Research on the Effect of Coastal Port City Development on Urban Economic Growth

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Abstract: In recent years, with the rapid advancement of port resource integration and port function adjustment, the economic development of China's coastal port cities has entered a new stage. Therefore, objectively analyzing the promoting effect of coordinated development of port cities on the economic growth of China's coastal port cities will help promote high-quality development of coastal port and urban economy in China. This paper takes 20 major coastal port cities in China as examples to examine the relationship between port city coordination and urban economic growth using panel data models, and proposes suggestions to promote high-quality economic development of China's coastal port cities.

Keywords: coastal port city, urban economic growth, panel data model

1. INTRODUCTION

In recent years, with the gradual slowdown of global economic and trade growth and port development, as well as the continuous promotion of port resource integration, the development of port cities has entered a new stage of development. How to evaluate the relationship between coordinated development of ports and cities and urban economic growth, besides the role of coastal ports in promoting urban economic growth, is very meaningful for studying and promoting high-quality development of coastal ports and urban economy in China.

There is a wealth of research on the relationship between ports and cities both domestically and internationally. In recent years, with the deepening of research on the relationship between ports and cities, evaluation methods and models have been continuously innovated. Santos [1], Vim [2] and Cavallo [3] analyzed the impact and importance of Lisbon Port, Rotterdam Port and Naples Port on the local economy using input-output method, regression analysis method and multi-criteria decision-making method, respectively. By reviewing foreign research literature, we can find that different experts have inconsistent research methods for different ports. It is difficult to systematically analyze the role of ports in promoting urban economic growth from both horizontal and vertical perspectives, in order to provide targeted suggestions for promoting high-quality development of ports and urban economy. Domestic research on the relationship between ports and cities has achieved rich results in terms of quantity. Gao [4]

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used partial correlation analysis and data envelopment analysis methods to discuss the interactive relationship between ports and cities, and explored the factors that promote the coordinated development of the relationship between cities and ports; Xiong [5] used panel data model, Granger causality test and Johansen cointegration test to study the dynamic relationship between port logistics and port city economy along the Maritime Silk Road; Bi [6] improved the relative concentration index and combined it with GIS spatial statistical analysis method to evaluate the port city relationship of 38 important ports and port cities on the 21st century Maritime Silk Road, providing scientific reference for the construction of overseas ports and port city hinterland; Fan [7] explored the relationship between port city synergy and urban economic growth using synergy and panel data models, exploring a new method for the study of port city synergy development. From the existing research results in China, most of the research is limited to data collection and on-site research, and a relatively complete evaluation index system for port city relations has not yet been formed; The quantitative analysis of the dynamic evolution of the relationship between ports and cities has not proposed targeted measures and suggestions that can be transformed into government decision-making and industry practice.

Therefore, this paper takes 20 major ports and port cities in China's Yangtze River Delta, Bohai Rim, Pearl River Delta, Southeast Coast and Southwest Coast as examples, and uses panel data model to study the relationship between China's coastal ports and urban economic growth. Compared with previous studies, the innovations of this paper lie in: (1) Using panel data model to analyze the relationship between urban economic growth and port city synergy, total social fixed asset investment and the number of employees at the end of the year; (2)Through the quantitative calculation and analysis of the model, this paper proposes suggestions to promote the high-quality economic development of China's coastal ports and port cities, thereby promoting the coordinated development of China's port city relationship.

2. ANALYSIS ON THE RELATIONSHIP RELATIONSHIP BETWEEN PORT AND URBAN ECONOMIC GROWTH

In order to deeply analyze the relationship between the capital, labor, synergy degree of port city composite system and urban economic growth, this section establishes the production function model. At the same time, in order to further explore the impact of China's coastal ports, especially the port city synergy degree on urban economic growth.

2.1 establishment of production function model

This paper studies the relationship between port and urban economic growth, innovatively adds the synergy degree of port city composite system into the variables, and constructs a new production function:

$$Y = AK^{\beta_1} L^{\beta_2} D^{\beta_3} \mu \tag{1}$$

In the formula, Y is the gross domestic product (GDP); A is the comprehensive technical level; K is the amount of capital invested, expressed by the total investment in fixed assets of the whole society; L is the number of labor input, expressed by the number of employees at the end of the year; D is the new input, which is expressed by the coordination degree of port city composite system; β_1, β_2, β_3 are the elasticity coefficient of the output of capital, labor and port city composite system; μ is the influence of random interference, $\mu \leq 1$ (in this section, μ is taken as 1). Among them, the data on the gross domestic product (GDP), the total investment in fixed assets of the whole society, and the number of employees at the end of the year come from the statistical bulletins and statistical yearbooks of 20 cities from 2001 to 2020.

Since the data of the above variables are absolute quantities, logarithmic processing is required to reduce the fluctuation range. Perform natural logarithm processing on formula (1) to obtain formula (2):

$$\ln Y = \ln A + \beta_1 \ln K + \beta_2 \ln L + \beta_3 \ln D \tag{2}$$

2.2 Building panel data model

Panel data models can be classified into three types according to the values of intercept terms and coefficients, namely constant coefficient, variable intercept and variable coefficient panel data models. Before model estimation, F-test is required for the model, and the type of panel data model is determined by panel covariance analysis. The covariance analysis mainly tests two hypotheses: H_1 and H_2. If the test result accepts H_2, it is determined as a constant coefficient model; If the inspection result accepts H_1 and rejects H_2, it is determined as a variable intercept model; If the test result rejects H_1 and H_2, it is determined as a variable coefficient model.

2.3 Model checking

1. Unit root test

To ensure the effectiveness of the results and eliminate false regressions, we need to test the stationarity of the panel sequence. Among them, the most widely used method is the unit root test. The inspection methods of panel unit roots mainly include LLC, Hadri, Breitung, IPS and Fisher, which can be summarized into two categories: One is LLC, Hadri and Breitung tests, which are unit root tests under the same root case; the other is IPS and Fisher tests, which are unit root tests under different root cases. In this section, LLC, IPS, Fisher ADF and Fisher PP inspection methods are used, and Eviews software is used to perform unit root test for each sequence. The unit root test results show that lnY, lnK, lnL and lnD are all zero-order single integers at the 5% significance level, which is recorded as I(0).

2. Cointegration test

Cointegration test is a method to test the stability of long-term equilibrium among variables. In time series analysis, if the result of unit root test shows that the variables are single integration of the same order, cointegration test can be carried out. Since the lnY, lnK, lnL and lnD of the 20 port cities are all zero order single integration, the cointegration test can be carried out to determine whether there is a long-term stable equilibrium relationship between the Gross Domestic Product (GDP) and the total social investment in fixed assets, the number of employees at the end of the year and the synergy degree of the port city composite system. There are two types of cointegration test methods for panel data: one is the panel cointegration test based on Johansen cointegration test; the other is the panel co-integration test based on the Engle and Granger two-step test, mainly Pedroni and Kao tests. In this section, Pedroni test and Kao test are used for cointegration test, and Eviews software is used to determine the optimal lag order of the model as 1. From the test results, only Panel rho-Statistic and Group rho-Statistic have P values greater than 0.05, and the rest are less than 0.05. Therefore, the test results of Pedroni and Kao show that there is a cointegration relationship among lnY, lnK, lnL and lnD, that is, there is a long-term equilibrium and stable relationship between the gross domestic product (GDP) of 20 port cities and the total investment in fixed assets of the whole society, the number of employees at the end of the year and the synergy degree of the port city composite system, so regression analysis can be carried out.

3. Determine the model

Fixed effect and random effect are two common models in panel data analysis. The Eviews software is used here, and the P value is less than 0.05 through Hausman test, which confirms the establishment of fixed effect model. In order to further analyze the relationship between the total social fixed assets investment, the number of employees at the end of the year and the synergy degree of the port city complex system and the urban economic growth in 20 port cities, it can be found that the covariance analysis test results reject the hypotheses H_1 and H_2 and determine to establish a variable coefficient model by setting tests in the form lnY, lnK, lnL and lnD models.

2.4 Model calculation

Based on the above analysis, the variable coefficient model with fixed influence is selected for calculation, and the formula (3) is as follows:

$$y_{it} = \alpha + \alpha_i^* + \ln K_{it}\beta_{1i} + \ln L_{it}\beta_{2i} + \ln D_{it}\beta_{3i} + \mu_{it} \quad i = 1,2,\cdots 20; t = 1,2,\cdots 21 \tag{3}$$

In the formula, y_{it} represents the variable to be regressed; α represents the average regional GDP created by the 20 port cities relying on their own economic internal power; α_i^* represents the deviation of the regional GDP created by the internal economic power of the i-th city from the average regional product; β_{1i}, β_{2i}, β_{3i} respectively represent the driving effect of total investment in fixed assets, number of employees at the end of the year and the coordination degree of the composite system of Hong Kong and city on the GDP of the i-th city.

Use Eviews software to estimate the model, the formula (4) is as follows:

$$y_{it} = \underset{(0.305635)}{0.351667} + \alpha_i^* + \ln K_{it}\beta_{1i} + \ln L_{it}\beta_{2i} + \ln D_{it}\beta_{3i} + \mu_{it} \quad i = 1,2,\cdots 20; t = 1,2,\cdots 21 \tag{4}$$

According to the estimated value of a_i^*, β_{1i}, β_{2i}, β_{3i} (as shown in Table 1), the fitting degree of panel data model is 99.719%. The results show that the fitting effect of the equation is very good.

Table 1. Estimated results of model parameters

City i	a_i^* estimated value	β_{1i} estimated value	β_{2i} estimated value	β_{3i} estimated value
Dalian	-1.645	-0.041	1.665	0.725
Yingkou	-3.280	0.193	1.832	0.863
Qinhuangdao	18.833	0.723	-3.296	0.267
Tianjin	-5.763	-0.092	2.323	0.676
Yantai	11.108	-0.046	-0.316	1.938
Qingdao	-10.798	0.436	2.456	-0.184
Rizhao	4.606	0.258	0.157	1.171
Shanghai	-6.713	0.910	1.196	-0.036
Lianyungang	12.669	0.269	-1.262	1.695
Ningbo-Zhoushan	-6.102	0.192	2.103	0.725
Wenzhou	-4.726	0.230	1.787	1.150
Fuzhou	-8.203	0.876	1.489	-0.991
Xiamen	0.961	0.042	1.165	0.451
Shenzhen	-0.625	0.067	1.393	0.763
Guangzhou	2.048	0.464	0.514	0.579
Zhuhai	1.841	0.544	0.354	0.298
Shantou	-7.476	0.357	2.219	0.247
Zhanjiang	-6.006	0.019	2.339	1.367
Beibu Gulf	8.777	-0.219	0.201	2.578
Haikou	0.492	0.259	0.872	0.013

3. CONCLUSION AND SUGGESTION

This paper takes 20 major coastal ports and port cities in China's Yangtze River Delta, Bohai Rim, Pearl River Delta, Southeast Coast and Southwest Coast as the objects of the research. In order to further explore the active effect of port city synergy degree on urban economic growth, this paper establishes a production function model, and deeply explores the relationship between the total investment in fixed assets, the number of employees at the end of the year, the port city complex synergy degree and the urban gross domestic product (GDP) through the panel data model. Through the analysis, it is concluded that: (1) The growth of urban economy is affected by three factors: capital, labor and the synergy degree of port city composite system. The synergy degree of port city composite system has a positive effect on the economic growth of main coastal ports, which also reflects that the coordinated development of port city can accelerate the growth of urban economy; (2) Different coastal ports have different levels of promoting effect on urban economic growth, but the overall characteristics of large-scale ports are better than small and medium-sized ports, and professional ports are better than general ports. This is closely related to the fact that the cities where large ports and specialized ports are located pay more attention to the coordinated development of port city relationship and have a deeper understanding of the role of port development in promoting urban economy; (3) At present, the economic growth of the cities where the main coastal ports are located in China is still relies on the role of ports, and the separation of the relationship between the port and the city has not been able to enter the stage of development entirely dependent on the self-growth effect of the city.

Therefore, in order to further promote the high-quality economic development of China's coastal port cities, suggestions are as follows: (1) Coastal port cities should vigorously develop industries with local characteristics and development advantages, accelerate the transformation and upgrading of the manufacturing industry, increase the investment attraction for domestic and foreign well-known manufacturing enterprises, give corresponding preferential policies in land, coastline and taxation, and optimize the layout of port industries according to the different development stages of ports and cities, so as to improve the scale of port industries and the level of support for urban economic development; (2) The competent transportation departments at all levels shall strengthen the regular monitoring of the economic operation of the ports. Once the development of the port city relationship deviates from the benign development track, or there is a contradiction between the port and the city, they shall put forward solutions in a timely manner to promote the sustainable and coordinated development of the relationship between the coastal ports and the cities in China and serve the high-quality development of the ports and the cities in which they are located.

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