China’s Easily Overlooked Monetary Transmission Mechanism: Real Estate Monetary Reservoir

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Abstract

While the traditional monetary transmission mechanism usually uses the equity and capital markets as monetary reservoirs, due to China’s unique fiscal and financial system, the real estate sector has become China’s ‘invisible’ non-traditional monetary reservoir for many years. Firstly, based on the perspective of the real estate sector as a monetary reservoir, this paper constructs a dynamic general equilibrium model that includes fiscal investment and financing and uses Chinese housing market data as well as central bank data on refinancing rates to financial institutions and GDP data for parameter estimation. We reveal the laws of the monetary transmission mechanism of the monetary reservoir-fiscal financing investment: Firstly, there is a commitment to pay and the existence of government utility. Secondly, local governments have an incentive to carry out credit expansion and investment and also financing operations through money pool assets, and there is a financing effect when the tax return on fiscal investment is higher than fiscal financing. Thirdly, the bubble effect is greater than the financing effect and it will push the monetisation of fiscal deficits when the financing effect is greater than the bubble effect and then the economic growth masks the credit expansion of local governments. In order to address the problem of monetary transmission mechanism under the perspective of real estate monetary reservoir, this paper carries out the design of a de-bubble financing mechanism for monetary reservoir assets.

Keywords: Monetary Policy, DSGE Model

1. Introduction

Since the financial crisis in 2008, both the Chinese housing market and the US equity market have entered a period of prosperity significantly higher than the price levels of consumer and industrial goods, and as the rapid price and market value inflation of these assets relative to other assets has coincided with

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the easing monetary policy cycles in China and the US, the notion that "Chinese housing and US stocks" are "monetary reservoirs" has spread. The term "monetary reservoirs" has become widespread. Figure 1 illustrates the level of cumulative premium increases in the two markets relative to the PPI and CPI, the US Federal Reserve’s initiation of quantitative easing since 2009 and China’s offsetting of additional US dollar issuance through RMB over-issuance in order to maintain its export price advantage. The trends in both the US and China have certain commonalities as well as individual characteristics. The commonality between the US and China is that both the housing and stock markets have experienced significantly higher price increases to the CPI and PPI, particularly in China, where the price premium to consumer prices has accumulated to over 45 times in less than a decade, and to around 5 times for industrial goods. This phenomenon is also present in the US, but the level of premium accumulation is much lower than in China. On the other hand, there are also significant differences between the two. Firstly, the increase in asset prices is much higher in China than in the US, and secondly, in China the real estate sector acts as a reservoir of money, whereas in the US it is the stock market that performs this 'function'. Indeed, the US real estate sector also absorbed much of the excess money and speculative capital before the bursting of the mortgage-backed securities bubble in 2008, and the US equity market became a currency reservoir asset in large part because of the US government’s heavy-handed regulatory measures on housing securitisation.

The main feature of the money pool asset phenomenon is a counter-cyclical boom in the money pool sector. The main rationale for the view that accommodative monetary policy is a money pool is that the central bank’s monetary easing cycle largely coincides with the rise in the prices of money reservoir assets, but at best this suggests a correlation between the money reservoir phenomenon and the accommodative monetary policy of the central bank. However, at best, this suggests a correlation between the money reservoir phenomenon and the central bank’s accommodative monetary policy, but it does not explain the following questions: (i) why, under the same conditions of monetary excess, did the "money pool" assets stand out and show a significant increase in premiums? (ii) Did all the new market value of the "money pool" in aggregate come from central bank monetary easing? The significance of the first question lies in the fact that if money reservoir assets have the characteristic of naturally attracting excess money, on the one hand they can help alleviate inflation and serve the real economy with their financing effect, but on the other hand they can lead to serious asset price bubbles and eventually to serious systemic financial crises.

One possible explanation for this phenomenon is that the particularities of a particular sector have led to an increase in the issuance of money outside the central banking system, and one of the supporting arguments for this is that the premium increase in the Chinese housing market relative to the PPI and CPI is much higher than the level of the premium increase in the US stock market. If the Chinese central bank is subject to both economic growth and imported inflation, then the level of the monetary reservoir asset premium should not be too different from that of the PPI, CPI or the US monetary reservoir asset.
premium, which for example tops out at around twice the level in the US, while the Chinese housing market premiums relative to the CPI and PPI reach 45 and 5 times respectively, a phenomenon that is difficult to explain even given China’s higher economic growth rate. Another support is that within China the stock market and the housing market also show significantly different premium trends, with the cumulative increase in the Chinese stock market from 2009 to 2017 being at a premium to the price levels of consumer and industrial goods but not far apart, while the real estate sector is characterised by an extremely pronounced “one-upmanship” among the various asset markets in China, showing significant structural differentiation. Both horizontal and vertical comparisons suggest that the extraordinary boom in China’s real estate sector cannot be explained solely by the central bank’s monetary excesses or by the investment properties of housing, but that possible explanations include speculative bubbles, etc. However, historical experience suggests that there must have been an extraordinary boom in one market followed by speculative demand, so other explanations do not answer either of these questions, and there is a lack of systematic academic research on this issue. There is a lack of systematic research on this issue.

The existence of a money-raising mechanism outside the central banking system means that the traditional top-down theory of the monetary transmission mechanism still needs to be supplemented. In fact, local governments have certain pricing rights over production factors and tax guarantees, so they finance and invest through financial intermediaries, forming a monetary transmission mechanism of monetary issuance - increasing credit - driving economic growth or over-issuing money to curb growth. This mechanism has been “invisible” to the academic community, i.e. only partial but not overall, only secondary but not primary contradictions.

If the monetary reservoir provides a financing base for local governments and leads to an increase in monetary issuance, it will most likely create an asset price bubble - as happened in 2008 with the sub-prime mortgage crisis in the U.S. On 2 March 2021, Guo Shuqing, Secretary of the Party Committee of the People’s Bank of China and Chairman of the China Banking Regulatory Commission, said at a press conference: “The core problem in the real estate sector is still a relatively large bubble, with a relatively strong tendency towards financialisation and bubbling, which is the biggest grey rhinoceros in the financial system”. On the other hand, the positive effects of monetary reservoir assets should also be properly understood. As mentioned above, local governments have used monetary reservoir assets for credit expansion, obtaining large amounts of fiscal financing to drive China’s rapid development. However, the mechanisms involved are still not fully understood, with many scholars focusing on the macro effects of land finance and the incentives of the tax sharing system, ignoring the local government investment in the public goods sector behind the massive credit expansion, which includes, but is not limited to, infrastructure, education, and fiscal transfers for technology, management innovation, etc. China’s high investment growth is an important development experience, with local governments providing the financial support for high government investment to drive growth.
Figure 1: Comparative chart of price increases in the Chinese housing and US equity markets
Previous studies have examined issues such as land finance and local government debt, but have rarely included these issues in the framework of credit expansion and even monetary growth. It also fails to look at the issue of credit expansion and even monetary growth by local governments. In conclusion, there is merit in the monetary reservoir-fiscal financing and investment monetary transmission mechanism, and a systematic and in-depth study of this monetary transmission mechanism is of high theoretical value and practical guidance.

The marginal contributions of this paper are: (i) the construction of a dynamic general equilibrium model that includes the public goods sector and fiscal transfers as well as financial accelerators, which provides a detailed and rational explanation of the monetary transmission mechanism of monetary reservoir-fiscal financing and investment in China and a mathematical and dynamic simulation analysis of its macro effects; (ii) the analysis of the financing effect and bubble effect of local government monetary increase based on the monetary transmission mechanism of monetary reservoir fiscal financing and investment monetary transmission mechanism, and provide a systematic explanation for the phenomena of high growth rate, high housing price, high local government debt and high investment in China; (3) design a government financing and de-bubble mechanism using monetary reservoir assets based on the monetary reservoir-fiscal financing investment monetary transmission mechanism, and provide a reference for resolving the local debt crisis triggered by the stock of monetary issuance and establishing a development model of high growth and high quality at the same time.

The following parts of the paper are organised as follows: the second part is a literature review; the third part develops a theoretical model and calibrates the parameters of the above DSGE model and estimates Bayesian simulation moments based on China’s housing market and relevant macroeconomic data, followed by a dynamic simulation analysis; the fourth part proposes a design for a fiscal financing de-bubble mechanism based on the theory of monetary reservoir assets; and final part is the conclusion and policy recommendations.

2. Literature Review

Public opinion has mostly attributed the boom in the real estate and stock markets to the central bank’s monetary excesses, arguing that the real estate and stock markets acted as monetary reservoirs to absorb excess monetary excesses. This view is still essentially a central bank-centred and top-down perspective, and even though many scholars have studied issues such as land finance or local debt, scholars still analyse local finance and the monetary transmission mechanism independently of each other.

To understand the monetary expansion outside the central bank, it is necessary to clarify the two core issues of the subject of monetary expansion and its motivation. If the credit expansion of fiscal financing investment brings higher return than the debt, then it should not be called a monetary increase. On
the contrary, the accumulation of surplus government deficit is converted into money through financial intermediation, and this conversion is not limited to the central bank’s payments. In addition, for a long period of time, GDP was the main performance indicator in the evaluation of local government officials in China, and local governments, due to factors such as performance evaluation of officials and the fiscal system, promoted the development of local governments through financial subsidies, construction of supporting facilities, tax preferential treatment, land discount, etc. to promote local economic growth or maximize fiscal revenue [Huang (2012) [1]; Shao (2016) [2]]. Empirical evidence such as Wang (2015) [3], etc., local governments promote the real estate sector through credit expansion and financial leverage investment. However, this has also led to a faster rate of additional money issuance by local governments, most of which flows into the monetary reservoir. The core support assets for local government credit expansion are land finance, shadow banks and invisible guarantees [Mei (2021) [4]; Fu (2017) [5]; Liang (2019) [6]; Wu (2013) [7]; Wu et al. (2016) [8]]. The essence of fiscal financing based on land finance is the capitalization of land resources by local governments under monopolistic land market conditions [Shao Xinjian (2012)], and local governments indirectly form local debts through bank project loans, urban investment bonds and capital market financing. According to the 2013 government debt audit report, the debts for which local governments have repayment, guarantee and certain bailout responsibilities amounted to RMB 108.85917 billion, RMB 266.577 billion and RMB 433.9372 billion respectively, with the highest proportion of loans from financing platforms at 45.57%. Although the credit expansion of local governments is based on land capital as the underlying asset, its rapid growth relies on the backing of government tax revenue. Local governments push up land prices by restricting land supply in various ways for continuous financing, further increasing the total amount of loans invested in the real estate sector by the financial sector. Financial intermediaries cooperate with the credit expansion of local governments for two main reasons: Firstly, the local financing platforms are the main financial. In short, there is a common interest between financial intermediaries and local governments. Secondly, financial intermediaries and social capital “trust” the guarantees of the central and local governments.

In order to distinguish in detail between the two different mechanisms, we first analyse the widely accepted monetary transmission mechanism. The empirical and theoretical models related to the monetary transmission mechanism have remained relatively controversial over the years and, in general, there are three views on the monetary transmission mechanism: Firstly, the Keynesian view, which argues that monetary policy affects long-term interest rates through the manipulation of short-term interest rates, thereby influencing real investment and long-term growth [Bernanke et al. (1992) [9]]. Secondly, the monetarist view, which argues that monetary policy acts first on asset prices, affecting the asset and liability positions of firms and banks, and ultimately affecting output through the level of aggregate social credit. The transmission channels discussed in the three perspectives are mainly four mediating variables: interest rates, exchange rates, asset prices and credit. Without exception they all study
the transmission path from the central bank to commercial banks and then to enterprises. According to the above analysis, there are two main additions to the traditional view: on the one hand, in contrast to the traditional view that the central bank is the only centre of the monetary transmission mechanism, the credit expansion of local governments also has a monetary issuance-circulation transmission mechanism under certain conditions. [Huang(2012)] finds that rising housing prices lead to an overall decline in corporate tax revenues and profits, and that local government financing through land rents is equivalent to financing through corporate taxes, suggesting that fiscal financing and tax revenue growth are not independent of each other, whether it is the capitalisation of land resources or the pledge of tax revenues, and that fiscal financing implies the possibility of monetising fiscal deficits and of generating much higher fiscal revenues than taxes in the short term. On the other hand, there is a need to consider the benefits of fiscal investment, such as the role of public goods investment on output efficiency, for example, the contradiction that increased monetary issuance under conditions of resource allocation imbalance instead aggravates the reduced efficiency of financial resource allocation, while public goods investment originating from fiscal financing enhances output efficiency. [Chen(2016)] finds that the higher education population contributes positively to urban housing prices from the perspective of human capital growth, but the expansion of human capital cannot grow permanently, which also leads to a "new normal" in China’s real estate market. [Liu(2020)] finds an inverted U-shaped threshold for local governments to use the unique arrangement of the land system to promote economic growth through a threshold regression. If local government credit expansion is used to invest in human capital or infrastructure, it can have positive externalities, at least for a certain period of time, but the low return on fiscal investment will lead to the conversion of credit expansion into increased monetary issuance, and the situation of high local government debt and low growth will emerge.

This paper extends the concept of China’s main monetary reservoir, the real estate sector, from the commonly used narrow concept of corporate property and family housing to include property used for office and residential purposes and the facilities required to fulfil its functions. In fact, the realisation of the function of property depends on public goods such as water, electricity and gas networks and other public transport. For example, [Fan (2018)], based on micro data on new housing transactions in Shanghai from 2012-2015, finds that the addition of the metro increased the price of new housing within 1 km of the station by 26.5% and reduced the average housing area by 3.25 sq m. Both of these spillover effects diminish with increasing distance, illustrating the close relationship between property and public facilities. Secondly, the real estate sector is defined only in terms of consumption attributes ignoring investment attributes [Yang(2014)], and the real estate sector is not only linked to public welfare in China, but also has the role of preserving and appreciating value.

The previous literature on the relationship between the real estate sector and economic growth has been divided into two main lines of research, which are the asset price channel and the financial system channel. [Chaney(2012) and
Atif (2014) believes that the appreciation of housing assets, especially homeownership assets, has a significant boosting effect on consumption. Using data from the 2002-2009 China Urban Household Survey, Yang (2014) finds that higher house prices have a squeeze effect on consumption for both single- and multiple-unit households, but a wealth effect in the less economically developed western part of the country and no significant wealth effect or counter-effect in the central part of the country. Li (2014) distinguishes and compares the effects of productive household fixed assets and non-productive housing assets on residential consumption and reaches a conclusion largely similar to that of Yang (2014) that housing price appreciation does not help to increase residential consumption, and that the wealth and asset effects on residential consumption are mainly derived from productive fixed assets. Xiao (2014) study concludes that house prices inhibit consumption. Among other things, both Chinese and foreign studies suggest that the wealth effect or cost effect of house prices is related to the mortgage financing of housing assets provided by financial intermediaries, the difference being that mortgage financing poses a liquidity constraint or support to homeowners such as increased leverage. In contrast to the usual domestic and foreign studies that examine the path between house prices and consumption or investment, Song (2021) finds that high house prices significantly increase the probability of university graduates leaving local employment, leading to an outflow of highly skilled human capital, while Bernstein (2021) uses data on the productivity of workers who experienced a sharp fall in house prices after the 2008 mortgage crisis in the US to find that The productivity of highly innovative workers declined. Both Song Hong (2021) and Bernstein (2021) show that the rise and fall in housing values has a very clear real output effect in reality and is not limited to consumption and investment. In terms of the financial intermediation channel, most of the literature examines the short- or long-term macro effects of the real estate sector in terms of output efficiency gains. Luo (2015) finds that an increase in urban real estate investment leads to a significant decrease in resource allocation efficiency in the manufacturing sector. The conclusion that real estate investment crowds out consumption, investment and reduces financial efficiency is the more widely accepted conclusion in the two main lines mentioned above, which suggests at least two things: first, that the monetary reservoir represented by the real estate sector takes up more financial funds, i.e. credit preference; and second, that the excessive boom in the real estate sector weakens the potential for long-term growth by crowding out consumption and innovative investment and reducing financial efficiency.

The result of credit preference is an increased flow of financially intermediated funds to the real estate sector, increased leverage and a push up in the market value of the sector, where financial funds include increased money issuance, providing an explanation for the countercyclical boom phenomenon of the money reservoir asset phenomenon, for which some scholars have also presented empirical evidence. Landvoig et al. (2011) uses housing microdata from San Diego to empirically find a strong link between the housing boom and credit expansion everywhere through a survey of Chinese housing market.
data. [cong et al.\[21\]] use data on lending to manufacturing firms by 19 Chinese listed banks to find that since 2008 implicit government guarantees and economic stimulus packages have increased the proportion of lending by financial intermediaries to state-owned firms. [Wei(2017)\[22\]] finds that the relationship between leverage and house prices has three response mechanisms: negative, immune and positive. It is important to distinguish that there is no direct causal relationship between financial credit and asset leverage. Financial credit generally uses the volume of loans from financial intermediaries as a proxy variable, but an increase in the volume of loans does not necessarily increase asset leverage, but rather the transaction regime such as credit (pledge), down payment or guarantee determines asset leverage, and explaining the boom in the real estate sector in terms of the volume of loans is not sufficient to explain the money storage pool in the real estate sector. The essence of the phenomenon is to explain credit expansion and economic cycles in terms of leverage. Similar findings from other countries include [Justiniano.et.al. (2015)\[23\], Mian et al.(2016)\[14\]. [Justiniano.et.al. (2015)\[23\] investigates the relationship between credit easing and credit leverage in the US subprime crisis through a dynamic general equilibrium model, arguing that leverage cycles are largely determined by factors affecting house prices, while the two-way response of borrowers and lenders Mian et al.(2016)\[14\] finds that the rise in the household sector debt-to-GDP ratio was accompanied by a consumption boom. [schularick (2012)\[24\]] argues that credit growth is a powerful predictor of financial crises. [Iacoviello(2010)\[25\]] studies the sources of volatility in the US housing market from 1980 to 2010 and argues that the fraction from monetary policy shocks is less than 20\%, but has a significant impact on the housing market cycle. Thus, credit appetite and money reservoir asset booms should be causally related, with leverage leading to initial credit appetite, which drives an increase in credit size, generating boom cycles, which in turn increase credit appetite.

There are two main aspects of leverage: the trading regime and the refinancing mechanism. The leveraged trading system consists of a down payment ratio or margin system, while the refinancing mechanism is indirectly leveraged. Assuming that an asset has to be purchased in full and that the financial intermediary provides a partial "rebate" of the amount paid, and that the purchaser of the asset can continue to repay the loan with a loan, the refinancing has essentially the same practical effect as a leveraged trading system. The interest rate is the central factor in a leveraged trading system, and because of information asymmetries and financial frictions, financial intermediaries create an interest rate premium, or financial accelerator mechanism [Bernanke et al.,(1999)\[9\]], which is introduced in this paper as a refinancing mechanism based on the financial accelerator for mortgage financing of housing assets.

The excessive boom in the money pool squeezes out consumption and innovative investment as well as reduces financial efficiency, so that in the long run the return on the money pool - financially financed investment is bound to fall, and financial intermediaries as profit-making institutions further widen the credit imbalance, forming a vicious circle of credit imbalance - money pool boom - aggravated imbalance, so the money pool - financially financed investment
monetary transmission mechanism in the absence of external intervention. In the absence of external intervention, the monetary transmission mechanism of monetary pools - fiscal financing and investment - inevitably leads to monetary excesses.

3. General dynamic equilibrium theory analysis

3.1. Theoretical analysis

In figure 2 the left and right panels depict the traditional monetary transmission mechanism and the monetary reservoir-finance-financed investment monetary transmission mechanism respectively. The traditional view is that financial intermediaries provide financing services to the productive sector, the household sector and the government at all levels, and that the central bank influences the cost of funds and the availability of funds through various policy variables, so the traditional transmission mechanism is a unidirectional and top-down credit supply process. In addition, it should also be noted that even when local governments are in fiscal surplus, they objectively issue additional money through fiscal financing investments and put it into circulation, but this money is partially covered by the new output. This is covered by the new output.

The argument for extra-central bank monetary growth might be argued as follows: If there is extra-central bank monetary growth in China’s real estate sector, why are house prices significantly correlated with money supply rather than showing independent movements or even counter-cyclical characteristics? It is undeniable that the rise and fall in the prices of monetary reservoir assets is strongly correlated with central bank monetary easing, but the run-cycle correlation between the two is not strong. In order to measure the operating cycle, this paper performs a Fourier transform on the growth rate series to convert the original signal into frequency and its corresponding amplitude, and ranks the phases in order according to the amplitude (due to symmetry only the part
Table 1: Comparison of stock market indices and house price levels in China and U.S.

|                | CPI  | PPI  | SSE index | M2 Corr. | M2 Rank Corr. | Interest Rate Corr. | Interest Rate Rank corr. |
|----------------|------|------|-----------|----------|---------------|---------------------|--------------------------|
| M2             | -0.19| -0.02| 0.016     | -0.134   | -0.052        | -0.134              | -0.052                   |
| M2             | -0.10| -0.34| -0.098    | -0.310   | 0.229         | 0.074               | 0.130                    |
| Interest Rate  | 0.03 | 0.137| -0.091    | -0.440   | -0.097        | -0.108              | -0.086                   |
| Interest Rate  | 0.043| 0.04 | 0.044     | 0.075    | -0.01         | -0.092              | -0.096                   |

1. \( P_h \) denotes the house price index made by data in over 30 cities in China. \( P_{h,c} \) is the SSE index.
2. \( P_s \) denotes the Dow Jones industrial index. \( P_h \) is the house price index in U.S.

With absolute value greater than 0 is considered), and finally by calculating the rank (amplitude size ranking) correlation coefficient corresponding to the same frequency of the two variables, the results are presented in Table 1. The results in Table 1 show that both the housing and stock markets in China and the US are significantly correlated with money supply and price-based policy variables, with the increase in the housing market premium in China having a strong cyclical correlation with the M2 money supply, while the cyclical correlation between housing prices and the M2 money supply is not significant (a negative cyclical correlation also implies a weak cyclical correlation). As a comparison, the US stock market index and market interest rates have a stronger cyclical correlation with CPI/PPI, and the US Federal Reserve has a strong correlation with both the price series. The operating cycle as the price level of consumer and industrial goods has been driven up by the monetary excesses of quantitative easing and fiscal deficit monetisation since 2008 [Iacoviello(2010)]25. Since money supply works as the main monetary policy control variable in China, it does not have a significant impact on the price level cycle in all sectors at least suggests that the understanding of monetary growth from the central bank perspective alone is incomplete.

Figure 3 depicts the relationship between financial intermediaries, the real
estate sector, the household sector, local governments and the public goods sector. The straight line in the diagram indicates the obvious visible financial flow relationship, i.e., the buying and selling of property, while the dotted line indicates the hidden financial flow relationship, indicating the expansion of local government credit. Local governments are not involved in the sale of property, but they influence the real estate market in two ways: on the one hand, they ensure the realisation of the property’s functions and value-added through discounted land transfers and increased construction of ancillary facilities (e.g., the introduction of shopping malls, public transport systems), and on the other hand, they raise funds from financial intermediaries to invest in the public goods sector through fiscal financing. The positive externalities of the public goods sector simultaneously increase the productivity of all productive sectors, and the largest beneficiaries of infrastructure, which accounts for a larger share of public goods investment, remain the household sector and the real estate sector (the non-real estate sector is not directly affected by the positive externalities of infrastructure compared to the real estate sector in terms of market value). In addition, the leverage of the real estate sector also implies a high value, which is more conducive to improving the performance of officials in the short term, as local governments and financial intermediaries provide more loans to the real estate sector through fiscal financing in the common interest. In the long run, credit preference inevitably leads to a marginal decrease in production efficiency, and the credit expansion cannot be covered by the increase in output efficiency resulting in monetary growth. Due to the imbalance between local governments’ powers and financial powers and the performance appraisal system of officials that emphasises short-term achievements at the expense of long-term benefits, local governments form a path dependency and a cycle of debt expansion, with a large amount of incremental money actually formed by local government debt entering the real estate sector, forming the so-called monetary reservoir.

3.2. Model

The theoretical model is based on the following assumptions: 1. In order to exclude possible economic effects due to nominal price changes, this paper standardises all inflation levels to 1 and assumes that inflation levels are always stable, which facilitates the analysis of real economic variables in this paper; 2. The model is assumed to be a closed economy, i.e., the monetary transmission effects of exports and exchange rates are not considered, this assumption simplifies the model but does not affect the core conclusions of this paper. 3. There is no production sector distinction in the labour income of households, which are all defined as $W^*n^*_w$. 4. Public goods and fiscal transfers are introduced as comparative models to study the efficiency of government financing and investment, but only the benchmark model is considered in the impulse response and variance decomposition analysis to analyse the shock effects.

3.2.1. Household sector

In this paper, consider households surviving indefinitely, choosing to purchase consumption goods $C_t$ and housing $h_t$, providing labour $N_t$ and holding
a certain amount of money $M_t$ in each period, with utility in each period depending on money, consumption, housing and labour.

$$Max : E \sum_{t=0}^{\infty} \frac{C_t^{1-\sigma}}{1-\sigma} + \chi * M_t + j * \log[h_t] - \kappa * N_t$$  

where $E$ denotes expectations, $M_t$ is the money balance held by residents, $\sigma$ is the household’s risk aversion coefficient, $\beta$ is the discount factor, $j$ is housing preference, and $\kappa$ denotes the household’s aversion to labour. Representative households supply equal amounts of labour $n_{\epsilon,t}$ and $n_{h,t}$ to both the non-real estate and real estate sectors, respectively.

$$N_t = n_{\epsilon,t} + n_{h,t} = 2 * n_t$$  

This paper considers the borrowing constraint of using current money and the market value of housing assets in the proportion of $\mu_t$ as the loan amount, where $\mu_t$ denotes the proportion of housing assets refinanced.

$$B_{k,t} \leq M_t + \mu_t * P_{h_t}(h_{k,t})$$

The first-order conditions under which households determine consumption, labour, money and borrowing are as follows:

$$- C_t^{-\sigma} = \lambda_t$$

$$- 2 * \kappa * n_t - \omega_{h,t} * (1 - T_g) * W_{h,t} * \lambda_t = 0$$

$$\frac{\beta * \lambda_{t+1}}{1 + R_t} + \lambda_t - \Lambda_t + \chi = 0$$

$$\beta * \lambda_{t+1} * (1 + r_{h,t-1}) - \lambda_t + \Lambda_t = 0$$

3.2.2. Financial intermediation

Financial intermediaries earn interest on loans by lending to the household sector. The nominal interest rate on loans to representative households is represented by the following equation.

$$i_{h,k} = f_h(\omega_{h,t})R_t, f_h(x < 1) = 1, f'_h > 0, f''_h(x) < 0$$

where $R$ is the base rate and $\omega_{h,t}$ denotes household leverage for home purchase. $f_h(\omega_{h,t}) = \omega_{h,t}^{\xi_{h,t}} > 0$ denotes that the financial intermediary’s mortgage interest rate premium increases monotonically with the household sector’s mortgage leverage. Financial intermediaries determine the proportion of household housing refinancing $\mu_t$ and the coefficient of the mortgage interest rate premium $\xi_{h,t}$. $\mu_t$ is correlated with the central bank’s money supply, economic prosperity and regulatory policy, and is viewed in this paper as a proxy variable for exogenous shocks to quantitative monetary policy.
3.2.3. House mortgage contracts

The representative household takes the initiative to choose the best loan term for each instalment based on the base interest rate so that it has the highest leverage and thus the lowest mortgage amount per instalment. The mortgage contract is designed so that for a down payment of $\theta(h,t)$, the financial intermediary makes the remaining payment to the real estate agent, becomes the creditor of the purchasing household and collects from the debtor household an equal amount of mortgage payments per instalment, for which the total mortgage contract for the debtor household is:

$$(1 - \theta_{h,t})P_{h,t} \times h_t \times (1 + i_{h,k})^T = T \times D$$ (9)

where $D$ denotes the amount of mortgage repaid per period and home purchase leverage is defined as the ratio of total home purchase per period to mortgage per period, thus defining home purchase leverage as $\omega_{h,t}$, whereupon the following results can be obtained:

$$\omega_{h,t} = \frac{T}{(1 - \theta_t) \times (1 + i + h, k)} = \frac{P_{h,t}h_t}{D_{k,t}}$$ (10)

The household sector first chooses the optimal maturity $T$, with the first-order condition that $T^* \approx \frac{1}{R(\omega_t)(\xi_h)}$. Assuming that the debtor chooses the maturity $T$ that minimizes for a given housing value $P_{h,t} \times h_t$ and that $D_{k,t}$, the leverage ratio, is maximized and substituted into the original equation, one can find that $\omega_{k,t}$ is approximately equal to the following equation.

$$\omega_{h,t} \approx R_t \times (1 - \theta_{h,t})^{\frac{1}{1 - \psi_{h,t}}}$$(11)

3.2.4. Real estate sector

The production function corresponding to the employment of labour $n_{h,t}$ and the purchase of land $L_{h,t}$ in each period, in addition to the capital required for the production of a real estate firm, is as follows.

$$Y_{h,t} = K_{h,t}^{\rho_h}L_{h,t}^{\psi_h}n_{h,t}^{1-\rho_h-\psi_h}$$ (12)

$\psi_h$ is the share of factor rewards of land in total factors, and a larger $\psi_h$ indicates a larger role for land in the production function; $\phi_h$ is the share of returns to capital in total factor rewards. The real estate sector satisfies the following conditions in its profit maximisation, $W_{h,t}$ is the wage per unit of labour, $PL_{h,t}$ is the price of land, given exogenously by the local government, and $PK_{h,t}$ is the price of capital goods, determined by the capital goods sector.

$$W_{h,t} = \frac{P_{h,t} \times (1 - \phi_h - \psi_h)}{n_{h,t}}Y_{h,t}, PL_{h,t} = \frac{P_{h,t} \times \psi_h}{n_{h,t}}Y_{h,t}, PK_{h,t} = \frac{P_{h,t} \times \phi_h}{n_{h,t}}Y_{h,t}$$ (13)
3.2.5. Non-real estate sector

First-order conditions in the non-real estate sector differ from those in the real estate sector only in the extent to which each factor of production - land, labour and capital - contributes to output.

\[
W_{f,t} = \frac{P_{f,t} \cdot (1 - \phi_f - \psi_f)}{n_{f,t}} Y_{f,t}, \quad PL_{f,t} = \frac{P_{f,t} \cdot \psi_h}{n_{f,t}} Y_{f,t}, \quad PK_{f,t} = \frac{P_{f,t} \cdot \phi_f}{n_{f,t}} Y_{f,t}
\]

(14)

3.2.6. Local government

In this paper, the objective decision function of the local government is to optimise local economic growth and the main measures are government investment \(G_t\) and transfer \(TF_t\). The local government is able to decide on fiscal expenditure to influence economic growth. In this paper, the local government objective function is set as:

\[
\text{Max : } E_t \sum_t^\infty \beta_t G_t' + T F_t ^{1-\gamma_d}
\]

(15)

\(\gamma_d\) denotes the degree of local government preference for government investment. Local governments face the following budget constraints, where \(\sum_k P L_{k,t} \cdot L_{k,t}\) denotes land grant revenue, \(T_g \sum_k W_{k,t} \cdot n_{k,t}\) denotes personal income tax, \(T_g \sum_k Y_{k,t}\) denotes corporate income tax, \(T_g\) and \(T_q\) denote personal income tax rate and corporate income tax rate respectively.

\[
G_t + TF_t \leq = \sum_k P L_{k,t} \cdot L_{k,t} + T_g \sum_k W_{k,t} \cdot n_{k,t} + T_q \sum_k P_{k,t} \cdot Y_{k,t}
\]

(16)

The first-order conditions for government expenditure and transfers under the above constraints maximize utility.

\[
\frac{G_t}{TF_t} = \frac{\gamma_d}{1 - \gamma_d}
\]

Denoting \(\sum_k P_{k,t} \cdot Y_{k,t}\) and \(\sum_k P L_{k,t} \cdot L_{k,t}\) by \(\sum_k W_{k,t} \cdot n_{k,t}\) respectively, according to Eqs. (10), (13) and (14), we get:

\[
G_t + TF_t \leq \sum_k W_{k,t} \cdot n_{k,t}[1 + \frac{\psi_f + T_g}{1 - \psi_f - \phi_f} + \omega_t \frac{\psi_h + T_q}{1 - \psi_h - \phi_h} + \omega_t \frac{\psi_h \cdot \omega_t + T_q}{1 - \psi_h - \phi_h} + 2 * T_g]
\]

(18)

The sum of the household wage and income supplement is \(\sum_k W_{k,t} \cdot n_{k,t}[1 + (1 - \gamma_d) \frac{\psi_f + T_g}{1 - \psi_f - \phi_f} + \omega_t \frac{\psi_h + T_q}{1 - \psi_h - \phi_h} + \omega_t \frac{\psi_h \cdot \omega_t + T_q}{1 - \psi_h - \phi_h} + 2 * T_g]\), where \((1 - \gamma_d) \frac{\psi_f + T_g}{1 - \psi_f - \phi_f} + \omega_t \frac{\psi_h + T_q}{1 - \psi_h - \phi_h} + \omega_t \frac{\psi_h \cdot \omega_t + T_q}{1 - \psi_h - \phi_h} + 2 * T_g\) is defined as the level of fiscal transfers, while the positive externality \(\exp(-\lambda (\alpha * G_t - \delta_k))\) from the public goods sector increases production efficiency and provides higher tax revenues to local governments, so that total fiscal revenues should be

\[
\frac{[1 - \gamma_d] \frac{\psi_f + T_g}{1 - \psi_f - \phi_f} + \omega_t \frac{\psi_h + T_q}{1 - \psi_h - \phi_h} + \omega_t \frac{\psi_h \cdot \omega_t + T_q}{1 - \psi_h - \phi_h} + 2 * T_g]}{\exp(-\lambda (\alpha * G_t - \delta_k))}
\]

with fiscal financing as \((\omega - 1) \sum_k W_{k,t} \cdot n_{k,t} \cdot \frac{\psi_h + T_q}{1 - \psi_h - \phi_h}\). To simplify the discussion, the price of land is set to 1.
3.2.7. Capital goods producers

Each period the firm depreciates the remaining capital goods \((1 - \delta_K)\) at a depreciation rate \(\delta_k\) to realise them, and the capital goods producer can likewise produce the final capital goods in conjunction with the newly increased investment \(I_t\), with the final capital goods being produced in the next period. The capital accumulation equation is as follows.

\[
K_{t+1} = (1 - \delta_k)K_t + I_{t+1}
\]  
(19)

To simplify the discussion, the price of capital is set to 1.

3.2.8. Central bank

In most DSGE models, the central bank sets monetary policy according to the Taylor monetary rule.

\[
\frac{R_t}{R} = \left[\frac{R_t-1}{R}\right]^{\rho R} \left[\frac{GDP_t}{GDP}\right]^{\rho Y}
\]  
(20)

3.2.9. Public goods sector and fiscal transfers

The difference between the comparative model and the benchmark model lies in the introduction of fiscal transfers to explore the financing effect and bubble effect of the monetary reservoir. In this paper, we define public goods investment and fiscal transfers as coming from two parts of government expenditure respectively: \(G_t\) and \(TF_t\), where \(G_t\) denotes direct government investment for public goods construction, and it is worth noting that public goods here include factors such as infrastructure, science and technology and human capital accumulation, and \(TF_t\) denotes fiscal transfers to the household sector. For the public goods sector and fiscal transfers satisfy the following conditions:

\[
\Phi_t = \exp(\lambda[\alpha*G_t - \delta_k \sum_{0}^{T-1} G_i]), \lambda > 0, 1 > \alpha > 0
\]  
(21)

\[
W_tN_t = \frac{W_tn_t + TF_t}{\Phi_t}
\]  
(22)

where \(\Phi_t\) denotes the positive externality that the public good brings to the production sector, causing the production cost of the production sector to fall, and \(\Phi_t\) is determined by \(G_t\), the capital depreciation rate \(\delta_k\) and the proportion \(\alpha\) spent on infrastructure construction. For simplicity of consideration, the depreciation rate of infrastructure is set to be equal to that of capital goods in this paper, and the public goods sector stops growing when the parameter \(\lambda\) in the formula is 0. \(\exp(\lambda[\alpha*G_t - \delta_k \sum_{0}^{T-1} G_i]) \leq 1\), and in addition \(W_tN_t\) indicates that due to the positive externality of public goods and the government’s subsidy to household sector’s income subsidy, the productive sector can achieve higher levels of production by paying only less labour costs \(W_tN_t\).
3.2.10. Market clearing conditions and macro equilibrium

The model assumes that the market is in equilibrium when all markets are cleared, where government investment is used in the non-real estate sector and real demand is $G_t/P_{f,t}$.

$$Y_{f,t} = C_t + I_t + G_t/P_{f,t}$$

(23)

The corresponding clearing conditions in the labour market, capital goods market and land market are expressed as:

$$K_{f,t} + K_{h,t} = K_t$$

(24)

$$W_{f,t}N_{f,t} = W_{h,t}N_{h,t}, n_{h,t} = n_{f,t}$$

(25)

$$PL_{h,t} = PL_{f,t}, PK_{h,t} = PK_{j,t}$$

(26)

3.3. Model parameter calibration and estimation

The parameters $\beta$ and $\beta_G$ denote the subjective discount rates of residents and local governments respectively, and are set to 0.98 according to the classical DSGE model. The depreciation rate $\delta_k$ for capital goods is taken to be about 0.01. The labour supply elasticity $\phi$ is set to range from 1 to 2, and is taken to be 1.2 in this paper. Referring to the classical financial accelerator model, the household sector risk aversion coefficient $\sigma$ is set to 0.9, based on the mean value of housing preference $j$ taken as 0.2 and labour preference $\kappa = 0.1$. Personal income tax rate $T_g$ and corporate income tax rate $T_q$ are taken as 0.05 and 0.05. Based on housing market data from April 2020 to February 2021, the down payment ratio is set to 0.2833 and calculated from the first home loan interest rate in steady state by simulating moment estimation of financial. The level of the interest rate premium of intermediaries on home purchase loans is $E(\xi_{h,t}) \approx 0.0357$. The preference of government investment $\gamma_d$ is 0.5. Using the one-year interest rate on refinancing loans from the central bank to financial institutions and GDP data from 1991 to 2015, we estimate $\rho_R \approx 0.9929, \rho_Y \approx 0.0071$.

The non-real estate sector production function has a capital goods share $\phi_f$ of 0.3 and a land share $\psi_f$ of 0.06, a land share $\psi_h$ of 0.3 and a capital goods share $\phi_h$ of 0.4 for the real estate sector. The home mortgage ratio and the mortgage rate premium coefficient are constructed given first-order optimality conditions and the moment conditions are estimated using the Bayes formula and the prior distributions of the benchmark loan rate. The posterior parameters of the target parameters are estimated using the Bayes formula and the prior distributions of the benchmark loan rate, the down payment ratio and the premium level, and the results are presented in Table 3.

3.4. Numerical simulation and analysis

Using $\%(x)$ to denote the growth rate of variable $x$ and comparing the market value of the real estate sector with that of the non-real estate sector, the increase
premium of the market value of the real estate sector relative to the non-real estate sector is mainly determined by the following equation.

\[
\% \left( \frac{P_{h,t}Y_{h,t}}{P_{f,t}Y_{f,t}} \right) = \% (\omega_{h,t})
\]

(27)

In short, the market value premium of the real estate sector relative to the non-real estate sector is caused by the leverage used by the household sector to purchase products in the real estate sector, and the greater the increase in leverage, the greater the relative increase in the market value of the real estate sector. From \( \omega_{h,t} = \left[ R_t \left( 1 - \theta_{h,t} \right) \right] \frac{1}{1 + \xi_{h,t}} \), mortgage leverage is mainly determined by the down payment ratio \( \theta_{h,t} \), the interest rate \( R_t \) and the mortgage interest rate coefficient \( \xi_{h,t} \), while the down payment ratio can be considered relatively stable in the short run, the interest rate and the mortgage interest rate premium coefficient can be determined by the central bank and the financial intermediaries on a case-by-case basis, so that the growth rate of \( \omega_{h,t} \) in the short run can be decomposed into two sources: the mortgage rate premium coefficient and the base rate.

\[
\% (\omega_{h,t}) = \% \left[ R_t \left( 1 - \theta_{h,t} \right) \right] \frac{1}{1 + \xi_{h,t}} = \% R_t \left( 1 - \theta_{h,t} \right) \frac{-1}{1 + \xi_{h,t}} + \% \left( \frac{1}{R_t \left( 1 - \theta_{h,t} \right)} \right) \left( \frac{-1}{1 + \xi_{h,t}} \right) \]

(28)

The economic implication of the above equation is that when interest rates fall and the house mortgage interest rate premium coefficient is constant, as \( \frac{-1}{1 + \xi_{h,t}} < 0 \) mortgage leverage will rise and drive up the market value of the real estate sector, which explains the phenomenon of market value inflation in the price of a monetary reservoir asset. In short, a necessary condition for an asset to function as a money reservoir is the presence of leverage in the trading system. Both housing and equities have this characteristic, with housing assets being naturally leveraged due to their high value, which inevitably requires a down payment plus regular repayments, and equity markets, where trading activity is fully settled in most countries, but institutional and professional investors are able to use their capital advantage to fully leverage a wide range of financial instruments, such as the US stock market, which is dominated by institutional and professional investors. For example, the US stock market is dominated by

| Params | Type of prior distribution | Prior Mean | Prior Std. |
|--------|----------------------------|------------|------------|
| \( \tilde{R} \) | Beta | 3.2% | 1.092% |
| \( \theta \) | Beta | 0.2833 | 0.0471 |
| \( f_h(\omega_{h,t}) \) | Gamma | 1.1275 | 0.0694 |

| Params | Type of posterior distribution | Prior Mean | Prior Std. |
|--------|-------------------------------|------------|------------|
| \( \mu \) | Beta | 3.36% | 1.19% |
| \( \xi_h \) | Beta | 3.22% | 1.53% |

Table 2: Bayes Estimation Result of Important Params


Table 3: Decomposition of the weighting of the currency reservoir sector premium factor

| Signals | Factors | Weighting Coefficients |
|---------|---------|------------------------|
| %(%(ω_{h,t})) | Percentage change in leverage of money reservoir assets | ω_{h,t} - ψ_{h} - φ_{h} |
| %(%(W^*n_t^* + TF_t)) | Percentage change in household sector non-asset based income | ω_{h,t} - ψ_{h} - φ_{h} |
| %(%(n_t)) | Percentage change in labour supply | ω_{h,t} - ψ_{h} - φ_{h} |
| %(%(PL_t)) | Percentage change in land price | ω_{h,t} - ψ_{h} - φ_{h} |

The data in Table 4 show trends that are generally consistent with the
| Year | $I_h/GDP$ | $A_h/A$ | $\omega$ |
|------|----------|--------|--------|
| 2010 | 11.71%   | 55.56% | 27.3   |
| 2011 | 12.65%   | 53.82% | 27.9   |
| 2012 | 13.33%   | 55.94% | 30     |
| 2013 | 14.51%   | 53.99% | 33.5   |
| 2014 | 14.77%   | 53.60% | 36     |
| 2015 | 13.93%   | 54.70% | 39.2   |
| 2016 | 13.74%   | 52.78% | 44.7   |

Annual Growth Rate: 2.83% -0.81% 8.63%

| Year | $LL_h/LL$ | $NFL/LL$ | $IH/LL_h$ |
|------|----------|----------|----------|
| 2014 | 11.38%   | 23.27%   | 19.08%   |
| 2015 | 11.76%   | 22.33%   | 17.54%   |
| 2016 | 13.53%   | 21.91%   | 14.12%   |
| 2017 | 15.07%   | 23.29%   | 12.50%   |
| 2018 | 16.16%   | 23.97%   | 11.52%   |
| 2019 | 17.21%   | 24.40%   | 10.62%   |
| 2020 | 18.52%   | 25.38%   | 9.19%    |

Annual Growth Rate: 8.52% -1.52% -11.35%

Table 4: Contribution of the real estate sector to economic growth and the level of credit to the household sector

1 Data source: National Bureau of Statistics, National Balance Sheet Research Centre, Guotaian database, China Financial Yearbook (2020)

2 $I_h/GDP$ denotes Investment in property development /GDP.$A_h/A$ is the residential sector housing assets /Total Assets.$LL_h/LL$ represents the Medium and long-term loans to the residential sector/total loans to financial institutions, while $NFL/LL$ is the Medium and long-term loans to non-financial institutions/total loans to financial institutions.$IH/LL_h$ denotes Disposable income per urban household/medium and long-term loans to the residential sector.$\omega$ denotes residential sector leverage.
findings of the analysis in this paper: the ratio of disposable income per urban household to medium- and long-term loans has been declining year on year since 2010, and the proportion of medium- and long-term loans by financial institutions to the residential sector has been growing at a much higher rate than to the non-financial sector. Considering the rapidly growing leverage of the residential sector and the increasing amount of investment in property development as a share of GDP, it can be concluded that the household sector is expanding its financing of housing assets, and that the source of financing is none other than financial intermediation. The leveraged trading system for housing asset purchases provides the underlying conditions for the real estate market to become a money reservoir, local governments provide a source of credit funding for the household sector and financial intermediaries through fiscal financing. Financial intermediaries’ loan premiums become less dependent on loanable funds, providing the impetus for a countercyclical boom in the prices and market value of money reservoir assets, such as the December 2015 to June 2019 US Federal Reserve raised its benchmark interest rate from 0.25% to 2.5%, but both the US stock market and the Chinese housing market, which is indirectly influenced by dollar liquidity, maintained higher price levels over the same period. According to the model above, most of the boom cycle was driven by the lending preferences of financial intermediaries and the credit expansion of local governments. Second, housing loans are essentially mortgages, and financial intermediaries must prefer mortgages to credit loans; third, the risk of depreciation and depreciation of housing assets as fixed assets has a clear advantage over all types of fixed assets, for example, housing assets are mainly sensitive to factors such as location and the public benefits tied to them, which is why first- and second-tier cities have a higher property market than less economically developed areas. This is an important reason why real estate markets in first- and second-tier cities are more prosperous than in less economically developed regions. Financial assets are also non-depreciable and leveraged, but the Chinese stock market is still dominated by retail investors, derivatives are not widely available, the leverage of the stock market is extremely constrained, and the stock market does not have a third-party utility i.e. it does not take into account local economic growth and local governments do not have the will to finance it, so all the money absorbed comes from the loose monetary policy of the central bank, which explains why this explains why the real estate sector is the main money reservoir asset and the stock market shows a cyclical boom.

Many scholars have studied the role of land finance in financing local economic development [Fu et al.(2017)5; Huang(2012)11], so land finance is essentially a policy tool for local government credit expansion, where more land at higher prices results in more debt, and less land at lower prices results in less debt. The direct collateral asset for land finance is land but the core asset is still tax revenue. According to the local government budget constraint equations (16) and (18), the total value of GDP will be much higher than average through local government credit expansionωh,t, which provides an explanation for China’s high growth rate, whereby local governments finance both supply and demand for real estate, a high-value and highly leveraged productive sector,
through land and future tax guarantees, with mortgage contracts amounting to household sector commitments to the real estate sector. Therefore it provides the local government with the function of ‘cashing in’ on economic growth in advance, thus also explaining the phenomenon of land prices driving up house prices [Wu(2016)[8]], where the local government uses fiscal financing to drive high growth, which inevitably drives up land prices in order to service debt and continue financing. The rise in land costs eventually pushed up house prices further Mei(2021)[26], and the result of this development approach was a rapid increase in the leverage of the residential sector and the share of real estate development investment in GDP at the same time (Table 2).

This paper uses both impulse response and variance decomposition forms to analyse how the price-based monetary policy proxy R, the quantity-based monetary policy proxy and the main housing market variables affect the macroeconomy under a monetary transmission mechanism of monetary reservoir-finance-financed investment. Where the impulse response analyses all take one standard deviation of the upward shock, and to observe the net effect, the \( \lambda \) parameter is set equal to zero, i.e. positive externalities in the public goods sector are not considered. Figure 4 depicts the results of the impulse response analysis for four exogenous shocks: interest rate, housing refinancing ratio, down payment ratio and mortgage interest rate premium coefficient. Consumption is affected by all four shocks - interest rate, housing refinancing ratio, down payment ratio and mortgage interest rate premium - in a way that deviates from theoretical expectations, with the shock effects of interest rate and mortgage interest rate premium being the most significant. While those of refinancing ratio and down payment ratio are more subtle, mainly because the cost of funding mortgage payments squeezes the budget constraint of the household sector, the other two shocks are indirectly affected through mortgage leverage and central bank monetary policy adjustment rules indirectly affect consumption. The effect of shocks on interest rates, which are the traditional monetary policy mediating variable, is divided into two transmission mechanisms: consumption in the household sector and mortgage leverage. The consumption transmission mechanism follows the interest rate-consumption-wage-labour supply-production sector transmission chain, while the mortgage leverage channel generates a shock effect on the economic system through the mortgage leverage - fiscal financing - fiscal transfer channel. The difference from the traditional monetary policy transmission mechanism is that important policy variables in the real estate market such as the down payment ratio, mortgage interest rate premium and refinancing ratio have a shock effect on the macroeconomic system outside the real estate sector through the leverage of the monetary reservoir assets \( \omega_{h,t} \), which is consistent with the empirical experience of domestic and international macroeconomic impacts through the credit channel.

Table 2 depicts the results of the variance decomposition. The results of the variance decomposition show that non-traditional monetary policy variables such as housing refinancing ratio, down payment ratio and mortgage interest rate premium have a moderating effect that is no weaker than the base rate in both the conditional and unconditional decomposition scenarios, with house-
Figure 4: Impact Response Analysis by $R_t$
Figure 5: Impact Response Analysis by $\mu_t$
Figure 6: Impact Response Analysis by $\theta_t$
Figure 7: Impact Response Analysis by $\xi_{h,t}$
hold sector home purchase behaviour, mortgage leverage and land finance acting as a transmission bridge. There is no significant difference in the ranking of the strength of key economic variables such as consumption, investment, prices across sectors and production output affected by the four factors in both the short and long run. Financial financing and household leverage are mainly affected by interest rates in the short run, but in the long run, the highest degree of influence is seen in the down payment ratio, which accounts for over 50% of the total, and the long run impact of the loan interest rate premium is second only to the down payment ratio, suggesting that the asset leverage of the money storage pool channel plays an important role in the long run.

In conclusion, the previous view that real estate absorbed central bank excess money and blocked its transmission to the general consumer goods and production sectors is not valid for two reasons: firstly, the core cause of the phenomenon of market value inflation and premium increases in money pool assets is asset leverage, where the inflationary phenomenon caused by credit expansion amplifies the market value and price volatility of some assets through a leveraged trading system, manifesting itself as Second, the leveraged trading system for money pool assets provides a commitment to pay from the household sector, i.e. pledged labour income financing, which is essentially an atypical security if it has third-party utility (e.g. local governments can obtain performance and financing effects by promoting real estate development). If the asset has third-party utility (e.g. local governments can obtain performance and financing effects by promoting real estate development), then the asset has ample incentive to expand itself creditworthily without the constraints of lending funds available to financial intermediaries, while the cost of risk is borne by the third party or the next counterparty to the third party. In the case of land finance, for example, local government officials are incentivised by GDP tournaments to overdraw future tax revenues to finance investment in public goods, generating positive externalities to drive economic growth, which can be understood as a third-party utility. Similarly, in the US real estate market prior to 2008, as third-party financial institutions were able to make large profits by reselling mortgage-backed securities, the real estate sector began to expand its own credit rapidly until the asset bubble became too large and caused a financial crisis.

We refer to the process of credit expansion leading to fiscal surpluses as the financing effect, and vice versa as the bubble effect. An important way in which credit expansion leads to fiscal surpluses is through large government investments in the public goods sector, so this paper introduces the public goods sector to analyse the financing and bubble effects of fiscal financing investments in the public goods sector.

3.5. Financing of monetary reservoir assets and the bubble effect - introducing a discussion of public goods

The monetary transmission mechanism of monetary reservoir-fiscal financing investment has clear advantages in that investment in public goods results in higher output at the same factor pricing, i.e. the productive sector receives higher income without having to pay for investment in public goods, while local
governments reap more corporate income tax, and this positive externality is reflected in both the real estate and non-real estate sectors, and fiscal transfers \( TF \). An increase in public goods would also be beneficial in terms of raising labour incomes and thus labour supply to expand production.

The positive externalities of public goods in the period significantly increased economic output forming tax rebates and fiscal deficits were mitigated or even reached surpluses. This also explains another important reason for the rapid growth across China at the beginning of the 21st century. The main experience was that local governments were given a certain degree of financing autonomy to finance public goods based on their own credit expansion of monetary reservoir assets, and to feed the sector of non-monetary reservoir assets with the support of positive externalities of public goods to achieve high joint growth.

Equation (30) indicates the difference between fiscal financing and fiscal investment returns divided by the ratio of labour income, indicating the investment efficiency of local government credit expansion, greater than 0 means that government investment produces a net gain, otherwise it produces a net loss. Equation (30) takes into account the positive externalities of the public goods sector, the leverage of monetary storage pool assets and fiscal transfers in a unified manner, and the financing effect is higher than the bubble effect as a result of high economic growth, fiscal surpluses coexist with credit expansion, but at the same time mask the process of credit expansion, when investment in the public goods sector becomes less efficient and excessive credit expansion results in increased monetary issuance, creating a system of increased monetary issuance outside the central banking system.

\[
\frac{\psi_h * (\omega_{h,t} - 1)}{1 - \psi_h - \phi_h} = \frac{1 + (1 - \gamma_d) * \left( \frac{\psi_f + T_q}{1 - \psi_f - \phi_f} \right) + \frac{\psi_h * \omega_{h,t} + T_q}{1 - \psi_h - \phi_h} + 2 * T_g}{\exp(\lambda * [\alpha * G_t - \delta_k \sum_{i=0}^{T-1} G_i])} 
\]

(30)

Many scholars have conducted a number of studies on high investment and government-driven public goods investment in China [Chenet al.(2016), Fan et al.(2018)]: where the positive externalities of Chinese government investment mainly arise from the accumulation of technology, management, and human capital absorbed by the provision of fiscal subsidies, i.e., growth outside of traditional factors of production, yet non-traditional factors of production such as technology are marginal decreasing in the absence of non-traditional factors of production such as technology are marginal decreasing in the long run without revolutionary innovation. Human capital accumulation is also dependent on population growth in the long run, and credit preference for one sector will undermine the productivity of other sectors (Luo(2015)), so \( \lambda \) will gradually decrease in the long run. This is more evident in regions with insufficient absorption of production factors such as technology and human capital.

Figure 8 depicts the stochastic simulation analysis of the degree of government credit expansion and government investment efficiency under stochastic simulations, where the stochastic simulation shocks are set as the down payment ratio \( \theta_t \), the housing value refinancing ratio \( \mu_t \), the benchmark interest rate \( R \) and the interest rate premium \( \xi_{h,t} \) randomly sampled in each period of their re-
Figure 8: Random Simulation

Figures 8: Perspective distributions, for a total of 100 simulations. Figure 5 shows, in top and bottom order, the level of leverage $\omega_{h,t}$, the level of positive externalities adding value to aggregate output $\exp(\lambda \ast [\alpha \ast G_t - \delta_k \sum_{i=0}^{T-1} G_i])$ and the fiscal deficit divided by labour income $\psi_{h}^* \frac{(\omega_{h,t} - 1)}{1 - \psi_{h} - \phi_{h}} - 1 + (1 - \gamma_d) \ast \left(\frac{\psi_{h} + T_g}{1 - \psi_{h} - \phi_{h}}\right)$, indicating whether the benefits of government fiscal transfers can cover the financing costs, and finally calculating equation (30). From the simulation results, due to the cumulative investment characteristics of the public goods sector, the response of investment efficiency to the parameter $\lambda$ is very significant. When the $\lambda$ parameter increases from 0 to 0.02, the positive externalities of the public goods sector play a significant role, increasing the output level by 20-30 times. When the public goods sector is not considered, the ratio of fiscal deficit to labour income is at a level of around 50. After the introduction of the public goods sector, the value added to output increases significantly and the fiscal position shifts from deficit to surplus, and the absolute value of the ratio of fiscal surplus to labour income is also much higher than the deficit level. Although this paper is only a theoretical analysis, it explains why the monetary reservoir-fiscal-financed investment monetary transmission mechanism has been "invisible" to academics for so long, not least because the positive externalities of the public goods sector drive high economic growth, as there are no widespread fiscal deficits and thus no significant local government fiscal deficits. Monetisation, economic growth almost completely masked the credit expansion of local governments, and government credit did not translate into increased
money issuance - until the marginal value of investment in the public goods sector declined and the real estate boom triggered by local fiscal deficits and excessive money issuance gradually came to academic attention, but remained in "out of sight, out of mind".

To sum up the above process, the monetary transmission mechanism of monetary reservoir-fiscal financing investment is a spontaneous credit expansion, which is part of the non-traditional monetary transmission mechanism, but this process inevitably translates into monetary over-issuance by the central bank in the long run for two main reasons: firstly, the exogenous positive shock to fiscal investment is not sustainable and stable; secondly, the credit imbalance will lead to an allocation of financial resources irrational and reduce productive efficiency. The monetisation of fiscal deficits is not only limited to the central bank monetising its debt to maintain the stability of local finances, or rigid payments, but also to local governments issuing bonds or borrowing to repay old debts for the same purpose. Without the design of a de-bubble mechanism, the monetary transmission mechanism of a monetary reservoir - fiscal financing investment - is bound to lead to a financial and fiscal crisis.

4. Design of a mechanism to finance the de-bubble of a currency reservoir

![Figure 9: Schematic design of the financeable de-bubble mechanism](image)

In the current situation where the efficiency of positive externalities of public goods $\lambda$ is at a low level and the problem of local debt is becoming increasingly prominent, restraining the credit expansion of local governments is tantamount to restraining the issuance of additional money and the imbalance of financial credit. In addition, the specificity of China’s economic situation requires local governments to have a stable source of new financial resources to plan their own construction, and the central government needs to play an active role in the construction of local governments under the performance appraisal system.
of officials to promote the coordinated development of the overall economy. In order to solve the above problems, this paper proposes a financeable de-bubble design based on the theory of monetary reservoir assets, which can be used not only to solve the problem of incremental stock issuance of money, but also to use and improve the monetary transmission mechanism of monetary reservoir-finance financing investment to form a development model with both high speed and high quality.

The reasons for this are twofold: on the one hand, there is a short-term ceiling on the productivity of public goods, which does not match the maturity structure of fiscal debt; on the other hand, the return on investment in public goods is highly influenced by external shocks and is highly uncertain. It should also be noted that there is a need for local governments to retain a certain degree of autonomy in credit expansion. Firstly, it is necessary to achieve political and economic policy objectives; there is a clear heterogeneity in the situation across China and the central bank. The Ministry of Finance and the tax authorities cannot set out the details one by one in the face of a complex policy implementation environment. Moreover, maintaining local economic stability does not only rely on monetary policy but also on the role of fiscal policy. Secondly, the extent to which local economies are affected by external shocks [Mei(2020)] or internal factors such as the new crown epidemic varies significantly and is difficult to quantify. All in all, local governments should be given appropriate fiscal autonomy, but the scale and maturity structure of credit expansion should be kept within appropriate limits. In summary, the focus of the de-bubble design is to provide local governments with a stable instrument for credit expansion and recovery.

There are two main problems that need to be addressed in a de-bubble design. The first problem is the inability to identify in practice the portion of loans used for real estate that are loanable funds of financial intermediaries or government financing. The second problem is that the specificity of public goods obscures the actual lender status of local governments, and that there is only a potential debt relationship between the government and the owner of the money pool assets. Local governments need new policy instruments such as property taxes to obtain claims on the household sector through taxation rights.

According to the monetary reservoir asset theory, the property tax, as a mandatory payment commitment, is in fact equivalent to a mortgage contract with zero down payment and therefore can also be offset against the debt to the financial intermediary, where the property tax is converted into an extension of the mortgage contract and the financial intermediary collects the property tax from the household sector. As shown in Figure 6, unlike the traditional method of property tax collection by local governments, debts between local governments and financial intermediaries can be offset (in whole or in part) by transferring ownership of the property tax. This not only simplifies the debt clearance process between financial intermediaries and local governments, saves tax collection costs by using the loan collection system of financial intermediaries, especially banks, but also avoids unclear collection amounts and asset.
also avoids problems such as unclear levy amounts and unclear asset affiliation. The most suitable period \( T \) and the tax rate \( t_h \) for the payment of property tax can be obtained according to the formula.

\[
T = \omega_{h,t}(1 - \theta_h) = \omega_{h,t} = \left[ \frac{1}{R_t \cdot (1 - \theta_t)^{1 + \xi_{h,t}}} \right] = (R_t)^{-1}
\]

The optimal property tax rate is calculated from \( \omega_h \) and \( R_t \) to give \( t_{h,t} = \frac{\psi_h - \psi_f}{1 - \psi_h - \phi_h - \psi_f} \), and the amount of property tax levied should be the inflated portion of the market value of housing assets, where from Table 2, the proportion of the incremental money caused by money reservoir assets, which should be \( \frac{\psi_h - \phi_h}{1 - \psi_h - \phi_h + \psi_f} \), the amount of property tax is only the \( \frac{1 - \psi_h - \phi_h}{1 - \psi_h + \phi_h - \psi_f} \) part of the total growth market value \( (P_{h,t} - \bar{P}_{h,0})Y_h \), and the economic interpretation of this part of the growth market value is that when the land element (government supply) contributes to the output of the real estate sector to a higher extent than the non-real estate sector. Local governments already finance land finance for the \( \frac{\psi_h - \psi_f}{1 - \psi_h - \phi_h + \psi_f} \) portion of the growth market value of housing assets, so that the household sector pays for the remaining portion, and the amount of property tax to be paid each period is

\[
\frac{\psi_h - \psi_f}{1 - \psi_h - \phi_h + \psi_f} \cdot (P_{h,t} - \bar{P}_{h,0})Y_h R_t^{-1}
\]

The essence of the financing of monetary reservoirs is that the government invests future tax revenues in public goods that generate high positive externalities, and the financing is recovered over time by means of a long-term levy, so that even if the positive externalities do not meet expectations, fiscal financing does not cause monetary growth in the long term, creating a good cycle of rapid and high-quality economic growth - fiscal financing - fiscal surplus.

An important reason for the bursting of the real estate bubble in the sub-prime crisis was that the securitisation of assets under unregulated regulation greatly increased the refinancing ratio providing the conditions for the continued expansion of leveraged finance in the household sector. Financial intermediaries provided this apparently risk-increasing financial service because real estate securities could be packaged and sold to third parties without risk to themselves, and China’s previous model of debt issuance by local governments - with financial intermediaries earning profits - could also lead to financial intermediaries actively expanding lending to the real estate sector, transferring risk to local governments and ultimately creating a situation of overleverage and credit imbalance in the real estate sector. If the monetary reservoir - public goods and fiscal transfer development model is combined with asset value-added tax offset, the local government will transfer long-term risks back to the financial intermediary, which will guide the financial intermediary to reasonably adjust the loan structure and loan interest rate pricing, thus largely avoiding the moral hazard of the financial intermediary. In addition, the assessment system for local government officials should also appropriately increase the weight of the evaluation of the effectiveness of the government’s direct investment projects, so as to solve the problem of principal-agent. In order to solve the problem of principal and agent of government officials.
It is important to note that the above design is not limited to the real estate sector, as any asset such as a REITS can become a money reservoir as long as the three conditions of a leveraged trading system, balance instalment commitments and third party utility are met. Consumer durables such as cars and computers have a significant leverage ceiling due to high depreciation, so leverage increases are relatively stable. However consumer loan securitisation allows consumer durables to escape their natural leverage ceiling. If consumer loan securitisation were to become widely available for consumer durables it would result in consumer loan securities having the characteristics of a money pool asset similar to housing assets, but the underlying assets of consumer loans do not have the low depreciation rates of housing assets and the two characteristics of a better secondary market. The above de-bubble mechanism is designed on the premise of payment commitments by the residential sector, and if the market value of the underlying asset decays rapidly below the amount required to be paid, the household sector will abandon its payment commitments. The secondary market value of consumer goods is much less than that of housing assets, making the use of consumer loan securities for monetary reservoir assets for financial financing highly risky. In order to prevent serious systemic risks in financial intermediation, money pool assets also need to have low depreciation rates and a well-established secondary market, so securitisation for money pool-finance financing also needs to take into account market liquidity, various impairment risks and the moral hazard of sellers of securitised assets.

5. Conclusions and policy recommendations

This paper constructs a dynamic general equilibrium model including fiscal financing investment and financial accelerator based on the monetary reservoir phenomenon of "Chinese housing and US stocks" and China's unique fiscal and financial system to provide a rational explanation for the monetary transmission mechanism of monetary reservoir-fiscal financing investment, using data on China's housing market as well as data from 1991 to 2015. The macro effects of monetary policy and real estate market variables are discussed using the data on China's housing market, as well as data on the central bank's refinancing rate to financial institutions and GDP, for parameter estimation and dynamic numerical simulations. Based on the theoretical model and numerical simulation results, the theory of monetary pool assets is proposed: an asset can become a monetary pool asset and be financed by a third party if it satisfies three conditions: a leveraged trading system, a balance commitment payment and the existence of third-party utility. When the bubble effect is greater than the financing effect, it will lead to an increase in monetary issuance, forming a monetary transmission mechanism outside the central banking system. When the financing effect is greater than the bubble effect, economic growth conceals the credit expansion of local governments, resulting in the monetary transmission mechanism being "invisible" to academics. This paper proposes a design for a financeable de-bubble mechanism for monetary reservoir assets to address this problem.
Key findings, as well as policy implications, include: (1) The combination of land finance and fiscal financing is not only the capitalisation of land resources, but also the credit expansion of local finance. The process is often masked by high growth rates in the early stages of economic development, with local governments bearing the financial risks while financial intermediaries and the real estate sector enjoy a long boom cycle, so fiscal financing requires a reasonable mechanism design to ensure that financial intermediaries and the money storage sector take the risks of credit expansion. The financial financing needs to be reasonably designed to ensure that financial intermediaries and the monetary storage sector take the risks of credit expansion into account in their own operations and avoid disorderly credit expansion. In practice, due to the leveraged nature of money pools and the commitment to pay a fixed amount over time, the local government does not need to levy a separate tax, and the financial intermediary will add to the original loan contract a provision for levying the asset VAT on behalf of the local government. (i) The local government should pay attention to the human capital and the human resources. Local governments should pay attention to the accumulation of human capital, the introduction of innovative industries and the investment of public goods with strong positive externalities, so as to form a virtuous cycle of fiscal financing - tax return gain - refinancing of fiscal surplus; (ii) On the contrary, using all fiscal financing for consumption expenditure will not support long-term growth. The assessment of economic development indicators should be diversified and scientific. (iii) After the revenue from the transfer of state-owned land use rights is returned to the taxation department, although local government land transfer revenue is under the dual supervision of the central and local governments, the financial financing and shadow banking system is not fully in the hands of the central bank, and it is still challenging to prevent local debt crises in the foreseeable future, so the process of financial financing by local governments using money pool assets should be brought under the supervision of the central government. The process of fiscal financing by local governments using monetary reservoir assets should be brought under the supervision and control of the central government to avoid the phenomenon of local government officials focusing on short-term local gains and neglecting long-term overall gains, to minimise the possibility of local governments or financial intermediaries issuing additional money on their own, to maintain the stability of the economic system and to maintain the systemic consistency of monetary policy.

(2) Without taking into account third-party utilities, monetary reservoir assets are only affected by the increase in central bank money issuance and absorb more money than other assets, but because of the leverage this sector has higher price increases than other sectors, financial intermediaries and the household sector develop preferences and further increase their capital investment in this sector. The squeeze on financial resources by the money storage sector creates serious structural imbalances and undermines long-term growth potential, while the credit imbalance leads to a "too big to fail" dilemma of premium increase - credit preference - reverse bundling. Based on this conclusion, financial markets for assets that satisfy the nature of money pools, such as
derivatives in equity markets, futures markets, securitised consumer loans, etc., should be constrained to limit the refinancing of collateral (pledges), leverage and market access in order to control the overall size of credit.

(3) The higher the degree of leverage, the greater the macroeconomic impact of the sector, which is determined by three main factors: the down payment (margin or refinancing) ratio, the interest rate plus depreciation (including technical depreciation, value-in-use depreciation and market value depreciation, etc.) and the interest rate premium of financial intermediaries, which provides a more targeted non-traditional policy tool for macroeconomic regulation. This provides a more targeted and non-traditional policy tool for macroeconomic regulation, and also means that the regulation of variables in the money pool sector in addition to the traditional monetary policy variables (interest rates, money supply, etc.) can achieve similar policy objectives.

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