Simulation Analysis of the Impact of the Rural Financial Efficiency on the Rural Economic Fluctuations

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Abstract. This paper constructs a Dynamic Stochastic General Equilibrium model (DSGE) which includes external shocks such as technology shock, cost push shock and monetary policy shock. The static and dynamic parameters of DSGE model are estimated by using calibration method and Bayesian estimation respectively, and the financial efficiency of China's rural areas is measured. Using impulse response analysis and social welfare loss of rural residents, we studied the impact of external shocks on rural economy under the level of rural financial efficiency. The results showed that: the current rural financial efficiency is 0.64; in response to external shocks, when the rural financial efficiency is 0.85, it can most effectively iron the fluctuations of the external shocks on the rural economy.

Keywords: Simulation analysis · Rural financial efficiency · External shocks · Rural economic fluctuations · Dynamic Stochastic General Equilibrium model

1 Introduction

Agriculture is the foundation of our national economic development, rural financial system is not only an important part of our financial system, but also an important guarantee for the sustainable development of rural finance. For a long time, the level of rural financial efficiency has been an important factor affecting the development of rural economy, but on the whole, the current development of rural finance in China is relatively slow. The low efficiency of rural finance is the main obstacle to the development of rural economy, the transformation and upgrading of agricultural industry, and the growth of farmers' income. Chinese rural system has not fundamentally solved the problem of low efficiency of rural finance, the development of agricultural modernization is still not up to the requirements, and the rural economy is in urgent need of greater development. Therefore, the study of agricultural economic growth has an important practical significance.

Financial efficiency refers to the efficiency of banks and other financial institutions in converting deposits into loans (Yan, 2012) [1], while rural financial efficiency

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mainly refers to the efficiency of rural financial institutions in converting rural deposits into rural loans (Zhao and Zhu, 2015) [2]. Based on the window reference Malmquist index method, Wu and Zhang (2019) [3] used panel sample data from 31 provinces and cities in China from 2009 to 2016 to empirically test the development of rural financial efficiency on agricultural economy. The study found that rural financial efficiency has varying degrees of impact on current rural economic growth. The impact of rural financial efficiency on rural economically developed areas and rural economically backward areas is relatively weak. Sui et al. (2019) [4] analyzed the efficiency of rural financial services in China's major grain-producing regions, and research shows that the efficiency of rural financial services in China's major grain-producing regions is generally stable and effective. The growth of total factor productivity is mainly attributed to the improvement of technical efficiency. There is a positive correlation between the development of the rural economy and the efficiency of financial services. Jugnaru (2019) [5] studied the relationship between rural human resources development and financial efficiency in ten rural areas of Constanta County in 2016. The research results show that the effective combination of rural financial capital and labor development, that is, the improvement of rural financial efficiency will promote Rural economic development.

Most scholars mainly focus on the following two aspects: First, the research on the relationship between rural finance and rural economy, while the research on the relationship between rural financial efficiency and rural economy is less; second, most of the research methods adopt the traditional quantitative analysis methods such as co-integration and VAR model, but lacking of micro theory (Yu, Wang 2011) [6], and less consideration of the impact of external shocks. In view of this, this paper constructs a Dynamic Stochastic General Equilibrium model (DSGE) which includes external shocks such as technology shock, cost push shock and monetary policy shock, solves the shortcomings of quantitative analysis and micro foundation of traditional econometric model, and then introduces the Dynamic Stochastic General Equilibrium model into the field of rural economic research to simulate and analyze the external factors under different rural financial efficiency, the impact of shock on rural economy, using impulse response analysis and rural residents' social welfare loss analysis to find the best rural financial efficiency.

2 Model Construction

2.1 Rural Families

A rural economy is made up of countless families. The utility of each rural household is affected by the consumption of rural residents, the cash held by rural residents and the labor provided by rural residents. The utility function of rural family is assumed to be:

$$u(C_t, m_t, L_t) = \frac{C_t^{1-\sigma}}{1-\delta} + \frac{(M_t/P_t)^{1-v}}{1-v} - \frac{L_t^{1-\varphi}}{1-\varphi} \tag{1}$$

Among them, C_t refers to the actual consumption demand of rural residents, M_t is the amount of the nominal monetary balance of rural households, and P_t is the price level $m_t = M_t/P_t$, m_t refers to the actual monetary balance of rural households; L_t refers

to the working time of rural residents; σ indicates the reciprocal of the intertemporal substitution elasticity of rural residents' consumption; v indicates the reciprocal of rural monetary demand to interest rate elasticity, and φ indicates the reciprocal of rural labor supply to real wage elasticity. In the t period, the budget constraints faced by rural families are:

$$W_t L_t + r_t^k(i_{t-1} + (1-\sigma)k_{t-1}) + R_t B_{t-1}/\pi_t + (M_{t-1}/P_{t-1})/\pi_t = C_t + I_t + m_t + B_t \tag{2}$$

Among them, W_t means that the rural residents get real wages in the period; R_t means the nominal deposit interest rate of the rural credit cooperatives in the period; r_t^k means the real return on capital of the rural residents. i_t represents the actual investment of rural residents, π_t represents the inflation rate in rural areas, and B_t represents the actual deposit balance of rural residents. The following first-order conditions can be obtained by deriving the consumption of rural residents, the amount of real money balance of rural residents, the labor time of rural residents, the real capital stock of rural residents and the real deposit balance of rural residents:

$$\frac{\partial LN}{\partial C_t} = o \Rightarrow \frac{1}{C_t^{\sigma}} = \lambda_t \tag{3}$$

$$\frac{\partial LN}{\partial m_t} = o \Rightarrow \frac{V_t}{m_t^{v}} + \beta E_t \frac{\lambda_{t+1}}{\pi_{t+1}} = \lambda_t \tag{4}$$

$$\frac{\partial LN}{\partial L_t} = o \Rightarrow L_t^{\phi} = \lambda_t W_t \tag{5}$$

$$\frac{\partial LN}{\partial B_t} = o \Rightarrow \beta E_t \lambda_{t+1} \frac{R_t}{\pi_{t+1}} = \lambda_t \tag{6}$$

$$\frac{\partial LN}{\partial k_t} = o \Rightarrow \beta E_t \lambda_{t+1}((1-\delta) + r_t^k) = \lambda_t \tag{7}$$

2.2 Final Township Enterprises

The final products consumed by rural residents and government departments are provided by the final township enterprises. Under the condition that the scale of production technology remains unchanged, when the nominal price of the intermediate commodity of i is P_{it}, the production function of the final township enterprise is $y_t = \left[\int_0^1 y_{it}^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$. Among them, θ represents the substitution elasticity of intermediate products, and the fixed price of the final product township enterprises facing the market is P_t, then the first-order condition for the profit maximization of the final product township enterprises is $y_t(i) = (\frac{P_t(i)}{P_t})^{-\theta} y_t$, the first-order condition function represents the demand function of the intermediate product of i, and under the first-order condition for the profit maximization of the final township enterprises, θ is the demand price elasticity of the intermediate product. The demand price elasticity of intermediate goods reflects the

competition intensity of intermediate goods. The larger the price elasticity θ is, the more incentive the market competition of intermediate goods is. According to the definition of perfect competitive market, the profit of township enterprises in perfect competitive market is 0. Therefore, the price P_t in the period t must be met: $P_t = (\int_0^1 P_t(i)^{1-\theta} di)^{\frac{1}{1-\theta}}$.

2.3 Intermediate Township Enterprises

Referring to the research of Ball (1999) [7] and Walsh (2010) [8], it is assumed that the production of products is monopolistic, and the production technology will have an impact on the output of intermediate products, and its production function is $y_{it} = Z_t K_{it-1}^{\alpha} N_{it}^{1-\alpha}$. Among them, K_t means the capital required for the production of intermediate products, N_t means the quantity of labor required for the production of intermediate products, and Z_t means the level of production technology, and it has: $\ln(Z_t) = (1-\rho_Z)\ln(Z) + \rho_Z \ln(Z_{t-1}) + \varepsilon_Z$, $\rho_Z \in (-1, 1)$, $\varepsilon_Z \sim N(0, \delta_z^2)$.

For township enterprises, the choice of the optimal pricing model and the optimal factor demand is mainly based on the cost minimization. Assuming that the wage rate faced by township enterprises is the same as the marginal cost of labor, the total cost of township enterprises is minimized to $\min_{N_t, K_{t-1}} W_t * N_{it} + r_t^k * K_{it-1}$. Therefore, according to the cost minimization of the enterprise of i under the constraint of production function, the following equation can be obtained:

$$\frac{N_{it}}{K_{it-1}} = \frac{(1-\alpha) * r_t^k}{\alpha * W_t} \tag{8}$$

In addition, the actual marginal cost of the township enterprise of i is:

$$mc_t(i) = \frac{W_t * N_t}{(1-\alpha) * y_t(i)} = \frac{W_t^{1-\alpha} * (r_t^k)^{\alpha} * \alpha^{-\alpha} * (1-\alpha)^{\alpha-1}}{Z_t} \tag{9}$$

It can be seen from Eq. (9) that under the same conditions of wages, return on capital and production technology in the same cycle, the marginal cost of all township enterprises is the same.

In addition, according to the marginal cost equation, the capital equation and labor equation needed by township enterprises can also be obtained, as shown in Eqs. (10) and (11):

$$r_t^k * K_{it-1} = \alpha * mc_t * y_{it} \tag{10}$$

$$W_t * N_{it} = (1-\alpha) * mc_t * y_{it} \tag{11}$$

It is assumed that the intermediate township enterprises have the nature of monopoly, the monopoly competition township enterprises have the ability to price the goods, and the price of the goods will produce stickiness. According to the enterprise pricing rule of Calvo (1983) [9], in each period, only $1-\rho$ township enterprises can optimize the price, and the rest of the township enterprises can only maintain the price of the previous period,

and $P_{it} = P_{i.t-1}$. When the intermediate township enterprises can specify the commodity price separately, assuming that all township enterprises choose the same price P_{it}^*, the problem of maximizing the number of township enterprises can be expressed as follows:

$$Max\, E_t \sum_{j=0}^{\infty} \beta^j \rho^j Q_{t+j}(P_{it}^* y_{i,t-1} - W_t N_{it} - r_t^k K_{i,t-1}) \tag{12}$$

Among them, the marginal utility of wealth is $Q_{t+j} = C_{t+j}^{-\delta}/C_t^{-\delta} * P_t/P_{t+k}$. The demand equation and cost equation are brought into the above equation, and the optimal price of intermediate township enterprises is obtained by solving the first-order reciprocal:

$$P_{it}^* = \frac{\theta}{\theta - 1} * \frac{E_t \sum_{j=0}^{\infty} (\beta\rho)^j C_{t+k}^{-\delta} y_{t+j} P_{t+j}^{\beta} mc_{t+j}}{E_t \sum_{j=0}^{\infty} (\beta\rho)^j C_{t+k}^{-\delta} y_{t+j} P_{t+j}^{\theta-1}} \tag{13}$$

At the same time, the equation for price level movement is:

$$P_{it}^{1-\theta} = \rho(\pi P_{t-1})^{1-\theta} + (1-\rho)P_t^{*(1-\theta)} \tag{14}$$

Because all township enterprises have the same marginal cost, so in each period, P_{it}^* are same for all township and village enterprises that can adjust prices. Gali and Gertler (1999) [10] on the basis of Calvo (1983) [9] cross price adjustment model, assuming that there are $1-\zeta$ proportion of the township enterprises that adjust the price follow the thumb rule of forward behavior, and the remaining township enterprises follow the backward expectation rule, we can get the hybrid New Keynesian Phillips Curve (NKPC) in the following form:

$$\hat{\pi} = \frac{\beta\rho}{\zeta + \rho + \zeta\rho(\beta - 1)} E_t\hat{\pi}_{t+1} + \frac{\zeta}{\zeta + \rho + \zeta\rho(\beta - 1)}\hat{\pi}_{t-1} + \frac{(1-\zeta)(1-\rho)(1-\beta\rho)}{\zeta + \rho + \zeta\rho(\beta - 1)}\hat{mc}_t + \varepsilon_t^c \tag{15}$$

Among them, $\hat{\pi}_t$ represents the deviation of rural inflation rate from the steady state, $E_t\hat{\pi}_{t+1}$ represents the expected rural inflation, $\hat{\pi}_{t-1}$ represents the inertia of rural inflation, $\hat{mc}_t$ represents the deviation percentage of actual marginal cost from the steady state, respectively, ζ, ρ, β represent the proportion of backward pricing, the proportion of maintaining price and the discount factor. ε_t^c represents cost driven impact, $\varepsilon_t^c \sim N(0, \delta_c^2)$, and follows the AR (1) process: $\hat{c}_t = \rho_c\hat{c}_{t-1} + \varepsilon_t^c$.

2.4 Rural Financial Institutions

The management system of township banks is consistent with that of other banks. Assuming that the financial market is a completely competitive market and the financial intermediary in the economy is the banking system, the following methods are adopted to convert the deposits of rural residents into loans needed for the production of township enterprises:

$$I_t = \Gamma * (Y_t/Y)^{\gamma} * B_t \tag{16}$$

Among them, the parameter Γ represents the ratio of rural deposits to rural loans under the condition of steady-state equilibrium, which reflects the efficiency of township banks in transforming rural deposits into rural loans under the condition of steady-state equilibrium. The larger Γ is, the financial efficiency is, the smaller the friction in the financial market is; on the contrary, the smaller Γ is, the financial efficiency is, the greater the friction in the financial market is. γ indicates the degree of sensitivity parameter of financial credit volume to economic state. $(Y_t/Y)^{\gamma}$ indicates that the actual loan volume is affected by the economic status. When the rural economic form is better than the steady-state level, the loan amount of financial institutions such as banks is higher than the steady-state level; otherwise, it is lower than the steady-state level. Assuming that the financial market is a completely competitive market, under the equilibrium condition, the profit of banks and other financial institutions is 0, then there is $(r_t^I - 1)^* I_t = (r_t^B - 1)^* B_t$.

2.5 Monetary Authority

Drawing on the research results of Wang et al. (2016) [11] and improving, the expression of monetary policy rules is as follows:

$$\hat{r}_t^B = \rho_r \hat{r}_{t-1}^B + (1 - \rho_r)(\varphi_\pi E\hat{\pi}_{t+1} + \varphi_y \hat{y}_t) + \varepsilon_t^r \tag{17}$$

Among them, ε_t^r represents exogenous interest rate shock, $\varepsilon_t^r \sim N(0, \delta_r^2)$, and follows the AR (1) process: $\hat{r}_t = \rho_u \hat{r}_{t-1} + \varepsilon_t^r$.

2.6 Market Equilibrium

When the market is balanced, the market in the model can be cleared at the same time. Among them, the conditions for clearing the labor market is $N_{it} = N_t$, the condition for the capital market is $K_{it} = K_t$, the product market price relationship is $P_{it} = P_t$, the condition for the money market is $M_t^s = M_t$, and the condition for the overall equilibrium is $y_t = C_t + I_t$.

3 Data Processing, Processing and Parameter Estimation

3.1 Data Source and Processing

The data of this paper mainly come from China Financial Yearbook, China Financial Yearbook, China Rural Statistical Yearbook, website of National Bureau of statistics, website of people's Bank of China and wind database. The time interval is from the first quarter of 2002 to the third quarter of 2017. This paper constructs a DSGE model including technology shock, cost driven shock and monetary policy shock. According to the principle of Bayesian estimation, the number of observation variables should be less than or equal to the number of exogenous shocks. In order to ensure that exogenous shocks can be well identified and estimated, and to make the results of subsequent analysis more reliable, the rural output gap (Y) and rural residents' price consumption index (CPI) are used as observation variables in Bayesian estimation. Rural GDP, referring to the research of sun Yu et al. (2014) [12], is characterized by the sum of total agricultural

output value and added value of output value of township enterprises. According to Hu (2015) [13], the actual rural GDP is equal to the ratio of the nominal rural GDP to the rural GDP deflator.

The data processing process of this paper is as follows: firstly, take the logarithm of the actual rural GDP and CPI; secondly, take the logarithm of the actual rural GDP and CPI to remove the seasonality by using X-12; finally, use HP filter to remove the actual rural GDP and CPI to remove the seasonality In the long run, we can get the gap value of rural output and the gap value of rural consumer price index.

3.2 Parameter Estimation

The parameters in DSGE model are generally divided into two categories: one is the parameters reflecting the steady-state characteristics of the model, the other is the parameters describing the dynamic characteristics of the model.

Using the existing literature for reference to calibrate the steady-state parameters of the model, referring to the research of He and Li (2017) [14], the discount factor of rural residents β is set as 0.99, and the corresponding actual annual interest rate of rural financial institutions is 4%. Referring to the research of the army and Zhong (2003) [15], the reciprocal of the elasticity of labor supply to real wages of rural residents ϕ is taken as 1, the reciprocal of the intertemporal substitution elasticity of rural residents' consumption σ is 1.5, and the reciprocal of the elasticity of money demand to interest rate of rural residents v is taken as 2. According to the research results of Chen (2017) [16], Yang Yuanyuan and Yu (2017) [17], the capital output elasticity is 0.5, and the stable value of the smoothing index of technological shock Z is 1. Based on Xie P and Luo X (2002) [18], the steady-state rural inflation δ is set as 1. For the capital depreciation rate, referring to the research of Gong and Xie (2004) [19], the annual depreciation rate value of capital is set as 10%, and the corresponding quarterly value is 2.5%. Based on the research of Liu Bin (2008) [20], the marginal cost parameter of township enterprises mc is set as 0.91. Referring to the research of Hu and Zhang (2015) [13], we set the substitution relationship between leisure and consumption φ as 1, the price forward probability ζ as 0.25, and the price proportion ρ as 0.85. According to Yan (2012) [21], the sensitivity parameter of financial intermediary credit volume to economic state γ is set as 1.12.

This paper focuses on the analysis of the impact of different rural financial efficiency on rural economy. Parameters Γ are the key indicators to measure rural financial efficiency. The larger Γ is, the rural financial efficiency is, the higher the rural financial efficiency is; the smaller Γ is, the rural financial efficiency is, the lower the rural financial efficiency is. From the function formula (16) of rural financial institutions, it can be seen that Γ is equal to the ratio of deposits of rural financial institutions to loans of rural financial institutions, because the efficiency of rural financial institutions does not have a fixed value. Therefore, this paper chooses the ratio of rural financial institution deposits to rural financial institution loans to calibrate, since 2002, the ratio of deposits of rural financial institutions to loans of rural financial institutions (i.e., rural financial efficiency) has changed greatly, so it is difficult to find a value to represent the steady state deposit and loan ratio. Therefore, the base value of this paper is 64%, and the other values are

50%, 85% and 95% to compare the effects of different rural financial efficiency on rural economy, so as to determine the optimal value of rural financial efficiency.

For the dynamic parameter estimation of DSGE model, the Bayesian estimation method is mainly used. Firstly, the prior step-by-step determination of the estimated parameters is needed. Referring to the research of Liu and Yao (2016) [22], etc., the prior probability distribution of parameters with values between 0 and 1 is set as beta distribution, the prior probability distribution of parameters with values between 0 and infinity is set as gamma distribution, and the prior probability distribution of standard deviation of exogenous impact is set as Inv-Gamma distribution. According to Coenen and Straub (2005) [23], the smoothing index of exogenous shock ρ is set to obey the beta distribution with the mean value of 0.5 and the standard deviation of 0.1; the standard deviation parameter of exogenous shock σ is set to obey the Inv-gamma distribution with the mean value of 0.01.

When using Bayesian estimation method to estimate the parameters of DSGE model, considering the impact of technology and money supply in the model, we should select the corresponding rural output gap value and the fluctuation of real money balance as samples to estimate. However, in the estimation process, it is found that there is a problem of unrecognized parameters φ_π. Therefore, this paper selects the gap value of rural output and the gap value of rural consumer price index to estimate, and finds that all parameters can be identified. The Bayesian estimation results are shown in Table 1.

Table 1. Bayesian estimation results.

Parameter	Index meaning	Distribution type	Bayesian estimation	
			Average	90% confidence interval
ρ_Z	Technical impact smoothing coefficient	Beta[0.5, 0.2]	0.8408	[0.7606, 0.9286]
ρ_C	Cost driven impact smoothing factor	Beta[0.5, 0.2]	0.8475	[0.7058, 0.9893]
ρ_R	Smoothing coefficient of monetary policy impact	Beta[0.5, 0.2]	0.6985	[0.6137, 0.7743]
σ_Z	Standard deviation of technical shock	Inv-gamma[0.01, ∞]	0.0379	[0.0298, 0.0456]
σ_C	Standard deviation of cost driven impact	Inv-gamma[0.01, ∞]	0.0110	[0.0022, 0.0225]

(*continued*)

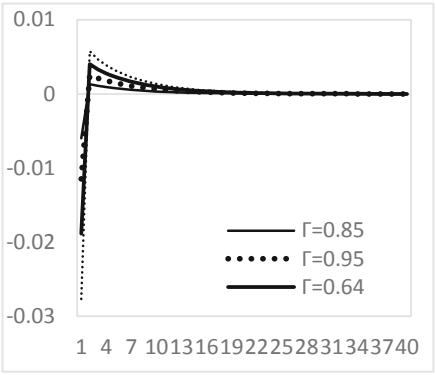
Table 1. (*continued*)

Parameter	Index meaning	Distribution type	Bayesian estimation	
			Average	90% confidence interval
σ_R	Standard deviation of monetary policy shock	Inv-gamma[0.01, ∞]	0.0082	[0.0065, 0.0098]
φ_π	Inflation response coefficient	Gamma[1.5, 0.2]	1.2469	[1.1179, 1.3648]
φ_y	Output response coefficient	Gamma[0.5, 0.2]	0.6612	[0.5026, 0.8548]

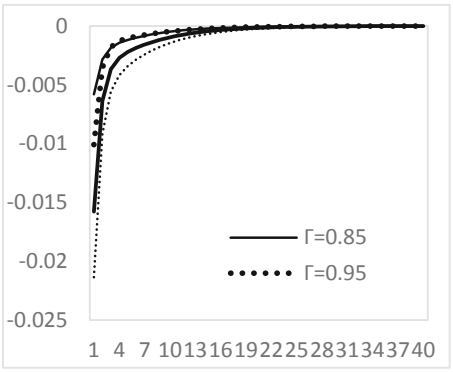
4 Simulation Result Analysis

4.1 Impulse Response of Technology Shock to Rural Output, Inflation, Consumption and Investment

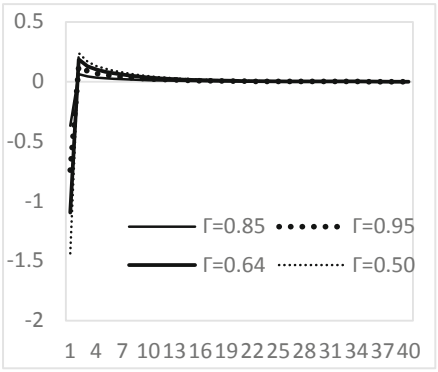
Figure 1 shows the response of rural output, inflation, investment and consumption to external shocks under the four rural financial efficiency with 1% increase in technological progress. In the sense of economics, the progress of industrial and agricultural technology leads to the improvement of the production efficiency of township enterprises, which will reduce the marginal cost of agricultural products. In the short term, the decrease of the marginal cost of agricultural products will produce downward pressure on the price of agricultural products. The price level will fall, and the inflation in rural areas will be restrained, which is shown in Fig. 1 (b) the negative fluctuation of rural inflation. With the development of industrial and agricultural technology, the scale of township enterprises will be adjusted to the optimal production scale after a period of development. Therefore, township enterprises have the ability to increase agricultural output at the original level of employment. At this time, the best choice of manufacturers is to increase investment and expand production scale by using the advantage of actual marginal cost reduction, which is shown in the negative and positive fluctuations of rural output in Fig. 1 (a) and rural investment in Fig. 1 (c). Technological progress reduces the marginal cost of products, but also reduces the demand for rural labor. The decline of rural labor demand leads to the decline of rural consumption, which is shown as the negative fluctuation of rural consumption in Fig. 1 (d). From Fig. 1 (a), Fig. 1 (b), Fig. 1 (c) and Fig. 1 (d), it can be seen that in the case of rural financial efficiency, the fluctuation of technological shock to rural output, inflation, investment and consumption is the smallest and the speed of returning to the steady-state equilibrium is the fastest, which shows that when the rural financial efficiency is $\Gamma = 0.85$, there are more effective to cope with exogenous shocks and smooth rural economic fluctuations. Therefore, in response to the impact of technology, the optimal rural financial efficiency value is 0.85.



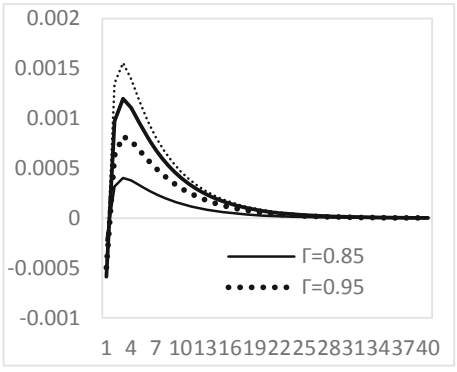
(a) Rural output



(b) Rural inflation



(c) Rural investment



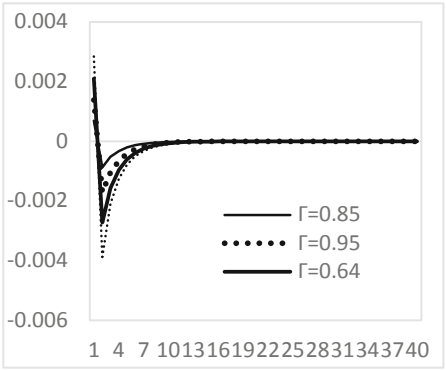
(d) Rural consumption

Fig. 1. Impulse response of technology shock to rural output, inflation, consumption and investment under four financial efficiency

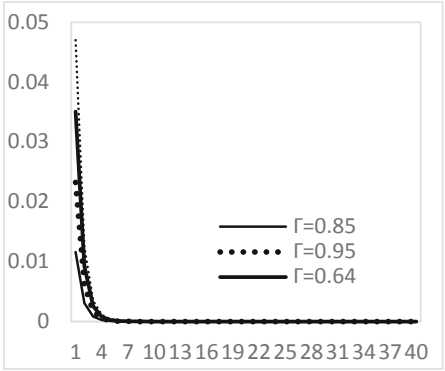
4.2 Impulse Response of Cost Driven Shocks to Rural Output, Inflation, Consumption and Investment

Figure 2 shows the response of rural output, inflation, investment and consumption under four different rural financial efficiency in the face of the impact of cost promotion. In the sense of economics, the rise of agricultural product cost will first promote the rise of rural inflation, which is shown in Fig. 2 (b) as the positive fluctuation of rural inflation. When the cost of products increases, the output of the whole market is restrained, resulting in the decline of output level, which is shown as the negative fluctuation of rural output in Fig. 2 (a). With the increase of cost, enterprises spend more money on raw materials of products and occupy the investment in other industries, which leads to the decrease of rural investment level, which is shown as the negative fluctuation of rural investment in Fig. 2 (c). The decrease of rural investment makes the liquidity in the hands of rural residents increase, and the consumption of rural residents increases rapidly in the short term. However, with the passage of time, the impact of rural inflation on the

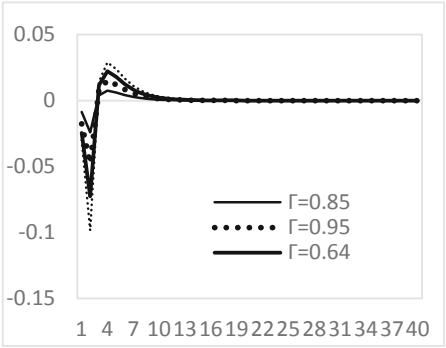
agricultural product market is more and more obvious. The price of agricultural products is rising, which makes rational consumers make cross period choices to reduce current consumption and increase future consumption driven by the maximization of lifetime utility. Therefore, it is shown as the first positive and then negative fluctuation of rural consumption in Fig. 2 (d). From Fig. 2 (a), Fig. 2 (b), Fig. 2 (c) and Fig. 2 (d), it can be seen that when the rural financial efficiency is $\Gamma = 0.85$, the impact of cost promotion should be dealt with, and the fluctuation of rural output, inflation, investment and consumption should be the smallest and the speed of returning to equilibrium state should be the fastest. It shows that when the optimal rural financial efficiency is 0.85, the impact of cost promotion can be dealt with more effectively and the fluctuation of rural economy can be ironed out.



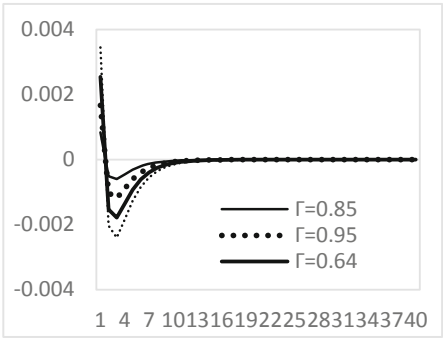
(a) Rural output



(b) Rural inflation



(c) Rural investment



(d) Rural consumption

Fig. 2. Impulse response of cost driven shocks to rural output, inflation, consumption and investment under four financial efficiency

4.3 Impulse Response of Monetary Policy Shock to Rural Output, Inflation, Consumption

Figure 3 shows the response of rural output, inflation, investment and consumption to the impact of monetary policy. The monetary policy equation in DSGE model is Taylor equation, and the impact of monetary policy is mainly reflected in the impact of interest rate impact on rural economy. Therefore, in the economic sense, the increase of interest rate of rural financial institutions first impacts on the township enterprises that have loans in the bank, and the increase of interest rate makes the financing cost of township enterprises rise. At the same time, the increase of interest rate makes the investment profit space of township enterprises be compressed. In the case of no profit, township enterprises will reduce the production scale and investment, which makes the rural output and investment decrease, which is shown as the negative fluctuation of rural output in Fig. 3 (a) and rural investment in Fig. 3 (c). With the decrease of rural investment and rural output, township enterprises will reduce the production scale of enterprises and the investment of enterprises. With the decrease of the production scale of enterprises, the demand for rural workers will be reduced. In order to get the job opportunities,

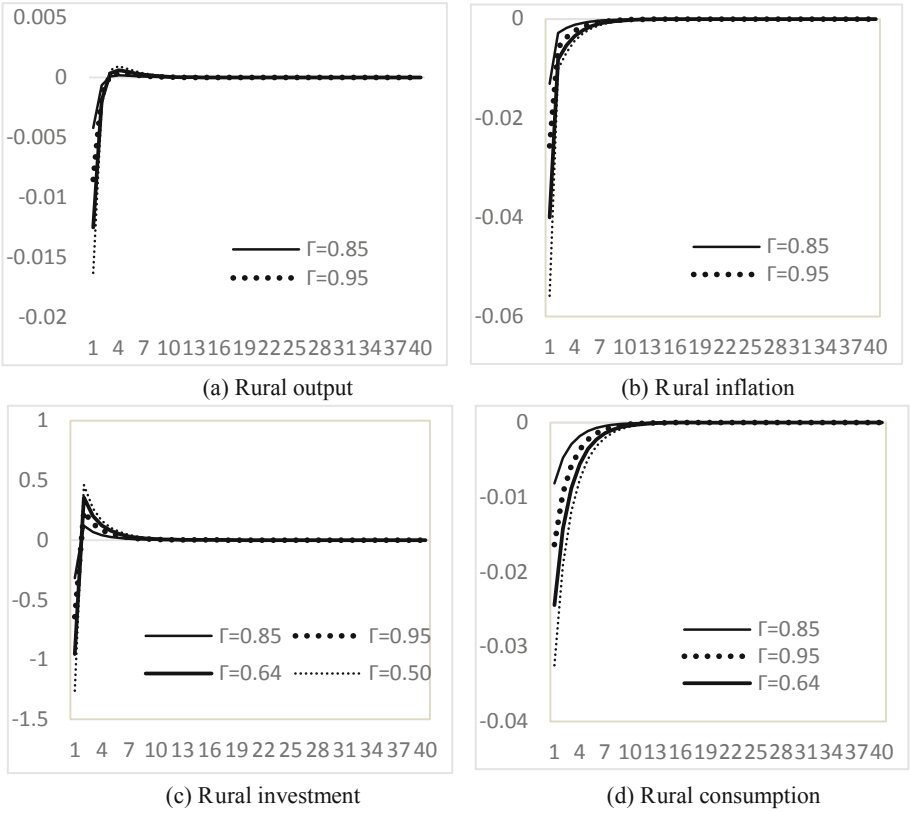


Fig. 3. Impulse response of monetary policy shock to rural output, inflation, consumption and investment under four financial efficiency

workers have to reduce the demand for wage remuneration, so that the wages will be reduced. Residents do not have more funds for consumption, which is shown in Fig. 3 (d) The negative fluctuation of consumption. With the decrease of consumption demand, there will be a phenomenon that the supply of goods is greater than the demand in the agricultural product market. In order to reduce inventory, township enterprises have to reduce the price of agricultural products to sell more goods, which makes the inflation driven by consumption demand lower, which is shown as the negative fluctuation of rural inflation in Fig. 3 (b). From Fig. 3 (a), Fig. 3 (b), Fig. 3 (c) and Fig. 3 (d), it can be seen that when the rural financial efficiency is 0.85, the impact of monetary policy (i.e. the impact of interest rate) should be dealt with, and the fluctuation of rural output, inflation, investment and consumption is the smallest and the fastest to return to the equilibrium state, indicating that when the rural financial efficiency is $\Gamma = 0.85$ can more effectively deal with the exogenous impact and iron out the rural economic fluctuation.

5 Conclusions

This paper first constructs a Dynamic Stochastic General Equilibrium model including technology shock, cost push shock and monetary policy shock, estimates the static parameters and dynamic parameters respectively through calibration method and Bayesian method, and calculates the current rural financial efficiency value; secondly, uses impulse response analysis method and social welfare loss analysis to investigate different financial effects respectively The impact of technology shock, cost push shock and monetary policy shock on rural output, inflation, investment and consumption, as well as the loss of social welfare of rural residents, in order to seek the optimal rural financial efficiency. The results show that: first, the current rural financial efficiency is 0.64; second, from the four rural financial efficiency of rural output, inflation, investment and consumption response to external shocks, when the rural financial efficiency is 0.85, it can more effectively respond to external shocks and quickly iron the fluctuations of external shocks on the rural economy; third, from the four rural financial efficiency, when the rural financial efficiency is 0.85, it can more effectively stabilize the rural economy.

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