The implications for the overall economy are complex. Shadow banking operates as an

endeavour to liberalise the financial system in a financially repressive context. My findings show that shadow banking channels funds to private firms that are under-financed by bank loans and enables a favourable transformation of the economic structure. In this respect, shadow banking is associated with general welfare improvements. There is no concrete evidence that it stimulates real estate speculation or bubbles. To the contrary, bank loans remain the main driver of national debt.

However, China's shadow banking system can hardly be considered a financial innovation or an advance in financial engineering. It is largely based on non-standard and opaque accounting practices that are used to hide assets and evade regulation. These practices make the system vulnerable to various risks and are in themselves unsustainable. As a result of stricter regulations imposed by the government since 2017, the growth of the shadow banking sector has slowed down considerably. However, the problem of structural imbalances in the economy remains to be addressed. Hopefully, future financial reforms will further liberalise the system and promote transparent and rule-based competition among financial institutions.

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# Appendix A Model Details

## Households

The representative household obtains utility from consumption goods $C_t$ and durable goods $H_t$, and disutility from labour $N_t$. The household's optimisation problem is

$$\max_{\{C_t,H_t,N_t\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_h^t \left[\ln C_t + \omega \ln H_t - \frac{\psi}{2} N_t^2\right]$$

subject to the budget constraint

$$C_t + q_t H_t + D_t + S_t = R_{t-1}^D D_{t-1} + R_{t-1}^S S_{t-1} + w_t N_t + d_t + T_t. \tag{1}$$

$q_t$ is the relative price of durable goods to consumption goods. The household thus chooses $C_t$, $H_t$, $N_t$ to maximise utility, taking $D_t$, $S_t$, $R_t^D$, $R_t^S$ as given. The latter are determined by the bank or the monetary authority. $d_t$ is the dividend received from the bank. $T_t$ is a lump sum transfer to the household to make the model flow consistent.

Assume $\lambda_t$ is the Lagrangian multiplier associated with the budget constraint. The first-order conditions are:

$$\begin{aligned} \frac{1}{C_t} - \lambda_t &= 0, \\ \frac{\omega}{H_t} - \lambda_t q_t &= 0, \\ -\psi N_t + \lambda_t w_t &= 0. \end{aligned}$$

Substituting out $\lambda_t$, we have

$$\omega \left(\frac{C_t}{H_t}\right) = q_t, \tag{2}$$

$$\psi N_t C_t = w_t. \tag{3}$$

## Firms

**The $k$-firm** The $k$-firm, the capital (durable goods) producer finances its working capital entirely from bank loans. Therefore, the production function is

$$Y_{k,t} = L_{k,t}^{\alpha} N_{k,t}^{1-\alpha}. \tag{4}$$

The firm maximises its profit by choosing the optimal level of capital and labour inputs.

$$\max_{L_{kt},N_{kt}} \; q_t Y_{k,t} - r_t^L L_{k,t} - w_t N_{k,t} - \Upsilon(L_{k,t}, L_{k,t-1})$$

$\Upsilon$ is the cost of adjusting capital stock, which is included to smooth out the responses to changes in financial conditions. In particular,

$$\Upsilon(K_t, K_{t-1}) = \frac{\kappa}{2}\left(\frac{K_t}{K_{t-1}} - 1\right)^2.$$

The $k$-firm faces no credit constraint. The interest rate and the wage rate are determined competitively, i.e. by the marginal product of factor input. First-order conditions with respect to $L_{kt}$ ,$N_{kt}$ gives

$$r_t^L = \alpha q_t \frac{Y_{k,t}}{L_{k,t}} - \Upsilon_{L_t}, \tag{5}$$

$$w_t = (1-\alpha) q_t \frac{Y_{k,t}}{N_{k,t}}. \tag{6}$$

**The $c$-firm** The $c$-firm, the producer of consumer goods, faces a credit constraint from bank loans. It is assumed that only a small fraction of bank loans is rationed to the $c$-firm, forcing it to borrow shadow products. Let $L_{c,t}$ denote the bank loans to the $c$-firm; and let $B_t$ denote the shadow borrowing. The optimisation problem of the $c$-firm is given by

$$\max_{L_{ct},B_t,N_{ct}} \; Y_{c,t} - r_t^L L_{c,t} - r_t^B B_t - w_t N_{c,t} - \Upsilon((L_c + B)_t, (L_c + B)_{t-1})$$

subject to

$$\begin{aligned} &Y_{c,t} = (L_{c,t} + B_{c,t})^{\gamma} N_{c,t}^{1-\gamma}, \\ &L_{c,t} \leq \theta L_t. \end{aligned} \tag{7}$$

The share of consumer credit cannot exceed $\theta$ of total bank loans. The quota $\theta$ is an exogenous parameter, independent of the firm's collateral or profits. Nevertheless, this setup is in line with the institutional fact that the total credit is rationed by the authority to mostly finance state-owned enterprises (the $k$-firm).

Assume $\mu_t$ is the Lagrangian associated with the borrowing constraint. First-order conditions are given by

$$r_t^B = \gamma \frac{Y_{c,t}}{L_{c,t} + B_{c,t}} - \Upsilon_B, \tag{8}$$

$$r_t^L + \mu_t = \gamma \frac{Y_{c,t}}{L_{c,t} + B_{c,t}} - \Upsilon_L, \tag{9}$$

$$w_t = (1 - \gamma) \frac{Y_{c,t}}{N_{c,t}}, \tag{10}$$

$$\mu_t (L_t^c - \theta_L L_t) = 0. \tag{11}$$

The market clearing conditions imply all goods produced by the firms are consumed by the households, all loans and shadow bonds supply by the bank are used by the firms, and labour supply equals labour demand.

$$C_t = Y_{c,t}, \tag{12}$$

$$H_t = Y_{k,t}, \tag{13}$$

$$L_t = L_{c,t} + L_{k,t}, \tag{14}$$

$$N_t = N_{c,t} + N_{k,t}. \tag{15}$$

## Banks

For simplicity, it is assumed that traditional loans are fully funded by deposits $L_t = D_t$, shadow bonds are fully funded by shadow deposits $B_t = S_t$, and the bank pledges all its capital as reserves, $G_t = K_t$. The bank maximises expected dividend payment streams:

$$\max_{\{L_t, B_t, G_t, d_t\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta_b^t \ln(d_t)$$

subject to

$$(R_t^L - R_t^D) L_t + (R_t^B - R_t^S) B_t = G_{t+1} - (1 - \delta) G_t + \Psi^L(L_t, G_t) + \Psi^B(B_t, G_t) + d_{t+1}. \tag{16}$$

To grow the size of lending, the bank has to accumulate capital. The cost of lending depends on the reserve requirement. The cost function is designed to incur infinite loss

if the bank violates the reserve requirement.

$$\Psi^L(L_t, G_t) = -\nu \ln\left(\frac{G_t}{\omega_L L_t} - \mu_L\right) L_t,$$
$$\Psi^B(B_t, G_t) = -\nu \ln\left(\frac{G_t}{\omega_B B_t} - \mu_B\right) B_t.$$

The first-order conditions are given by

$$R_t^L - R_t^D = \Psi_L^L(L_t, G_t), \tag{17}$$
$$R_t^B - R_t^S = \Psi_B^B(B_t, G_t), \tag{18}$$
$$(1-\delta) - \Psi_G^L(L_t, G_t) - \Psi_G^B(B_t, G_t) = \frac{1}{\beta_b}\mathbb{E}_0\left[\frac{d_{t+1}}{d_t}\right]. \tag{19}$$

Therefore, given the capital requirements for each asset, the bank optimally chooses the amount of loans and bonds it provides to the economy, and in the meantime issues the corresponding deposits and shadow assets as its liabilities. The latter determines the total financial wealth available to the households.

$$L_t = D_t, \tag{19}$$
$$B_t = S_t. \tag{20}$$

## Monetary and Fiscal Policies

The monetary authority sets the deposit rate exogenously. This is a simplification, but it also corresponds to the reality that deposit rates are rigidly set by the authority and do not reflect the actual return opportunities. The competitive market sets interest rates on loans and bonds according to the marginal return on capital for firms. The bank's optimisation behaviour determines the spread between the lending and savings rates. The deposit rate is regulated. The interest rate on shadow assets is left as a degree of freedom.

$$r_t^d = \bar{r} + \epsilon_{r,t}. \tag{21}$$

The fiscal authority collects all charges on bank reserves, the cost to banks due to capital requirements, and transfers them to the household so that the flows are consistent within the economy.

$$T_t = r_t^L L_{kt} + r_t^B(L_{ct} + B_t) - r_t^D D_t - r_t^S S_t - d_t. \tag{22}$$

## Equilibrium

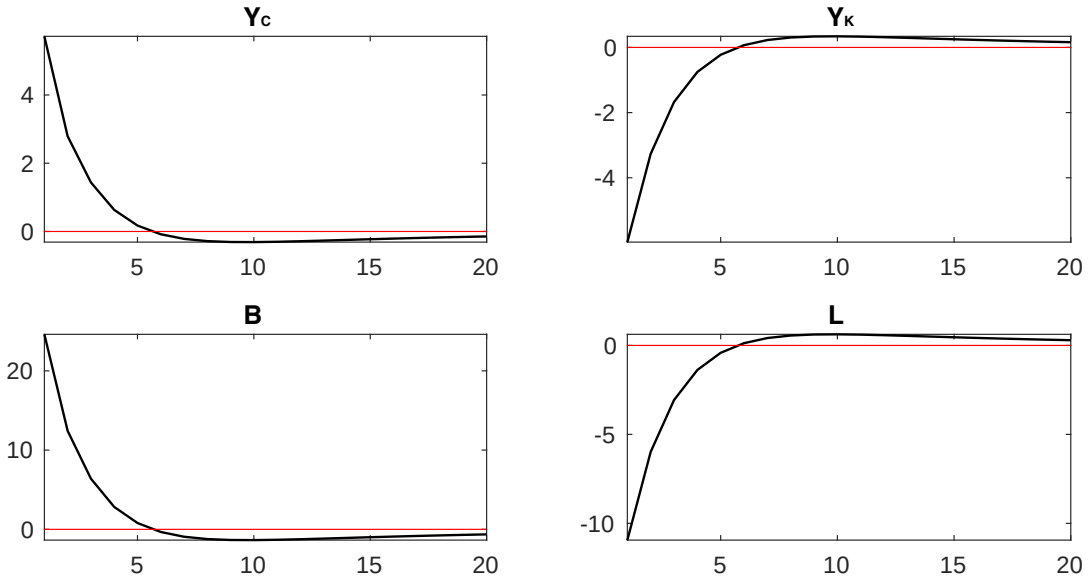
The equilibrium is an allocation $\{C_t, H_t, Y_{ct}, Y_{kt}, L_{ct}, L_{kt}, N_{ct}, N_{kt}, N_t, L_t, B_t, D_t, S_t, G_t, d_t, d_{t+1}\}_{t=0}^{\infty}$ together with the sequence of values $\{R_t^L, R_t^B, R_t^D, R_t^S, w_t, q_t, \mu_t\}_{t=0}^{\infty}$ satisfying equations (1) to (22) and the market clearing conditions for goods ($C_t = Y_{ct}$, $H_t = Y_{kt}$), labour ($N_t = N_{ct} + N_{kt}$), assets and liabilities ($L_t = L_{ct} + L_{kt} = D_t$, $B_t = S_t$), given the predetermined values and the sequence of monetary shocks $\epsilon_{r,t}$. There are 22 endogenous variables and 22 equations, the system should be exactly solved.

## Calibration and Numeric Simulation

For a quick calibration, in reality the ratio of final consumption to GDP is about 60% and the ratio of gross investment to GDP is about 40%, implying $H/C$=0.67, hence $\omega = 0.67$. State-owned enterprises account for about 70% of total bank credit, therefore $\theta = 0.3$. For the parameters of the banks, setting $v = 0.003$, risk weight $\omega = 0.6$, capital requirement $\mu = 0.15$ gives a bank equilibrium close to reality, where the capital adequacy ratio is about 15% and the size of shadow assets is about 50% of traditional loans. Use interest rates as observables and calibrate the production parameters. Set $r^D = 0.02$, $r^S = 0.055$, $r^L = 0.06$, $r^B = 0.075$. This gives calibrated values of $\alpha = 0.45$, $\gamma = 0.58$. Setting $\psi = 0.001$ gives an employment ratio of $k$-firm to $c$-firm of 55%. For the capital adjustment function, set $\kappa = 0.1$.

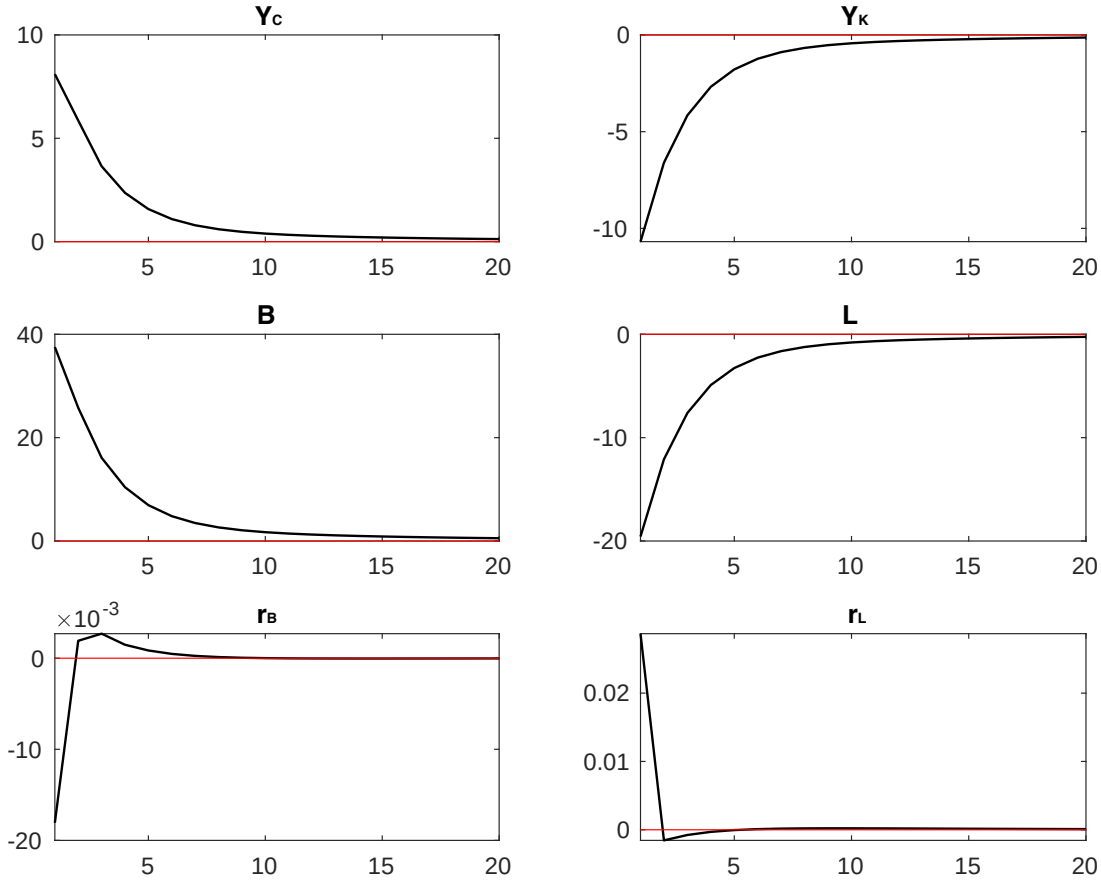
I simulate the model in Dynare and obtain the response of the endogenous variables to shocks to either reserve requirements or interest rates (reported in Figure A.1 and Figure A.2, respectively). In both cases, the bank optimally substitutes shadow lending for traditional loans. The change in the financing structure further triggers a change in the production structure. As the $c$-firm obtains more funds from shadow banking, it produces more consumer goods. Meanwhile, as the supply of traditional loans tightens, the $k$-firm shrinks its output. The result is an overall higher ratio of consumption to total output.

**Figure A.1: Response to Tightening Reserve Requirement**




Notes: The figure shows the response of consumption goods output $Y_c$, capital goods output $Y_k$, shadow lending $B$ and bank loans $L$ to a 5 percentage point increase in the reserve requirement on bank loans. Values are expressed as percentage deviations from steady states.

**Figure A.2: Response to Tightening Interest Rate**



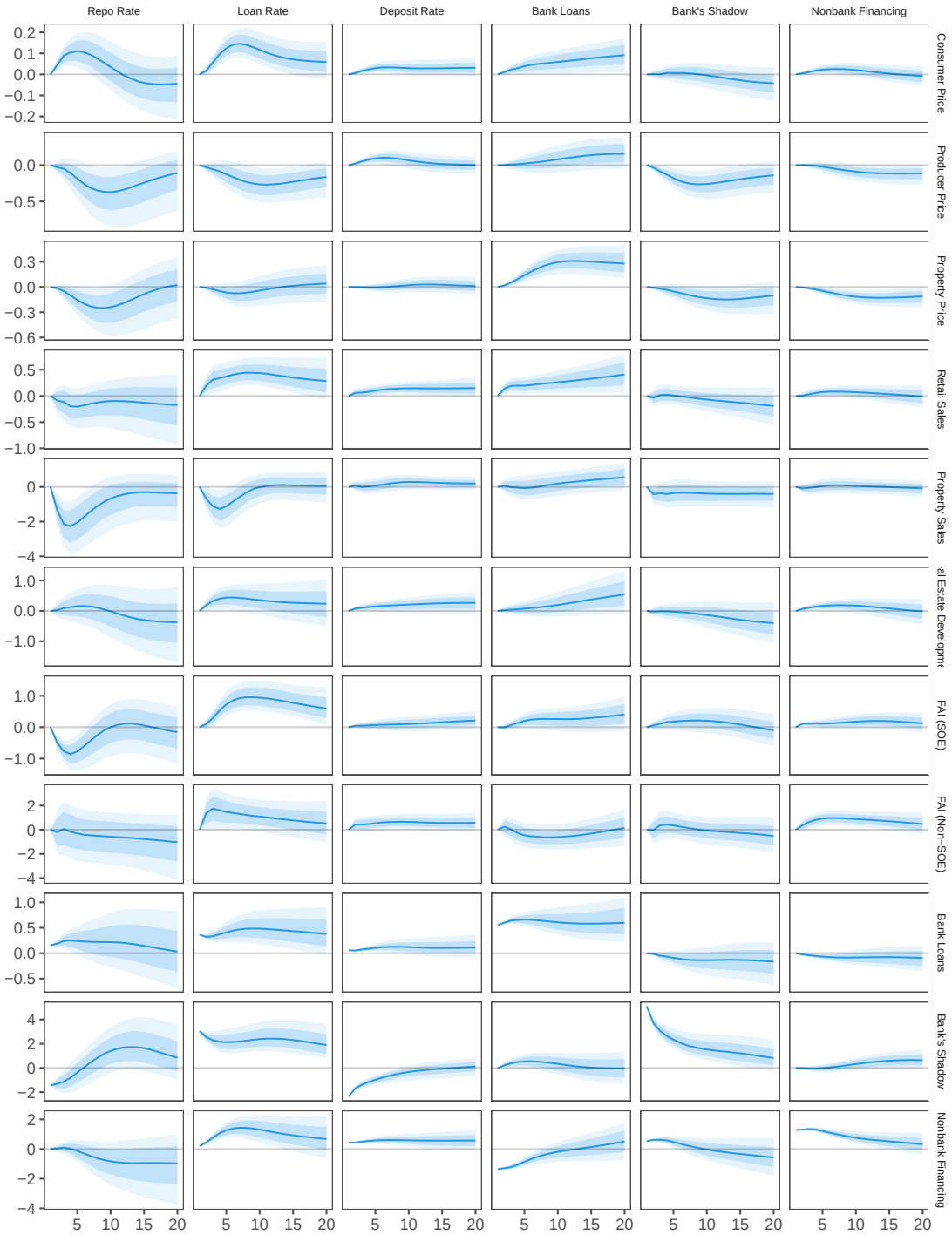

Notes: The figure shows the response of consumption goods output $Y_c$, capital goods output $Y_k$, shadow lending $B$, bank loans $L$, interest rate on bank loans $r^L$ and bonds $r^B$ to one basis point increase in the deposit rate. Values are expressed as percentage deviations from steady states.

# Appendix B Supplements to SVAR

**Table B.1: Construction and Description of Key Variables**

| Variable | Description (Source: CEIC unless specified otherwise) |
|---|---|
| Consumer Price Index | Quarterly series averaged from monthly observations. Seasonally adjusted. |
| Producer Price Index | Quarterly series averaged from monthly observations. Seasonally adjusted. |
| Property Price Index | The index is based on the Price Index of Newly Constructed Residential Buildings in 70 Cities published by NBS. The index has been published since 1998. Until 2005 it covered 35 major cities. Since 2005 it extended to cover 70 medium and large cities. Since 2011, NBS changed the methodology of calculating the price index. The price index used here is a concatenation of the three series. The index is constructed based on the YoY series (prior-2015) and the MoM series (post-2005). The index is normalized against 2010 Q4 and seasonally adjusted. |
| Retail Sales of Consumer Goods | Adapted from the monthly YTD series. Seasonally adjusted and deflated by CPI. |
| Commodity Buildings Sold | AKA Property Sales. Adapted from the monthly YTD series. Seasonally adjusted and deflated by the Property Price Index. |
| Real Estate Investment | Investment in real estate development refers to investment by real estate developers, building construction companies, etc. Adapted from the monthly YTD series. This series differs from the last one as it mainly concerns the land purchases and construction investment from developers' side. Seasonally adjusted and deflated by the Property Price Index. |
| Fixed Asset Investment | Adapted from monthly YTD series. For separate SOE and Non-SOE FAI series, data are only available from 2004. Early values are linearly extrapolated. FAI series are seasonally adjusted and deflated by PPI, since FAI Price Index is highly correlated with PPI and the latter has more observations. |
| 7-Day Interbank Repo Rate | The volume-weighted daily average of collateralized borrowing rates between depository institutions. The quarterly data are averaged from the monthly series in CEIC. The interbank repo market was started in 1996 as a market-based borrowing channel for banks. The 7-day repo rate has become the key operating target of PBC's open market operations in recent years. The series is not seasonally adjusted. |
| 1-Year Benchmark Loan Rate | Benchmark lending rate for 1-year or shorter loans. Averaged from monthly series. The benchmark rate is the policy guidance rate for bank loans but does not necessarily reflect the average actual lending rate. PBC abandoned the benchmark lending rate in favor of Loan Prime Rate (LPR) in 2019. This paper uses the 1-year benchmark loan rate as the proxy for bank lending rate for data availability and consistency. The series is not seasonally adjusted. |
| 1-Year Benchmark Deposit Rate | Benchmark deposit rate for 1-year time deposits. Averaged from monthly series. PBC has set to reform the deposit rate to be market-oriented in 2022. Non-seasonally adjusted. |
| Bank Loans | Adapted from the monthly series. Seasonally adjusted. |
| Banks' Shadow | Adapted from Sun (2019)'s dataset based on the balance-sheet deduction method. Updated with the latest data. Early values are linearly extrapolated. Seasonally adjusted. |
| Nonbank Financing | Adapted from Higgins and Zha (2015)'s dataset. Updated with the latest data. Early values are linearly extrapolated. Seasonally adjusted. |

## Figure B.3: Full Impulse Responses



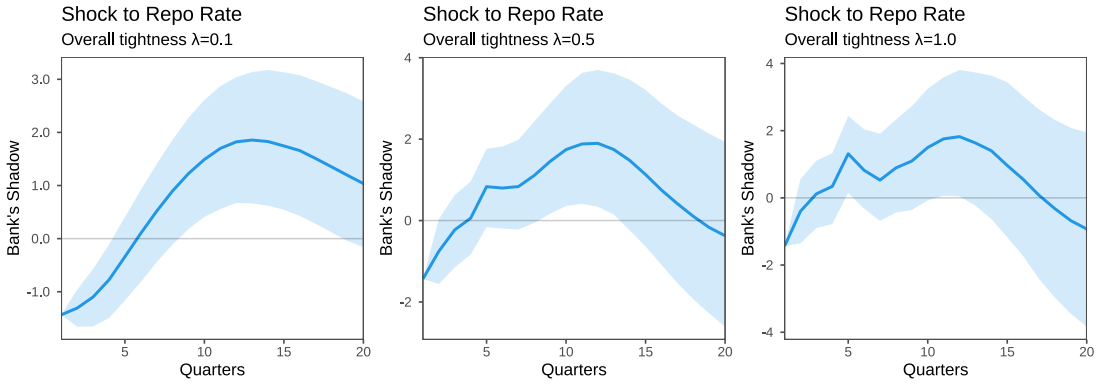
## Prior Tightness

This section examines the sensitivity of the main results to alternative priors. A crucial parameter to consider is the overall tightness $\lambda_1$, which plays an important role in determining the trade-off between incorporating prior information and relying on the observed data. A smaller value of $\lambda_1$ indicates greater reliance on prior information, while a large value gives more weight to the observed data.

As an illustration, Figure B.4 shows the response of the Bank's Shadow to a shock in the repo rate under different levels of prior tightness. It is notable that despite the different levels of tightness, the main results of the analysis remain consistent. This implies that the overall conclusions drawn from the estimation are robust and not significantly affected by the choice of prior tightness.

However, the degree of tightness has an observable effect on the volatility of the response. As the prior tightness increases, the response becomes smoother. This can be attributed to the fact that a tighter prior constrains the estimation closer to the prior beliefs, resulting in a more constrained and predictable response. On the other hand, a looser prior allows for more flexibility in the estimation process, potentially leading to a more volatile and jagged response.

**Figure B.4: IRFs under Different Prior Tightness Levels**



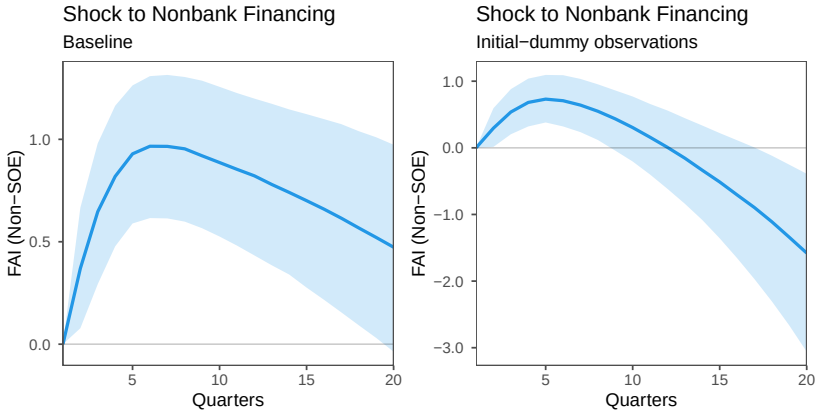

## Dummy Initial Observations

Bayesian inference is not particularly undermined by the presence of unit roots in the endogenous variables. However, the literature suggests the use of "dummy initial observations" for unit root and cointegration processes. "Dummy initial observations" in Bayesian estimation refer to the inclusion of artificial or dummy observations at the beginning of the dataset. These observations are added to the data to incorporate prior

beliefs about the behaviour of the variables being estimated. The purpose of including these artificial observations is to influence the estimation process to produce results consistent with certain assumptions, such as unit roots and cointegration processes.

I re-estimate the model using dummy initial observations with a tightness parameter of 0.1. The result is compared with the baseline in Figure B.5, focusing on the response of non-SOE investment as an example. The trend of the response in the short run remains unchanged when using dummy initial observations. However, for longer horizons, the response shows an explosive behaviour. It is worth noting that this explosive behaviour is a common problem associated with dummy initial observations. Taking this into account, we can conclude that the main results of the analysis remain unchallenged, at least for the near horizon.

**Figure B.5: IRFs Estimated with Dummy Initial Observations**



# Appendix C Additional Robustness Results

**Table C.2: Summary Statistics for City-level Variables**

| | | 2013 | | 2016 | | 2019 | |
|---|---|---|---|---|---|---|---|
| | N | mean | sd | mean | sd | mean | sd |
| GDP per capita (RMB th) | 768 | 49.55 | 36.68 | 53.21 | 28.49 | 63.19 | 34.20 |
| GDP (RMB bn) | 768 | 226.34 | 281.59 | 272.45 | 358.87 | 338.34 | 466.92 |
| Industrial Output (RMB bn) | 768 | 112.47 | 122.51 | 119.99 | 134.91 | 133.09 | 157.47 |
| Service Output (RMB bn) | 768 | 95.29 | 165.68 | 131.67 | 231.97 | 182.61 | 322.45 |
| Fixed-Asset Investment (RMB bn) | 768 | 122.67 | 123.98 | 166.47 | 163.06 | 170.94 | 165.92 |
| Consumer-Good Retail (RMB bn) | 768 | 178.09 | 571.21 | 195.35 | 651.98 | 278.36 | 982.35 |
| Gov Revenue (RMB bn) | 768 | 21.36 | 42.08 | 26.28 | 58.56 | 30.49 | 66.64 |
| Gov Expenditure (RMB bn) | 768 | 33.63 | 47.02 | 45.49 | 68.58 | 58.07 | 81.82 |
| Total Wages (RMB bn) | 768 | 29.75 | 59.49 | 38.35 | 79.83 | 49.22 | 111.05 |
| Total Savings (RMB bn) | 768 | 156.44 | 240.27 | 202.27 | 286.09 | 278.17 | 383.94 |
| Total Loans (RMB bn) | 768 | 245.52 | 491.09 | 338.63 | 664.91 | 496.32 | 940.55 |
| Population (mn) | 768 | 4.55 | 3.20 | 4.66 | 3.30 | 4.71 | 3.34 |
| No. Industrial Enterprises (th) | 768 | 1.32 | 1.52 | 1.34 | 1.48 | 1.33 | 1.68 |
| No. New Registered Firms (th) | 768 | 34.74 | 31.77 | 55.02 | 54.96 | 81.42 | 85.33 |
| No. WMP Issuance | 768 | 1521.51 | 218.82 | 1436.96 | 213.59 | 1936.27 | 312.35 |
| No. Bank Branches | 768 | 477.87 | 485.13 | 465.89 | 479.04 | 470.57 | 479.82 |
| Urbanisation (%) | 759 | 52.67 | 14.26 | 56.03 | 13.37 | 59.49 | 12.36 |

**Table C.3: Panel Regressions with Subsample**

| | $\Delta Y$ | $\Delta I$ | $\Delta C$ | $\Delta S$ | $\Delta N^{ind}$ | $\Delta N^{new}$ |
|---|---|---|---|---|---|---|
| $\Delta$Loan | 0.318*** | 0.368*** | 0.249 | 0.098*** | 0.481*** | 0.118 |
| | (0.085) | (0.089) | (0.155) | (0.024) | (0.124) | (0.099) |
| $\Delta$WMP | -0.074 | -0.247* | 0.018 | 0.146*** | -0.452*** | 0.139 |
| | (0.138) | (0.146) | (0.127) | (0.020) | (0.168) | (0.108) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Control × Year | Yes | Yes | Yes | Yes | Yes | Yes |
| Num.Obs. | 681 | 681 | 681 | 681 | 681 | 681 |
| R2 Adj. | 0.295 | 0.368 | 0.115 | 0.510 | 0.285 | 0.194 |

Notes: This table shows the impact of changes in conventional loans and shadow financing available to a city on its economic outcomes. Dependent variables include output, fixed-asset investment, retail consumption, household savings, number of medium to large industrial firms, and number of newly registered firms. Changes are evaluated over three-year periods (2011-2013, 2014-2016, 2017-2019). Control variables include urban characteristics such as population, per capita income, coastal proximity, and the number of bank branches, all measured in the pre-sample period (2007-2009 average). The subsample includes only observations with per capita income between 20,000 and 70,000 RMB. Standard errors are clustered at the provincial level and reported in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

**Table C.4: Panel Regressions with Recent Periods Only**

| | $\Delta Y$ | $\Delta I$ | $\Delta C$ | $\Delta S$ | $\Delta N^{ind}$ | $\Delta N^{new}$ |
|---|---|---|---|---|---|---|
| ΔLoan | 0.379*** | 0.431*** | 0.260 | 0.074*** | 0.543*** | 0.036 |
| | (0.110) | (0.113) | (0.170) | (0.024) | (0.153) | (0.116) |
| ΔWMP | -0.014 | -0.222 | 0.121 | 0.138*** | -0.362** | 0.181* |
| | (0.143) | (0.139) | (0.139) | (0.021) | (0.151) | (0.104) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Control × Year | Yes | Yes | Yes | Yes | Yes | Yes |
| Num.Obs. | 513 | 513 | 513 | 513 | 513 | 513 |
| R2 Adj. | 0.164 | 0.206 | 0.042 | 0.437 | 0.178 | 0.222 |

Notes: This table shows the impact of changes in conventional loans and shadow financing available to a city on its economic outcomes. Dependent variables include output, fixed-asset investment, retail consumption, household savings, number of medium to large industrial firms, and number of newly registered firms. Changes are evaluated over three-year periods (2014-2016, 2017-2019). The subsample discards the early period (2011-2013) compared to the baseline. Standard errors are clustered at the provincial level and reported in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

**Table C.5: Panel Regressions with Simultaneous Controls**

| | $\Delta Y$ | $\Delta I$ | $\Delta C$ | $\Delta S$ | $\Delta N^{ind}$ | $\Delta N^{new}$ |
|---|---|---|---|---|---|---|
| ΔLoan | 0.339*** | 0.357*** | 0.275* | 0.102*** | 0.466*** | 0.070 |
| | (0.092) | (0.101) | (0.144) | (0.021) | (0.115) | (0.095) |
| ΔWMP | -0.018 | -0.193 | 0.126 | 0.130*** | -0.348** | 0.165* |
| | (0.135) | (0.131) | (0.137) | (0.020) | (0.149) | (0.100) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Control × Year | Yes | Yes | Yes | Yes | Yes | Yes |
| Add. Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Num.Obs. | 759 | 759 | 759 | 759 | 759 | 759 |
| R2 Adj. | 0.250 | 0.372 | 0.131 | 0.528 | 0.256 | 0.176 |

Notes: This table shows the impact of changes in conventional loans and shadow financing available to a city on its economic outcomes. Dependent variables include output, fixed-asset investment, retail consumption, household savings, number of medium to large industrial firms, and number of newly registered firms. Changes are evaluated over three-year periods (2011-2013, 2014-2016, 2017-2019). Control variables include urban characteristics such as population, per capita income, coastal proximity, and the number of bank branches, all measured in the pre-sample period (2007-2009 average). Simultaneous controls include time-varying registered unemployment and urbanisation rate. Standard errors are clustered at the provincial level and reported in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.

**Table C.6: 2SLS Estimation with Instrumental Variable**

| | $\Delta Y$ | $\Delta I$ | $\Delta C$ | $\Delta S$ | $\Delta N^{ind}$ | $\Delta N^{new}$ |
|---|---|---|---|---|---|---|
| $\Delta$Loan | 0.359*** | 0.391*** | 0.223 | 0.093*** | 0.505*** | 0.071 |
| | (0.092) | (0.102) | (0.144) | (0.020) | (0.115) | (0.099) |
| $\Delta$WMP | -0.037 | -0.210 | 0.147 | 0.135*** | -0.391** | 0.169 |
| | (0.152) | (0.143) | (0.145) | (0.023) | (0.162) | (0.112) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Control × Year | Yes | Yes | Yes | Yes | Yes | Yes |
| 1st-Stage F Stat | 4.349 | 4.349 | 4.349 | 4.349 | 4.349 | 4.349 |
| Num.Obs. | 768 | 768 | 768 | 768 | 768 | 768 |
| R2 Adj. | 0.241 | 0.375 | 0.126 | 0.526 | 0.270 | 0.179 |

Notes: This table shows the impact of changes in conventional loans and shadow financing available to a city on its economic outcomes. Dependent variables include output, fixed-asset investment, retail consumption, household savings, number of medium to large industrial firms, and number of newly registered firms. Changes are evaluated over three-year periods (2011-2013, 2014-2016, 2017-2019). Control variables include urban characteristics such as population, per capita income, coastal proximity, and the number of bank branches, all measured in the pre-sample period (2007-2009 average). The shadow banking measure, $\Delta$WMP, is instrumented by the predicted local exposure to refinancing difficulty (see Section 5.3). Standard errors are clustered at the provincial level and reported in parentheses. $^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$.