Monetary Policy Shocks and the Effects of Industrial Economic Transformation - Research Based on DSGE Model in Computer Environment

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Abstract. With the impact of the new epidemic situation, the global economy is in a downturn, and many countries have issued monetary policies. Therefore, it is of great value to study the role and effect of monetary shock and industrial economic transformation effect on national economic operation. Based on this, this paper first studies the analysis method of DSGE model, and then uses DSGE model to study the impact of monetary policy and the effect of industrial economic transformation based on the computer environment.

Keywords: Monetary Policy, Industrial Economic Transformation, DSGE Model, Computer Environment

1. Introduction

As the focus of economists and policy makers, the impact of monetary policy and the effect of industrial economic transformation will have an important impact on the economic operation of the country[1]. At present, although the academia has not reached an agreement on the impact of monetary policy and the effect of industrial economic transformation, but with the outbreak of the new crown epidemic, the global economy has stagnated, and countries have introduced monetary policies to stimulate market demand, which has become the current academic research and focus.

Figure 1. The economic subject of macroeconomic operation

At present, the research on the impact of monetary policy impact on macroeconomic operation is mainly carried out under the condition of perfect market economic system, so these research results cannot be directly applied to the regions and countries with imperfect market economic system. DSGE
model, as a common analysis tool in the current macroeconomic field, can analyze the behavior of economic entities as shown in Figure 1 through the dynamic optimal analysis method of economic fluctuation and economic growth, so as to describe the balanced state of the optimal decision-making of each subject[2]. It can be seen that the analysis of the expected mechanism of China's monetary policy in the process of adjusting industrial economy based on DSGE model has important value and role in clarifying the relationship between monetary policy impacts on industrial economic transformation.

2. Research on Analysis Method of DSGE Model

2.1. Introduction of DSGE model

DSGE model is based on the micro and macro-economic theory, using the dynamic optimization method to investigate the decision-making of each actor, and get the behavior equation of each. In the decision-making process, each actor must consider the current impact and future follow-up impact of their behavior[3]. However, there are many uncertainties in the real economy. Therefore, DSGE model studies the interaction and influence among different actors with the introduction of various exogenous random shocks.

DSGE model analysis framework can be divided into several parts as shown in Figure 2 below. Model setting is the most critical step. Model solving is to depict the dynamic path followed by the changes of various variables in the model, and the determination of model parameters is directly related to the significance of the model. In addition, through the above steps, DSGE model can be used to simulate the impact of external shocks on the whole economy, and guide the promulgation and implementation of macroeconomic policies.

![Figure 2. Aspects of DSGE model analysis framework](image)

2.2. Derivation of DSGE model

The characteristics of DSGE model are dynamic, stochastic and general equilibrium, which reflects the dynamic nature of variables and time changes. It means that the economic system is affected by various exogenous random shocks. Based on the expectation of the future, the optimal choice is made, and the impact of monetary policy shocks on market equilibrium is obtained[4]. The lifetime utility function of representative consumers is as follows:

\[ U = E_0 \sum_{t=0}^{\infty} \beta^t u_t \]  \hspace{1cm} (1)

In which, \( u \) is the present value of lifetime utility, \( 0 \leq \beta \leq 1 \) is the discount rate and \( u_t \) is the \( t \)-period utility. For enterprises, Cobb Douglas production function is adopted:

\[ y = k^l l^j \]  \hspace{1cm} (2)

Under the constraint condition:

\[ \beta h_t + h_{t-1} + \beta c_t + c_{t-1} = \frac{1}{1 + r} w_t + w_{t-1} \]  \hspace{1cm} (3)
The maximum \( U = E_0 \sum_{t=0}^{X} \beta^t u_t \) is solved, and the market equilibrium conditions are obtained by DSGE model\(^5\).

### 2.3. Practical application of DSGE model

The quantitative application level of DSGE model constructs a benchmark for measuring real economy and a laboratory for policy analysis. At the qualitative application level, DSGE model is an information saving tool and provides a framework for thinking about economic issues\(^6\). Because the model estimates rely on sample information, it requires enough sample information. Therefore, these estimates only have certain good properties in the case of large samples. However, in many practical applications, because it is difficult to obtain a large number of observation results through experiments, only a small amount of sample information can be obtained.

### 3. Simulation Analysis of DSGE Model

#### 3.1. Simulation of economic fluctuation and industrial fluctuation characteristics

DSGE model simulates the characteristics of real economic fluctuation and industrial fluctuation, analyzes the main influencing factors in actual fluctuation, lays a foundation for simulating the effect of monetary policy under expected and unexpected shocks, and analyzes the exogenous shock effect under different mechanisms, so as to determine the impact of expected mechanism on economic fluctuation.

In the actual industrial economy level, the relationship between the overall economy and the industrial economy in the industrial economic fluctuation is obtained by simulating the fluctuation of the cross industry economy and the overall economy. The simulation results of the actual industrial economic fluctuation obtained after the economic parameterization are shown in Table 1 below. From the simulation results, it could see that the implementation and implementation of industrial transformation policy can effectively deal with the impact of the economic and financial crisis.

**Table 1. Simulation results of cross industry economic fluctuation**

| Types       | Total economic correlation | Output related | Cross industry autocorrelation |
|-------------|-----------------------------|----------------|-------------------------------|
| Produce     | 0.467                       | 1.000          | 0.521                         |
| Consumption | 0.498                       | -0.597         | -0.603                        |
| Inflation   | 0.482                       | 0.654          | 0.736                         |
| Labour      | 0.571                       | 0.684          | 0.741                         |
| Material Science | 0.481                 | 0.789          | 0.881                         |

#### 3.2. Industrial fluctuation under the impact of monetary policy

In the industrial fluctuation level of monetary policy impact, the volatility effect of industrial economy under the policy with or without expectation has a high correlation between different industries and output. The existence of expectation makes the policy effect expand, the industrial economic fluctuation increases, and the correlation between the industry itself and the overall output weakens. In the relationship between structure and output, the output correlation under the expected situation gradually increases, which shows that the industrial structure fluctuation under the expected situation is closely related to the overall economy.

In addition, the monetary policy directly affects the industrial economy when adjusting the macro-economy, which makes the monetary policy deviate from the actual policy direction in the industrial economic adjustment, and the effect of the policy itself has the problem of amplification or reduction. During the implementation of monetary policy, the fluctuation of industrial economy has been increased, or under the condition that the policy can carry out targeted supporting policies according to
the actual situation of industrial economy, the development of industrial economy can be well transformed and upgraded.

3.3. The persistence of monetary policy shocks
The persistence of monetary policy shocks includes the fluctuation effect of industrial economic structure under low persistence and the fluctuation effect of industrial economic structure under high persistence. Among them, the volatility effect of highly persistent industrial structure is significantly improved, which indicates that the persistence of monetary policy will enhance the impact of monetary policy on industrial structure. On the other hand, under the condition of high sustainability, high sustainability of monetary policy can reduce the impact of output on the industry itself.

In terms of the impact on the real economy, the impact of the tolerant interest rate rule on the output is equivalent to that of the monetary rule, while the impact of the radical interest rate rule on output and inflation is less than that of the tolerant interest rate rule, and has little effect on the fluctuation of other variables.

4. Conclusion
In summary, DSGE model is a widely used analysis tool in the field of macro-economy. It can describe the equilibrium state of the optimal decision-making of each subject through the dynamic optimal analysis method of economic fluctuation and economic growth. DSGE model analyzes the expected mechanism of China's monetary policy in the process of regulating industrial economy, the industrial fluctuation of monetary policy impact, the persistence of monetary policy impact, the actual economic fluctuation and the characteristics of industrial fluctuation. It is of great value and role to clarify the relationship between monetary policy impact and industrial economic transformation.

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