

Research on the Correlation between Ningbo-Zhoushan Port Logistics and the Regional Economic Development

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Abstract: This paper mainly takes Ningbo-Zhoushan port as the research object, which plays a significant role in promoting the development of Zhejiang province and its surrounding economy. This article mainly is the comprehensive analysis of the relationship between port logistics and regional economic development, using the method of grey correlation analysis, to find the actual data, and analyze the relationship between port logistics and regional economic development. It also provides some references and strategies for the development of Ningbo port logistics and regional economy.

1. Introduction

1.1 The development status of Ningbo-Zhoushan port

Ningbo-Zhoushan port is an important container ocean mainline port in mainland China. It is also an important iron ore transfer base and crude oil transfer base in China. Moreover, it is an important liquid chemical storage and transportation base in China, and an important coal and grain storage and transportation base in east China. It is one of the country's main hub ports.

In 2018, the annual cargo throughput of Ningbo-Zhoushan port exceeded “one billion tons” again, maintaining the status of the only super port exceeding “one billion tons”, and achieving “ten successive championships” in the ranking of global ports. The port's annual container throughput exceeded 26 million TEU for the first time, ranking among the “top three” ports in the world for the first time and ranking second in China. The rapid growth of container throughput of Ningbo-Zhoushan port is closely related to the steady development and transformation and upgrading of China's foreign trade economy. According to data from the general administration of customs, in 2018, China's foreign trade import and export value reached 30.51 trillion yuan, up 9.7% year-on-year. Among them, the total import and export volume of goods in Zhejiang province from January to November 2018 reached 2,608.44 billion yuan, up 12.7% year-on-year, both maintaining a fast growth rate and laying a supply base for the growth of container throughput.

1.2 The development status of regional economy in Zhejiang province

In 2018, Zhejiang province's GDP was 5619.7 billion yuan, ranking the fourth in the country, with an actual growth rate of 7.1% year-on-year, 0.5 percentage point higher than that of the country. In recent years, the present situation and tendency of Zhejiang's economic development are better than the national average level. The endogenous driving force of economic growth is obviously strengthened. The annual added value of the “three new” economy (new industries, new forms of business and new models) accounted for 24.9% of the GDP. The service industry characterized by low carbon emissions has become an important growth pole leading the development of low carbon economy. In 2018, the added value of the service industry in Zhejiang province reached 3,072.4 billion yuan (RMB, the same below), an increase of 7.8% over the previous year, and the contribution of the tertiary industry to GDP growth was 56.2%.

(The data comes from the official website of Zhejiang Statistics Bureau.)

2. The Analysis on the Correlation between Ningbo-Zhoushan Port Logistics and the Regional Economic Development

2.1 Grey correlation analysis

Quantifying the degree to which two systems are related to each other, and can change depending on time and object, is called correlation^[1]. With the continuous development of the system, if the two factors in the system show the same trend, it can indicate that the two factors are highly correlated. Conversely, inconsistent trends can indicate low correlation^[2]. Therefore, the grey correlation analysis method is to answer the question of the correlation between factors, which is the so-called “grey correlation”.

2.2 The case analysis of Ningbo-Zhoushan port

2.2.1 The index selection

In this paper, through reference to the past journals, literature, it can be known that the evaluation of a port's capacity, can be weighed with the data index in many aspects, such as throughput of goods or containers, capital input, and number of berths. The selection of the index needs to conform to the actual situation, the real existence of data and strong comprehensiveness. Therefore, the throughput of containers or goods becomes the most preferred index. Among them, the throughput of cargo is not only an important index of production operation, but also a main index reflecting the port's structure configuration, production scale and economic situation of port area. At the same time, it is the main index of the port's scale and surrounding economy. Starting from the function of a port, the basic task of it is to complete the connection of transportation modes, and to speed up the transport and turnover of goods, vehicles and ships. The throughput of the goods of a port reflects the status of the port in social economy and national life. Therefore, this paper takes this index as the index to reflect the development level of port logistics.

In order to show the actual economic situation of Zhejiang province in a more scientific and reasonable way, this paper uses the most convincing indexes such as GDP, total foreign trade import and export value, industrial growth value to evaluate and locate the overall economic level of the region. In this paper, port cargo throughput (Y1) is selected as the index to reflect port logistics. GDP (X1), industrial added value (X2) and total foreign trade import and export value of Zhejiang province (X3) are taken as the reference indexes to measure the economic development of Zhejiang province^[14].

2.2.2 Select the reference sequence

Determine the comparison sequence of the reference sequence and the corresponding impact.

$$X = [X_1, X_2, \dots, X_n]^T$$

Thereinto, $X_i = (X_i^1, X_i^2, \dots, X_i^n)$ represents the data of each index for calculating the correlation coefficient for N years. According to the requirements of grey correlation analysis method, an index system for port logistics development of Ningbo-Zhoushan port and regional economic development of Zhejiang province is established, in which port cargo throughput (Y1) is a reference sequence, as shown in table 1.

Table 1 The Index Selection of the Port Logistics of Ningbo-Zhoushan Port and Regional Economic Development of Zhejiang Province

Year	Y ₁ (10 thousand tons)	X ₁ (100 million yuan)	X ₂ (100 million yuan)	X ₃ (100 million dollars)
2013	80978	37756.59	18447	3357.89
2014	87346	40173.03	19153	3550.40
2015	88929	42886.49	19707	3467.84
2016	92202	47251.36	20518	3365.76
2017	100933	51768.26	22472	3779.07
2018	108400	56197	23506	4324.80

(The data comes from Zhejiang Statistics Bureau.)

2.2.3 Dimensionless method

Thereinto, $X'_i = X_i / X_i^1 = X'_i(1), X'_i(2), \dots, X'_i(n); i=1, 2, \dots, n$

Table 2 Dimensionless Data Sequence

Year	Y_1 (10 thousand tons)	X_1 (100 million yuan)	X_2 (100 million yuan)	X_3 (100 million dollars)
2013	1	1	1	1
2014	1.0786	1.0640	1.0383	1.0573
2015	1.0982	1.1359	1.0683	1.0327
2016	1.1386	1.2515	1.1123	1.0023
2017	1.2464	1.3711	1.2182	1.1254
2018	1.3386	1.4884	1.2742	1.2879

2.2.4 Difference sequence

$$\Delta_i k = |X_i(k) - X'_i(k)|$$

Table 3 The Difference Between the Comparison Sequence and the Reference Sequence

Year	$ Y_1 - X_1 $	$ Y_1 - X_2 $	$ Y_1 - X_3 $
2013	0	0	0
2014	0.0146	0.0403	0.0213
2015	0.0377	0.0299	0.0655
2016	0.1129	0.0263	0.1363
2017	0.1247	0.0282	0.1210
2018	0.1498	0.0644	0.0507

2.2.5 Find the two-level maximum difference and minimum difference

$$M = \max_i \max_k \Delta_i(k)$$

$$m = \min_i \min_k \Delta_i(k)$$

It can be obtained from table 3, the maximum difference $M = \max_i \max_k \Delta_i(k)$ is 0.1498, the minimum difference $m = \min_i \min_k \Delta_i(k)$ is 0.

2.2.6 Find the correlation coefficient

$$\xi_{0i} = \frac{\Delta(\min) + \rho \Delta(\max)}{\Delta_{oi}(k) + \rho \Delta(\max)} \rho \in (0, 1)$$

Thereinto, $k=1, 2, 3, \dots, n; i=1, 2, 3, \dots, m$. The value range of identification coefficient is 0 ~ 1, The final value of this paper is set as 0.5.

Table 4 The Correlation Coefficient of Grey Correlation Analysis

Year	ξ_1	ξ_2	ξ_3
2013	1.0000	1.0000	1.0000
2014	0.8369	0.6502	0.7786
2015	0.6652	0.7147	0.5335
2016	0.3988	0.7401	0.3546
2017	0.3753	0.7265	0.3823
2018	0.3333	0.5377	0.5963

2.2.7 Find the correlation

$$r_i = \frac{1}{N} \sum_{k=1}^N \xi_i(k)$$

Thereinto, $k=1,2,3,\dots,n$; $i=1,2,3,\dots,m$

Table 5 The Correlation between Zhejiang Economy and Port Logistics Index

	X_1	X_2	X_3
Correlation	0.6016	0.7282	0.6076

As can be seen from the data in table 5, the correlation between the cargo throughput of Ningbo-Zhoushan port and the GDP of Zhejiang province is 0.6016, and that of industrial added value is 0.7282, and that of total foreign trade import and export value is 0.6076. Among them, the correlation degree between the throughput of cargo and the industrial added value is the highest, and the lowest correlation degree also reaches 0.6016, which is the total import and export value of foreign trade. It can be seen that the logistics activities of Ningbo-Zhoushan port are closely related to the economic development of Zhejiang province, and they affect each other and develop synchronously.

The industrial added value is at the position with the highest correlation, which indicates the improvement of logistics service level and the construction and improvement of infrastructure of Ningbo-Zhoushan port. Some industries with high demand for logistics services, such as energy, petrochemical, logistics and processing industries, began to form a convergence zone there. Because of the agglomeration effect, the demand for port logistics increases. Economic development is in the stage of continuous transformation. The continuously developing automobile and appliance manufacturing industry, information technology industry, new energy industry, aerospace industry and other industries of Zhejiang province have expanded the service fields and objects of the port and accelerated the progress of port logistics.

3. Conclusion and Suggestions

By collecting the data of cargo throughput of Ningbo-Zhoushan port and the data reflecting the economic development of Zhejiang province, this paper calculates the data that specifically reflects index correlation, so as to further verify the relationship between port logistics and regional economy, and puts forward the following suggestions.

3.1 Strengthen the facilities construction of the port collection and distribution system

According to the development status of Ningbo-Zhoushan port and the statistical yearbook of the port, it is found that the waterway transport mode of Ningbo-Zhoushan port accounts for the majority. It can be seen that Ningbo-Zhoushan port is short of railway transportation mode, so it is difficult to give full play to its advantages as a good deep-water port. In the process of transporting containers, ships need to reach Yangshan port in Shanghai and cross the sea bridge to turn inland, which takes a lot of time and cost. With the construction of Yongzhou railway, a multimodal transport integrated system can be built in the future, integrating river, sea, railway, land and air into one, forming a smooth and flexible logistics transport system.

Ningbo-Zhoushan port is striving to improve and establish the system. In addition, with the construction of cross-sea Bridges in Zhoushan and Hangzhou bay, the connection between branch lines in Hongzhen, Beilun, Baisha port area and Xiaoyong railway, and the planning and construction of railway lines in Shanghai and Hangzhou^[5], the transport of port logistics has gotten huge support. Port planning needs to meet the requirements of the overall planning of regional cities. The traffic of ports and regional cities should be separated to reduce the interference to regional cities. Logistics parks and container terminals need to be reasonably planned to make the market order more standardized. Intelligent management system needs to be perfect. The low cost and high efficiency should be reached in the management of the collection and distribution system. These are important ways to improve competitiveness and expand the radiation range of ports^[6].

3.2 Establish the port economic circle

As the social and economic development is in the stage of transformation, Ningbo city, Zhoushan city and Zhejiang province should focus on improving the economic structure and quality development. Through the port, Ningbo and Zhoushan are more closely connected. Besides, the infrastructure between the two cities is also increasing. That the planning of Yongzhou railway, the completion of Zhoushan cross-sea bridge and the establishment of Wugongzhi tourist gathering and distribution center provides hardware facilities to support the port economic circle of Ningbo-Zhoushan port.

Therefore, Ningbo-Zhoushan port needs to play a core role, improve the management level and logistics service level of the port, and build a modern hub port for collection, distribution and transportation. It also needs to analyze the radiation range of the port, expand its role in the region, improve the supporting facilities of the city, optimize the allocation of resources of the port, and improve the integration degree of the port and the city. The port should strengthen the development of modern port industry and promote the industrial development of port and shipping logistics by using professional port information system. For excellent financial institutions at home and abroad, Ningbo-Zhoushan port should lead them to settle in the port and expand the shipping service business. It can also develop credit entrustment, guarantee business, financing, credit rating and fund management and other services to create a more favorable financial market belonging to the port.

3.3 Build an intelligent port

With the proposal of “the Silk Road Economic Belt and the 21st-Century Maritime Silk Road” strategy in China, in order to connect with the national strategy at a higher level, it is urgent to build intelligent ports. Ningbo-Zhoushan port needs to seize the opportunity, promote the innovation and breakthrough of port operation mode, and make “Internet + port” as an important method, so as to improve the efficiency of the port, reduce cost and create more value. In addition, building an international integrated hub port should be the goal of port construction. But there is still plenty of room for improvements in such features as timely tracking, electronic payments and online services. At the same time, it is necessary to promote the development of “Internet plus” shipping transactions, open up information channels at every link of suppliers, strengthen the communication, build convenient trading platforms, promote the mutual integration and complementarity of online and offline, tangible and intangible markets and the integration of domestic and foreign trade. On the technical level, it is necessary to strengthen the promotion and application of satellite navigation, automatic identification, radio frequency and other science and technology and intelligent systems, and deeply improve the electronic data exchange system and automatic management of vehicles and cargo.

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