Research on the Relationship between National Economy and Energy Price Fluctuation Based on CGE Model and Computer Simulation Technology

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Abstract. The goal of China's economic system reform is to establish a socialist market economic system and the price mechanism is the core of the market mechanism. Only by establishing a perfect price formation mechanism, so that prices can truly reflect the market supply and demand, resource scarcity and environmental damage costs and give full play to the basic role of the market mechanism in resource allocation, can we improve the efficiency of economic operation and promote the adjustment of economic structure. Therefore, it is of positive significance to study the relationship between the national economy and energy price fluctuations by applying CGE model and computer simulation technology.

Keywords: CGE Model, Computer Simulation Technology, Volatility, Price

1. Introduction

Simply relying on the increasing energy supply makes it difficult to meet the continuously increasing consumer demand. The development strategy of the national economy changes from high energy consumption to low energy consumption and it is necessary to change the energy price formation mechanism so that the energy price fully reflects the scarcity of resources. Therefore, China's call for comprehensive resource product prices is increasing. Therefore, it is extremely important to use the CGE model to study the relationship between the national economy and energy price fluctuations.

2. CGE model analysis

CGE was first proposed by Johansen in 1960 and is a classical econometric method (Amman et al., 1996). According to the regions included in the model, the CGE model can be divided into single-country CGE model, multi-country CGE model and global CGE model. According to the length of time studied by the model, it can be divided into standard static CGE model and dynamic CGE
model. CGE models are often used to analyze the effects of changes in taxation, public consumption, tariffs, and other foreign trade policies on national or regional welfare, industrial structure, trade, labor market, and income distribution. Computable general equilibrium model, or CGE model for short, is an important tool for quantitative analysis of economics and public policy popular in the world, also known as the general equilibrium model. The characteristic is to describe the interlocking relationship between various sectors of the national economy and various accounting accounts and to describe, simulate and predict the impact of policies and economic activities on these relationships\cite{1}. It is the improvement and deepening of the multi-sector economic model based on the input-output model. The design basis of the CGE model is the social accounting matrix, referred to as SAM or SAM table, includes all socio-economic accounting accounts, such as input-output the data matrix, residents, society, government, foreign sector, accounting such as current and capital accounts, taxes, fiscal expenditures, transfer payments, savings and investments, etc. The CGE model uses the modern general equilibrium theory to establish the relationship between these accounts into a simultaneous system of nonlinear equations. The CGE model is widely used and is mostly used for quantitative analysis of public policies, such as macroeconomic balance, trade, employment, tax reform and impact, education expenditure and human resources, energy and natural resources, social security, environmental and economic sustainable development, Health public expenditure and health policy. There are many examples of CGE's applications in finance and taxation. Most domestic studies include the impact of VAT transformation, RMB appreciation, social security, fiscal expenditure, water resources, carbon cycle, etc. on various economic sectors and account variables\cite{2}. Constructing the CGE model requires familiarity with modern economic theory, including the theory of consumers, companies, markets, and general equilibrium in advanced microeconomics and the foundation of intermediate macroeconomics. Only by mastering these theoretical knowledge can one know how to set the function, the determination of endogenous and exogenous variables and the theoretical setting of macro closure. In addition, computer skills are required and the model needs to be programmed. The GAMS programming language used by the American genre model is more commonly used.

3. Relationship between national economy and energy price fluctuations based on CGE model

3.1. Financial changes

Positive fluctuations in energy prices will push up real interest rates, affect industrial growth and inhibit stock market prices\cite{3}. We further want to know the short-term response of macroeconomics to energy price fluctuations. Through the impulse response function, we see that positive fluctuations in energy prices will raise real interest rates, affect industrial growth and suppress stock market prices. In Chinese industrial structure, the chemical and smelting industries, which consume a lot of energy, which is greatly affected by rising oil prices. However, with the optimization of industrial structure and technological progress, this effect is getting smaller and smaller in the long run. The stock market is not completely effective for changes in energy prices and there is a phenomenon of "under-reaction". Here, we also found that the rise in energy prices caused the rise in profit margins. Income and Profit margin is shown as table 1.

| Table 1. Income and Profit Margin\cite{1} |
|-----------------|-----------------|-----------------|-----------------|
| Year            | 2016            | 2017            | 2018            |
| Income          |                 |                 |                 |
| Profit Margin   |                 |                 |                 |
3.2. Industrial changes

Analysis of the impact of industrial demand and interest rate hikes on energy prices. By raising interest rates and other means, raising real interest rates and regulating inflation caused by rising energy prices, the effect is obvious. Decreases personal wealth and restricts consumption. For companies, high interest rates increase the cost of capital and inhibit investment, thereby reducing their use of energy-related products. It is foreseeable that in the next few years, as prices rise further, the central bank will continue to stabilize inflation expectations through monetary policy measures such as interest rate hikes to maintain the overall price level basically stable. The fluctuation of industrial growth rate has a small impact on energy prices, but the impact period is longer\textsuperscript{49}. Therefore, the continuous increase in energy demand by industry is a reason for the rise in energy prices, but its promotion of prices is very small, which to a certain extent negates the "growth of international oil prices attributed to China's economic growth." The above analysis and judgment ultimately depend on the increase and duration of oil prices, and the increase and duration depend on the combined effects of oil demand, oil supply, and oil speculation. From the analysis of these factors, the price of oil may rise in the short term, but it is likely to remain stable at a high level for a long time. The reason why oil prices have risen indefinitely in the recent period is, first of all, a marked increase in demand. With the acceleration of world economic growth since 2002, especially since the second half of last year, the demand for oil has increased significantly. In 2003, the world's daily oil demand reached 78.8 million barrels, an increase of 1.48 million barrels from the previous year, of which China and the United States increased by 600,000 barrels and 310,000 barrels, respectively. In addition, some countries' plans to establish an oil reserve mechanism have also put some pressure on oil demand. Secondly, oil prices have remained stable at a low level for a long time, leading oil producers to maintain their current production levels, maintain low oil inventories, and limit oil production capacity. The third is that geopolitics and tight market conditions have stimulated speculation. At present, the potential oil supply capacity in the world is relatively large, but due to geopolitical reasons, it is difficult to form a realistic supply, mainly in Iraq, Russia, Venezuela and the Middle East. The tight supply has relatively made it possible for speculation, which has helped fuel oil price increases. Therefore, the currently rising oil price has a stable foundation in the long run, but stability is not likely to be at the low level in the past.

3.3. Changes in consumption

It is an inevitable choice for business difficulties. As the prices of oil and domestic coal continue to rise in the international market, there are many difficulties in the production and operation of oil and power companies. Due to the rise in crude oil prices in the international market, the contradiction between refined oil and crude oil prices has intensified and enterprises have suffered severe losses in processing and imports\textsuperscript{51}. The sharp rise in the price of thermal coal, the increase in desulfurization costs, water resources in the reservoir area have caused power generation companies to suffer industry losses\textsuperscript{61}. Therefore, appropriately raising the prices of refined oil and electricity is an inevitable choice to alleviate the difficulties in the operation of pillar industries such as petroleum and electricity. On the

| Income      | 279.69 | 405.26 | 541.33 |
|-------------|--------|--------|--------|
| Profit Margin (%) | 15.34% | 20.65% | 29.13% |


other hand, the low price of refined oil has led to excessive oil consumption growth. A large number of vehicles from neighboring countries and regions have refueled in our country. Some users who originally consumed imported fuel oil switched to domestic diesel, which further exacerbated the tight supply and demand of refined oil. The contradictions in some areas, such as file cuts, supply restrictions and unauthorized price hikes, have occurred from time to time.

|       | 2016 | 2017 | 2018 |
|-------|------|------|------|
| Consume Index | 1.36 | 2.71 | 4.69 |

### 4. Energy price fluctuation treatment plan

In order to control the rise in energy prices, it is also necessary to comprehensively consider the factors of macroeconomic and monetary policies. The increasing value added of industry has increased China's demand for energy and increased energy prices to a certain extent, but it is not the main factor for the soaring energy prices. At the same time, we can see that the increase in interest rates is conducive to the control of energy prices. This article studies the relationship between energy prices and the macro economy at a macro level. The relationship between fluctuations in energy prices and the various sectors of the macro economy is still to be further studied. At the same time, for different energy price levels, how to formulate monetary policies that will minimize economic impact, also worth further discussion.

### 5. Conclusion

At the same time, the prices of coal, crude oil and other energy products in the international market have risen sharply, causing a series of problems for China's production and life. As the world's second largest energy consumer, China has a more difficult task in price work. At the same time, doing a good job of social stability has become a difficult problem that China's economy must continue to maintain stable and rapid development. Resource product price reform is imperative, not only the primary task of improving the supply and demand relationship of resource products, but also an important link to promote economic structural adjustment and industrial structure optimization and upgrading.

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