Analysis of the Related Effects of Forestry Industry in Shaanxi Province

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Abstract: The development of the forestry industry requires the synergy of various industries, so it is of practical significance to measure the correlation between the forestry industry and other industries. This paper uses the data of the total value of forestry output and the value-added of eight industrial sectors from 2004 to 2017 to study whether there is a correlation effect between the forestry industry and various industries through the Granger causality test and gray correlation analysis model. The Granger causality test concludes that there is a strong backward correlation between construction, transportation, warehousing and postal industries, wholesale and retail, accommodation and catering, financial and real estate, and forestry. At the same time, the grey correlation analysis results show that the correlation coefficients between the forestry industry and the wholesale and retail industry, transportation storage and postal industry, construction industry, accommodation and catering industry, financial industry, and real estate industry are: 0.6665, 0.6164, 0.6157, 0.6021, 0.5771, 0.5766.

1. Introduction

With China's economic development entering a new stage, the party and the state's awareness of ecological protection has been further enhanced. As the largest green economy, forestry industry has multiple functions of ecology and economy. The development of forestry industry has a wide, complex and close economic relationship with other industries, which is reflected in the influence of other industries on forestry industry and other industries at the same time, having industrial correlation effect. Therefore, the research on the correlation effect of forestry industry plays an important role in exploring the potential of forestry industry and promoting the coordinated development and green development of various industries in Shaanxi Province.

At present, a large number of domestic scholars use input-output model, grey correlation analysis model and AHP model to measure the correlation effect, analyzing the industrial structure and the development of various industries in China. The research group of China input-output society uses the national input-output table in 2002 to calculate the current situation and characteristics of China's industrial association, putting forward suggestions for the adjustment of China's industrial structure [1]. Jingyuan [2] uses the method of grey correlation analysis to analyze the relationship between various industrial sectors and tourism in the tourism industry chain of Bama. Shi Xiaoliang et al. [3] studied the selection of leading industries in Yichun forest region by using AHP, giving the top four leading industries in Yichun forest region.

As the largest green economy industry, forestry industry has attracted the attention of many scholars at home and abroad. The academic research on the correlation effect of forestry industry mainly focuses on the correlation within the forestry industry sector. The research of rodela R et al. [4] shows that the internal correlation effect of forestry industry not only controls the consumption of environmental resources, but also affects the allocation efficiency of forest resources. Chen Tongying et al. [5] analyzed the internal correlation degree of the Department through the input-output table of the forestry system in Nanping City, Fujian Province, which was established

with the columns of forest management, mining and transportation, and forest industry. Dingsheng et al. [6] studied the relationship among the first, second and third industries of forestry from the development of Jiangsu forestry industry. Wang Hui [7] made clear the position of non-wood forest products industry in the current forestry industry development by analyzing the correlation effect between non wood forest products industry and forestry industrial structure. Based on the statistical data of the three forestry industries in Jiangxi Province, Tao Li et al. [8] obtained the industrial development stage and industrial structure characteristics of Jiangxi forestry industry. Wu Zhenjiang et al. [9] made impulse response analysis on the driving effect of enriching people industry in six aspects of state-owned forest area of Heilongjiang Province from 2005 to 2015 by using impulse response function, concluding that forest tourism plays a leading role in the development of forestry economy in Heilongjiang Province.

As a large industrial province in China, the contradiction between rapid economic growth and fragile ecological environment restricts the local sustainable development. As the largest green economy, forestry industry plays an important role in local sustainable development. In the 13th five years plan for forestry development in Shaanxi Province, the local government clearly proposed to realize the great development of forestry industry. Therefore, this paper uses Granger causality test and grey correlation analysis model to measure the correlation effect between Shaanxi forestry industry and other industries from the perspective of industrial coordinated development, which is of great significance to the local forestry industry and the economic development of the whole society. At the same time, based on the backward correlation sequence of forestry industry, this paper puts forward suggestions for the development of forestry industry in Shaanxi Province from the perspective of industrial correlation.

2. Materials and methods

2.1 Data source and processing

The data sources of this paper are National Bureau of statistics, China forestry statistical yearbook 2005-2018 and Shaanxi statistical yearbook 2018. In order to eliminate the price interference, this paper deals with the total output value of forestry and the added value of various industries with the price in 2004 as the constant price. At the same time, in order to eliminate the influence of heteroscedasticity, the data of total output value of forestry and added value of various industries are logarithmically processed.

2.2 Research methods

2.2.1 Granger causality test

This paper intends to solve the following problems through the causal test: (1) using the stability test and co integration test to determine whether there is a long-term stable relationship between the forestry industry and other industries, which is the premise to ensure the validity of the model; (2) using the Granger causality test to determine whether there is a stable causal relationship between the total output value of forestry and the added value of various industries.

According to the above modeling ideas and selected variables, the econometric model constructed in this paper is as follows [11]:

$$lny = b_0 + b_1 lnx_i + \mu_i$$

lny, lnx_i It represents the natural logarithm of the total output value of forestry and the added value of other industries, b_0 is the corresponding constant term, μ_i is the random disturbance term.

2.2.2 Grey relation analysis model

(1) First of all, the data are standardized, and the "total output value of Shaanxi forestry industry" is taken as the reference sequence, and the added value of other industries are taken as the comparison sequence.

(2) Dimensionless processing of reference sequence and comparison sequence.

(3) Calculate the absolute difference between the corresponding elements of index sequence and reference sequence of each evaluated object.

(4) Calculate the correlation coefficient and determine the correlation sequence.

$$\xi_i(p) = \frac{\min\limits_{i}\min\limits_{p}|x_0(p) - x_i(p)| \quad + \rho \max\limits_{i}\max\limits_{p}|x_0(p) - x_i(p)|}{|x_0(p) - x_i(p)| \quad + \rho \max\limits_{i}\max\limits_{p}|x_0(p) - x_i(p)|}$$

$\xi_i(p)$ is the correlation coefficient between each comparison sequence and the corresponding element of the reference sequence. ρ is the resolution coefficient, here ρ is 0.5.

3. Analysis of empirical results

3.1 Causality test

3.1.1 Stability test

Unit root test determines the stationarity of the sequence by checking whether there is unit root in the sequence. Because cointegration analysis requires the time series to be stable, the data must be tested before cointegration analysis. In this paper, Stata is used to test lny 及 lnx_i and the unit root of sum and its difference in order to test the stationarity of the sequence. The inspection results are shown in the table below.

Table 1: Table of results of stationarity test

	test-value	P-value	stationarity
lny	-1.270	0.6426	non-stationary
Δlny	-3.816	0.0027	stationary
lnx_1	-2.170	0.2173	non-stationary
Δlnx_1	-2.059	0.2611	non-stationary
lnx_2	-2.169	0.2175	non-stationary
Δlnx_2	-2.434	0.1324	non-stationary
lnx_3	-1.683	0.4397	non-stationary
Δlnx_3	-2.875	0.0484	stationary
lnx_4	-2.166	0.2187	non-stationary
Δlnx_4	-4.209	0.0006	stationary
lnx_5	-2.121	0.2361	non-stationary
Δlnx_5	-2.896	0.0458	stationary
lnx_6	-1.048	0.7354	non-stationary
Δlnx_6	-4.119	0.0009	stationary
lnx_7	-2.085	0.2507	non-stationary
Δlnx_7	-2.897	0.0457	stationary
lnx_8	-0.440	0.9032	non-stationary
Δlnx_8	-4.522	0.0002	stationary

The results of unit root test show that the first-order difference sequence can be rejected at 5% significance level Δlny , $\Delta lnx_3, \Delta lnx_4, \Delta lnx_5, \Delta lnx_6, \Delta lnx_7, \Delta lnx_8$ that the original hypothesis has unit root,which is $lnx_3, lnx_4, lnx_5, lnx_6, lnx_7, lnx_8$ and lny single integration of the same order meets the precondition of cointegration test. Based on the above test results, this paper further studies whether there is a long-term equilibrium relationship between the forestry industry and the construction industry, transportation storage and postal industry, accommodation and catering industry, financial industry, wholesale and retail industry, real estate industry through the co integration test.

3.1.2 Cointegration test

In order to test whether there is a long-term equilibrium relationship between forestry industry

and other industries, this paper uses Eagle Granger two-step method to test lny and lnx_i and carry out co integration test. In this paper, the least square method is used to obtain the cointegration equation. The results show that all the regression equations are significantly effective, and the coefficients of explanatory variables in each cointegration equation are all positive. On this basis, this paper constructs the residual sequence of each cointegration equation and tests the stationarity of the residual sequence of each regression equation. The test results are shown in the table below.

Table 2: Table of residual sequence stationarity test results

	test-value	P-value	stationarity
ε_3	-2.969	0.0379	stationary
ε_4	-3.170	0.0218	stationary
ε_5	-3.105	0.0262	stationary
ε_6	-3.250	0.0173	stationary
ε_7	-4.116	0.0009	stationary
ε_8	-3.355	0.0126	stationary

The test results of the stationarity of the residual sequence show that at the significance level of 5%, lny and lnx_i The residuals of the regression equation are all stable, which can be considered as $lnx_3, lnx_4, lnx_5, lnx_6, lnx_7, lnx_8$ all has the Cointegration relationship with lny, That is to say, there is a long-term equilibrium relationship between the added value of construction industry, transportation, storage and postal industry, accommodation and catering industry, financial industry, wholesale and retail industry, real estate industry and the total output value of forestry industry.

3.1.3 Granger causality test

Based on the above results, this paper holds that there is a long-term equilibrium relationship between the forestry industry and the construction industry, transportation, warehousing and postal industry, wholesale and retail industry, accommodation and catering industry, financial industry and real estate industry. Therefore, this paper continues to test the Granger causality of forestry and the above industries to determine whether there is a causal relationship between them. In this paper, through trial calculation, the optimal lag order is 3, and then Granger causality test of lag order 3 is carried out. The test results are shown in the table below.

Table 3: Granger Causality Test Results Table

	lag order	F-value	P-value
lnx_3 not the Granger cause of the lny change	3	15.43	0.0250
lny not the Granger cause of the lnx_3 change	3	0.47	0.7222
lnx_4 not the Granger cause of the lny change	3	10.81	0.0408
lny not the Granger cause of the lnx_4 change	3	0.52	0.6958
lnx_5 not the Granger cause of the lny change	3	11.09	0.0394
lny not the Granger cause of the lnx_5 change	3	10.54	0.0422
lnx_6 not the Granger cause of the lny change	3	32.44	0.0087
lny not the Granger cause of the lnx_6 change	3	4.69	0.1182
lnx_7 not the Granger cause of the lny change	3	10.53	0.0422
lny not the Granger cause of the lnx_7 change	3	3.06	0.1917
lnx_8 not the Granger cause of the lny change	3	13.52	0.0300
lny not the Granger cause of the lnx_8 change	3	3.31	0.1760

The result of Granger causality test shows that at the level of 5% significance, it is not the Granger cause that causes the change that can be rejected, but cannot be rejected lny is not the reason for causing lnx_3 to change, This shows that there is a one-way causal relationship between the construction industry and the forestry industry, that is, the increase of the added value of the construction industry is the Granger cause of the increase of the forestry output value. In the same way, based on the above test results, this paper believes that there are correlation effects between

the forestry industry and the construction industry, transportation, warehousing and postal industry, accommodation and catering industry, wholesale and retail industry, financial industry and real estate industry. Among them, transportation, warehousing and postal industry, accommodation and catering industry, financial industry and real estate industry all have one-way causal relationship with the forestry industry, that is to say, the above industries are all Granger reasons for the increase of the total output value of forestry, which shows that the above industries have backward correlation effect with the forestry industry. There is a two-way causal relationship between the wholesale and retail industry and the forestry industry, that is, the increase of the GDP of the wholesale and retail industry and the growth of the total output value of the forestry industry are mutually Granger reasons, which shows that the forestry industry and the wholesale and retail industry have both forward and backward correlation effects.

3.2 Grey correlation analysis

The results of Granger causality test only reflect whether there is a correlation effect between the added value of each industry and the growth of the total output value of the forestry industry in the long-term equilibrium state, but it cannot measure the size of the correlation effect. In order to study the correlation effect between forestry industry and each industry, based on the results of Granger causality test, this paper analyzes the industries with backward correlation effect with forestry industry, obtains the correlation sequence, and then determines the influence sequence of each industry on the growth of forestry industry. The calculation results of grey correlation series are shown in the table below.

Table 4: Gray correlation analysis table

industry	correlation order	influence ranking
wholesale and retail trade	0.6665	1
transportation, warehousing and postal	0.6164	2
accommodation	0.6157	3
catering	0.6021	4
finance	0.5771	5
estate	0.5766	6

The results of grey correlation analysis show that among the above industries, wholesale and retail industry have the greatest impact on the growth of total output value of forestry industry, followed by transportation, warehousing and postal industry. The influence of construction industry, accommodation industry and catering industry on the total output value of forestry is in the middle level, while the influence of finance industry on the total output value of forestry is relatively small, and the influence of real estate industry is the least.

3.3 Result analysis

The results of Granger causality test and grey correlation analysis show that forestry industry has two-way correlation effect with wholesale and retail industry, and the development of wholesale and retail industry has the greatest impact on the development of forestry industry. This paper believes that the rise of network sales platform is the main reason for this result. With the development of retail industry, commodity trading is not limited to offline sales, more and more forest users use the Internet platform to sell their own forest products. Therefore, the development level of local retail industry determines the way to sell forest products to a certain extent. The development of the local wholesale and retail industry promotes the diversification of the sales channels of the farmers' forest products, and then promotes the development of the forestry industry. At the same time, the results show that the growth of forestry industry is Granger's reason for the increase of value-added of wholesale and retail industry, which shows that forestry industry has a certain role in promoting the development of wholesale and retail industry. This paper holds that the development of forestry industry increases the supply of local forest products, directly promotes the

development of local wholesale and retail industry; meanwhile, a large supply can It can lead to the result that local supply exceeds demand, which requires local distributors to expand sales channels, promote the development of local wholesale and sales channel diversification, and indirectly promote the growth of added value of wholesale and retail industry.

At the same time, transportation storage and post industry have strong backward correlation effect on forestry industry. This is because a relatively complete transportation infrastructure is a prerequisite for the transportation of forest products such as timber and fruit. The development of local transportation industry improves the safety and efficiency of forest products transportation within and between provinces. Therefore, the development of transportation infrastructure can bring positive growth of forestry economic benefits [12].

The results show that the backward correlation effect of construction industry, accommodation industry and catering industry on forestry industry is in the middle level. As the main product of the forestry industry, wood is also one of the main consumption materials for the development of the construction industry [13]. The development of the local construction industry will increase the demand for wood, and then promote the development of the local wood mining and transportation industry, and finally achieve the result of increasing the total output value of the forestry industry.

The correlation effect of accommodation and catering industry on forestry industry is mainly reflected by tourism industry. At present, the improvement of people's living standard has expanded people's demand for tourism, and the local ecological environment is often one of the main factors for people to choose a tourist destination. As the largest green economy, the development of forestry industry is one of the best ways to improve the local environment and promote the development of tourism. At the same time, with the development of tourism in Shaanxi Province, forest tourism as a new type of tourism is gradually known by people. As an important part of tourism industry, accommodation and catering industry is closely related to the development of tourism industry, which can reflect the development level of local tourism industry. Therefore, it can be considered that the development of accommodation and catering industry promotes the development of forestry industry.

The results show that the development of financial industry and real estate industry has weak backward correlation effect on forestry industry. In terms of financial industry, with the continuous development of Shaanxi Province's economy and the increase of national ecological protection efforts, the focus of local government's work gradually inclines to the direction of green development. In recent years, Shaanxi Province has issued a number of economic policies to encourage the development of forestry industry. For example, in the "opinions on promoting the reform of collective forest right system" issued by Shaanxi Provincial Government in 2007, it was clearly pointed out that "the financial system should increase the credit support for forestry construction" [14]. The credit support of financial system to forestry industry is closely related to the development of local financial industry. Only when the development of local financial industry reaches a certain level can the financial system be able to increase credit support for forestry construction. Therefore, the capital investment of Shaanxi forestry industry is closely related to the development level of local financial industry. Therefore, it can be considered that the development of financial industry plays a role in promoting the development of forestry industry. In the field of real estate, with the improvement of people's living standards and the strengthening of environmental protection awareness, environmental quality has gradually become an important factor affecting the price of real estate [15]. Trees can beautify the environment, clean the air and reduce the noise. In order to beautify the environment, planting a large number of trees in the community has become the first choice for real estate companies to attract customers. Therefore, the development of real estate industry promotes the growth of total output value of forestry to a certain extent. However, due to the fact that the economic foundation of Shaanxi Province is relatively weak, the development level of local cities is underdeveloped, the financial industry is not concentrated enough, and the development of capital market lags behind [16], the development level of local financial industry and real estate industry is relatively low, and the promotion of forestry industry is relatively weak.

4. Conclusion

First of all, through the stability test, co integration test and Granger causality test, this paper concludes that the construction industry, transportation storage and postal industry, accommodation and catering industry, financial industry, real estate industry, wholesale and retail industry are Granger reasons for the growth of the total output value of the forestry industry, while the growth of the forestry industry is Granger reasons for the wholesale and retail industry. According to this, this paper holds that the forestry industry in Shaanxi Province has obvious correlation effect with many industries. Its development level has a strong relationship with the development of local construction industry, transportation, warehousing and postal industry, accommodation and catering industry, finance industry, real estate industry, wholesale and retail industry. In this paper, the gray correlation analysis is further carried out for the industries with causal relationship with the development of forestry industry. The analysis results show that the order of the impact of each industry on the growth of forestry industry is: Wholesale and retail industry, transportation and storage and postal industry, construction industry, accommodation and catering industry, financial industry, real estate industry.

Based on the above research results, this paper puts forward the following suggestions for the development of Shaanxi Forestry Industry: (1) develop e-commerce system to promote the development of local wholesale and retail industry. Online sales can greatly improve the sales volume of local forest products because it is not limited by the region. Therefore, Shaanxi provincial government should make full use of communication technology, combine the Internet with local forest products sales, and combine local enterprises and e-commerce platforms to improve the e-commerce system of forest products. At the same time, local governments at all levels should arrange training personnel to conduct various training and return visits to forest households, so as to promote the development of local wholesale and retail industry, and further promote the development of Shaanxi forestry industry. (2) We will improve infrastructure and develop local transportation, warehousing and postal services. Governments at all levels in Shaanxi Province should appropriately increase investment in infrastructure construction and improve the construction of local transportation infrastructure, water conservancy infrastructure and communication infrastructure. At the same time, because too large-scale infrastructure construction is harmful to the ecology, the local government should pay attention to keep the infrastructure within a reasonable level, so as to promote the development of local forestry industry. (3) The local government shall ensure the coordinated development of all industries. As the six industrial sectors of Shaanxi Province, such as construction industry, transportation and storage industry, post industry, accommodation industry and catering industry, all have backward relevance to the forestry industry, therefore, the governments at all levels in Shaanxi Province should issue industrial policies for different industries, encourage the coordinated development of various industries, and jointly promote the development of the forestry industry.

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