RESEARCH ON THE MACRO NET FINANCIAL ASSETS VALUE EFFECT OF MONETARY POLICY

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Abstract: *This paper focuses on the impact of Chinese and US monetary policy on the net financial assets value of macro balance sheet from both theoretical and empirical aspects and reveals the sectoral solvency risk conduction path based on the balance sheet channel. In addition, the paper is focused on the effects of the interest rate as a target tool for monetary policy on the macro net financial assets. In the theoretical analysis, the net present value model of the economy is constructed, and a general equilibrium model representing the relationship between the real interest rate and net asset value of five sectors is derived (government, financial, resident, enterprise and central bank sector). This model explains the basic principle how interest rates affect net financial assets values. The dataset includes the central bank, commercial banks and shadow banks, and the stock and equity liabilities of the debtor are taken as the net asset of financial institutions during the period 2000–2016. The empirical results show that an increase in the real deposit interest rate improves the net financial assets value of the four sectors, and an increase in the real loan interest rate reduces the net financial assets value of the four sectors, while the effect of the real loan interest rate is greater than the real deposit interest rate. The effect ranking of interest rates on the four sectors is financial, enterprise, government, and resident sector. Overall, loose monetary policies can reduce macro-financial risks through the balance sheet channel, while the negative effects of long-term low-interest policies should be prevented; the macro-policies should hedge sectoral risks triggered by the exit of the easing policy via the macro balance sheet channel.*

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Introduction

The financial crisis is a manifestation of excessive debt, the so-called balance sheet recession (Krugman, 2014). A typical feature of a balance sheet recession is that the business objectives of most companies have been changed from profit maximization to debt minimization due to increased liabilities, and the decline in credit demand prolonged the recession. The continued accumulation of excessive debt burdens as well as an abrupt drop of debt scale may increase the probability of a financial crisis (Cecchetti et al., 2011; Khoo et al., 2017; Jarmuzek & Rozenov, 2019). The countries like Japan, the United States, the United Kingdom, Spain and Ireland experienced severe debt expansion during the crisis (Koo, 2011). Koo (2015) believes that the global economic recession in 2008 is essentially the same as the Japanese economic recession that began in the early 1990s. These phenomena motivated academics and policymakers to

examine the cause and policy mitigation of excessive debt.

Previous studies established that monetary policy can affect the entire economy by affecting debt leverage (Cafiso, 2017; Blanchard, 2019; Benigno et al., 2020). Therefore, to establish an appropriate framework for the prevention of excessive debt, policymakers must accurately grasp the implemented effect of monetary policy and resist the negative impact of monetary policy on debt. What has been less studied in the literature is the macro balance sheet channels of monetary policy.

The high debt of excessive economic prosperity reduced the ability of the economic system to resist external shocks. Once the central bank implemented a tight monetary policy, the possibility of an economy falling into recession would increase dramatically. To address this recession, a series of quantitative easing monetary policies are implemented by maintaining long-term low-level policy interest rates. Although it has greatly promoted the recovery of the economy, the implementation and exit of the quantitative easing monetary policy have exerted an inestimable impact. The channel and effect of monetary policy is an important issue that deserves attention. The interest rate is an important variable affecting the operation of the macroeconomy and monetary policy. It affects the total output of a country by determining asset prices, consumption, and investment. As a result, we focus on the impact of interest rates which is a target tool for monetary policy. Moreover, the monetary policy of one economy also has a huge impact on another economy (Bian et al., 2013; Yi, 2014). This paper contributes to this line of the literature by studying the macro balance sheet channel of monetary policy. The objective of this paper is to explore the mechanism of the monetary policy on the net financial assets, from both theoretical and empirical aspects.

We start our analysis by constructing a net present value model of the separate sectors. The balance sheet recession is intuitively reflected in the macro balance sheet, which is the decline in the net financial assets value caused by asset prices, assets decreased and liabilities increased. The net financial assets value in this analysis is the difference between financial assets value and debts value. The debts covers all liabilities in the sector balance sheet. Our model explains the basic principle how interest rates affect net financial assets values. The rise in domestic and foreign interest rate reduces the net financial assets value of the banking, enterprise, resident, and the government sector's income, even can induce bank and government debt crises in an extreme situation.

We then study the sector balance sheet value effect in a general equilibrium model in five sectors. We extend Jeanne and Zettelmeyer (2002) and Gómez (2005) analysis from currency crises to debt crises. By establishing inter-sectoral linkages, based on the identity of the net financial assets equal to asset minus liability and budget constraints of the various sector, a general equilibrium model can be derived that represents the relationship between the domestic and foreign real interest rate and the sectoral net financial assets value. We find that the domestic real risk interest rate, the foreign real risk interest rate, the exchange rate, and the budget constraint can affect the net financial assets value of each sector.

To quantify the relevance between the interest rate and net financial assets value, we examine the influence of the CNY interest rate and the foreign currency interest rate (represented by US dollar) on the net financial assets value of China' macroeconomic sectors' balance sheets, clarify the macro-balance sheet effect channel of the interest rate. We find that an increase in the real deposit interest rate improves the net financial assets value of the four sectors, and an increase in the real loan interest rate reduces the net financial assets value of the four sectors. The US federal funds rate has a less significant impact on various sectors.

Our study has the following contributions. Our study provides new insights into the mechanism of monetary policy acting on macroeconomics through the balance sheet channel. The monetary policy can affect the economy through the exchange rate channel (Kim & Lim, 2018; Dybowski et al., 2018), expected channel (Berge & Cao, 2014; Góes et al., 2017), investor sentiment channel (Forbes et al., 2018), bank credit transmission channel (Ippolito et al., 2018; Salachas et al., 2017) and the asset price approach (Rahal, 2016; Chatziantoniou et al., 2017; Fausch & Sigonius, 2018). In addition to the traditional transmission channels, monetary policy can also affect the entire economy by affecting the macro balance

sheet. However, studies on the macro balance sheet of monetary policy are limited.

Our study provides a new indicator to measure debt leverage risk. In the existing research, the variable of debt leverage is mainly the debt-income ratio (Cecchetti et al., 2011; Siddique et al., 2016; Baharumshah et al., 2017), used to measure the sustainability of debt (Dalio, 2012). There are logical mismatches in the debt-income ratio. It ignores the health of the macro balance sheet that determines the sustainability of debt. The macro balance sheet is an important monitoring tool, transmission channels and management methods for the financial crisis. The net financial assets value of the macroeconomic sector exposes solvency risk and balance sheet recession.

We provide new evidence on the effect of monetary policy to debt leverage risk. Devereux (2010), Schularick (2012), Benigno et al. (2016) and Rogoff (2020) argue that loose monetary policy can cause the increase of debt leverage, both in private debt (Cafiso, 2017) and public debt (Barrett; 2018; Mehrotra, 2018). This paper contributes to this line of the literature by documenting the measurement and evaluation of macro debt accumulated risk in different sectors, providing a certain theoretical basis and empirical result for the implementation of the monetary policy.

This following paper is divided into three parts: the first section is the theoretical basis, the one-period economic net present value model and the general equilibrium model are constructed; the second section is the empirical analysis, which studies the impact of the CNY interest rate and the US dollar interest rate on the net asset value of the macroeconomic sector; the third section is the conclusion of this paper.

1. The Mechanism of Sectoral Balance Sheet Effect

An economy is constituted by different sectors according to its function and nature, including the resident, enterprise, government, financial sector, and the external sector. The wide-ranging failure of paying debts on time may increase the probability of solvency risks enter the sector, even spillover to the associated sectors and lead to crises. This risk can be reflected by the net value of the financial assets in the balance sheet. We use the net present value method to analysis the relationship between the expected interest rate and the net present value of net financial assets in one-period model. The one-period model is an approximate description of the real world. The analysis of one-period model is the basis of the multi-period. A one-period two-state economy will be considered to simplify the formation and change process of net financial asset value of each sector.

1.1 The Basic Principle of the Relationship between the Expected Interest Rate and the Net Present Value

For the one-period and two-state economy, assuming that the sector does not hold any asset at the beginning of the period, the domestic net present value of net financial assets is:

$$W_D = R_0 + \frac{R_1}{1+i} - \left(D_0 + \frac{D_1}{1+i}\right) = \\ = R_0 - D_0 + \frac{R_1 - D_1}{1+i} \,. \tag{1}$$

Since foreign income and debt are denominated in foreign currencies, the foreign net present value of net financial assets expressed in the domestic currency is:

$$W^* = (R_0^* - D_0^* + \frac{R_1^* - D_1^*}{1+i^*}) \times E_0 \,. \tag{2}$$

The total net present value of a country's sector net financial assets is as follows:

$$W = R_0 - D_0 + \frac{R_1 - D_1}{1+i} + \\ + (R_0^* - D_0^* + \frac{R_1^* - D_1^*}{1+i^*}) \times E_0 \,, \tag{3}$$

where i denotes the domestic risk-free rate, time is denoted by t. D_t donates the domestic debt stock in the time t. R_t donates the domestic income in the time t, W_D denotes the domestic sectoral net present value of net financial assets, i* denotes the foreign risk-free rate, D_t* donates the foreign debt payment in the time t, R_t* donates the foreign income in the time t, W* denotes the foreign sectoral net present value of net financial assets, W denotes the total sectoral net present value of net financial assets. E_t is the exchange rate of domestic to one unit of foreign currency in the time t, which increase indicates a depreciation of the domestic currency.

It can be seen from formula (3), under the condition that the changes in income and debts are not taken into account, as well as the influence of other factors on income and debts. The net present value of the net financial assets decreases when the domestic interest rate and the foreign interest rate rise during the period. The increase in the exchange rate has raised the domestic net present value of net financial assets. Since the exchange rate of the CNY foreign currency is still relatively stable under state control, the change is small. Therefore, in the analysis, the exchange rate is assumed to be constant, and only the impact of the interest rate change on the net present value of net financial assets is analyzed. As the expected interest rates rises, the total net present value of the sector net financial assets decreases. If $D_0 > R_0$, $D_0^* > R_0^*$, and the expected interest rate is large enough, regardless of how high R_1 and R_1^* are, the net present value of net financial assets is still negative, and there will be solvency problems.

1.2 The Net Present Value Model of the Separate Sectors

The reduction of net present value of net financial assets in different macroeconomic sectors will generate macro-financial risks and even trigger economic crises from different channels. For the enterprise sector, a low net present value of net financial assets will limit the financing capacity and actual investment of enterprises, which will lead to a slowdown in economic growth. For the banking sector, a low net present value of net financial assets can result in liquidity risks, solvency risk and even the collapse of the entire financial system. For the government sector, the lower net present value of net financial assets may make it difficult for repaying loans or bonds and borrowing new government debt, which increase the probability of debt crisis of local and central government. As the ultimate risk undertaker in the general sense, the reducing of the net present value of net financial assets in the resident sector can cause large-scale defaults and directly spread to the banking sector. This part extends Jeanne and Zettelmeyer's (2002) analysis from currency crises to debt crises. On the basis of their financial sector and the corporate sector balance sheet approaches, a stylized net value discount model of financial, corporate, household and the government sector has been documented.

Financial Sector

A decrease in the net financial assets value of a bank may lead to a reduction in the ability to absorb losses, while the condition of no bankruptcy is that the net financial assets value of the banking sector W_B is positive. Assuming no asset at the beginning of the period:

$$W_B = R_0^B - D_0^B + \frac{R_1^B(i) - D_1^B(i)}{1+i} + \\ + (R_0^{B*} - D_0^{B*} + \frac{R_1^{B*}(i^*) - D_1^{B*}(i^*)}{1+i^*}) \times E_0 \geq 0 \quad (4)$$

among them, R_t^B and R_t^{B*} represent the domestic and foreign incomes of the banking sector in the time t, D_t^B and D_t^{B*} represent the domestic and foreign debts of the banking sector in the time t.

It can be seen from formula (4), that the mechanism and direction of domestic interest rate and the foreign interest rate on the banking sector are consistent. When the net financial assets value satisfies the formula (4), the depositor believes that all debts can be paid off, so there is no incentive to withdraw in advance. However, if the formula (4) is not satisfied, it means that the bank can only repay part of the deposit, and the bank depositor will withdraw in advance in the phase 0. For banks, whose primary source of profit is the spread between deposits and loans, the income and debts of banks are the function of interest rates in the first period. When interest rates rise, income and debts increase both. In the case of the same change, i.e., the degree in the deposit interest rate and loan interest rate, the impact of the interest rate on the net financial assets value is mainly reflected in the denominator. As interest rates rise, the net financial assets value of banking decreases and solvency risks increase.

There exists an interest rate i' that makes $W_B = 0$. That is, all banks have a net financial assets value of zero. Suppose there is a cumulative distribution function $F(i)$, which describes the bankrupt bank ratio n with a net asset value of zero when $i < i'$. The bankrupt bank ratio n representing the risk of the banking sector is an increasing function of the expected interest rate i:

$$n = F(i), F' > 0, F(i') = 1 \quad (5)$$

On the one hand, the reduction in the net financial assets value of the banking sector

and the risk of bankruptcy will reduce the credit supply and bring the entire society into sustained austerity. Adrian et al. (2010) argue that the constraints of financial intermediaries' balance sheets determine their risk preference and credit supply, therefore a macro-risk spillover can be observed through the balance sheets. From the perspective of the individual bank and corporate balance sheet, Jiménez et al. (2012) and Patti and Sette (2012) find that the balance sheet of banking has a significant impact on credit supply. On the other hand, the liquidity risk or bankruptcy of the big size and excessive connection banks bring great negative externalities to the whole economy. Due to the special position of the banking sector in the economic system, the government has certain guarantee debts for these financial institutions, providing protection when these too big to fail banks are going to be bankrupt, which forms the contingent liability of the government. Therefore, the reduction in the net assets value of the banking sector will affect the net value of assets and debts in the government sector.

Enterprise Sector

The net financial assets value of the enterprise sector can be expressed as:

$$W_c = R_0^C - D_0^C + \frac{R_1^C - D_1^C(i)}{1+i} + \\ + (R_0^{C*} - D_0^{C*} + \frac{R_1^{C*} - D_1^{C*}(i^*)}{1+i^*}) \times E_0, \quad (6)$$

among them, R_t^C and R_t^{C*} represent the domestic and foreign income of the non-financial enterprise sector in the time t, D_t^C and D_t^{C*} represent the domestic and foreign debt of the non-financial enterprise sector in the time t.

In the same way as the banking sector, the domestic interest rate and foreign interest rate have the same mechanism and direction for the enterprise sector. In the daily operation, the income of the enterprise sector is rarely affected by the interest rate, which can be ignored here. The debt of the enterprise sector is positively correlated with interest rates, therefore when interest rates increase, the net financial assets value of the enterprise sector usually falls. The increase in the expected interest rate will reduce the net financial assets value of the enterprise in the time 0. However, that will not cause the default of enterprise in the time 0, for the reason that the enterprise does not need to repay the loan in the time 0, which would limit the amount of financing and investment in the time 0. When interest rates rise, the return of creditor increases while the investment return of equity holder decreases, which makes a decrease in the investment and income of the enterprise.

Changes in the net financial assets value of the enterprise can lead to changes in the amount of investment. Suppose the company has an optimal investment amount I^*, indicating the amount that the company is willing to invest without credit constraints, k represents a simple linear relationship between the investment amount and the net financial assets value, that is also called mortgage rate. Then, the actual investment amount of the enterprise I is:

$$I = \begin{cases} I^*, & I^* \le kW_C \\ kW_C, & 0 \le kW_C \le I^* \\ 0, & kW_C \le 0 \end{cases} \quad (7)$$

If the net financial assets value of the enterprise is large enough, the actual investment amount of the enterprise is equal to the optimal investment amount. A higher net worth can increase the source of internal financing (such as retained earnings), and it can also induce the investment by providing more collateral for external financing. With the decrease of the enterprise net financial assets value, the amount of actual investment of the enterprise will be reduced by the restriction of credit constraints. When the net financial assets value is less than 0, the enterprise has no investment. With the reduction of investment, the net financial assets value of the enterprise sector has further decreased, which reduces financing and investment, and results in a slowdown in economic growth and a vicious circle. Moreover, if enterprises rely on external financing, the effect of the reduction in the net financial assets value will be amplified through the financial market and produce 'financial accelerator effect' (Bernanke et al., 1999).

The two sectors which have the highest relevance to the enterprise sector are the banking sector and government sector. First, the reduction in the amount of finance and profits in the enterprise will reduce the income of the banking sector, accompanied by the decrease in the net financial assets value in the banking sector. The increase of default risk and profit fluctuation in the enterprise sector

have increased the credit risk of the banking sector. Second, the government sector has a guarantee liability for the debts of the state-owned enterprise, and the tax revenue will also be affected by the net financial assets value of the enterprise. The reduction of the net financial assets value in the enterprise sector will also reduce the net financial assets value of the government sectors.

Resident Sector

The net financial assets value of the resident sector is as follows:

$$W_H = R_0^H - D_0^H + \frac{R_1^H(i) - D_1^H(i)}{1+i} + \\ + (R_0^{H*} - D_0^{H*} + \frac{R_1^{H*}(i^*) - D_1^{H*}(i^*)}{1+i^*}) \times E_0, \quad (8)$$

among them, R_t^H and R_t^{H*} represent the income of domestic and foreign residents in the time t, D_t^H and D_t^{H*} represent the domestic and foreign debt in the time t.

The interest income and net financial assets value are positively correlated, so the expression of the resident sector is similar to that of the banking sector. However, the proportion of interest income in the total income of residents is relatively low, and the interest expense depends on the amount of debts the residents hold. With the rise of domestic and foreign interest rates, both the interest income and loan interest expense increase. When interest rates change, income and outcome change in the same amount. If the deposit interest rate and loan interest rate change in the same degree or the difference is small, the interest rate changes inversely with the net financial assets value of the resident sector.

The decline in the net financial assets value of the resident sector reduces household investment, consumer expenditure and aggregate demand, which triggers economic contraction (Mian et al., 2013), and thus reduces tax revenue and the net financial assets value of the government. The decline in the value of assets owned by a household may cause households insolvency, then large-scale defaults will reduce the net financial assets value of the banking sector, inducing liquidity risks and credit risks in the banking sector.

Government Sector

The net financial assets value of the government sector is as follows:

$$W_G = R_0^G - D_0^G + \frac{R_1^G(W_B, W_C, W_H) - D_1^G(i)}{1+i} + \\ + (R_0^{G*} - D_0^{G*} + \frac{R_1^{G*}(i^*) - D_1^{G*}(i^*)}{1+i^*}) \times E_0 \quad (9)$$

among them, R_t^G and R_t^{G*} represent the domestic and foreign income of the government sector in the time t, D_t^G and D_t^{G*} represent the domestic and foreign debt of the government sector in the time t.

Since tax revenue is the main source of government income, which is positively correlated with the net financial assets value of the banking, enterprise, and the resident sector. The rise of interest rates leads to a decline in the net financial assets value of the remaining sectors, thus decreasing the government revenue and increasing the debt burden of the government sector. Therefore, the rise in the interest rate has an indirect effect on the net financial assets value of the government sector through the net financial assets value of other sectors. The decline in the net financial assets value of the government sector will reduce government investment and may also trigger local government debt crises and sovereign debt crises. Besides, the operational risk of other sectors will affect the entire economy through the government sector. For the income and debt expressed in foreign currencies, they are mainly related to the foreign interest rate, depending on the relative amount of foreign assets and debts. The decline in the net financial assets value of the government sector may result in the failure to perform government functions and causing solvency risk. Through studying the risk spillover effects of the banking sector and government sector, Bi et al. (2014) find that if the banking sector is not bankrupt, the risk of sovereign default has little impact on the economy. If the banking sector goes bankrupt, stagflation will occur, while sovereign debt default will have a large negative impact on the economy.

In addition, the capital flow between two countries leads to the reallocation of domestic and foreign accounts in the balance sheet within and between sectors. To maintain the independence of monetary policy, China currently implements a relatively fixed exchange rate policy and an incomplete capital flow policy. Therefore, we assume that the exchange rate does not change, and only the net effect of the interest rate is studied in

our analysis. Above all, we conclude that the rise in domestic and foreign interest rates will reduce the net financial assets value of banking, enterprise, resident and government sectors, which will further trigger the decline in investment and consumption, even induce bank and government debt crises in an extreme situation. Conversely, the reduction of domestic interest rates and foreign interest rates will increase the stability of the economic system by increasing the net financial assets value of economic sectors. If the interest rate of the two countries changes in the opposite direction, the impact on the total sectoral net financial assets value needs to be comprehensively analyzed according to the distribution of assets and debts between domestic and foreign sectors and the different range of the interest rate change.

The Effect of Sector Net Financial Assets Value on Interest Rate

There is a certain relationship between the interest rate and the sectoral net financial assets value. The analysis above shows that the change of the interest rate will cause the change of the sectoral net financial assets value, and the net financial assets value change can also affect the interest rate in the opposite direction. On the one hand, the low net financial assets value of the enterprise and resident sector raises the risk premium, and the banking demand higher risk returns, which will lead to the higher interest rate for enterprise and resident sectors. The low net financial assets value of banking accompanies with the higher outcome and capital pressure. On the other hand, low investment in the enterprise sector leads to less output and a lower interest rate. In addition, the loose monetary policy during the crisis will reduce the short-term interest rate. The direction and change of the interest rate in different strength and type of crises are also different. Therefore, the relationship between the interest rate and the sector net financial assets value is complex.

1.3 Sector Balance Sheet Value Effect in General Equilibrium Model

Through the above analysis, we find that in a one-period economy, if the economic sector does not hold any assets at the beginning of the period, the change in the interest rate will cause a reverse variety in the net financial assets value. In the process of preparing and using the actual balance sheet, the assets and debts of different sectors have a certain relationship, that is, the assets of one sector is part of debts in other sectors. On the basis of the balance sheet approach of exchange rate risk analysis (Gómez, 2005), we add the financial sector and enterprise sector into the general equilibrium analysis, providing a more comprehensive path of interest rates acting on net financial assets value. By establishing inter-sectoral linkages, based on the identity of the net assets equal to assets minus debts and budget constraints of the various sector, a general equilibrium model can be derived that represents the relationship between the domestic and foreign real interest rate and the sectoral net financial assets value.

Average Real Risk Rate

The domestic and foreign nominal risk rates are:

$$i_t = i_t^f + \varphi_t \tag{10}$$

$$i_t^* = i_t^{f^*} + \varphi_t^* \tag{11}$$

among them, i_t^f is the domestic nominal risk-free rate, and $i_t^{f^*}$ is the foreign nominal risk-free interest rate, which are determined by the monetary policy authorities. φ_t and φ_t^* represent national and foreign risk premium.

The real risk rates in a domestic and foreign country are:

$$r_t = i_t - \pi_t \tag{12}$$

$$r_t^* = i_t^* - \pi_t^* \tag{13}$$

among them, π_t and π_t^* are domestic and foreign inflation rates. The average risk interest rates for domestic and foreign unexpired debt are:

$$\rho_t = \frac{1}{\tau}\sum_{t=0}^{T-1} r_t + \phi_t \tag{14}$$

$$\rho_t^* = \frac{1}{\tau}\sum_{t=0}^{T-1} r_t^* + \phi_t^* \tag{15}$$

among them, ϕ_t and ϕ_t^* represent the domestic and foreign term premium.

Sectoral Balance Sheet Value Effect

The economic sector of a country can be divided into five sectors: the government sector (*g*), the financial sector (*f*), the resident sector (*h*), the non-financial enterprise sector (*c*) and

the central banking sector (*cb*). The financial sector mainly includes deposit financial institutions such as banks. Assume that the government sector and non-financial enterprise sector do not hold currency. The government sector holds local currency debt B_t^G, foreign currency debt D_t^G, the government net asset value N_t^G. The financial sector holds a foreign asset A_t^F, a domestic asset such as loans L_t^F, a domestic deposit D_t^F, a foreign deposit J_t^F. The net financial assets value of the financial sector is N_t^F. Residents hold government bonds B_t^H, a foreign asset A_t^H, currency H_t. The net financial assets value of the resident sector is N_t^H. The non-financial enterprise sector holds local currency loans K_t^C, a foreign currency loan L_t^C. The enterprise sector net financial assets value is N_t^C. The central bank sector holds international reserves A_t^{CB}, a government bond B_t^{CB}, currency in circulation H_t. The central bank net financial assets value is N_t^{CB}. E_t represents the real exchange rate. The basic account settings of the sectoral balance sheet are shown in Tab. 1.

According to the formula:

Assets − Debt = Net asset value. (16)

The foreign currency asset and liability are expressed in domestic currency. After standardization with the steady-state gross domestic income $\bar{Y}$, we obtain:

$$-b_t^G - d_t^G e_t + n_t^G = 0 \tag{17a}$$

$$l_t^F + a_t^F e_t = d_t^F + J_t^F e_t + n_t^F \tag{17b}$$

$$b_t^H + a_t^H e_t + h_t = n_t^H \tag{17c}$$

$$-k_t^C - l_t^C e_t + n_t^C = 0 \tag{17d}$$

$$a_t^{CB} e_t + b_t^{CB} = h_t + n_t^{CB} \tag{17e}$$

According to the budget on straints of each sector, we obtain:

$$G_t = T_t^H + T_t^F + S_t^{T,G} - (1+\rho_{t-1})\frac{B_{t-1}^G}{P_{t-1}} + \\ + \frac{B_t^G}{P_t} - (1+\rho_{t-1}^*)\frac{D_{t-1}^G E_{t-1}}{P_{t-1}} + \frac{D_t^G E_t}{P_t} \tag{18a}$$

$$H_t = (1+\rho_{t-1}^*)\frac{A_{t-1}^F E_{t-1}}{P_{t-1}} - \frac{A_t^F E_t}{P_t} + \\ + (1+\rho_{t-1})\frac{L_{t-1}^F}{P_{t-1}} - \frac{L_t^F}{P_t} - (1+\rho_{t-1}) \\ \frac{D_t^F}{P_{t-1}} + \frac{D_t^F}{P_t} - (1+\rho_{t-1}^*)\frac{J_{t-1}^F E_t}{P_{t-1}} + \frac{J_t^F E_t}{P_t} \tag{18b}$$

Tab. 1: Sectoral balance sheet account

Government sector		**Financial sector**		**Resident sector**	
	local currency debt	domestic assets (such as loans)	domestic deposit	government bonds	net financial assets value
	foreign currency debt	foreign financial assets	foreign deposit	foreign financial assets	
	net financial assets value		net financial assets value	currency	
(a)		**(b)**		**(c)**	

Enterprise sector		**Central bank sector**	
	local currency loans	government bond	currency in circulation
	foreign currency loans	international reserves	net financial assets value
	net financial assets value		
(d)		**(e)**	

Source: own

$$C_t = \frac{W_t}{P_t} \times L_t + S_t^{T,H} - T_t^H + (1+\rho_{t-1})$$
$$\frac{B_{t-1}^H}{P_{t-1}} - \frac{B_t^H}{P_t} + (1+\rho_{t-1}^*)\frac{A_{t-1}^H E_{t-1}}{P_{t-1}} - \quad (18c)$$
$$- \frac{A_t^H E_t}{P_t} + \frac{1}{1+\pi_t} \times \frac{H_{t-1}}{P_{t-1}} - \frac{H_t}{P_t}$$

$$I_t = M_t - (1+\rho_{t-1})\frac{K_{t-1}}{P_{t-1}} + \frac{K_t}{P_t} -$$
$$- (1+\rho_{t-1}^*)\frac{L_{t-1}E_{t-1}}{P_{t-1}} + \frac{L_t E_t}{P_t} \quad (18d)$$

$$Z_t = -T^{CB} + (1+\rho_{t-1}^*)\frac{A_{t-1}^{CB}E_{t-1}}{P_{t-1}} -$$
$$- \frac{A_t^{CB}E_t}{P_t} + (1+\rho_{t-1})\frac{B_{t-1}^{CB}}{P_{t-1}} - \frac{B_t^{CB}}{P_t} - \quad (18e)$$
$$- \frac{1}{1+\pi_t} \times \frac{H_{t-1}}{P_{t-1}} + \frac{H_t}{P_t}$$

among them, the government expenditure funds G_t come from the taxes T_t^H, the central bank sector transfer T_t^F, the net public transfer in the balance of payment $S_t^{T,G}$, the payment of domestic debt and foreign debt in the previous period and the income of bonds issued in the current period.

The application of funds in the financial sector H_t composed of foreign assets and domestic assets returned in the previous period, funds allocated in foreign assets and domestic assets in the current period, domestic and foreign deposit produced in the previous period, and current deposited domestic and foreign deposits.

Consumer spending in the residential sector C_t comes from the disposable income $\frac{W_t}{P_t} \times L_t + S_t^{T,H} - T_t^H$, $\frac{W_t}{P_t}$ represents the actual wage level, L_t is the quantity of labour, $S_t^{T,H}$ is the transfer payments to the private sector, T_t^H is taxation, the change in government bonds in the previous period and purchase of government bonds in the current period, the foreign asset and currency value of the previous maturity and current investment.

Investment constraints in the enterprise sector come from asset returns M_t, repay the previous period of local and foreign currency bank loans, borrowed current and foreign currency bank loans.

The application of funds by the central bank is for the transfer of the government T_t^F. The government returned the bonds, the bonds purchased in the current period, the changes in international reserves and currency values.

After standardization with the steady-state gross domestic income $\bar{Y}$, we obtain:

$$g_t = \tau_t^H + \tau_t^F + s_t^{T,G} - \frac{1+\rho_{t-1}}{1+\bar{r}} b_{t-1}^G +$$
$$+ b_t^G - \frac{1+\rho_{t-1}^*}{1+\bar{r}} d_{t-1}^G e_{t-1} + d_t^G e_t \approx$$
$$\approx \tau_t^H + \tau_t^F + s_t^{T,G} - (1+\rho_{t-1}-\bar{r}) b_{t-1}^G + \quad (19a)$$
$$+ b_t^G - (1+\rho_{t-1}^*-\bar{r}) d_{t-1}^G e_{t-1} + d_t^G e_t$$

$$\pi_t^F = (1+\rho_{t-1}^*-\bar{r}) a_{t-1}^F e_{t-1} -$$
$$- a_t^F e_t + (1+\rho_{t-1}-\bar{r}) l_{t-1} - l_t -$$
$$- (1+\rho_{t-1}-\bar{r}) d_{t-1}^F + d_t^F - (1 + \quad (19b)$$
$$+ \rho_{t-1}^*-\bar{r}) j_{t-1}^F e_{t-1} + j_t^F e_t$$

$$c_t = y_t + s_t^{T,H} - \tau_t^H + (1+\rho_{t-1}-\bar{r})$$
$$b_{t-1}^H - b_t^H + (1+\rho_{t-1}^*-\bar{r}) a_{t-1}^H e_{t-1} - \quad (19c)$$
$$- a_t^H e_t + (1-\pi_t-\bar{r}) h_{t-1} - h_t$$

$$i_t = m_t - (1+\rho_{t-1}-\bar{r}) k_{t-1}^C + k_t^C -$$
$$- (1+\rho_{t-1}^*-\bar{r}) l_{t-1}^C e_{t-1} + l_t^C e_t \quad (19d)$$

$$z_t = -\tau_t^{CB} + (1+\rho_{t-1}^*-\bar{r}) a_{t-1}^{CB} e_{t-1} -$$
$$- a_t^{CB} e_t + (1+\rho_{t-1}-\bar{r}) b_{t-1}^{CB} - b_t^{CB} - \quad (19e)$$
$$- (1-\pi_t-\bar{r}) h_{t-1} + h_t$$

among them, $\bar{r}$ represents the growth rate of steady-state output.

The simultaneous formulas between (17) and (19) can be solved as:

$$n_t^G = g_t - \tau_t^H - \tau_t^F - s_t^{T,G} +$$
$$+ (1+\rho_{t-1}-\bar{r}) n_{t-1}^G + \quad (20a)$$
$$+ (\rho_{t-1}^* - \rho_{t-1}) d_{t-1}^G e_{t-1}$$

$$n_t^F = -\pi_t^F + (1+\rho_{t-1}-\bar{r}) n_{t-1}^F +$$
$$+ (\rho_{t-1}^* - \rho_{t-1}) a_{t-1}^F e_{t-1} + \quad (20b)$$
$$+ (\rho_{t-1} - \rho_{t-1}^*) j_{t-1}^F e_{t-1}$$

$$n_t^H = -c_t + y_t + s_t^{T,H} - \tau_t^H +$$
$$+ (1+\rho_{t-1}-\bar{r}) n_{t-1}^H + \quad (20c)$$
$$+ (\rho_{t-1}^* - \rho_{t-1}) a_{t-1}^H e_{t-1} -$$
$$- (\rho_{t-1} + \pi_t) h_{t-1}$$

$$n_t^C = i_t - m_t + (1 + \rho_{t-1} - \overline{r})n_{t-1}^C + \\ + (\rho_{t-1}^* - \rho_{t-1})l_{t-1}^C e_{t-1} \quad (20d)$$

$$n_t^{CB} = -\tau_t^{CB} - z_t + (1 + \rho_{t-1} - \\ - \overline{r})n_{t-1}^{CB} + (\rho_{t-1}^* - \rho_{t-1})a_{t-1}^{CB} e_{t-1} + \\ + (\rho_{t-1} + \pi_t)h_{t-1} \quad (20e)$$

The account of Tab. 1 corresponds to formulas (17a–e) through (20a–e). It can be seen from the formula (20a–e) that the variables affecting the net financial assets value of the sector include the domestic real risk interest rate, the foreign real risk interest rate, the exchange rate and the budget constraint. Under the hypothesis of a constant exchange rate, domestic interest rates and foreign interest rates have an impact on the net financial assets value of various domestic sectors. Changes in interest rates have various effects on different sectors. The empirical analysis also needs to further verify the specific relationship between the interest rate and the sector net financial assets value.

2. Data and Empirical Analysis

2.1 Data

The net assets value of the balance sheet uses the results and methods of Li and Zhang (2018) estimation of the balance sheets of various sectors in China. Li and Zhang (2018) divided the economic sector into the residential sector (1993–2016), the non-financial enterprise sector (2000–2016), the financial sector (1952–2016), the government sector (2000–2016), and the external sector. Since Li and Zhang (2018) did not separately prepare the balance sheet of the external sector, and the State Administration of Foreign Exchange adjusted the statistical standards and statistical calibre in 2014, so our empirical research does not analyze the net assets value of the external sector separately. For the balance sheet of the financial sector, because of the simple division of the financial sector in 1952–1992, the asset and liability were mainly based on deposits and loans, which made the preparation method in this period different from that in the subsequent years. Therefore, these years are not contained in the analysis. The data used in the analysis include the central bank, commercial banks and shadow banks, and the stock and equity liabilities of the debtor are taken as the net assets of financial institutions. We select the balance sheet from 2000 to 2016 as the analysis sample.

To apply our empirical methodology, we collect data about inflation rate, interest rate and net assets value of the balance sheets of various sectors in China, the variables are drawn from several sources. The data on the net assets value of the balance sheets of residential sector, the net assets value of the balance sheets of non-financial enterprise sector, the net assets value of the balance sheets of financial sector, and the net assets value of the balance sheets of external sector are from Li and Zhang (2018). The data on Chinese 1-year real deposit benchmark interest rate and Chinese 1-year real loan interest rate data are taken from The People's Bank of China Annual report (2001–2017). The data for Chinese inflation rate is from China Statistical Yearly report (2000–2016) and for US inflation rate from Labor Department inflation and Price data of World Bank. The data on 1-year Fed federal funds rate are from Federal Reserve Economic Data.

Tab. 2 reports summary statistics for net present value of asset and real interest rate used in the analysis. The variables are measured over the years 2000–2016. For each characteristic, the table reports means, standard deviations, minimums and maximums. In the last column, the table reports the sample interval. From the descriptive statistics, it can be found that the average value of the resident sector's net asset value (*NR*) is the largest among the four sectors, followed by the enterprise sector (*NE*) and the government sector (*NG*), and the financial sector (*NF*) comes last. The real value of the sectoral net asset is the value of the nominal net asset excluding the price factor using the GDP flattening index in which the based year 2000. The US federal funds rate (*RU*) is a watershed in 2008 and was increasing year by year before 2008. The occurrence of the subprime mortgage crisis and the series of quantitative easing policies implemented by the Federal Reserve have caused the nominal and real interest rates to decline since 2008. *RD* is the Chinese 1-year real deposit benchmark interest rate after excluding the Chinese inflation rate (*CCPI*). *RL* is the Chinese 1-year real loan interest rate data after excluding the Chinese inflation rate. *RU* is the 1-year Fed federal funds rate after excluding the 1-year

Tab. 2: Descriptive statistical table of variables (net asset value unit: ¥100 million)

Variables	Mean	Std. dev.	Minimum	Maximum	Sample interval
NR	910,436	492,492	286,820	1,865,209	2000–2016
NE	428,807	275,633	121,050	911,855	2000–2016
NF	43,299	35,207	9,681	121,742	2000–2016
NG	374,573	216,106	93,482	695,922	2000–2016
RD	0.24	1.68	−3.68	2.98	2000–2016
RL	3.43	1.77	−0.62	6.04	2000–2016
RU	−0.73	1.55	−3.70	2.03	2000–2016

Source: own

US inflation rate (*UCPI*). The federal funds rate is the US interbank market rate, which is also a key variable representing the Fed's monetary policy stance, and the most important market-based interest rate variable in the United States.

2.2 Research Model and Results

To determine the relation between the interest rate and the net assets value, we develop a model as follows. We estimate the regression of formula (20) using the ordinary least squares (OLS) method.

$$ln\ N_t = \alpha + \beta_1 RD + \beta_2 RL + \beta_3 RU + u_t \quad (21)$$

among them, N_t represents the sectoral net assets value, RD represents the real deposit interest rate, RL represents the real loan interest rate, RU represents the real Federal Funds interest rate. The impact of the real deposit interest rate, the real loan interest rate and the Federal Funds interest rate on the sectoral net assets value is examined separately.

The results are shown in Tab. 3. Models (1) to (4) are the results of the regression analysis of each sector using formula (20). From the regression results, the impact of real deposit interest rates on the resident, enterprise, financial, and government sectors is significantly positive at the significance level of 1%. It has the largest impact of the financial sector, followed by the enterprise sector, the government sector comes third, and the resident sector comes last. The real loan interest rate has a negative impact on the net assets value of each sector at the significance level of 1%. The impact of the real loan interest rate is greater than that of the real deposit interest rate, and the ranking of the impact levels is the same as that of the real deposit interest rate. The US federal funds rate has a less significant impact on various sectors and only has a positive impact on the resident

Tab. 3: The OLS regression results of real interest rates on net asset value in each sector

Explanatory variables/ Explained variable	(1) $LnNR$	(2) $LnNE$	(3) $LnNF$	(4) $LnNG$
RD	2.20*** (8.53)	2.57*** (8.56)	3.19*** (8.15)	2.32*** (6.92)
RL	−2.26*** (−8.89)	−2.63*** (−8.88)	−3.27*** (−8.47)	−2.39*** (−7.22)
RU	0.11* (2.12)	0.11* (1.87)	0.16* (2.04)	0.07 (1.01)
R^2	0.88	0.88	0.87	0.84
DW	1.70	1.73	1.69	1.55

Source: own

sector, the enterprise sector and the financial sector are at the significance level of 10%.

Tab. 3 presents estimates of the regression in formula (21). *LnNR* is the natural logarithm of the *NR*. *LnNE* is the natural logarithm of the *NE*. *LnNF* is the natural logarithm of the *NF*. *LnNG* is the natural logarithm of the *NG*. The sample period spans 2000–2016. *,*** denotes significance at the 10% and 1% level. Variable definitions are in the Tab. 2.

2.3 Analysis of the Impact of Interest Rates on Various Sectors

The net financial assets value of the government sector is affected by both government revenue and expenditure. Government revenues are mainly tax revenues, while government expenditure includes government purchases, transfer payments and repayment of public debt. Among them, government purchases and transfer payments are to accomplish the public functions of the government, to maintain the normal operation of the society and to realize the goal of fiscal policy, which is affected by interest rates finitely. The repayment of public debt is greatly affected by interest rates. As the deposit interest rate increases, the required interest on public debt increases accordingly. Without considering the influence of other factors, the increasing interest on public debt may increase the debt cost and debt repayment burden, inducing the reduction of government debt and further expenditure. As a consequence, the government net financial assets value increases. Increase in the real loan interest rate will reduce the net financial assets value of the government sector because of that the taxation is an important factor affecting the government income. With the increase of the loan interest rate, loan interest payments of other sectors increase, the investment and tax revenue decreases, leading to a decreasing in the net financial assets value of the government.

The increase in the real loan rate will reduce the net financial assets value of the financial sector. It can be seen from the formula (4) that the impact of the interest rate on the net financial assets value of the financial sector is mainly reflected in the denominator and the two change in the opposite direction. As the interest rate increases, the bankruptcy rate of the financial sector also increases. The credit risk of the enterprise sector and other sectors is one of the main risks faced by the financial sector, so the risk of changing in the net financial assets value of the financing sector is more related to loan interest rates. In reality, the rise in the real loan interest rate increases the income of the financial sector, as a consequence of that, the assets increase. However, the real loan interest rate and the real deposit interest rate tend to change in the same direction. As income increases, the cost of capital also rises. The margin between the deposit and loan rate is usually maintained at a relatively stable level which changes with the operating strategy and risk appetite of banks. Therefore, it is difficult to analyze the impact of the real loan interest rate and the real deposit interest rate on the net financial assets value of the financial sector separately. From the empirical results, the net financial assets value effect of the loan interest rate is greater than the income effect. As for deposits, they are the main source of bank funds, while the deposit rate of the Chinese resident sector remains at a relatively high and stable level. Different types of banks have different degrees of dependence on deposits, interbank markets, and financial markets. The large commercial banks are the main suppliers of funds in financial markets, the funds of which are mainly from deposits. Yet, the smaller banks, city commercial banks and rural commercial banks are the main demanders of financial market funds. The rise of deposit interest rates will increase the amount of bank deposits, reducing the reliance of banks on other high-cost funds sources such as interbank borrowing, then increasing revenue and reducing funds costs. The federal funds rate is not significantly positively related to the net financial assets value of the financial sector. Although the increase in the federal funds rate will reduce the net present value of foreign currency income in the financial sector, the increase in the federal funds rate will cause some capital to flow to the Chinese banking industry. Therefore, the investment effect of the federal funds rate is greater than the income effect.

A rise in the real deposit interest rate will increase the net financial assets value of the resident sector, which is mainly because it will increase the interest income on household deposits, consequently increasing the scale of financial assets. In 2000, the resident sector deposit ratio in China (the ratio of deposit to total financial asset) was 56.56% and has

remained stable since then. It was 48.92% in 2016, which accounts for a larger proportion of the resident sector assets. Increasing the real loan interest rate will reduce the net financial assets value of the resident sector. The resident sector debt maintains an average annual growth rate of 23%, and most of the loans are concentrated in housing loans. In reality, with the advancement of urbanization, the increase in population, house prices and demand for housing has increased, being accompanied by the increase in interest payments on residential mortgages. The increase in loan interest rates has led to an increase in household interest payments and a decrease in the net financial assets value. The rising of real federal funds rates will increase the net financial assets value of the resident sector. The federal funds rate will cause the inflow of capital and rise asset prices. As a result, the value of stocks and bonds held by the resident sector will rise.

When the deposit interest rate increases, the income generated by deposits in the enterprise sector increases, and the net financial assets value of the enterprise sector increases. The real loan interest rate reflects the cost and debt level of the enterprise. The increase in the loan interest rate makes the debt burden on the enterprise improve and the net financial assets value reduces. When the federal funds rate rises, companies will get more investment and income.

Besides, we also analyzed the interaction of the net financial assets value between sectors. The analysis found that there is a significant positive impact between any two sectors. As long as the net financial assets value of one sector increases, the net financial assets value of the other sectors will also increase.

The above analysis shows the impact of the interest rate on the net financial assets value in each sector and the interrelationship between the net financial assets value of the sectors, which has certain theoretical significance for the formulation and implementation of macroeconomic policies. From the perspective of the impact of the domestic interest rate on the sectoral net financial assets value, first of all, different types of interest rates have different impacts on different sectors. When using monetary policy controlling debt leverage to achieve the purpose of reducing risk, the type of interest rate which is relatively sensitive to the sectoral net financial assets value should be selected. Secondly, it can be concluded from the research that the reduction of the real loan interest rate can increase the net financial assets value of various sectors, so the structured loose monetary policy has a certain effect on reducing macro-financial risks from the balance sheet channel which promotes the improvement of economic development. However, long-term low-interest-rate policies usually bring large negative effects owing to that the interest rate cannot always be kept at a low level. When the policy tries to prevent the economy from overheating, and the interest rate tends to be returned to mean reversion, the bursting of the asset price bubbles and the reduction of the macro-sector net financial assets value will cause a balance sheet recession crisis. Moreover, long-term expansionary monetary policy has caused interest rates to lose their functions of allocation and signalling, resulting in a loss of real income (Schnabl, 2013). When solving the crisis caused by the balance sheet recession, fiscal policy is more effective than monetary policy. Loose fiscal policies implemented by the government sector are used to offset private deleveraging through government investment (Koo, 2014). The negative effect of active fiscal policy is a reduction in the government net financial assets value and an increase in government debt risk. Monetary or fiscal policy tool is used to adjust the macro balance sheet, which must accurately grasp the scope and duration to reduce macro risks and promote economic development. From the perspective of the impact of the foreign interest rate on the sectoral net financial assets value, a change in the federal funds rate will affect the net financial assets value of the Chinese resident sector, the enterprise sector and the financial sector, but the impact is not significant. After the US subprime mortgage crisis and in the COVID-19 time, the Federal Reserve Board has maintained a real interest rate at a relatively low level for a long time through multiple rounds of quantitative easing. The subsequent exiting of quantitative easing will inevitably affect the Chinese economy through various channels. Changing in the direction of monetary policy will increase the sectoral solvency risks and macro-financial risks from the channel of reducing the macroeconomic sector net financial assets value. Macroeconomic policies should also hedge this risk against multiple channels.

Conclusions

In this study, we analyze the impact of the interest rate on the net financial assets value of the macroeconomic sector from both the theoretical and empirical analysis, reveal the macro balance sheet channel of monetary policy.

Through the construction of the theoretical model, we find that an increase in the domestic real interest rate and the real foreign interest rate will lower the net financial assets value of the financial, enterprise, government, and the resident sector. Further, the low net present value of the banking sector's net assets will lead to the credit crunch and bank failure. The low net present value of the enterprise sector's net assets limits the credit demand and actual investment capacity of the enterprise, which leads to a slowdown in economic growth. A reduction in the net financial assets value of the government sector will result in a reduction in government spending, which may increase the probability of local and central government debt crises when the debt is insolvent. The resident sector, as the ultimate undertakers of risk in the general sense, have a lower net present value of net financial assets, which can reduce their consumption demand and even lead to large-scale debt default. In addition, the general equilibrium model representing the relationship between the real interest rate and the net financial assets value shows that variables that can affect the net financial assets value of the sector include the domestic real interest rates and foreign real interest rates, the net financial assets value, and the budget constraints.

The empirical results show that an increase in the real deposit interest rate improves the net financial assets value of the four sectors, and an increase in the real loan interest rate reduces the net financial assets value of the four sectors, while the effect of the real loan, the interest rate is greater than the real deposit interest rate. The effect ranking of interest rates on the four sectors is the financial, enterprise, government sector and the resident sector. Our analysis is in line with the research on interest and debt. The issue of relations between the debt of different sectors and the interest rate or monetary policy is a controversial topic. Studies have demonstrated that falling real interest rates result in more debt in households (Stockhammer & Wildauer, 2017), governments (Barrett, 2018; Mehrotra, 2019) and all private and public sectors (Rogoff, 2020). Our analysis extends the result from the debt indicator to the net financial assets value indicator, also documents the different effect of monetary policy on each sector.

Our study has an important practical implication for the implementation of macroeconomic policies. According to the results of this study, loose structural monetary policy can reduce macro-financial risks from the balance sheet channel, while the negative effects of long-term low-interest-rate policies should be prevented. Active fiscal policies can effectively alleviate the economic pressure caused by the recession of the balance sheet, but we should pay attention to the reduction of the net financial assets value of the government sector and the increase in government debt risk. The macroeconomic policies should hedge and resolve sectoral risks and macro-financial risks triggered by the changes in the easing policy via the macro balance sheet channel. However, in further research, it is necessary to consider the dynamic adjustment effect of monetary policy and the difference between the interest rate and the economic growth rate.

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References

Adrian, T., Moench, E., & Shin, H. S. (2010). Macro Risk Premium and Intermediary Balance Sheet Quantities. *IMF Economic Review, 58*(1), 179–207.

Baharumshah, A., Soon, S-V., & Lauc, E. (2017). Fiscal sustainability in an emerging market economy: When does public debt turn bad? *Journal of Policy Modeling, 39*(1), 99–113. https://doi.org/10.1016/j.jpolmod.2016.11.002

Barrett, P. (2018). *Interest-Growth Differentials and Debt Limits in Advanced Economies* (IMF Working Paper No. 18/82). Washington, DC: International Monetary Fund.

Benigno, P., Eggertsson, G. B., & Romei, F. (2016). Dynamic debt deleveraging and optimal monetary policy. *American Economic Journal: Macroeconomics, 12*(2), 310–350. https://doi.org/10.1257/mac.20160124

Berge, T. J., & Cao, G. (2014). Global effects of US monetary policy: is unconventional policy different. *Economic Review, Q I,* 5–31

Bernanke, B., Gertler, M., & Gilchrist, S. (1999). The Financial Accelerator in a Quantitative Business Cycle Framework. *Handbook of Macroeconomics, 1*(C), 1341–1393. https://doi.org/10.1016/S1574-0048(99)10034-X

Bi, H., Leeper, E. M., & Leith, C. (2014). *Financial Intermediation and Government Debt Default* (Working Paper). Bank of Canada, Indiana University, University of Glasgow.

Bian, W., Lu, X., Gao, Y., & Tao, C. (2013). The influence and countermeasures of quantitative easing monetary policy adjustment in the United States. *International Financial Research,* (9), 21–28 (in Chinese).

Blanchard, O. (2019). Public Debt and Low Interest Rates. *American Economic Review, 109*(4), 1197–1229. https://doi.org/10.1257/aer.109.4.1197

Cafiso, G. (2017). *GDP Growth, Private Debt and Monetary Policy* (Working Paper No. 6500). Munich: CESifo.

Cecchetti, S. G., Domanski, D., & von Peter, G. (2011). New Regulation and the New World of Global Banking. *National Institute Economic Review, 216*(1), 29–40. https://doi.org/10.1177/0027950111411378

Chatziantonioua, I., Filisb, G., & Floros, C. (2017). Asset prices regime-switching and the role of inflation targeting monetary policy. *Global Finance Journal, 32,* 97–112. https://doi.org/10.1016/j.gfj.2015.12.002

Dalio, R. (2012). How the Economic Machine Works. *Economic Principles*. https://economicprinciples.org/

Devereux, M. B., & Yetman, J. (2010). Financial deleveraging and the international transmission of shocks. *The International Financial Crisis and Policy Challenges in Asia and the Pacific, 52,* 274–298.

Dybowski, T. P., Hanisch, M., & Kempa, B. (2018). The role of the exchange rate in Canadian monetary policy: evidence from a TVP-BVAR model. *Empirical Economics, 55,* 471–494. https://doi.org/10.1007/s00181-017-1305-7

Fausch, J., & Sigonius, M. (2018). The impact of ECB monetary policy surprises on the German stock market. *Journal of Macroeconomics, 55,* 46–63. https://doi.org/10.1016/j.jmacro.2017.09.001

Forbes, K., Hjortsoe, I., & Nenova, T. (2018). The shocks matter: Improving our estimates of exchange rate pass-through. *Journal of International Economics, 114,* 255–275. https://doi.org/10.1016/j.jinteco.2018.07.005

Góes, C., Kamil, H., & Imus, D. P. (2017). *Spillovers from U.S. Monetary Policy Normalization on Brazil and Mexico's Sovereign Bond Yields* (IMF Working Paper WP/17/50). Washington, DC: International Monetary Fund. https://doi.org/10.5089/9781475586077.001

Gómez, J. (2004). *Towards a Framework for Macroeconomic Stability in Emerging Market Economies.* Bogotá: Banco De La República, Research Department.

Ippolito, F., Ozdagli, A. K., & Perez-Orive, A. (2018). The transmission of monetary policy through bank lending: The floating rate channel. *Journal of Monetary Economics, 95,* 49–71. https://doi.org/10.1016/j.jmoneco.2018.02.001

Jarmuzek, M., & Rozenov, R. (2019). Excessive private sector leverage and its drivers: evidence from advanced economies. *Applied Economics, 51*(34), 3787–3803. https://doi.org/10.1080/00036846.2019.1584383

Jeanne, O., & Zettelmeyer, J. (2002). *"Original Sin", Balance Sheet Crises, and the Roles of International Lending* (IMF Working Paper No. 02/234). Washington, DC: International Monetary Fund.

Jiménez, G., Ongena, S., Peydró, J. L., & Saurina, J. (2012). *Credit Supply versus Demand: Bank and Firm Balance-Sheet Channels in Good and Crisis Times* (Discussion Paper 2012-005). Tilburg: Tilburg University, Center for Economic Research. https://doi.org/10.2139/ssrn.1980139

Khoo, J., Durand, R. B., & Rath, S. (2017). Leverage adjustment after mergers and acquisitions. *Accounting & Finance, 57*(S1), 185–210. https://doi.org/10.1111/acfi.12148

Kim, S., & Lim, K. (2018). Effects of monetary policy shocks on exchange rate in small open Economies. *Journal of Macroeconomics, 56*(6), 324–339. https://doi.org/10.1016/j.jmacro.2018.04.008

Koo, R. C. (2011). The World in Balance Sheet Recession: Causes, Cure, and Politics. *Real-World Economics Review, 58,* 19–37.

Koo, R. C. (2015). *The Escape from Balance Sheet Recession and the QE Trap: A Hazardous Road for the World Economy.* Tokyo: John Wiley and Sons.

Krugman, P. (2014). Four Observations on Secular Stagnation. In *Secular Stagnation: Facts, Causes, and Cures.* London: CEPR Press.

Li, Y., & Zhang, X. (2018). *China National Balance Sheet 2018*. Beijing: China Social Science Press (In Chinese).

Mehrotra, N. (2018). Debt Sustainability in a Low Interest Rate World. *Journal of Monetary Economics, 124(*S), S1–S18. https://doi.org/10.1016/j.jmoneco.2021.09.001

Mian, A. R., Rao, K., & Sufi, A. (2013). Household Balance Sheets, Consumption, and the Economic Slump. *The Quarterly Journal of Economics, 128*(4), 1687–1726. https://doi.org/10.1093/qje/qjt020

Patti, E., & Sette, E. (2012). *Bank balance sheets and the transmission of financial shocks to borrowers: evidence from the 2007–2008 crisis* (Working Paper No. 848). Roma: Bank of Italy.

Rahal, C. (2016). Housing markets and unconventional monetary policy. *Journal of Housing Economics, 32,* 67–80. https://doi.org/10.1016/j.jhe.2016.04.005

Rogoff, K. (2020). Falling real interest rates, rising debt: A free lunch? *Journal of Policy Modeling, 24,* 778–790.

Salachas, E. N., Laopodis, N. T., & Kouretas, G. P. (2017). The bank-lending channel and monetary policy during pre- and post-2007 crisis. *Journal of International Financial Markets, Institutions and Money, 47,* 176–187. https://doi.org/10.1016/j.intfin.2016.10.003

Schnabl, G. (2013). *The Macroeconomic Policy Challenges of Balance Sheet Recession: Lessons from Japan for the European Crisis* (Working Paper No. 4249). Munich: CESifo.

Schularick, M., & Taylor, A. M. (2012). Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870-2008. *American Economic Review, 102*(2), 1029–1061. https://doi.org/10.1257/aer.102.2.1029

Siddique, A., Selvanathan, E. A., & Selvanathan, S. (2016). The impact of external debt on growth: Evidence from highly indebted poor countries. *Journal of Policy Modeling, 38*(5), 874–894. https://doi.org/10.1016/j.jpolmod.2016.03.011

Stockhammer, E., & Wildauer, R. (2017). *Expenditure Cascades, Low Interest Rates or Property Booms? Determinants of Household Debt in OECD Countries* (Working Paper 1710). Kingston upon Thames: Kingston University, School of Economics.

Yi, X. (2014). Economic analysis of the withdrawal of US Federal Reserve's loose monetary policy. *International Financial Research,* (2), 12–24 (In Chinese).