Influence of Government'S Monetary Policy on Exchange Rates

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Abstract
Nowadays the steady pursuit of economic growth is an important goal of the current national economic growth, and in the current complicated international and domestic situation, Chinese economic growth will inevitably be affected, economic volatility has become increasingly evident. In order to solve the bad influence we build the DSGE model. The model use the hypothesis of CIA and let the international interest rate as a function of a country's net foreign debt or savings, while adding domestic currency impact, then establish dynamic DSGE models. By comparing the monetary shocks impact between the actual data and simulated data, we find that in the short term the impact of technology can rapidly decrease the exchange rate, and then gradually rise back to steady equilibrium. Also hold international assets can reduce the negative impact by monetary shocks. International assets as a shock absorber, can slow the impact of domestic monetary shocks.
Key words: DSGE, EXCHANGE RATE, MONETARY SHOCKS

1. Introduction

Nowadays the steady pursuit of economic growth is an important goal of the current national economic growth, and in the current complicated international and domestic situation, Chinese economic growth will inevitably be affected, economic volatility has become increasingly evident. The use of monetary policy, fiscal policy and other macro-economic policy interventions is a common practice in today's world, the inherent link between macroeconomic policy and economic fluctuations is self-evident. Thus, with regard to monetary policy, fiscal policy on economic fluctuations question is worth exploring. This paper use the New Keynesian DSGE model framework to analyze the impact of monetary, fiscal policy, monetary policy on the exchange rate, to analyze the impact of the currency impact on the Chinese economy. The adoption of DSGE analytical framework can enrich Chinese research. And it is beneficial for our thinking of macroeconomic monetary policy interventions.

DSGE model appeared in Kyland and Prescott [1]. This paper creating a real business cycle school, belonging to the third attack on the Keynesian neoclassical initiated. The first wave and the second wave were the 1968 Friedman monetarist revolution and the rational expectations revolution in 1976. The neo-Keynesians actually generated In the 1970s, but not many followers, neo-Keynesians in the 80s and 90s absorb a lot the contents of RBC school, and undertake a DSGE modeling approach, then in the mid-90s New Neoclassical Synthesis was built. This is not a single school, but rather a kind of absorbing and blending two schools.

The hypothesis of RBC theory is that price and wage have full flexibility, the product market and the labor market always on

clearing state, the information is complete and people have rational expectations, so that the nominal variables will not affect the real economy, economic fluctuations are mainly from the impact of technology. Such as Kydland & Prescott [1], Long & Plosser [2], Preseott [3]. DSGE analytical framework of these studies in a small number of exogenous shocks, fit well the American economic fluctuations, thereby underlining the impact from the supply side.

King & Plosser [4] introduced Banking and monetary in RBC framework, it was found money still just a passive reflection of the economic cycle, does not alter the conclusion of monetary neutrality. Cooley & Hansen [5] believed the impact of monetary policy on economic fluctuations was minimal. As the "flexible price" assumptions, prices can quickly adjust to changes in supply and demand, to get "monetary policy is no real effect on the economy," the conclusion is natural.

Although RBC theory cannot analyze the contribution of monetary policy to economic fluctuations, domestic scholars still concentrated in RBC framework. Bo Yongxiang and Jin Yan (2002) in a hypothetical labor exogenously given RBC model, they introduced the impact of technology and the random monetary policy shocks, by calculating the Kydland-Prescott variance ratio, they found the technological shock can explain 76% of China's economic fluctuations.

Chen Kunting et al. (2004a) in accordance with Preseott [3] variance estimation method, found that basic RBC model can simulate the characteristics of China's actual economic fluctuations in most macro variables. Chen Kunting et al. (2004b) added sunspot shocks in basic RBC model, the researchers found that sunspots impact limited contribution to economic fluctuations, it explains the main part of the actual impact of volatility and explains the supply shocks is more important than the demand shocks.

Huang Yilin (2005, 2006) by calculating the variance ratio Kydland-Prescott examined the explanatory power of exogenous shocks on economic fluctuations. Huang Yilin (2005) analyzes the technical impact and the impact of fiscal policy on macroeconomic volatility effects. She believes that the impact of technology and the impact of government spending can be explained by the fluctuation characteristics more than 70% , Chinese economic fluctuation is a common product of technical factors, supply factors and demand factors influence. Huang Yilin (2006) believed that the major economic fluctuations part of China can be explained by the impact of technology. Li Hao and Zhong Changbiao (2008) according to open economy RBC model, calculated the consumption of Kydland-Prescott variance ratio was equal to 84.13%, it explains that the model output volatility of 84.13%.

Compared with RBC theory and DSGE model, the new Keynesian DSGE model assumes that prices and wages are sticky and not "flexible adjustment", economic agents have rational expectations, the market is fully competitive rather than monopolistic competition, while introduced monetary policy shocks in the model. Monetary policy shocks in the short term output has real effects. As Gali (1999) believed the demand shock is a major factor in output and labor fluctuations. Calvo (1983) [6], Gali & Gertler [7] believed that the impact of monetary policy decisions and price behavior in understanding the economic cycle plays a central role. Christiano & Eichenbaum (1992a, 1992b) confirms the importance of money in the economic cycle. Christiano, Eichenbaum & Evans (2005) [8] was constructed containing viscous sticky prices and wages, consumption habit formation and investment adjustment costs, variable capital utilization, the borrower may pay wages New Keynesian model. It can explain persistent inflation inertia and output. Adolfson (2007) [9] used open economy DSGE model shows that technology, preferences, labor supply shocks can explain most of the output fluctuations; the impact of monetary policy is the main factor of inflation fluctuations.

In recent years, scholars have begun to build a new Keynesian DSGE model in order to analyze the volatility of the economy. Chen Kunting and Gong Liutang (2006) through the introduction of sticky prices and endogenous monetary mechanism, simulated the RBC model is closer than the basic features of China's economic cycle. The model is taking shape New Keynesian theoretical framework, including the new Keynesian theory "monopolistic competition" and "price stickiness" two core elements. Liu Bin (2008) based on an open economy DSGE model,

testing the "financial accelerator" role of banks in economic fluctuation. On the use of Bayes' parameter estimation method, and analyzed the dynamic effects of government spending shocks by impulse response, we found that the rise in aggregate demand will lead to increased government spending and the total output, but there is upward pressure on interest rates crowding-out effect on private consumption and investment .

Because of the current complicated international and domestic situation Chinese government need a model to forecast the economic indicators, so that can bill the correct and effective implementation of economic policies.

We build the DSGE model. It is very practical, and it assumed various actors in decision-making must take into account the impact of their behavior in the period, and the ensuing consequences for the future, while adding many factors of uncertainty in the real economy, so that the model has highly persuasive. Therefore, DSGE model under random introduce various exogenous shocks case, to study the interaction and mutual influence between each subject, and you can explore the dynamic nature of the economic system, how the variables change over time and change.

2. Monetary policy and exchange rate

Through 30 years of reform and opening up, especially since the 1992 reform of determining the socialist market economy, the economic development has made remarkable achievements in economic. The total output basically maintained an average annual growth rate of 10 per cent. In 2012 the total GDP reached 53412.3 billion yuan, ranked second in the world, total foreign trade amounted to 1455.8 billion yuan, accounting for 2.72%. In 2013 the total GDP reached 58801.8 billion yuan, of which foreign trade volume amounted to 1609.3 billion yuan, accounting for 2.73%. GDP grew by 10% compared to 2012, foreign trade has maintained a certain percentage. According to Figures 1. and 2.2 can be seen in China's GDP growth is relatively stable foreign trade growth is to maintain a certain speed.

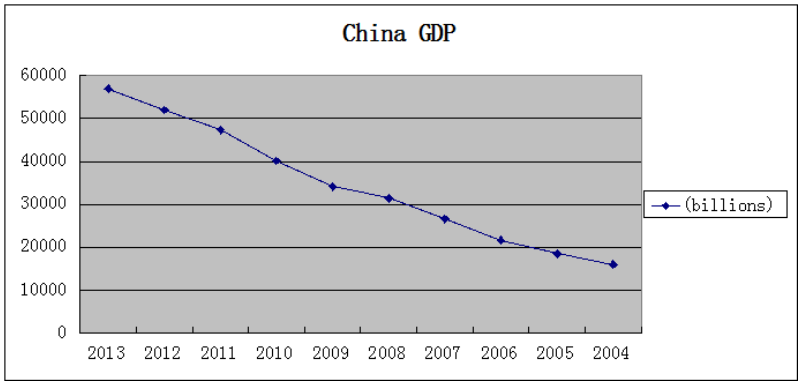

Figure 1. Chinese GDP annual data

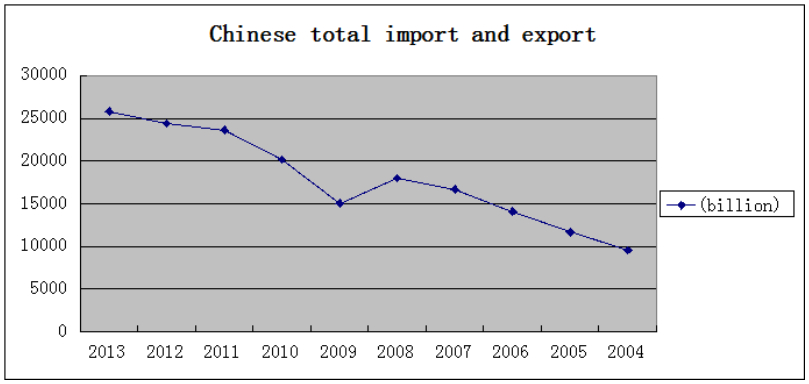

Figure 2. Chinese total import and export

With Chinese rapid economic development, economic output rising, the central bank to use monetary policy macroeconomic action more frequently. Meanwhile, since 2001, China joined the WTO, Chinese export-oriented economy characterized became increasingly obvious, and the trade has become particularly important. But improving economic openness also makes Chinese economy more vulnerable, especially economic ties with China closely affect the US economy: Since the second half of 2008, affected by the US subprime mortgage crisis, China economic growth has slowed down in the fourth quarter of 2008 increased by only 6.7% growth rate in 2009 of only 8.7%. Figure 2. it is clear that Chinese total imports and exports have decreased significantly in 2009.

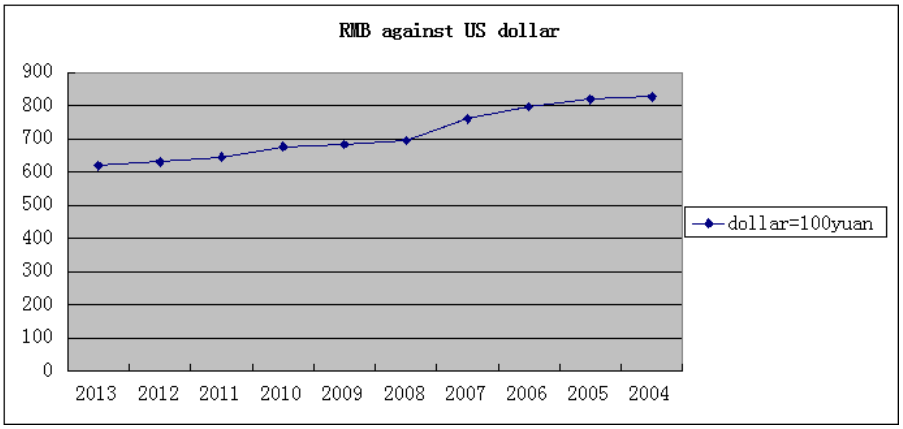

Figure 3. RMB against the US dollar

This shows that the international environment had significant effects in China. This paper focuses on the face of changes in the international environment, changes in exchange rates, like how China should use fiscal policy and monetary policy to offset the adverse effects.

This article choose to use structured dynamic stochastic general equilibrium model, that DSGE. Since DSGE models can as much as possible to introduce various economy variables, and including the richer feature information, also can effectively overcome the simplicity of econometric models for policy simulation analysis difficult problems. Using DSGE models for policy analysis, model structure parameters under the assumption of constant, when the policy parameters are changed by solving the equation of rational expectations, you can get a simple variable dynamic evolution equation.

3. Construction and calculation of dynamic model

Open economy DSGE model is standard Hansen models on the basis of the general joined the international assets because international assets is an important feature of an open economy. In this paper, a risk-free bonds to represent international assets and assuming people can hold any number of the bonds, and does not affect the interest rate or asset prices. However, due to the presence of arbitrage lead to non-deterministic problems, hence the addition of adjustment costs in the capital. Since the introduction of capital adjustment costs would change the rate of return between capitals and bonds, so to determine capital accumulation and international savings. Meanwhile, the model assumes that international interest rates become a nation of net foreign debt or saving function, such economies will have a single, determined steady state. Finally, add CIA domestic currency impact and the impact on foreign prices.

Firstly, build a simple standard Hansen model of a small open economy without money. The difference between the model and the general model is that Hansen contain a risk-free bond in the international market, in each issue, its actual net income is $r^f = 1/\beta - 1$, here β is the family intertemporal discount factor.

Just like inseparable of labor Hansen model, in order to select the sequence of individual families $\{c_t, h_t, k_{t+1}, b_t\}_{t=0}^{\infty}$ to maximize value

$$\max_{\{c_t,h_t,k_{t+1},b_t\}} E_t\sum_{t=0}^{\infty}\beta^t[\ln c_t + Bh_t]$$

This model have a insurance market for all families to participate in , the household budget constraint is:

$$b_t + k_{t+1} + c_t = w_t h_t + r_t k_t + (1-\delta)k_t + (1+r_{t-1}^f)b_{t-1} + \xi_t \quad (1)$$

Limited by its budget constraint, families can receive a one-time transfer of money or disposable monetary tax. Its flow budgetary constraints is:

$$c_t^i + \frac{m_t^i}{P_t} + \frac{e_t b_t^i}{P_t} + k_{t+1}^i = w_t h_t^i + r_t k_t^i + (1-\delta)k_t^i - \frac{\kappa}{2}(k_{t+1}^i - k_t^i)^2 + \frac{e_t(1+r_{t-1}^f)b_{t-1}^i}{P_t} + \frac{m_{t-1}^i + (g_t - 1)M_{t-1}}{P_t} \quad (3)$$

By removing the element from the CIA constraints, budget constraints is:

$$\frac{m_t^i}{P_t} + \frac{e_t b_t^i}{P_t} + k_{t+1}^i + \frac{\kappa}{2}(k_{t+1}^i - k_t^i)^2 = w_t h_t^i + r_t k_t^i + (1-\delta)k_t^i + \frac{e_t(1+r_{t-1}^f)b_{t-1}^i}{P_t} \quad (4)$$

$\frac{\kappa}{2}(k_{t+1}^i - k_t^i)^2$ is capital adjustment costs. At the end of each period, household wealth held by domestic currency, foreign bonds, and physical capital formation.

Through CIA constraint introduced the domestic currency to buy consumer goods and the purchase of foreign currency to pay foreign debts and purchase foreign goods. At each stage there is a foreign market clearing conditions.

$$B_t - (1+r_{t-1}^f)B_{t-1} = P_t^* X_t$$

Foreign interest rates is a function of the actual value of the stock: $r_t^f = r^* - a\frac{B_t}{P_t^*}$

This article assumes that foreign price levels follow a stochastic process:

$$P_t^* = 1 - \gamma^* + \gamma^* P_{t-1}^* + \varepsilon_t^*$$

This article assumes that purchasing power parity between the two countries.

Budget constraints are:

$$0 = P_t c_t^i - m_{t-1}^i - (g_t - 1)M_{t-1}$$

$$0 = \frac{m_t^i}{P_t} + \frac{e_t b_t^i}{P_t} + k_{t+1}^i + \frac{\kappa}{2}(k_{t+1}^i - k_t^i)^2 - w_t h_t^i - r_t k_t^i - (1-\delta)k_t^i - \frac{e_t(1+r_{t-1}^f)b_{t-1}^i}{P_t}$$

Production Function is $f(\lambda_t, k_t h_t) = \lambda_t k_t^\theta h_t^{1-\theta}$,Random technology variables is $\lambda_{t+1} = \gamma\lambda_t + \varepsilon_{t+1}$

Assume factor markets are competitive, we get real wages and rents conditions are:

$$r_t = \theta\lambda_t k_t^{\theta-1} h_t^{1-\theta}$$

$$w_t = (1-\theta)\lambda_t k_t^\theta h_t^{-\theta}$$

Domestic enterprises are perfectly competitive, and have a standard Cobb-Douglas production function $Y_t = \lambda_t K_t^\theta H_t^{-\theta}$

Capital market equilibrium condition is:

$$r_t = \theta\lambda_t K_t^{\theta-1} H_t^{1-\theta} \quad (5)$$

The total national economy resource constraints is:

$$\lambda_t K_t^\theta H_t^{1-\theta} = C_t K_{t+1} - (1-\delta)K_t + X_t$$

Domestic output can be used as a consumer, net domestic capital accumulation (investment) or net exports.

Money supply rule to follow is:

$$M_t = g_t M_{t-1} \quad (6)$$

Foreign price levels follow a stochastic process:

$$P_t^* = 1 - \gamma^* + \gamma^* P_{t-1}^* + \varepsilon_t^* \quad (7)$$

Steady-state first-order equation by simplifying the conditions to obtain steady-state value into the parameter. (8)

Table 1. Steady-state value

variable	$\overline{C}$	$\overline{K}$	$\overline{B}$	$\overline{H}$	$\overline{Y}$	$\overline{X}$
Steady-state value	0.9095	12.2672	1.9899	0.3229	1.1961	-0.0201

After calculating steady-state value, we undertake log-linear process. Define $\tilde{Z} = \ln Z_t - \ln \bar{Z}$.

Assumption:

$$x_t = [\tilde{K}_{t+1}, \tilde{M}_t, \tilde{P}_t, \tilde{B}_t, \tilde{r}_t^f]^T \; y_t = [\tilde{C}_t, \tilde{r}_t, \tilde{w}_t, \tilde{H}_t, \tilde{e}_t, \tilde{X}_t]^T$$

Gain:

$$0 = Ax_t + Bx_{t-1} Cy_t + Dz_t$$

$$0 = E_t[Fx_{t+1} + Gx_t + Hx_{t-1} + Jy_{t+1} + Ky_t + Lz_{t+1} + Mz_t]$$

$$z_{t+1} = Nz_t + \varepsilon_{t+1}$$

Policy function and skip function are:

$$x_t = Px_{t-1} + Qz_t \quad (15)$$

$$y_t = Rx_{t-1} + Sz_t \quad (16)$$

It can be calculated by the MATLAB software:

P =[0.9692 0.0000 0.0000 0.0042 0.0000
0.0000 1.0000 -0.0000 -0.0000 0.0000
-0.3556 1.0000 -0.0000 -0.0984 -0.0010
0.0943 -0.0000 0.0000 0.8342 0.0083
-0.1857 0.0000 -0.0000 -1.6433 -0.0164]

R =[0.3556 0.0000 0.0000 0.0984 0.0010
-0.6321 -0.0000 0.0000 -0.1749 -0.0017
0.3556 0.0000 -0.0000 0.0984 0.0010
0.0123 -0.0000 0.0000 -0.2732 -0.0027
-0.3556 1.0000 -0.0000 -0.0984 -0.0010
-9.3319 0.0000 -0.0000 17.4163 0.1742]

Q = [0.0511 -0.0055 -0.0174
0.0000 1.0000 -0.0000
-0.7724 1.7194 0.2758
0.1760 0.1160 0.5182
-0.3466 -0.2285 0.9492]

S =[0.7724 -0.7194 -0.2758
1.4047 -0.4100 0.4904
0.7724 0.2306 -0.2758
0.6323 -0.6406 0.7662
-0.7724 1.7194 -0.7242
-17.4201 -11.4853 -52.2977]

Matrix P and R in the price of the corresponding column is zero, which means that the price is not a state variables. Currency affects only himself, domestic prices and the exchange rate. Net exports coefficient (matrix R and S are the last line) is quite large, and the steady state value of net exports compared to foreign deposits or borrowing is relatively small. Make relatively small adjustments to assets held abroad will cause net exports to the relatively large number of differential changes.

4. Simulation of dynamic model and actual contrast

Determined by the upper section of the matrix P, Q, R, S can gain linear dynamic model:

$$x_t = Px_{t-1} + Qz_t$$

$$y_t = Rx_{t-1} + Sz_t$$

In order to visualize the effect of monetary shock is given, we simulate the sequence. According to:

$$x_t = [\tilde{K}_{t+1}, \tilde{M}_t, \tilde{P}_t, \tilde{B}_t, \tilde{r}_t^f]^T \; y_t = [\tilde{C}_t, \tilde{r}_t, \tilde{w}_t, \tilde{H}_t, \tilde{e}_t, \tilde{X}_t]^T$$

We can draw simulation sequence, Descriptive statistics feature simulated sequence data in the following table:

Table 2. Simulated sequence data of each statistical characteristics

	CT	RT	WT	HT	ET	XT
Mean	0.005935	0.000538	0.003757	0.002030	-0.155450	0.005966
Median	0.006460	-0.000616	0.003407	0.002057	-0.187359	0.006793
Maximum	0.015838	0.015358	0.014788	0.009691	0.004577	0.264351
Minimum	-0.002520	-0.011219	-0.004664	-0.006655	-0.286637	-0.203811
Std. Dev.	0.005019	0.005985	0.004060	0.003676	0.107290	0.121537

	KT	MT	PT	BT	RF
Mean	0.005248	-0.147439	-0.153380	0.003663	-0.007633
Median	0.005401	-0.165675	-0.173228	0.004866	-0.010448
Maximum	0.009742	0.004190	0.002409	0.014951	0.020781
Minimum	0.000000	-0.280561	-0.283236	-0.013817	-0.024387
Std. Dev.	0.002819	0.109543	0.107253	0.007619	0.011007

Table 3. The correlation coefficient simulated sequence data

Probability	BT	ET	MT
BT	1		
ET	-0.70	1	
MT	0.95	0.99	1

Next, based on historical consumption, average labor force, capital stock and capital rental rate, wages, the number of international bonds, the exchange rate, net exports, the actual price of the goods abroad and other data obtained descriptive statistics for each variable in the following table:

Table 4. Simulated sequence data of each statistical characteristics

	KT	MT	BT	
Mean	206864.2	481468.5	4086.621	
Median	167060.7	374522.9	3639.050	
Maximum	447601.6	1106525.	8631.700	
Minimum	64332.38	134610.3	1457.300	
Std. Dev.	125385.5	320544.8	2228.240	
	CT	WT	ET	XT
Mean	7923.000	14297.79	747.5986	10095.08
Median	6804.500	12772.65	778.7900	11201.37
Maximum	15632.00	26955.10	827.8400	20868.41
Minimum	3632.000	6280.000	619.3200	1865.200
Std. Dev.	3978.995	6780.495	84.19475	6913.056

Table 5. The correlation coefficient simulated sequence data

Probability	BT	ET	MT
BT	1		
ET	-0.98	1	
MT	0.98	0.96	1

Contrast the above table, we can see simulated data and actual data static characteristic has a high correlation. Exchange rate and the number of bond have a high negative correlation, the actual correlation is consistent with the model, they are negatively correlated. The relationship between exchange rate and money supply is the same as the relationship between the number of bonds and money supply are both positively correlated. That means this paper dynamic model reflects the actual situation of Chinese monetary policy on the exchange rate shocks every well.

5. Dynamic model currency impulse response

Using VAR model econometric analysis, undertake the further empirical analysis. After HP filtering the raw data, determine the root of the reciprocal of VAR models are all less than 1, indicating VAR model is stable, HP filtered data is stationary. By lag order tests, found that when the lag order in second order the model significantly. Thus, the VAR model as second-order lag order, the impulse response analysis is:

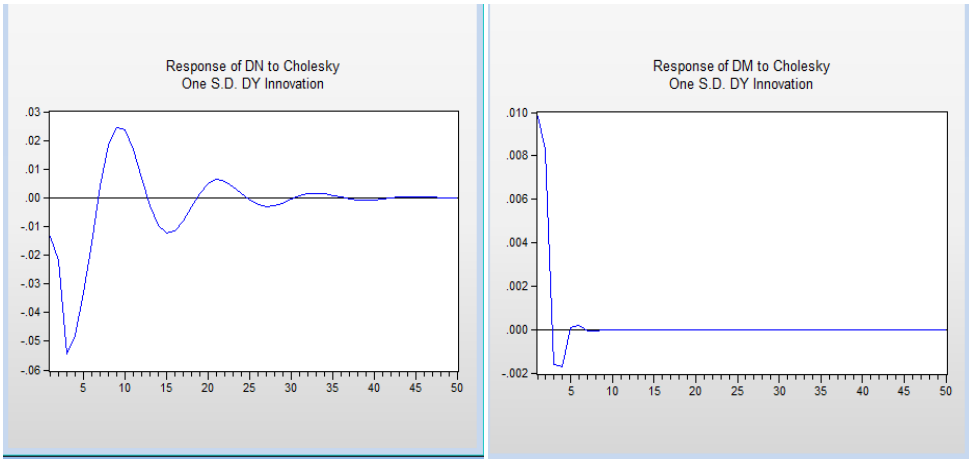

Figure 4. VAR impulse response results

Figure 4 are the impulse response results of the currency impact to the amount of foreign bonds and the impulse response results of the currency impact to real exchange rate. Next, we use the dynamic model to predict the impact of the currency, the results show below:

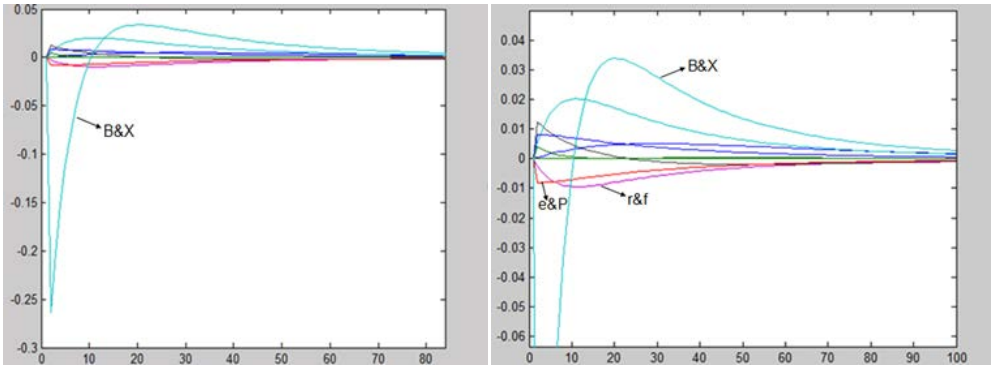

Figure 5. Dynamic model impulse response results

Figure 5 depicts the net foreign savings economy impulse response to monetary shocks. We can see the actual data and simulated data have obvious similarities, analog data have the same impact will converge to a positive value, and price and exchange rate convergence faster than money, the reaction of capital is very smooth, in short-term consumption is increase but only just before 50 stage. And just like the impact of simulation data the actual amount of foreign bonds respond quickly, both have a negative effect, then recovery. The impact of the exchange rate is also very similar, have a negative impact on the subsequent return to homeostasis. Model for the negative reaction to the shock is completely symmetrical, so the international holdings can reduce the negative impact. International assets as a shock absorber, can slow the impact of domestic monetary shocks.

6. Conclusions

This paper use the New Keynesian DSGE model framework to analyze the impact of monetary, fiscal policy, monetary policy on the exchange rate, to analyze the impact of the currency impact on the Chinese economy. The adoption of DSGE analytical framework can enrich Chinese research. And it is beneficial for our thinking of macroeconomic monetary policy interventions.

By analyzing a small open economy. In this paper, a risk-free bonds to represent international assets and assuming people can hold any number of the bonds, and does not affect the interest rate or asset prices. However, due to the presence of arbitrage lead to non-deterministic problems, hence the addition of adjustment costs in the capital. Since the introduction of capital adjustment costs would change the rate of return between capitals and bonds, so to determine capital

accumulation and international savings. Meanwhile, the model assumes that international interest rates become a nation of net foreign debt or saving function, such economies will have a single, determined steady state. Finally, add CIA domestic currency impact and the impact on foreign prices.

Based on observations obtain in the variable matrix P and R in the price of the corresponding column is zero, which means that the price is not a true state variables. Currency affects only himself, domestic prices and the exchange rate. Net exports coefficient (matrix R and S are the last line) is quite large, and the steady state value of net exports compared to foreign deposits or borrowing is relatively small. Make relatively small adjustments to assets held abroad will cause net exports to the relatively large number of differential changes.

According to the static test results of the model, the model can explain the situation of China have some explanatory power. Observe the impulse response results can be found that in the short term impact of technology can rapidly lower the exchange rate, but after 10 stage it becomes to decline and getting back to the steady state in 50 stage. This is consistent with the actual situation. Holding international assets can reduce the negative impact by monetary shocks. International assets as a shock absorber, can slow the impact of domestic monetary shocks. When the domestic implementation of monetary policy will lead to inflation in the short term, the dollar fell against the RMB exchange rate, so that the rapid decline in international bonds, but in long term all economic variables will return to steady-state value.

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