Research on the Effect of Coal Price Fluctuation on Shaanxi Province's Economy

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Abstract

This paper uses VAR model and VEC model to construct a dynamic relation system for the relationship between the coal price and GDP, fixed-asset investment, general financial revenue and price index of Shaanxi Province by studying sample data collected from January 2012 to February 2016 (50 months). The analysis of Granger causal relationship reveals that coal price fluctuation is the Granger reason causing changes of GDP, fixed-asset investment, price index and economic indicators of Shaanxi Province. The Impulse Response Analysis and Variance Decomposition show that the average time delay for the influence of declining coal price on GDP, fixed-asset investment, general financial revenue and price index of Shaanxi Province is five months, seven months, five months and six months respectively. In addition, analysis of VAR model and VEC model indicates that every time the falling speed of coal price has a change of only 1%, within one period lagged, the growth speed of GDP of Shaanxi Province will have a change of 0.123658% in the reverse direction, that of its fixed-asset investment will have a change of 0.618432% in the same direction, that of its general financial revenue will have a change of 0.457131% in the same direction and that of its price index will have a change of 0.000868% in the reverse direction.

Keywords

VAR model, VEC model, coal price, economy of Shaanxi Province.

1. Introduction

Shaanxi Province, a big province of coal resources, progressively forms an industrial system with the center of coal, oil gas, chemical engineering, building materials, electric power and other industries through accelerating the development of advantageous resources. After that, it obtains a significantly faster economy development speed. In 2008, its GDP growth reached 15.6%. However, in recent years, with the influence of international and domestic economic conditions, coal's demands continued falling down, leading to a sharp decreasing amplitude of coal price in China. What impact will the price fluctuation of coal, which is the main energy source for the economic development of Shaanxi Province, have on the economic growth of Shaanxi Province? Whether there are differences in terms of the influence of rising or dropping prices of the coal on economic growth? These are problems needing to the explored.

Due to the difference of energy consumption structure between western countries and China, most foreign researches focus on impacts of the fluctuation of oil price on a nation' s economy. Hamilton considers that the oil price fluctuation is a factor for several U.S. economic recessions before 1972. These impacts have more obvious influence on the macro economy of OPEC nations[1]. Sachs and Warner point out that the rising price of resource products in resource-based regions will promote the prosperity of resource industrial departments, but may not benefit the sustainable development of resource-based regions because the phenomenon of anti-industrialization may be triggered[2]. Collier and Goderis hold that the rising resource price in the short term has a positive effect on economy. However, if the government can only implement fragile control, the long-term price rising will have negatively impacting influence on economy[3]. As far as domestic studies on the influence of coal price fluctuation on economy are concerned, LIN Baiqiang and other experts estimate that the

long-term coal ex-factory price elasticity in China is－0.2579, explaining that coal is a necessity good to its economy[4]. LI Wenbo uses the sample of time series data to conduct a quantitative analysis on the influence of coal price fluctuation on the economic growth of China with the aids of Chow Test, Granger causal relationship inspection method and the impulse response function method[5]. QIU Dan and QIN Yuanjian think that there is a long-term stable equilibrium relationship between the coal price and the economic growth, showing that economic growth is a factor for the fluctuation of coal price[6].

Though there are many researches on the influence of energy price on economy, studies of scholars abroad are restricted to the influence of oil price fluctuation on the economy of European and American countries and they rarely refer to that on the economy of developing countries, such as China. In addition, people hardly see any literature researching the influence of coal price fluctuation on the economy of coal resource-rich provinces. This paper attempts to establish a VAR model studying the relationship between coal price and various economy indexes of Shaanxi Province so as to comprehensively analyze the influence degree and law of coal price fluctuation to its economy indexes.

2. Variable Selection and Data Processing

1) Variable selection

This paper selects several variables, including coal price (COP), gross domestic product (GDP), fixed-asset investment (FAI), general financial revenue (FR) and price index (CPI), to conduct empirical researches. The coal price there is that of the 5500 kilocalorie steam coal from Qinhuangdao. The monthly data (including 50 samples) selected from January 2012 to February 2016 are from 2015BP Yearbook of World Energy Statistics, WIND consultation, State Statistics Bureau and Statistical Bureau of Shaanxi Province. EVIEWS6.0 is used for analysis and process in the course of case study.

2) Data pre-processing

Considering that data have obvious seasonal fluctuation and trend variation, GENSUSX12 method is applied for seasonal adjustment. In order to eliminate the heteroscedasticity of time series and to reduce data fluctuation, digitizing processing is conducted to the variables after seasonal adjustments. The data processed are LCOP, LGDP, LFAI, LFR and LCPI respectively. Considering that GDP only has quarterly data, the weight of the industrial added value each month in each quarter is used to calculate the GDP value of each month. Besides, CPI is a kind of monthly chain-relative data and thus, the fixed-base process will be done to analyze the relationship between LCOP and LCPI. The base period is January 2012.

3. Analysis of Empirical Findings of VAR Model

1) Unit root test of sequences

ADF method is applied to conduct stationary inspections to sequences LCOP, LGDP, LFAI, LFR and LCPI. It finds that when the significance level is 5%, the above five sequences are all stationary series after a First-Difference Transformation.

2) Co-integration test of sequences

All five variables sequences, including LCOP, LGDP, LFAI, LFR and LCPI, belong to I (1) sequence. There may be a co-integration relationship between LCOP and the other four sequences. This paper uses the EG (Engle-Granger) two-step method to conduct the co-integration inspection and the results displays that there exists a (1,1) cointegration relationship between DLCOP and DLGDP; DLCOP and DLFAI; DLCOP and DLFR while a (2,1) co-integration relationship between DLCOP and DLCPI.

3) Granger test of causality

In order to confirm the mutual relationship between variables, we conduct a Granger test of causality to variables of VAR model before the VAR model is established. The results display that: Firstly, when the significance level is 5%, DLCOP and DLGDP are the Granger cause of each other. Secondly, when the significance level is 10%, DLCOP and DLFAI are the Granger cause of each other. Third, when the significance level is 10%, DLCOP is not the Granger cause of DLFR while DLFR is DLCOP's Granger cause. Fourth, DLCPI is not DLCOP's Granger cause while DLCOP is DLCPI's Granger cause.

4) Building VAR model

LCOP, LGDP, LFAI, LFR and LCPI are respectively regarded as endogenous variables while constant term C as an exogenous variable to establish a 5-dimension vector autoregression (VAR) model between the coal price and each economic variable of Shaanxi Province. The result indicates that the goodness-of-fit of the model is 0.988217, showing a good imitative effect. In the meantime, the calculation of AR characteristic polynomial of model fins that the inverse roots of the characteristic polynomial are all located in the unit circle (As shown in Figure 1), indicating that the VAR(2) model established is stable.

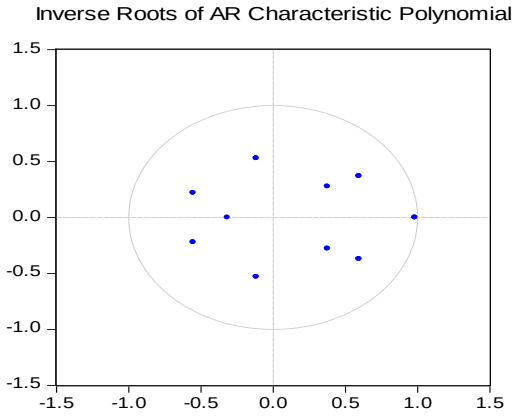

Figure 1 Inverse roots of the characteristic polynomial AR characteristic polynomial of VAR2

In order to test the response of GDP, general financial revenue and other indexes of Shaanxi Province to the positive impact of one coal price's standard deviation unit, an impulse response function is made (as shown in Figure 2).

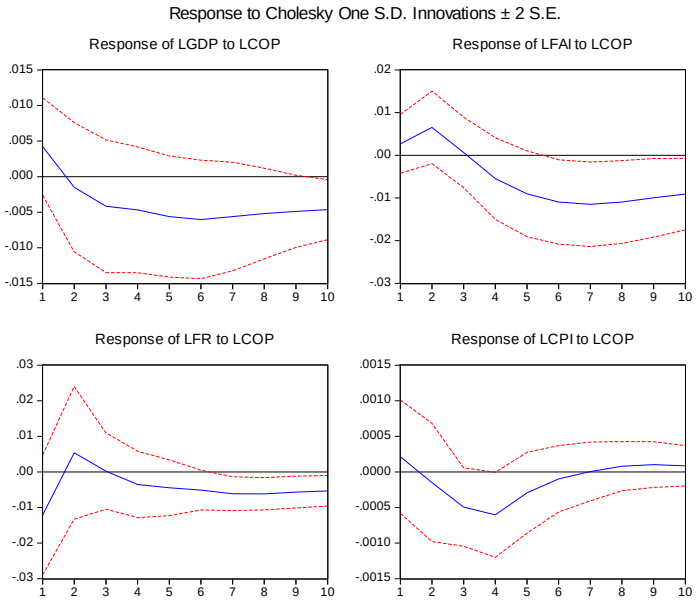

Figure 2 Response of GDP and other indexes of Shaanxi Province to impacts of coal price

As can be seen in Figure 2, GDP, fixed-asset investment and price index of Shaanxi Province will all give a positive response in Phase 1 when receiving a positive impact of one coal price's standard deviation unit while the general financial revenue will have a positive response in Phase 2.

The variance decomposition to VAR(2) model established shows that the contribution rate of coal price to GDP, fixed-asset investment, general financial revenue and price index of Shaanxi Province reaches a stable level of 11%, 12%, 1.4% and 3.5% respectively in Phase 5, Phase 7, Phase 5 and Phase 6.

5) Establishing VEC model

VAR(2) model is constructed at first and now, the same variables are used to construct a 5-dimension CEC (1) model to test the influential effect of changes of coal price on GDP and other indexes of Shaanxi Province, which is shown in Table 1.

Table 1 Error correction model for coal price fluctuation on each economy index of Shaanxi Province

Error Correction:	D(LGDP)	D(LFAI)	D(LFR)	D(LCPI)
CointEq1	-0.118273	-0.224876	-0.417566	0.002039
	(0.04951)	(0.05451)	(0.12043)	(0.00039)
	[-2.38863]	[-4.12577]	[-3.46717]	[5.20400]
D(LCOP(-1))	-0.123658	0.618432	0.457131	-0.000868
	(0.15620)	(0.17502)	(0.35626)	(0.01668)
	[-0.79165]	[3.53354]	[1.28313]	[-0.05200]
D(LGDP(-1))	-0.172744			
	(0.10232)			
	[-1.68822]			
D(LFAI(-1))		-0.464889		
		(0.12397)		
		[-3.75011]		
D(LFR(-1))			-0.214180	
			(0.15867)	
			[-1.34983]	
D(LCPI(-1))				-0.033342
				(0.14527)
				[-0.22951]
C	0.003966	0.029186	0.012730	0.000370
	(0.00477)	(0.00595)	(0.01218)	(0.00057)
	[0.83164]	[4.90235]	[1.04496]	[0.64524]
R^2	0.612001	0.577782	0.521652	0.684697

The coefficient of the error correction term in the Vector Error Correction Model with Gross National Product (GNP) as the dependent variable is -0.118273, indicating that if the short-term variability of coal price deviates from the long-term equilibrium, it will adjust the imbalanced situation to the equilibrium state with the speed of 11.8273%. Besides, from the influential effect of coal price changes we can see that every time the falling speed of coal price has a change of 1%, in each phase lagged, the development speed of GNP will have a change of 0.123658% in the reverse direction.

The coefficient of error correction term in Vector Error Correction Model with the dependent variable of fixed-asset investment is -0.224876, indicating that when the short time change of the coal price deviates from the long-term equilibrium, the price will be adjusted from the imbalanced situation to the equilibrium state with the adjusting speed of 22.4876%. Besides, from the influential effect of coal price changes we can see that every time the falling speed of coal price has a change of 1%, in each phase lagged, the growth speed of fixed-asset investment has a change of 0.618432% in the same direction.

The coefficient of error correction term in Vector Error Correction Model with the dependent variable of general financial revenue is -0.417566, indicating that when the short time change of the coal price deviates from the long-term equilibrium, the price will be adjusted from the imbalanced situation to the equilibrium state with the adjusting speed of 41.7566%. Besides, from the influential effect of coal price changes we can see that every time the falling speed of coal price has a change of 1%, in each phase lagged, the growth speed of general financial revenue has a change of 0.457131% in the same direction.

The coefficient of error correction term in Vector Error Correction Model with the dependent variable of price index is 0.002039, indicating that when the short time change of the coal price deviates from the long-term equilibrium, it will promote the development of the imbalanced situation with the speed of 0.2039%. Besides, from the influential effect of coal price changes we can see that every time the falling speed of coal price has a change of 1%, in each phase lagged, the growth speed of price index has a change of -0.000868% in the reverse direction.

4. Policy Suggestion

1) Improve technologies and promote the coal industry upgrading of Shaanxi Province. On the one hand, Shaanxi Province is a big province in transformation in terms of coal production and output. The improvement of coal production technology will give its coal industry an active position with lower cost when the price fluctuates. On the other hand, the extension of coal industry chain can effectively avoid unilateral impact borne by the supply side when price fluctuates.

2) Consolidate the whole coal industry and increase its anti-risk capability. On the whole, the coal industry of Shaanxi Province still has no comparative competitive force compared with domestic even international big companies. Its coal industry lacks a heavy industry cluster with upstream and downstream supports, which contributes to the disadvantageous position of coal industry in price fluctuation and even other marketing risks. Only after resource integration and optimization are applied can the core competitiveness and anti-risk capability of the industry be improved and can Shaanxi Province hold a dominant position when coal price fluctuates.

3) Speed up transforming the resource-based economic development pattern of Shaanxi and optimize the industrial distribution. Shaanxi economic growth pattern shall be accelerated according to its resource endowment and the overall requirements of major function regionalization. In addition, the economic growth point of Shaanxi in the next stage shall also be well grasped so that its economy can be spread more broadly and its industrial layout can be more reasonable.

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