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Measuring the Level of High-Quality Development of Regional Logistics in China and Its Convergence

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Abstract: High-quality logistics development is an inevitable link to achieve high-quality economic development, and is the key to accelerate the comprehensive competitiveness of the regional economy and the national economy. In order to clarify the high quality level of logistics in China and explore the differences in the level and dynamics of high quality development of logistics among different regions, this paper constructs indicators for measuring the level of high quality development of logistics, measures the level of high quality development of China's logistics industry from 2013 to 2019 using DEA-Malmquist method, and explores the differences of high quality of logistics in different regions of China and their convergence using α convergence model. The differences in logistics quality among different regions in China and their convergence were explored using the α convergence model. It was found that the level of high-quality development of logistics in China showed an upward trend across regions, but there was heterogeneity among regions, with the eastern region significantly outperforming the central and western regions, and some cities in the western region showing a slight downward trend. The level of logistics quality development does not show α convergence trend across the country and the eastern and central regions, while the western region shows a continuous divergence trend.

Keywords: Logistics; High Quality; α Convergence

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1 Introduction

According to the National Development and Reform Commission issued the "Opinions", as a representative industry of the productive service industry, the development of the logistics industry to promote the development of the national economy, high-quality logistics development is an inevitable link to achieving high-quality economic development. Logistics high-quality development as an opportunity to promote economic development is the key to cultivating new dynamics of economic development and accelerating the improvement of the regional economy and the comprehensive competitiveness of the national economy. This series of policies on the development of the logistics industry is a new opportunity and requirement, and how to further improve the quality of development of the logistics industry and coordinate the development of the logistics industry between different regions, which has become a major challenge to achieve high-quality development under the new normal. So what is the current level of high-quality development of logistics in China? What are the differences in the development level and dynamic changes between different regions? Based on this, it is proposed to explore the differences in logistics high quality in different regions and its dynamic changes based on the measurement of logistics high-quality development level.

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2 Review of the Literature

Regarding the research on high-quality development existing studies mainly focus on two levels, including high-quality development level measurement and influencing factors of high-quality development. Among them, in the measurement of high-quality development in the logistics industry, A. S Muradov and Z. S Atadzhanova [1] consider the level of quality of transport services, which depends to a large extent on the state of logistics infrastructure, as a very urgent issue. Caiming Zhang [2] established a panel data regression model based on the Cobb-Douglas production function model to analyze the relationship between logistics development and economic growth in each region of China. Futou Li [3] mainly derived the demand for regional logistics through a theoretical analysis of the relationship between regional logistics and regional economic development. Yan B. [4] and Guo Z. X. [5] sees logistics quality development Large regional differences exist. Gan et al. [6] constructed evaluation indicators of green logistics efficiency, based on the five development concepts of economy and society advocated by the Chinese government, namely "innovation, coordination, green, openness, and sharing", and analyzed the evolutionary characteristics of the high-quality development of green logistics efficiency in Jiangxi Province, China. Yan et al. [7] by establishing a high-quality economic development and logistics indicator system, using a coupled coordination model to measure the level of economic development and logistics high-quality development, and analyzing their coupled coordination degree, the study found that there are large regional differences in China in terms of economic high-quality development and logistics high-quality development. Li and Fu [8] combined R-factor analysis and gray cluster analysis to study the logistics development level of 12 provinces in the western region. Chen and Zhang [9] measured the comprehensive technical efficiency and pure technical efficiency of logistics industries in 30 provinces in China, and analyzed their development trends. In terms of research on the influencing factors of high-quality development, Amit Ghosh [10] explored the impact of globalization in the banking sector on the quality of economic development. Thomas Niebel [11] studied the impact of information and communication technology on the quality of economic development. Niebel [12] studied the impact brought by ICT on the quality of economic development. Jahanger [13] studied the impact of FDI quality on the economic development of 30 inland provinces in China (excluding Tibet), and the findings showed that FDI quality has a significant impact on the high-quality development of China's economy. Liu et al. [14] used a dynamic spatial Durbin model to analyze the direct and indirect effects of environmental regulation on high-quality economic development and regional heterogeneity in China, and the study found that high-quality economic development in China is spatially correlated among different provinces. Guo [15] and Xiao [16] measured and analyzed the trend of total factor productivity, regional differences and convergence characteristics from the microscopic perspective of enterprises, taking manufacturing and service industries as research objects respectively.

However, the existing research on high-quality development of logistics still has some limitations: firstly, the existing literature mainly discusses the problems and realization paths of high-quality development of the logistics industry from a macro perspective, and lacks the measurement of the high-quality development level of China's logistics industry from an empirical perspective; secondly, there is a large arbitrariness in the selection of evaluation indicators, with a single type of indicators, insufficient practical significance and less consideration of non-desired Finally, based on the measurement of the high-quality development level of the logistics industry, the convergence of the high-quality development level of regional logistics needs to be further explored. Therefore, this paper constructs a measure of the high-quality development level of the logistics industry, measures the high-quality development level of logistics in each province and city in China, and further analyzes the convergence characteristics of the high-quality development level of logistics in the country and the three regions using α convergence model, to point out the direction for the improvement of the high-quality development level of the logistics industry.

3 Logistic Industry Quality Development Level

3.1 The Construction of an Indicator System for High-Quality Development of Logistics

In this paper, the DEA-Malmquist index method is applied to measure the level of logistics high quality, and

30 provinces and cities are used as the basic decision-making units to construct a model for measuring logistics high-quality development as follows.

There are a total of n decision objects, and each decision object in the t period obtains s outputs with m inputs.

$x_j^t = \left(x_{1j}^t, x_{2j}^t, ..., x_{mj}^t\right)^T$ denotes the value of the input indicator for the t period at the j decision unit.

$y_j^t = \left(y_{1j}^t, y_{2j}^t, ..., y_{sj}^t\right)^T$ denotes the value of the output indicator in the t period at the j decision cell, $t \in N^+$, $j \in N^+$, with constant returns to scale, such that the distance function of (x^t, y^t) in the t period is $D_c^t\left(x^t, y^t\right)$ and in the t+1 period is $D_c^{t+1}\left(x^t, y^t\right)$

The value of the change in technical efficiency from t to t+1 under the t period technical conditions is

$$M^t = \frac{D_c^t\left(x^{t+1}, y^{t+1}\right)}{D_c^t\left(x^t, y^t\right)}$$

The value of the change in technical efficiency from t to t+1 under the t+1 period technical conditions is

$$M^{t+1} = \frac{D_c^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_c^{t+1}\left(x^t, y^t\right)}$$

The change from period t to period t+1 was obtained by calculating the average of the Malmquist index.

$$M\left(x^t, y^t, x^{t+1}, y^{t+1}\right) = \left(M^t \times M^{t+1}\right)^{\frac{1}{2}} = \left[\frac{D_c^t\left(x^{t+1}, y^{t+1}\right)}{D_c^t\left(x^t, y^t\right)} \times \frac{D_c^{t+1}\left(x^{t+1}, y^{t+1}\right)}{D_c^{t+1}\left(x^t, y^t\right)}\right]^{\frac{1}{2}} \tag{1}$$

Where j refers to the decision unit, t refers to the period, x and y represent the input and output variables respectively, and the measurement result is 1. When the measurement result is greater than 1, it means that the total factor productivity of the logistics industry is on an upward trend, and on the contrary, it is on a downward trend.

3.2 Indicator Selection and Data Description

This paper selects the data of 30 Chinese provinces and cities (except the Tibetan region) in the period 2013-2019 to construct the indicator system of high-quality development of logistics, the data mainly comes from the China Statistical Yearbook and the statistical yearbook of each province and city, and the description of the selection of indicators is shown in the following.

In terms of inputs, capital inputs are calculated in the form of fixed asset inputs and the number of people employed in the industry represents labor inputs.

The total energy consumption and energy consumption per unit of logistics are chosen to represent energy input, and raw coal, gasoline, kerosene, diesel, fuel oil, LPG, natural gas, and electricity, which are most used by the industry, are chosen to represent their energy consumption and converted to standard coal to obtain energy input; the ratio of total energy consumption to the added value of logistics industry is used as energy consumption per unit of logistics; capital input is chosen to be measured by the local financial expenditure in transportation, storage and postal industry; the number of Internet access households represents information technology input. The capital input is chosen to be measured by the local financial expenditures in the transportation, storage, and postal industry; the number of Internet access households represents the information technology input.

In terms of output, the desired output and non-desired output are considered. In terms of the desired output, the passenger volume and added value of logistics industry are selected to measure the quality of logistics industry, and the scale of logistics industry is represented by freight volume; in terms of non-desired output, the pollutants produced by logistics industry are mainly carbon dioxide emissions, and the various types of energy consumption of carbon dioxide output are standard coal in this paper as non-desired output index data.

3.3 Analysis of the Level of High-Quality Development in the Logistics Industry

The Malmquist index method is used to measure the level of quality development of the logistics industry nationwide and by region, as shown in the table below.

The average value of total factor productivity of logistics in China during 2013-2019 is 1.017, which indicates that the overall level of high-quality development of logistics in China is on the rise during the study period, indicating a good level of high-quality development of logistics in China. Among them, the value of technological change is 1.015, which promotes the level of development of China's logistics industry.

In general, the average value of total factor productivity from 2013 to 2019 is 1.017, indicating that total factor productivity in the national logistics industry increased by 1.7% on average, indicating that the productivity structure improved during the study period, enhancing the management capacity and rationalizing the allocation of resources. The average annual increase of 1.5% in technological progress in the logistics industry can be considered the main reason for the increase in total factor productivity. However, the efficiency changes remained unchanged, indicating that the technological improvements did not have a positive impact on logistics efficiency. Therefore, China's logistics industry is in the stage of transformation, upgrading, and high-quality development of the logistics industry, but still needs to work hard to improve its efficiency and effectiveness of the industry.

Regionally, the total factor productivity of all provinces in China achieved steady growth during 2013-2019, but the degree of growth of total factor productivity in the logistics industry varied widely among provinces. Qinghai ranks first with an average annual growth rate of 9.6%, and the total factor productivity of the logistics industry with average annual growth rates above the average are Beijing, Tianjin, Hebei, Jilin, Zhejiang, Anhui, Fujian, Shandong, Hubei, Guangdong, Guangxi, Chongqing, Yunnan, and Qinghai; the provinces and cities with annual growth rates below the national average level but still growing overall are Heilongjiang, Shanghai, Jiangxi, Hainan, Guizhou, and Shaanxi; while Shanxi, Inner Mongolia, Liaoning, Jiangsu, Henan, Hunan, Sichuan, Gansu, Ningxia, and Tibet show a slight downward trend.

Table 1 Changes in Malmquist index and its decomposition by province

Region	**Change in efficiency value**	**Technology Changes**	**Pure technical efficiency changes**	**Scale efficiency changes**	**Total factor productivity change**
Beijing	1.000	1.037	1.000	1.000	1.037
Tianjin	1.000	1.068	1.000	1.000	1.068
Hebei	1.000	1.036	1.000	1.000	1.036
Shanxi	0.995	0.964	0.997	0.998	0.959
Inner Mongolia	1.000	0.976	1.000	1.000	0.976
Liaoning	1.000	0.993	1.000	1.000	0.993
Jilin	1.038	0.990	1.025	1.013	1.028
Heilongjiang	0.984	1.021	0.990	0.993	1.004
Shanghai	1.000	1.014	1.000	1.000	1.014
Jiangsu	1.000	0.981	1.000	1.000	0.981
Zhejiang	1.000	1.047	1.000	1.000	1.047
Anhui	1.000	1.021	1.000	1.000	1.021
Fujian	1.008	1.075	1.000	1.008	1.084
Jiangxi	1.000	1.014	1.000	1.000	1.014
Shandong	1.000	1.054	1.000	1.000	1.054
Henan	1.000	0.988	1.000	1.000	0.988
Hubei	1.017	1.009	1.017	1.000	1.026
Hunan	1.000	0.960	1.000	1.000	0.960
Guangdong	1.000	1.088	1.000	1.000	1.088
Guangxi	1.015	1.045	1.006	1.009	1.061
Hainan	1.000	1.000	1.000	1.000	1.000
Chongqing	1.001	1.050	1.000	1.000	1.051
Sichuan	0.991	0.992	0.997	0.994	0.984
Guizhou	1.000	1.015	1.000	1.000	1.015
Yunnan	1.000	1.032	1.000	1.000	1.032
Shaanxi	1.005	1.002	1.006	0.999	1.007
Gansu	0.993	0.996	0.998	0.995	0.989
Qinghai	1.004	1.092	1.000	1.004	1.096
Ningxia	1.000	0.994	1.000	1.000	0.994
Tibet	1.000	0.913	1.000	1.000	0.913
Average value	1.002	1.015	1.001	1.000	1.017

4 Covergence Test of the Level of Quality Development of Logistics

This part will test the convergence of logistics high-quality development level, by exploring the convergence and analyzing the dynamic changes of different research objects, α convergence tests the convergence of logistics high-quality development level through its discrete degree change, if it shows a decreasing trend, it indicates convergence. The coefficient of variation CV_i is calculated by the following formula.

$$CV_i = \frac{S_i}{M_i} \tag{2}$$

Where, M_i denotes the sample mean of TFP for period i and S_i denote the sample standard deviation of TFP for period i.

Based on the total factor productivity obtained by measuring the development level of logistics quality development above, the coefficients of variation of total factor productivity in the national, eastern, central, and western regions are calculated respectively, as shown in Table 2.

Table 2 α convergence test results

year	CV	CV_i East	CV_i Central	CV_i West
2014	0.200	0.142	0.081	0.050
2015	0.173	0.098	0.086	0.076
2016	0.212	0.114	0.069	0.100
2017	0.189	0.084	0.140	0.105
2018	0.285	0.316	0.208	0.123
2019	0.125	0.271	0.082	0.262

The results show that there is no significant α convergence in the total factor productivity of China's logistics industry during the sample period 2014-2019. The national coefficient of variation as a whole is in a downward trend, from 0.200 in 2014 to 0.125 in 2019, but there is a larger upward trend in 2017-2018, probably because the various types of "quasi-fiscal" expenditures became significantly weaker in 2018; the eastern coefficient of variation as a whole shows a "W"-shaped distribution over time, reaching a peak of 0.316 in 2018, and a peak of 0.326 in 2017. The coefficient of variation in the central region has a lower value overall, reaching 0.2082 in 2018 and relatively stable between 0.069-0.140 in other years; the coefficient of variation in the western region has a rising trend, reaching 0.316 in 2018 and 0.084 in 2017. The coefficient of variation shows an upward situation, rising from 0.050 to 0.262 in the middle of 2014-2018, and in general, the national scope, the east, and the central region show a convergence of stages, while the western region shows a trend of divergence.

5 Conclusion

This paper constructs a system of indicators to measure the level of high-quality development of the logistics industry, uses the Malaquist index method to measure the level of high-quality development of the logistics industry, and uses the α convergence model to test the convergence of high-quality development of the logistics industry on this basis, and draws the following conclusions.

First, the level of high-quality development of logistics in all provinces of the country has achieved steady growth, although the level of high-quality development of logistics varies greatly from region to region, while the overall gap is gradually narrowing. The eastern provinces have the best level of high-quality development in logistics, and the entry of capital has led to rapid technological progress, which has become the main driving force behind the rapid development of the logistics industry, prompting it to move towards high-quality development in logistics.

Secondly, the level of high-quality development of the logistics industry in the country and the eastern and central regions did not show a convergence trend, while the western region showed a continuous divergence. The national coefficient of variation as a whole is in a downward trend, but the national and eastern regions have a phase α convergence feature; the coefficient of variation of the western region as a whole shows an upward trend, and the high-quality development of the logistics industry in the same period shows an obvious dispersion trend.

Due to the limitation of time and the difficulty of obtaining some data, this paper has certain shortcomings and limitations, and fails to further explore the specific factors leading to the convergence or divergence characteristics of the quality development level of the logistics industry among regions, which awaits a breakthrough and expansion of this part in the subsequent research.

References

[1] A. S Muradov and Z. S Atadzhanova. Logistic infrastructure development-the way to increase the quality of transport services [J]. An International Multidisciplinary Research Journal, 2020, 10 (3): 115-121.

[2] Caiming Zhang. Research on the Economical Influence of the Difference of Regional Logistics Developing Level in China. 2020, 05 (02): 19.

[3] Futou Li. Research on Regional Logistics Prediction Based on Genetic Neural Network. 2019, 7 (3).

[4] Yan B. R. Dong Q. L., Li Q, Amin Fahim UI, Wu J. N. A Study on the Coupling and Coordination between Logistics Industry and Economy in the Background of High-Quality Development [J]. Sustainability, 2021, 13 (18): 10360-10360.

[5] Guo Z. X., Tian Y., Guo X. M., He Z. F.. Research on Measurement and Application of China’s Regional Logistics Development Level under Low Carbon Environment [J]. Processes, 2021, 9 (12): 2273-2273.

[6] Gan W, Yao W, Huang S. Evaluation of Green Logistics Efficiency in Jiangxi Province Based on Three-Stage DEA from the Perspective of High-Quality Development [J]. Sustainability, 2022, 14 (2): 797.

[7] Yan B R, Dong Q L, Li Q, et al. A Study on the Coupling and Coordination between Logistics Industry and Economy in the Background of High-Quality Development [J]. Sustainability, 2021, 13 (18): 10360.

[8] Li GJ, Fu QY. Evaluation and empirical evidence of logistics development level in the western region [J]. Statistics and Decision Making, 2016 (03): 73-76.

[9] Chen YP, Zhang LL. Regional convergence or convergence: Efficiency of China's logistics industry and its convergence--a study based on 30 provincial panel data from 2006-2015 [J]. Business Economics and Management, 2018 (03): 5-19.

[10] Amit Ghosh. How does banking sector globalization affect economic growth? 2017, 48: 83-97.

[11] Thomas Niebel. ICT and economic growth - Comparing developing, emerging and developed countries. 2018, 104: 197-211.

[12] Niebel T. ICT and Economic Growth–comparing Developing, Emerging and Developed Countries [J]. World Development, 2018, 104: 197-211.

[13] Jahanger A. Influence of FDI Characteristics on High-quality Development of China’s Economy [J]. Environmental Science and Pollution Research, 2021, 28 (15): 18977-18988.

[14] Liu Y, Liu M, Wang G, et al. Effect of Environmental Regulation on High-quality Economic Development in China—An Empirical Analysis Based on Dynamic Spatial Durbin Model [J]. Environmental Science and Pollution Research, 2021, 28 (39): 54661-54678.

[15] Guo C N. A study of regional differences and convergence of total factor productivity in manufacturing industry--empirical evidence based on micro data of enterprises [J]. Operations and Management, 2020, 29 (02): 205-211.

[16] Xiao T. A study of total factor productivity changes and convergence trends in China's service industry--empirical evidence based on listed enterprises [J]. Finance and Trade Research, 2021, 32 (04): 28-43.