Analysis on the Linkage Development of Logistics Industry and Other Industries in Fujian Province Based on the Grey Relation Degree

Zhengbing Yu[1], Jing Liu[2], Junyan Deng[3], Xingyu Cheng[4], Mengyao Guo[5]

[1] Business School, Jiangxi Normal University, Jiangxi Nanchang 330022, China

[2] College of international education, Jiangxi Normal University, Jiangxi Nanchang 330022, China

[3] Business School, Jiangxi Normal University, Jiangxi Nanchang 330022, China

[4] Business School, Jiangxi Normal University, Jiangxi Nanchang 330022, China

[5] Business School, Jiangxi Normal University, Jiangxi Nanchang 330022, China

Abstract: Based on the panel data of logistics industry and other industries in Fujian Province, this article conducts a research on logistics industry and other industries in Fujian Province. Through the corresponding processing of the relevant data, it can be concluded from the grey correlation analysis that the logistics industry and other industries are relatively large in general, especially the accommodation and catering industry, forestry, wholesale and retail trade industry, manufacturing industry, agriculture and real estate industry, and these sectors are just the important sectors of economic development in Fujian Province. It can be concluded that in order to develop the economy of Fujian Province soundly and steadily, we must attach great importance to the development of logistics industry.

1. Introduction

The vigorous development of Fujian's economy is closely related to the development of Fujian's logistics industry [1-3]. The good development of the logistics industry also affects the development of other industries in Fujian Province. With the rapid economic development of Fujian Province, the development speed of the logistics industry is also gradually accelerating. At the same time, the development of the logistics industry drives the economic growth of other industries is gradually recognized by the government. In response to the call for Fujian to strive to build a national innovation province and city, in the context of socio-economic innovation and transformation, as the representative of producer services, the logistics industry has become the leading force in the process of transformation and development. Along with the proposal of "one belt and one road" initiative, the logistics industry has become a key construction industry, especially as a national logistics node province. Building a province, the development of the logistics industry has become the first development consensus. Therefore, in order to promote the continuous and stable economic growth of Fujian Province, it is particularly important to formulate the development strategy of "logistics first". With the continuous development of the logistics industry, it has become an important project in the national key industry revitalization plan to study the linkage development of the logistics industry and other industries. After Fujian Province has entered the service economy and formed the structure of taking the productive service industry as the leading industry, the logistics industry has become the accelerator of modern economic development. At the same time, the healthy development of other industries also has a huge demand pulling and promoting role for the logistics industry. In this context, it is of great value to study the linkage development mechanism between logistics industry and other industries.

2. Determination of Research Methods

In order to study and analyze whether the logistics industry has formed a good linkage

development with other industries in the process of continuous development under the background of rapid economic growth in Fujian Province, this paper selects the logistics industry and other industry data of Fujian Province in 2005-2017, based on the research of grey correlation analysis, through the combination of theory and empirical analysis, comprehensive qualitative analysis and quantitative analysis This paper analyzes the linkage development mechanism between the logistics industry and other industries in Fujian Province.

Because the grey relational analysis method is more perfect and mature than other data processing methods in the research of some problems, and there will be no inconsistency between quantitative results and qualitative analysis results, so it has been widely used by scholars after it was proposed. As a quantitative analysis method, grey relation aims to study the close relationship between the elements by analyzing each element's forward direction [4]. It is a quantitative comparative analysis of the development trend. In this paper, the development status of various industries in Fujian Province is proposed as a system and regarded as a constantly developing and changing system. The analysis of relation degree aims at this dynamic development Quantitative analysis of the situation in the exhibition process. Through comparative analysis of the geometric shape of the change curve of each factor, if the geometric shape of the change curve of each factor is more similar, it indicates that the development and change trend of each factor is closer, which indicates that the degree of correlation between each factor is greater. For the original observation data, grey correlation requires dimensionless processing first, and then through a series of calculations to get the size of the correlation coefficient between the factors and make the corresponding ranking comparison. It can be seen from the previous studies that the application of grey correlation analysis is very wide, involving various fields studied by natural science and social science, such as enterprise investment project decision-making, industrial structure adjustment, investment income of various sectors of national economy, etc [5]. Which have achieved very good application results. Therefore, this paper chooses the gray correlation analysis method to analyze the linkage development of Fujian logistics industry and other industries [6].

3. Analysis on the Current Situation of Fujian Logistics Industry

In order to analyze the current situation of the development of logistics industry in Fujian Province, this paper selects the relevant indicators of the development of transportation infrastructure in Fujian Province from 2013 to 2018. See Table 1 for the original data, which comes from the relevant statistical data of the official website of logistics industry in Fujian Province from 2013 to 2018.

Table 1 Development of transport infrastructure in Fujian Province from 2013 to 2018.

Index	2013	2014	2015	2016	2017	2018
Railway business length	2743	2755	3197	3197	3187	3509
Highway mileage	99535	101190	104585	106757	108012	108901
Expressway	4003	4053	4813	4831	5039	5155
Inland navi gation mileage	3245	3245	3245	3245	3245	3245
Railway mileage	209.21	284.91	305.34	338.61	373.61	385.20
Highway mileage	330.64	334.95	267.29	251.95	227.83	212.04
Waterway mileage	2.85	2.87	2.84	2.72	2.78	2.75
Air mileage	242.31	279.63	339.74	394.25	481.99	553.29
The volume of freight transport	96718	111779	111063	120379	132252	136974
Railway freight volume	3661	3403	2820	2918	3175	3518
Road freight volume	69876	82573	79802	85770	95599	96576
Water freight volume	23162	25782	28419	31668	33453	36854
Air freight volume	19	21	22	23	25	27

Cargo turnover	3943.77	4783.48	5450.96	6074.83	6785.16	7652.89
Railway freight turnover	164.81	149.80	128.71	129.45	135.90	147.35
Road freight turnover	821.44	974.80	1020.25	1094.70	1214.05	1289.52
Water cargo turnover	2954.71	3655.72	4298.52	4846.44	5429.82	6209.37
Air cargo turnover	2.81	3.16	3.48	4.24	5.39	6.64
Ownership of motor vehicles in the whole society	7614838	7994327	8541642	9108329	9661713	10427044
Car ownership of the whole society	3349445	3884930	4368030	4950939	5582343	6239188
Cargo throughput of main coastal ports	45475.19	49166.24	50282.09	50776.09	51995.49	55806.88
Cargo throughput of Fuzhou Port	12759.03	14391.14	13967.23	14515.66	14838.16	17876.32
Cargo throughput of Xiamen Port	19087.83	20503.96	21022.52	20910.78	21116.25	21719.93
Cargo throughput of Quanzhou port	10804.09	11200.70	12241.21	12560.57	12986.17	12832.37
Cargo throughput of Meizhou Bay Port	2824.25	3070.44	3051.13	2789.09	3054.91	3378.25

Data source: Fujian logistics official website

As shown in Table 1, in terms of transportation length, from 2013 to 2018, Fujian's railway business length, highway traffic mileage, highway traffic mileage, inland river traffic mileage, railway traffic mileage and air traffic mileage are generally increasing year by year, while highway traffic mileage and waterway traffic mileage are generally decreasing year by year, of which air traffic mileage is the fastest growing, with an average annual growth rate The growth rate is 17.95%; in terms of freight volume, the total freight volume, railway freight volume, water freight volume and air freight volume in Fujian Province are generally increasing year by year from 2013 to 2018, and the railway freight volume is generally decreasing first and then increasing, among which the water freight volume is the fastest growing with an average annual growth rate of 9.73%; in terms of freight turnover, the freight turnover in Fujian Province from 2013 to 2018 is the highest The total volume, road freight turnover, water freight turnover and air freight turnover are increasing year by year. The railway freight turnover is decreasing first and then increasing. Among them, air freight turnover develops the fastest with an average annual growth rate of 18.77%. In terms of the number of motor cars, the total number of motor vehicles in Fujian Province and the total number of motor vehicles in the whole society from 2013 to 2018 are increasing year by year In general, the volume shows a trend of increasing year by year, among which the car ownership of the whole society develops most rapidly, with an average annual growth rate of 18.77%; in terms of port development, the total cargo throughput of main coastal ports, Fuzhou port, Xiamen port, Quanzhou port and Meizhou Bay Port show an overall trend of increasing year by year, including Fuzhou port The throughput is the fastest growing with an average annual growth rate of 13.25%.

In order to analyze the current situation of the logistics industry in Fujian Province, this paper selects the relevant indicators of the traffic infrastructure construction in Fujian Province in 2018. See Table 2 for the original data, which comes from the logistics statistical yearbook of Fujian Province in 2018.

Table 2 Logistics infrastructure construction of Fujian Province in 2018.

Logistics index in 2018	Index value	Growth / increase over the same period last year
Railway business mileage	3509.5 kilometers	10.1%
Highway business mileage	108901.3 kilometers	889.7 kilometers
Average net load of water transport vessel	6043 Tons / ship	9.5%
Handling capacity of Coastal Ports	5.58 Million tons	7.3%
Average tons of commercial trucks	10.21 tons	0.64 tons

Data source: 2018 Fujian logistics statistical yearbook

As shown in Table 2, in 2018, the railway business mileage of Fujian Province was 3509.5km, an increase of 10.1% over the same period of last year; the highway business mileage was 108901.3km, an increase of 889.7km over the same period of last year; the average net load of water transport ships was 6043 tons / ship, an increase of 9.5% over the same period of last year; the throughput capacity of coastal ports was 558 million tons, an increase of 7.3% over the same period of last year; the average business truck The number of tons was 10.21 tons, an increase of 0.64 tons over the same period last year.

4. Empirical Results and Analysis

4.1 Select Data

In order to analyze the correlation between the logistics industry and other industries in Fujian Province, nine factors are selected as the key factors affecting the logistics industry, including agriculture, forestry, construction industry, wholesale and retail industry, financial real estate industry, accommodation and catering industry, manufacturing industry and mining industry.

4.2 Model Construction

Select evaluation index: firstly, select measurable factors to form evaluation index system according to measurement objects。

Determine the reference sequence: Y0 refers to transportation、 storage and post and telecommunications industry; Y1 refers to agriculture; Y2 refers to forestry; Y3 refers to construction industry; Y4 refers to wholesale and retail industry; Y5 refers to financial industry; y6 refers to real estate industry; Y7 refers to accommodation and catering industry; Y8 refers to manufacturing industry; Y9 refers to mining industry.

Dimensionless processing: because the data in various industries selected in the system will be different in dimensions, it is not easy to compare or it is difficult to get the correct conclusion when comparing. Therefore, in order to ensure the scientificity of the results, when using the gray correlation degree for analysis, the first step is to carry out the dimensionless processing of the data. In this paper, we use the mean method to deal with the data dimensionless.

$$y_i' = \frac{y_i}{y_i(1)} = （y_i'（1），y_i'（2），…,y_i'（n））$$

i=0,1,2,…,m

The calculation formula is:

$$\mu_i = \frac{\min\min|y_i'(k)-y_0'(k)|+\rho\max\max|y_i'(k)-y_0'(k)|}{|y_i'(k)-y_0'(k)|+\rho\max\max|y_i'(k)-y_0'(k)|}$$

Among them, ξ is the resolution coefficient, and the value is 0 < ξ < 1. The smaller the value of ξ is, the greater the difference between the correlation coefficients is, and the stronger the discrimination ability is. We usually take the resolution coefficient as 0.5.

Calculation of Grey Correlation Degree: since the data of logistics industry and related industries in 2005-2017 are selected in this paper, the correlation coefficient of logistics industry and other

industries corresponding to each time is calculated, so there are many results. In order to make a better overall comparison, it is necessary to centralize the correlation coefficient of each time into a certain value, that is, to use the average value as the correlation coefficient of logistics industry and other industries A quantitative representation of the degree of association. The calculation formula is as follows:

$$\mu_i = \frac{1}{n} \sum_{k=1}^{n} \mu_i(k), k=1,2,\ldots,n$$

4.3 Calculation Results and Analysis

In this paper, the grey correlation coefficient between the logistics industry and other industries in Fujian Province from 2005 to 2017 is calculated by using the grey correlation theory with a resolution of 0.5. The calculation results are shown in Table 3.

Table 3 Relationship between the development of logistics industry and the development of various industries in Fujian Province from 2005 to 2017.

Particular year	Agriculture	Forestry	Construction business	Wholesale and retail	Finance
2005	1	1	1	1	1
2006	0.97679302	0.973055309	0.978028729	0.987500142	0.959187551
2007	0.950584279	0.946472309	0.958085355	0.984344841	0.835235337
2008	0.94098199	0.976350015	0.90325274	0.999135399	0.756023835
2009	0.941322761	0.979671873	0.825048755	0.958902011	0.679370749
2010	0.940085415	0.978053332	0.762839659	0.907710355	0.610393781
2011	0.959888119	0.946823708	0.684448552	0.874323032	0.579058827
2012	0.944844421	0.973477341	0.63461151	0.875217477	0.530444176
2013	0.946047261	0.927755454	0.583118935	0.871457637	0.450106975
2014	0.932306902	0.936182289	0.558605068	0.876502942	0.413419414
2015	0.849550964	0.902174111	0.566797611	0.965495045	0.379528721
2016	0.845220155	0.835184404	0.55758986	0.974105783	0.352644992
2017	0.687677858	0.765970717	0.530801387	0.989178632	0.333333333

Particular year	Estate	Accommodation and catering	manufacturing industry	Mining industry
2005	1	1	1	1
2006	0.95885063	0.973982351	0.989502706	0.982444205
2007	0.960269748	0.985977309	0.994620031	0.914529758
2008	0.986762518	0.963933228	0.97904102	0.808059346
2009	0.919454398	0.925973053	0.959371876	0.715855314
2010	0.971927188	0.929872004	0.907485812	0.652405601
2011	0.852299328	0.911693848	0.847553722	0.558369935
2012	0.830461236	0.905634269	0.833735597	0.777771671
2013	0.766765097	0.920858836	0.808949239	0.780449246
2014	0.910945001	0.958511399	0.798211314	0.798310628
2015	0.941615438	0.954246225	0.874534039	0.917612328
2016	0.98318109	0.924072478	0.880920022	0.814614523
2017	0.755327869	0.900438577	0.871747046	0.781525774

Table 4 Correlation between the development of logistics industry and the development of various industries in Fujian Province.

	Agriculture	Forestry	Construction business	Wholesale and retail	Finance
Grey correlation degree of 2005-2008	0.967089822	0.973969408	0.959841706	0.992745096	0.887611681

Grey correlation degree of 2009-2012	0.946535179	0.969506564	0.726737119	0.904038219	0.599816883
Grey correlation degree of 2013-2017	0.852160628	0.873453395	0.559382572	0.935348008	0.385806687
Average grey correlation	0.91656178	0.93393622	0.734094474	0.943374869	0.606057515

	Estate	Accommodation and catering	manufacturing industry	Mining industry
Grey correlation degree of 2005-2008	0.976470724	0.980973222	0.990790939	0.926258327
Grey correlation degree of 2009-2012	0.893535538	0.918293294	0.887036752	0.67610063
Grey correlation degree of 2013-2017	0.871566899	0.931625503	0.846872332	0.8185025
Average grey correlation	0.91060458	0.942707198	0.903513263	0.807842179

As shown in Table 4, when the resolution is 0.5, the gray correlation coefficient between the logistics industry and other industries in Fujian Province in 2005-2017 is calculated. According to the calculation results, it can be seen that the average correlation degree of the nine selected influencing factors on the development of the logistics industry in Fujian Province is different. Among them, wholesale and retail industry and accommodation and catering industry have the greatest impact on the logistics industry, followed by forestry and agriculture, as well as real estate industry and manufacturing industry, and finally mining industry and financial industry. It can be seen that the development of Fujian's logistics industry is basically coordinated with other related industries, and the linkage effect of wholesale and retail industry, accommodation and catering industry and logistics industry is good.

5. Conclusion

Through the analysis of the linkage between the logistics industry and other industries in Fujian Province, it can be seen that among the nine other industry indexes and one logistics industry index selected, the logistics industry has a relatively large relationship with accommodation and catering industry, forestry, wholesale and retail trade, manufacturing industry, agriculture and real estate industry, which shows that accommodation and catering industry, agriculture, wholesale and retail trade, forestry, manufacturing industry The development of industry and real estate industry will directly affect the development of logistics industry, and bring greater value-added promotion, while mining industry, construction industry, financial industry, and logistics are relatively small, resulting in relatively small value-added promotion. Because accommodation and catering industry, forestry, wholesale and retail trade industry, manufacturing industry, agriculture and real estate industry and other industries are closely related to logistics industry, and Fujian Province also takes these sectors as important sectors of economic construction. Therefore, we can draw a conclusion

that in order to maintain a healthy and stable economic development in Fujian Province, we must attach great importance to the sound development of the logistics industry.

References

[1] Liu Pei. Study on the driving factors of carbon emission and the change of carbon emission structure in Fujian logistics industry [D]. Xiamen University, 2014.

[2] Ren Jikui, Huang Zhangshu. Research on the grey correlation between logistics industry and related industries in Fujian Province [J]. Fujian Forum (SOCIAL SCIENCE EDUCATION EDITION), 2007 (04): 109-112.

[3] Zheng Ying. SWOT analysis and development strategy selection of regional logistics in Fujian [J]. Journal of Fujian Commercial College, 2008 (01): 17-20.

[4] Tian Xue, Wang Dandan, Wang ruiyue, Ma Yuanyuan. The linkage development of logistics and manufacturing industry in Beijing based on the analysis of grey correlation degree [J]. China storage and transportation, 2018 (05): 122-124.

[5] Ji Guangyue. The relationship between GDP and industrial structure in Guangdong Province and the mathematical model of GDP prediction based on grey relational analysis [J]. Practice and understanding of mathematics, 2013, 43 (15): 198-203.

[6] Jia Lei. Grey correlation analysis on the linkage development of manufacturing and logistics industry in Fujian Province [J]. Journal of Sichuan Institute of Technology (SOCIAL SCIENCE EDITION), 2011, 26 (04): 87-90.