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Research Article

Energy Efficiency, Food Consumption Influence on China's Economy based on Energy and Agricultural Food Price Fluctuations

Yantao Wang, Yong Li, Jieping Han and Jing Yan
School of Economics and Management, Northeast Dianli University, Jilin 132012, China

Abstract: External shocks have significant effects on China's economy, as energy and agriculture food price. In recent years, the increasing of energy price will promote energy efficiency; also increasing prices of agricultural products will impact on production efficiency and economy. In this study, we make a statistical analysis on the impact of energy and agricultural food prices to domestic economy. The result shows that energy price will influence the energy efficiency in the short time, LnEP at lag 1 period increased one percentage can drive LnEE growth by 0.627 percentage, at the same time, agricultural food price will impact on the production efficiency, LnAFP at lag 1 period and the 2 period increased 1 percentage will drive the LnPE increased by 0.245 and 0.016 percentage respectively. Therefore, agricultural food prices have direct mutual promotion effect. Also, there exist at least one direct co-integration relationship between energy price and energy efficiency, which means that there exist a long-term equilibrium relationship between energy price and energy efficiency.

Keywords: Agricultural food price, energy efficiency, energy price, external shocks, food consumption

INTRODUCTION

External shocks have significant effects on China's economy, as energy price and agriculture food price. The problem of economic cycle fluctuation has been one of the key issues of national macroeconomic. Slow economic fluctuation and keep a sustained economic growth has been the main goal of macro-control of every government (Perry, 2009). But before that we must analyze in depth what cause the economic fluctuations to better regulate macro economics according to these factors. Since the 30s of nineteenth century, the study on the impact of economic fluctuations has been deepening. Now many scholars attributes economic fluctuations to the random exogenous impact, such as monetary policy shocks, technology shocks, preference shock and so on. The economic depression triggered by the Oil crisis happened in the 70s of last century made people incorporated the energy impact into macroeconomic problems especially the fluctuation problem of economy and energy price shocks to the economic impact cannot be ignored (Anna and Zied, 2014). This study firstly describes the characteristics in Chinese economic fluctuation and study the relationship between the energy price, agriculture food price and energy efficiency using the econometric and statistical analysis method. On the basis of this, the energy and food price is introduced into the indivisible labor RBC model and through the calibration and Simulation of the model, verify realistic explanation of the economy (Li and Ning, 2012). Through establishing impulse response function to the technology shocks and the energy price shock, we studied the impact of technology shocks and energy price shocks on the economy.

In recent years, prices of agricultural products in the worldwide, especially grain prices showed a rising trend. Since 2006, grain prices as well as the price of pork, edible oil and vegetables have been rising (Zhang and Chen, 2013). International financial crisis began in 2008, agricultural prices appear sharp decline. Prices of agricultural products gradually had gone flat until the first half of 2009. However, the prices of agricultural products had entered a new round of volatility cycle from the second half of 2009. Current round of agricultural prices was the overall rising trend, not only the grain crops but also agro-food prices are soaring; Raising prices not only involve the commodity, also careen agricultural (Zhou, 2013). Based on this background, the research on the characteristics of fluctuations in prices of agricultural products in China and the effect factors of price fluctuations has important practical significance.

With the development of national economy, energy problem becomes international hot topic (Chen and Zhou, 2013). Especially in the rapid development and increasing energy demand and Chinese economic stage, the study of the relationship between energy prices and the economy, more and more attention of scholars at

Corresponding Author: Yantao Wang, School of Economics and Management, Northeast Dianli University, Jilin 132012, China

home and abroad (Li, 2014; Ning and Li, 2013). The last century 70's, a severe oil crisis brought about by the economic recession, the relationship between makes more and more scholars begin to study energy prices and economic growth. Many scholars to study the empirical or theoretical analysis found a negative correlation between the universal existence between energy prices and economic growth, with rising energy prices, overall economy showed signs of recession (Qing and Li, 2014; Zhang and Chen, 2012). These scholars explain this phenomenon from different angles.

Abbas (2014) make research when energy prices rise, demand will increase the amount of money, if increasing the supply amount of money in a short period of time the government can not, it will cause the money supply, so as to promote the rising real interest rates and makes the increase in savings, reduced consumption and investment, economic growth has declined, lead to serious economic recession. Oleg and Alexander (2014) and Ulrich (2009) found that the rise in oil prices will occur in the transfer of wealth between different countries, namely from the oil importing countries to oil exporters in the transfer, which will lead to oil importing countries reduce their consumption demand, consumption demand to increase its oil exporter. In general, the country to reduce imports increase in consumer demand will be lower than the export country of consumption demand, so that the overall view will lead to economic recession finally.

Rachel and John (2014) pointed out supply shock theory to explain this phenomenon. They think that, as a factor of production is an important energy prices if the rise, will lead to the production cost increases, if the other conditions remain unchanged, it will lead to lower yield, output is decreasing, while the unemployment rate will also increase. But with the continuous development of the economy, through research, many scholars have found that between energy prices and economic growth is not simply showed a negative correlation, but a kind of non symmetry (Zhou and Chen, 2013). Florentine (2014) found that the relationship between oil prices and interest rates are not symmetrical and rising interest rates will cause the output to reduce, such indirect makes the relationship between oil price and output are not mutually symmetric.

At the same time, agricultural products are not only the most important necessities of the people's lives, but also the crucial industrial raw materials for economic development. The prices of agricultural food are the key economic variables for agricultural development and even the national economy conduction. Fluctuations of agricultural products prices not only affect the quality of people's lives, but also affect the vital interests of the farmers. Therefore, the study of the fluctuations in prices of agricultural products has important theoretical significance.

MATERIAL AND METHODS

VAR model: Vector Auto Regression (VAR) is a statistical model used to capture the linear interdependencies among multiple time series. An estimated VAR model can be used for forecasting and the quality of the forecasts can be judged. VAR model is the simultaneous form of autoregressive model, A VAR (p) model of a time series y (t) has the form:

$$A_0 y_{(t)} = A_1 y_{(t-1)} + \cdots + A_p y_{(t-p)} + \varepsilon_{(t)} \quad (1)$$

Stability conditions: The stability of the VAR model means that when we put an impulse to the innovation of on formula in the VAR mode, the impact of the effect will gradually reduce. The basic condition of stability is that: all the eigenvalue of Π1 should be located within the unit circle. According to the VAR formula, when t = 1, it should be:

$$Y_1 = c + \prod_1 Y_0 + \mu_1 \quad (2)$$

And when t = 2, we calculate the formula with iterative method, as:

$$Y_2 = c + \prod_1 Y_1 + \mu_2 = (1 + \prod_1) c + \prod_1^2 Y_0 + \prod_1 \mu_1 + \mu_2 \quad (3)$$

So that, when t=t, it could be written as:

$$Y_t = \left(1 + \prod_1 + \prod_1^2 + \cdots + \prod_1^{t-1}\right) c + \prod_1^t Y_0 + \sum_{i=0}^{t-1} \prod_1^i \mu_{t-i} \quad (4)$$

From the formula above, we can get that Y_t becomes a function to the vector μ, Y_0 and μ_t after the formula transformation. So we can analysis the impact result of these vectors to find out whether the VAR model is stable. If the VAR model is stable, it will satisfy the conditions as:

- If give one unit impulse to c at t = 1, when $t \to \infty$, the effect will have a Limit value as $(I-\Pi_1)^{-1}$
- If give one unit impulse to Y_0, the effect will be Π_1^t when t = t and will be gradually disappeared with time has been increased.

From the analysis about VAR model, we can get that if the VAR model has the unit root, it will have the memory about impulse impact for a long time, so this VAR model is not stable. Also, the response of endogenous variables will not reduce with time increased in this case.

Data collection and evaluation index: In order to analyze how energy price and agriculture food price

effect on production efficiency, we use STATA 12.0 software and make a statistical analysis of Energy Price (EP) and Agricultural Food Prices (AFP) and Energy Efficiency (EE) and Production Efficiency (PE). All data was collected from China statistic year book 2014 and Caixin database, period from 1990 to 2014. We also undertake log processing to data, noted as LnEP, LnAFP, LnEE and LnPE.

RESULTS AND DISCUSSION

ADF unit root test: Data stable is the premise of establishing VAR model, an augmented Dickey Fuller test (ADF) is a test for a unit root in a time series sample. We use ADF unit root test to inspect LnEP, LnAFP, LnEE and LnPE, the result as is shown in Table 1. Through the test results we can see that all data are non-stationary and then we test on d.LnEP, d.LnAFP, d.LnEE, d.LnPE and demonstrate that they are stable, so we can build the VAR model and use granger test and co-integration test.

Result: In this study, we use AIC, SC criterion to identify the lag length. From the result, we can get that the minimum AIC is in lag 2, so I choose lag 2 as the lag length. Then, we build the VAR model of LnEE and LnPE as:

$$LnEE = 1.425 + 0.627LnEP_{t-1} + 1.106LnEP_{t-2} + 0.942LnEE_{t-1} - 0.457LnEE_{t-2} \quad (5)$$

$$LnPE = -1.248 + 0.245LnAFP_{t-1} + 0.016LnAFP_{t-2} + 0.456LnPE_{t-1} + 0.572LnPE_{t-2} \quad (6)$$

According to the formula, it can be seen that energy price will effect on energy efficiency. LnEP at lag 1 period increased one percentage can drive LnEE growth by 0.627 percentages; LnEP at lag 2 period increased one percentage can drive LnEE growth by 1.106 percentage, so the effect of energy price on a energy efficiency is obvious. The rising of energy price will promote the energy price in short time. According to the formula 6, it can be seen that the agricultural food prices can also promote production efficiency; and LnAFP at lag 1 period and the 2 period increased 1 percentage will drive the LnPE increased by 0.245 and 0.016 percentage respectively. Therefore, agricultural food prices have direct mutual promotion effect.

In order to analyze the relations between energy price and energy efficiency, we use granger causality test to analyze this VAR model, the result is shown in Table 2. From Table 2, we can get that LnEP is the reason to LnEE, which means energy price is the reason to energy efficiency. At the same time, LnEE is not the granger reason to LnEP, so that energy efficiency is not the granger reason to energy efficiency; this is also same to the conclusion above. Also, LnAFP is the reason to LnEE, which means agricultural food price is the reason to production efficiency.

Table 1: Augmented Dickey-Fuller test (ADF)

Variable	Test statistic	1% critical value	5% critical value	10% critical value	Result
LnEP	-2.489	-3.709	-2.983	-2.623	Unstable
LnAFP	0.591	-3.709	-2.983	-2.623	Unstable
LnEE	-1.025	-3.709	-2.983	-2.623	Unstable
LnPE	-2.247	-3.709	-2.983	-2.623	Unstable
D.LnEP	-3.751	-3.709	-2.983	-2.623	Stable
D.LnAFP	-3.823	-3.709	-2.983	-2.623	Stable
D.LnEE	-3.904	-3.709	-2.983	-2.623	Stable
D.LnPE	-3.135	-3.709	-2.983	-2.623	Stable

Table 2: Granger causality test

Equation	Excluded	Chi2	df	Prob>chi2
LnEE	LnEP	15.024	2	0.000
LnEP	LnEE	28.714	2	0.612
LnPE	LnAFP	9.1580	2	0.004
LnAFP	LnPE	16.246	2	0.072

Table 3: Johnson Co-integration test

Rank	Parms	LL	Characteristic value	Statistic	5% Sig. level
0	6	65.9620		20.5671	15.41
1	9	73.6523	0.56201	1.3528*	3.760

According to the results, there exist at least one direct co-integration relationship between Energy Price (EP) and Energy Efficiency (EE), which means that there exists a long-term equilibrium relationship between energy price and energy efficiency (Table 3).

Impulse-response analysis: According to the results above, we can get that there exist a long-term equilibrium relationship between energy price and energy efficiency and energy price is the reason to energy price, also the VAR model is stable. In order to analyze the VAR model, we use Impulse-response function and cholesky variance decomposition, the results is shown in Fig. 1 and 2.

Figure 1, we can get that when LnEP received one unit impact, it will lead LnEE increase currently, LnEE at t = 1 period is 0.0195 and then increased to 0.0397 at t = 2 period. Then LnEE began to reduce and reach 0.011 at t = 4 period. It illustrates there is long-term effect between energy price and energy efficiency. At the same time, From Fig. 2 we can get that when LnAFP received one unit impact in, it will lead LnPE increase currently, LnPE is -0.036 at t = 1 period and increase to 0.024 at t = 4 period, then it become stable after t = 7 period as 0.060. According to the impulse analysis results, we can get that agricultural food prices will significant influence the production efficiency, so that it is important to the increasing of production efficiency.

Then, we make cholesky variance decomposition to the VAR model, the results is shown in Fig. 3 and 4.

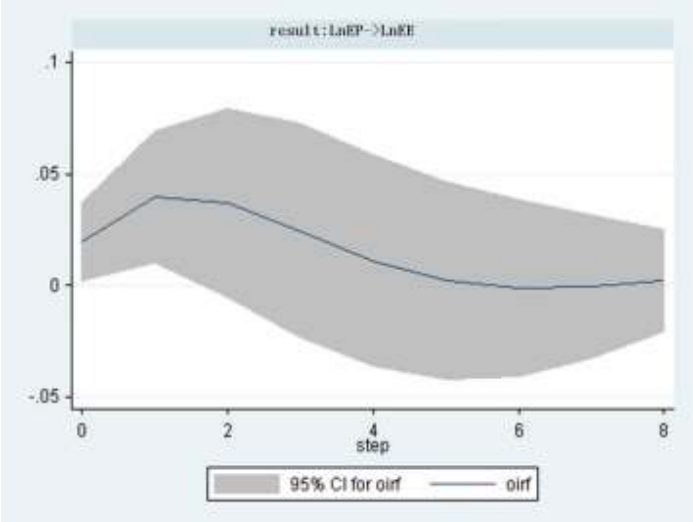

Fig. 1: Impulse-response analysis for LnEP to LnEE

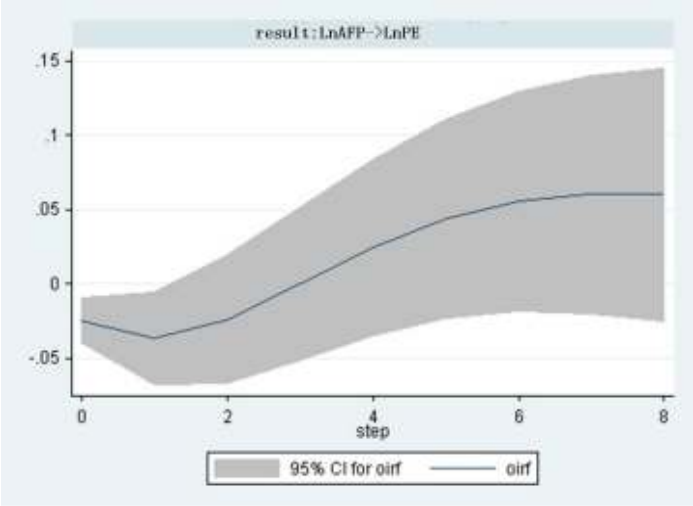

Fig. 2: Impulse-response analysis for LnAFP to LnPE

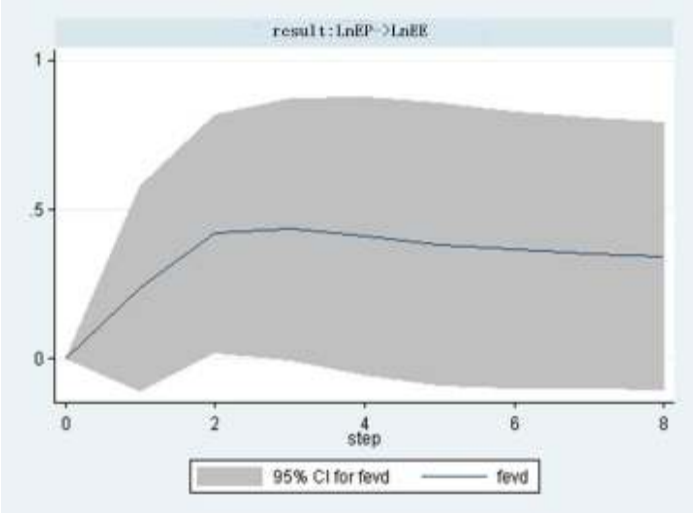

Fig. 3: Cholesky variance decomposition for LnEP to LnEE

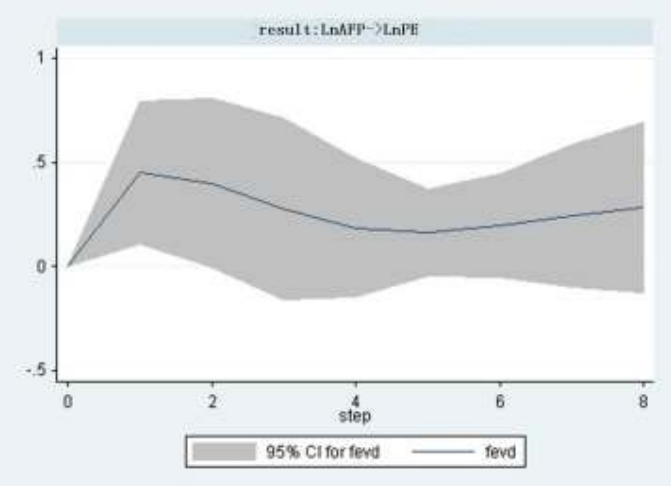

Fig. 4: Cholesky variance decomposition for LnAFP to LnPE

The cholesky variance decomposition also shows the same result, the contribution degree of LnEP to LnEE is gradually increased. From Fig. 3, we find the contribution degree of LnEP to LnEE at t = 1 period is 23.7% and then increase to 42% at step 2, this means energy price has obvious interpretative strengtht energy efficiency in the short-term. Then, the contribution degree of LnEP to LnEE increased gradually from step 2 and finally research to 34.5% at step 8. From the Fig. 4, we can find that LnAFP has a good contribution degree to LnPE, contribution degree of LnAFP to LnPE is reached 44.7% at step 1 and then decreased 18.5% at step 2. This proves that the agricultural food prices have a certain contribution degree to production efficiency. The result of variance decomposition means that agricultural food prices has an important contribution degree to the production efficiency and can be used to explain the rising of production efficiency.

DISCUSSION

Since 1978, Chinese each industry grows rapidly, especially the industrial promotion be obvious to people. So far, Chinese energy, including the basic energy and renewable energy has been obtained in each aspect has rapid development. First, ability to protect the supply of energy is obviously enhanced. All kinds of energy, including coal, crude oil and natural gas production are the forefront of the world. Second, to take measures for saving energy saving effect is remarkable. Countries to solve the problem of energy conservation has taken a lot of programs, such as green lighting, energy saving of motor, vigorously develop new energy sources, these initiatives have made great contributions to the construction of economical and clean new energy system. Third, hydropower, wind energy, solar energy lamp non fossil and renewable energy have been rapid development. But faced with huge energy dissipation system, in the face of all the areas of large energy consumption, the government in the management of energy and energy consumption in the process still exist many problems. First of all, while China is a big energy producing countries, but it is far lower than the world average per capita is stinginess. As people living standard rise, the per capita consumption of energy is more and more high, so the energy supply and demand further. Secondly, because of Chinese irrational industrial structure, the mode of economic development needs to be improved, energy development technology Chinese with respect to also great gap between China and developed countries, so the energy use efficiency is not enough. Secondly, a problem is Chinese now eager to solve the problem of environmental pollution, that is. Not only air pollution is quite serious, due to over exploitation of coal and other fossil fuels leads to the destruction of the ecological environment; industrial production of large quantities of sewage; increasing the vehicle exhaust emissions and so on, exacerbated by the deterioration of the environment, endanger people's physical and mental health. Finally, there is a problem, not only is the Chinese and even all over the world have to face the problem, the problem of energy security. In recent years, Chinese energy, especially oil, external dependence is constantly increasing, according to statistics now Chinese oil dependence on foreign energy has risen to 57%, so the price fluctuation in the international energy market can not be ignored.

CONCLUSION

Above all, there exist at least one direct co-integration relationship between energy price and energy efficiency, which means that there exist a long-term equilibrium relationship between energy price and energy efficiency. LnEP at lag 1 period increased one percentage can drive LnEE growth by 0.627

percentages; LnEP at lag 2 period increased one percentage can drive LnEE growth by 1.106 percentages, so the effect of energy price on energy efficiency is obvious. The rising of energy price will promote the energy price in short time. According to the formula 6, it can be seen that the agricultural food prices can also promote production efficiency; and LnAFP at lag 1 period and the 2 period increased 1 percentage will drive the LnPE increased by 0.245 and 0.016 percentage, respectively. Therefore, agricultural food prices have direct mutual promotion effect.

On this basis, we put forward relevant suggestions. First, government should improve the energy pricing mechanism; reduce the unstable factors in society. China is in the later stage of industrial development, China's demand for energy is still on the rise. As the most important factor in China's energy directly affect the energy supply, so the government for the regulation of energy price should strengthen constantly, constantly improve the energy pricing mechanism of slow fluctuations in energy prices. To improve the energy price mechanism, the first task is to create a transparent pricing mechanism, including the establishment of cost of energy companies clear and fair energy price subsidies.

While accelerating the market-oriented reforms, but China is still in the period of economic transformation. The energy industry has been monopolized industry, the price of energy directly by the government pricing, so to make the energy prices more transparent, energy companies more lasting and stable and effective development, the government must establish a fair and transparent and reasonable energy prices pricing mechanism. At the end of 2012, the government carried out the reform of energy prices, the reform measures are: from 2013 began to cancel the power, the double track system in coal prices, also abolished the key power and coal contract. In addition, the energy price reform program also stressed the need to continue to implement and the implementation of electricity, coal price linkage mechanism. Promote the market plays an important role in the resource allocation and the role of this important reform on the one hand, on the other hand, the abolition of coal, electricity price system, the implementation of the coal and electricity price linkage system, help to promote market-oriented direction towards the development of railway industry. However, any reform is there are both advantages and disadvantages. Coal price reform may lead to reduced energy subsidies for energy intensive industries, so in the short term is negative, but in the long run, this reform will reduce energy consumption, improving the efficient allocation of energy resources, to promote the economic structure improvement.

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