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Original Paper

Correlation Analysis of Road Freight Transport and Economic Development in Shaanxi Province

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Abstract

Based on the data from 1987-2017 of the Statistical Yearbook of Shaanxi Province, this paper selects Shaanxi Road freight transportation evaluation indicators and economic development evaluation indicators, and uses the method of co-integration test and ADF unit root test to determine whether there is a long-term equilibrium relationship between the indicators. Through the establishment of VAR model and analysis, it demonstrates the impact of road freight transportation on economic development in Shaanxi Province. Based on the impulse impact between the road freight transportation and economic development in Shaanxi Province, the correlation between road freight transportation and economic development in Shaanxi Province is analyzed and studied to provide suggestions for the coordinated development of road freight transportation and economy in Shaanxi Province.

Keywords

Road freight transportation, economic development, the VAR model

1. Introduction

Road transportation is the most popular and the most widely used transportation method, and occupies an important position in the comprehensive transportation system. Among them, road freight transportation and regional economic development are more inseparable.

In response to national policies, Shaanxi Province has attached importance to road construction, and has increased investment and construction efforts. After decades of development, as of the end of 2017, the mileage of roads in Shaanxi Province reached 170,000 kilometers. Shaanxi Province is an inland province. Among various modes of transportation, the road transportation industry occupies an important position in the transportation field due to its obvious advantages and irreplaceability.

In recent years, the economy of Shaanxi has developed rapidly, and the economic structure has been continuously optimized. As the pioneer of Shaanxi's economic development, the road transportation industry has traditional, extended, and extensive development models that still restrict Shaanxi's economy to develop faster and better. Therefore, in the context of the rapid development of Shaanxi's economy and highway, in-depth study of road freight transportation in Shaanxi Province can promptly find problems in road freight transportation, adjust the structure of road transportation, and promote the development of highway transportation to a modern, connotative, and refined development model. Change to better serve the economic development of Shaanxi Province.

2. Analysis of Shaanxi Economy and Road Freight Status

2.1 Economic Status of Shaanxi Province

The total economic volume of Shaanxi Province reached a new level of two trillion RMB in 2017. GDP per capita increased rapidly. The average annual growth rate of GDP was 1.2 percentage points higher than the national average. It has grown into a strong western province. By 2017, Shaanxi's annual GDP will be 2,189,881 million RMB, an increase of 8 percentage year-on-year. The proportion of total economic volume to the national total economic volume rose to 2.6%, and the total economic volume ranked 15th among 31 provinces (cities and districts) in the country.

2.2 Analysis of Road Freight Status in Shaanxi Province

As an inland province, Shaanxi Province takes most of the province's transportation volume by road freight volume. In the past two years, China's highway freight transportation volume and average annual growth rate have achieved very obvious and rapid growth. In 2017, the road freight volume in Shaanxi Province was 12.3721 million tons, an increase of 3.7% year-on-year; the road freight turnover was 211.82 billion tons kilometers, an increase of 10.0% year-on-year. In addition, from 2013 to 2017, the growth rate of road freight transportation and turnover in Shaanxi Province has decreased compared with 2009-2012.

The road network development in Shaanxi Province has a large gap with the needs of the social and economic development, compared with the domestic average level and the road network development level in the southeastern coastal areas. Insufficient transport capacity is still an important contradiction in the current economic operation One. The transformation of Shaanxi's transportation system is promoting the adjustment and upgrading of the industrial structure, but the process is slow and the pace is not large. The guiding role of highway transportation has not been fully exerted.

3. Index Selection and Model Selection

3.1 Index Selection

Based on the five principles of purposefulness, systematization, feasibility, representativeness and comprehensiveness, this paper selects five indicators to study the relationship between the road freight transportation system and economic development in Shaanxi Province. Shaanxi Province (GDP) was

selected as the road freight volume, cargo turnover volume and highway network density, and economic development indicators. This article selects five indicators of Shaanxi from 1987 to 2017 as the basic data from the "Shaanxi Yearbook" over the years.

3.2 Model Selection

When studying the relationship between variables, the most commonly used method is the vector autoregressive (VAR) model. The vector autoregressive model uses each endogenous variable in the system as a function of the lag value of all endogenous variables in the system to construct the model, thus extending the autoregressive model with single variable to the "vector" autoregressive model composed of multiple time series variables.

This paper studies the relationship between road freight transportation and economic development level, not only the relationship between the two, but also the relationship between the two and their lag values. The vector autoregressive model and the conclusion based on the vector autoregressive model Impulse response analysis can meet such research purposes. VAR model is one of the easiest models to handle the analysis and prediction of multiple related indicators.

Formula (1) is the formula of the VAR model:

$$\begin{aligned} y_t &= A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t \\ t &= 1, 2, \cdots, T \end{aligned} \tag{1}$$

y_t is a k-dimensional endogenous variable vector, p is the lag order, the number of samples is T, $k \times k$ dimension matrix, $A_1 \cdots A_p$ is the coefficient matrix to be estimated, ε_t is a k-dimensional perturbation vector, which can be related to each other at the same time, but it is not related to its own lag value and to the variable on the right side of the equation.

4. Correlation Analysis

In the process of multi-index comprehensive evaluation, we often encounter the problem that the evaluation cannot be performed directly due to the different units and magnitudes between the various indexes. In this paper, dimensionless processing is performed on each index, that is, natural logarithm is taken for each index, which is expressed by LN. The meaning of each index during the study is shown in Table 1.

Table 1. Correspondence between Symbol and Index

Symbol	Index
LNY	GDP of Shaanxi Province
LNX1	Road freight
LNX2	Road network density
LNX3	Road line length
LNX4	Cargo turnover

4.1 Data Stationary Test

In order to avoid the problem of pseudo-regression of data, it is necessary to perform a stationary test on the data.

The detection value of the adf stationary test of LNX2 and LNX3 was greater than the critical value initially, indicating that the sequence is not stable, so the stationary test was conducted again after the first-order difference of highway network density and highway line length.

In the end, at the 1% significance level, all five variables reject the null hypothesis that the sequence has a unit root. The five variables are stationary sequences and can be analyzed later. And there may be a long-term equilibrium relationship between them, namely the co-integration relationship.

4.2 Co-integration Test

Co-integration test is a method to check whether there is a long-term mutual equilibrium relationship between the time series of various indicators. After the basic data of this article passes the adf stationary test, the conditions for co-integration test are met, so the method of Johansen test co-integration test.

Since the Johansen co-integration test needs to determine the lag order first, according to Table 2, the lag order can be determined as 1.

Table 2. Lag Order Test Data

Lag	LogL	LR	FPE	AIC	SC	HQ
0	6.180457	NA	0.000157	-0.244651	-0.099486	-0.202848
1	58.81635	89.07613*	5.52e-06*	-3.601258*	-3.020598*	-3.434049*
2	66.59622	11.37057	6.27e-06	-3.507401	-2.491246	-3.214785
3	76.49863	12.18758	6.36e-06	-3.576817	-2.125168	-3.158795
4	84.87076	8.372131	7.92e-06	-3.528520	-1.641375	-2.985090
5	92.57688	5.927785	1.20e-05	-3.428991	-1.106351	-2.760154

Using EViews8 software for co-integration test, feature root trace test and maximum characteristic value test all show that there is a co-integration relationship between the research variables in this paper, that is, the basic indicators selected by the article have obvious correlations and have important research value and meaning.

4.3 Establishment of VAR Model

In order to further understand the dynamic relationship between the socio-economic indicators and the highway freight transportation indicators, this paper establishes a VAR model with lag order of 1, and uses EViews8 software for model calculation. The output results are shown in Table 3.

Table 3. VAR Model Estimation Results

	LNY	LNX1	LNX2	LNX3	LNX4
LNY(-1)	1.067321	0.022516	0.124398	0.141031	1.20574
	(0.06635)	(0.12408)	(0.11364)	(0.04587)	(0.15750)
	[15.0630]	[0.18146]	[1.09466]	[3.07426]	[-0.76556]
LNX1(-1)	-0.078908	0.036964	-0.163474	-0.148447	-0.427843
	(0.15026)	(0.28101)	(0.25737)	(0.10389)	(0.35669)
	[-0.52513]	[0.13154]	[-0.63518]	[-1.42884]	[-1.19948]
LNX2(-1)	-0.008899	-0.099929	0.686041	0.318270	-0.777985
	(0.23339)	(0.43646)	(0.39974)	(0.16136)	(0.55400)
	[-0.03813]	[-0.22896]	[1.71624]	[1.97236]	[-1.40430]
LNX3(-1)	-0.010968	0.244238	0.158353	0.427009	1.972311
	(0.39497)	(0.73864)	(0.67649)	(0.27308)	(0.93757)
	[-0.02777]	[0.33066]	[0.23408]	[1.56365]	[2.10365]
LNX4(-1)	0.047439	0.445819	0.038846	0.038736	0.837987
	(0.10552)	(0.19734)	(0.18074)	(0.07296)	(0.25049)
	[0.44956]	[2.25914]	[0.21493]	[0.53092]	[3.34543]
C	-0.182392	-3.527660	-0.317537	-1.236809	2.057296
	(1.06312)	(1.98814)	(1.82087)	(0.73504)	(2.52358)
	[-0.17156]	[-1.77435]	[-0.17439]	[-1.68263]	[0.81523]
R-squared	0.996877	0.961416	0.960626	0.992283	0.980483

It can be seen from Table 3 that the five selected indexes are all related to each other. Both the economic indexes and the road freight transportation indexes will first be impacted by themselves. In addition to its own impact, GDP also has a significant effect on highway freight volume, highway network density, highway line length, and cargo turnover; it is easy to find from the table that GDP lagging one period has a pulling effect on highway freight transportation. The growth of GDP can promote the development of the road freight transportation industry. Among the selected road freight transportation indicators, GDP has the greatest influence on the length of road routes and the turnover of goods.

4.4 AR Root Test

If the reciprocal of all roots and modules of the VAR model is less than 1, that is, all within the unit circle, the model is stable; otherwise, the model is unstable. If the estimated VAR model is unstable, some of the results obtained are invalid. It can be seen from the results of the AR root graph that this model is stable.

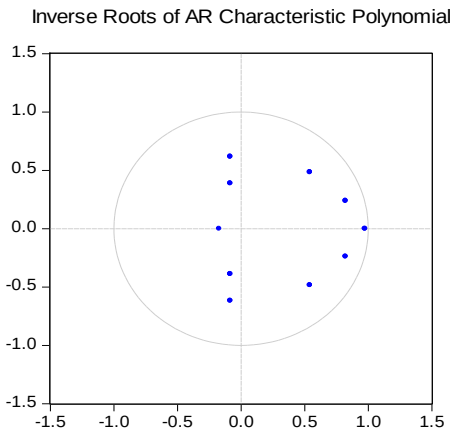

Figure 1. AR Root Diagram

4.5 Granger Causality Test

Carrying out a causal test on the VAR model under a 1% significance level, the probability of each indicator being affected is less than the confidence level 0.05 and rejects the null hypothesis. It is concluded that the highway freight volume, road line length, road network density and cargo turnover are The Granger cause of GDP changes is causality. And economic changes can cause changes in road freight volume, road line length, road network density, and cargo turnover.

Table 4. Granger Causality Test Results

Excluded	Chi-sq	df	Prob.
GLHYL	3.483526	1	0.0062
GLXLCD	0.720191	1	0.0396
GLWMD	0.625270	1	0.0429
HWZZL	3.170842	1	0.0450
All	5.011787	4	0.0286

4.6 Pulse Analysis of Each Time Series

Using Eviews8, the ten-phase impulse response analysis of the above VAR model is performed. The impulse response graph refers to the application of a unit pulse to a variable and the change of another variable.

4.6.1 Pulse Effect between GDP and Road Freight

As shown in the impulse response diagram of Figure 2, the impulse effect of GDP on road freight volume is positive in phases 1-4, and the impulse influence on road freight volume is negative in phases 5-10; The impulse impact of GDP is positive and the impulse impact is large, indicating that the freight transportation industry can promote economic development. The relationship between the freight transportation industry and economic growth is represented by the pulling relationship between

the freight transportation industry and economic growth.

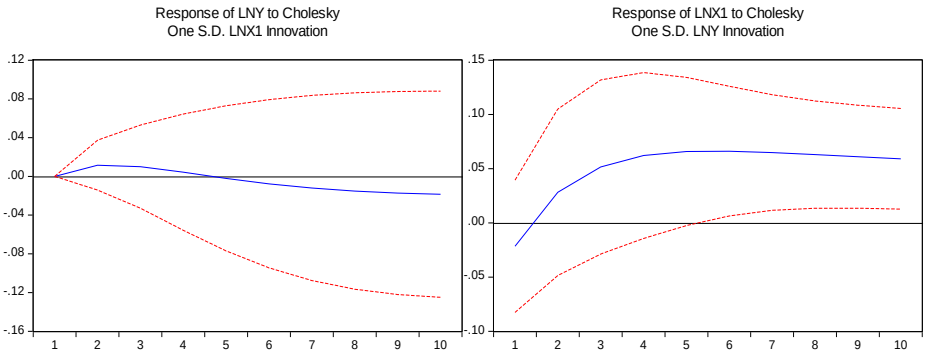

Figure 2. Impulse Response of GDP and Road Freight Volume

4.6.2 Pulse Effect between GDP and Road Network Density

As shown in the impulse response diagram of Figure 3, the impulse effect of GDP on the density of the road network is negative in periods 1-4, and the impulse effect of GDP on the density of the road network is positive in periods 5-10, and it will also be positive in the lag period. And the impulse response is small; the impulse impact of road network density on GDP is always positive in the period of 1-10, and the impulse impact is large. This is because with the rapid economic growth, the investment in transportation infrastructure construction. It is also continuously increasing, the means of transportation and transportation are constantly improving, and the scale and scope of transportation are becoming larger and larger.

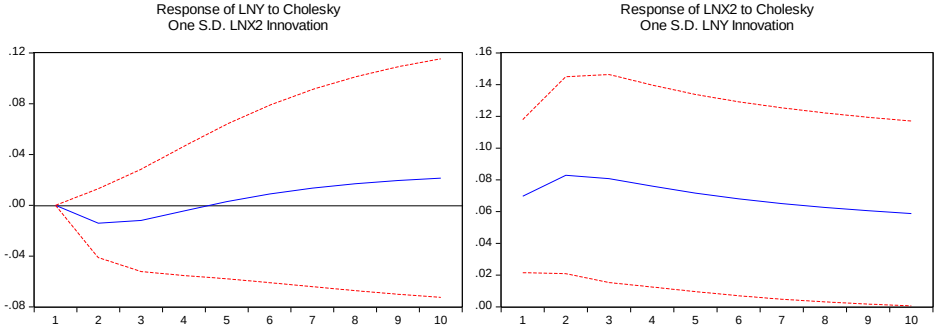

Figure 3. Impulse Effects of GDP and Road Network Density

4.6.3 Pulse Effect between GDP and Length of Road Route

As shown in the 3-impulse response graph, in the period 1-10, the impulse effect of GDP on the length of road route is positive and continues to rise. This is because with the rapid economic growth, the investment in transportation infrastructure construction is also increasing Larger, the means of transportation and transportation capacity continue to improve, the scale and scope of transportation are getting larger and larger; the pulse impact of road line length on GDP in the 1st to 10th phases is

positive, reaching the maximum in the 4th phase. There is a long-term equilibrium relationship between social economy and road freight transportation. With the development of social economy and transportation mode, the pulling effect of cargo transportation on social economy has gradually weakened.

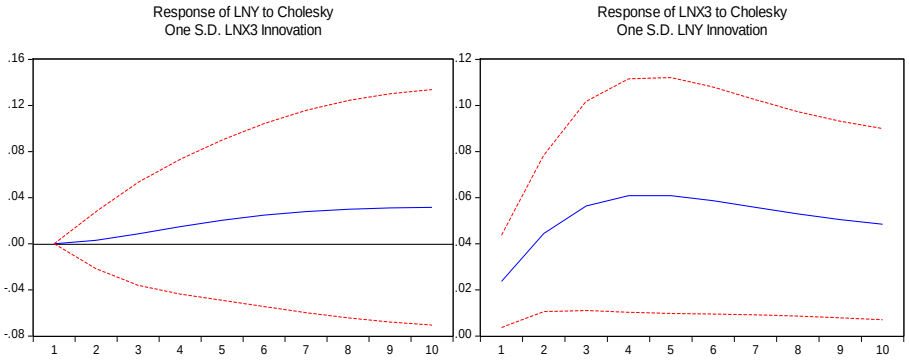

Figure 4. Pulse Effect of GDP and Road Line Length

4.6.4 Pulse Effect between GDP and Turnover Volume of Freight Transport

As shown in Figure 5 of the impulse response analysis, the pulse effects of GDP on turnover volume of freight transport in the 1-10 period are all positive. The pulse response is small and stable for a long time. The relationship between the cargo transportation industry and economic growth is that economic growth affects cargo transportation Industry's pulling relationship; the impact of the turnover volume of freight transport on GDP in the 1-2 period is negative, and the GDP impact on the GDP in the 3-10 period is positive, and the pulse has a large and continuous growth, indicating that the goods are transported The industry can promote economic development, and the relationship between the cargo transportation industry and economic growth is represented by the pulling relationship between the cargo transportation industry and economic growth.

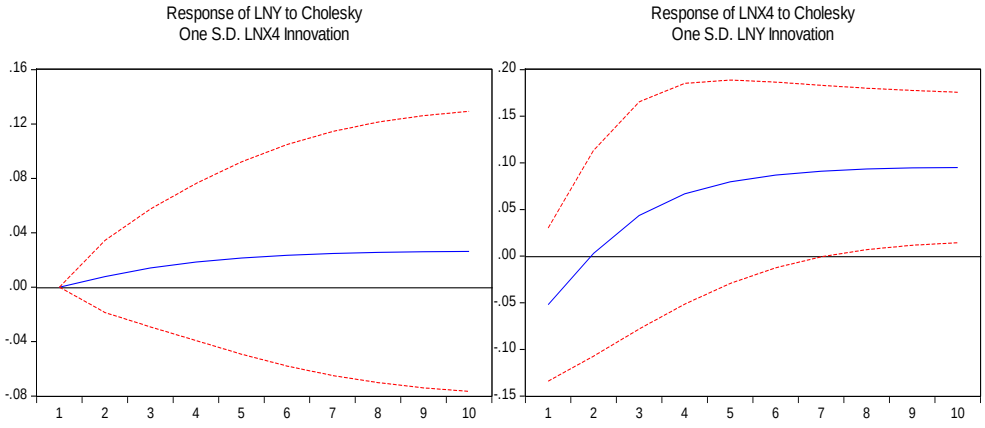

Figure 5. Impulse Effects of GDP and Cargo Turnover

5. Conclusion and Suggestion

5.1 Conclusion

(1) There is a positive correlation between the economic growth of Shaanxi Province and road freight transportation.

(2) The economic development level of Shaanxi Province is not only affected by the road freight transportation industry, but also by the economic situation of the previous period.

(3) The economic growth of Shaanxi Province has promoted the development of the road freight transportation industry to a certain extent. The development of the road freight transportation industry can greatly promote the development of social economy.

(4) Compared with other indicators, cargo turnover has the greatest impact on the economic development of Shaanxi Province.

5.2 Suggestion

(1) Optimize road transportation planning system

Vigorously promote the integrated planning of Shaanxi transportation and regional development of Shaanxi Province. Road transportation planning should fully consider the needs of economic development, so that transportation planning and regional development planning can be coordinated and developed fundamentally.

(2) Vigorously promote the construction of road transportation infrastructure

The most important factor restricting the economic development of Shaanxi Province is the development of the rural economy. The key to the integration of urban and rural areas is to vigorously develop road transportation infrastructure. The government should issue corresponding policies, increase financial support, accelerate transportation infrastructure construction, and promote economic development.

(3) Deeply promote regional cooperation

Shaanxi Province should strengthen the promotion of regional strategic development and reform, break down regional boundaries, open up cooperation channels with road freight companies outside the province and abroad, and carry out fruitful exchanges and cooperation in the field of road freight with neighboring provinces and countries and regions along the Silk Road. New logistics gathers in the highlands to expand new development space for the road freight transportation industry in Shaanxi Province.

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