Pacific International Journal, Vol. 6(2), 50-55; 2023
ISSN (Print) 2663-8991, ISSN (Online) 2616-4825
DOI: 10.55014/pij.v6i2.344
https://rclss.com/index.php/pij

Research on the Industrial Transfer from the Yangtze River Delta to Linyi City based on the Industrial Gradient Coefficient

Tian Yanmin[1,2]

[1] School of Business, Linyi University, Linyi, China
[2] Center for International Education, Philippine Christian University, Manila, Philippines.
Email: sdtym@163.com

Abstract: The Yangtze River Delta region, represented by Shanghai, Zhejiang and Jiangsu, has grown as one of the most developed regions in China based on the acceptance of international industrial transfer. However, along with the rising factor costs, increasing environmental pressure and resource constraints, it has become a general trend to upgrade industrial structure, give priority to intensive, high technology and high value-added industries, some labor-intensive and capital-intensive industries is moving to other regions in the country. As the southern gate of Shandong Province, Linyi City is close to the Yangtze River Delta, with a common history, and complementary resources, and is an important hub connecting the north and south economies. It should take full advantage of its location, natural resources and labor resources to actively undertake the industrial transfer of the Yangtze River Delta , participate in the regional economic cooperation and development of the Yangtze River Delta. The difference in the development level between the transferring and taking over places is a prerequisite for industrial transfer, which can be measured by the industrial gradient coefficient, which shows the different levels of industrial gradients to determine the transferring industries in the Yangtze River Delta region; in addition, the relative industrial gradient coefficient is introduced to determine the industries Linyi can take over.

Keywords: industrial transfer; industrial gradient coefficient; the relative industrial gradient coefficient

Introduction

The Yangtze River Delta region, led by Shanghai, Zhejiang and Jiangsu, is one of the strongest and most dynamic regions in China in terms of economic strength and development potential. In 2018, the China International Import Expo proposed to "support the integrated development of the Yangtze River Delta region and elevate it to a national strategy, focusing on implementing the new development concept and building a modern economic system ", which means that the Yangtze River Delta region will be built as a strong growth pole for China's development, and with rising factor costs, increasing environmental pressure and enhanced resource constraints, certain industries in the Yangtze River Delta will move to the periphery.

As the southern gate of Shandong Province, Linyi City has a role in the coordinated economic development between the north and the south, and is the forefront of Shandong Province's integration into the Yangtze River Delta. Regional gradient difference is a prerequisite for industrial transfer. By introducing the industrial gradient coefficient, this report identifies industries with advantages in the development of the Yangtze River Delta, and with the help of the relative industrial gradient coefficient, identifies the main sectors in Linyi to undertake industrial transfer.

Literature Review

Globally, a large number of industrial transfer research have been formed along with the great industrial transfer from the 1950s to the present.

The theory of industrial gradient transfer originates from the theory of industrial life cycle stages, which means that in a regional scope, due to the geographical environment, development conditions, natural resources and historical foundation, social and economic development is always unbalanced between gradients, and there is an objective economic and technological gradient, and there will be a spatial gradient transfer if there is a gradient, and the productivity and production technology will gradually transfer from the developed areas of high gradient to the backward areas of low gradient. This gradient transfer will lead to the common development of the overall economy. Vernon and others believe that individual industrial sectors are in different stages of life cycle, and they go through four stages of innovation, development, maturity and decline in the process of development[1]. Thereafter, the British

[Received 04 April 2023; Accepted 30 April 2023; Published (online) 30 June 2023]

geographer Esthar conducted a historical survey of the development of major industries in the United States from 1947-1967, which proved the above view.

In the 1930s, the Japanese economist Akamatsu was of the opinion that Japanese industrial development went through four stages: import, import substitution, export, and re-import, named because these four stages resembled geese flying with wings on a chart[2]. since the 1980s, some scholars have likened the postwar international division of labor and economic development process in East Asia to the geese model. In the early 1980s, the eastern coast of China began to participate in the international division of labor in East Asia, forming a geese pattern of economic development in East Asia with Japan as the leading goose, presenting a gradient industrial division of labor between technology-intensive and high value-added capital-technology industries and labor-intensive industries.

Along with the rapid economic development of the eastern region, the pressure of industrial restructuring and industrial upgrading, the demand for enterprise growth and market expansion, and the constraints of cost, resources and environment are gradually exposed. The large-scale transfer of certain industrial links from the eastern region to the central and western regions is an inevitable trend in the future, while the central and western regions are fully equipped to undertake the industries transferred from the eastern region (Wu, Xiaojun and Zhao, Haidong, 2004)[3]. According to Wei Houkai (2014)[4], after 2001, the industrial transfer with the migration of enterprises from the eastern coast entered a period of acceleration, and industries in coastal areas such as the Pearl River Delta, Yangtze River Delta, and southern Fujian accelerated their transfer to the central and western regions.

In this paper, with the help of industrial gradient coefficient, we analyze the industrial transfer between two places from the perspective of transferring out and taking over places respectively.
The data used comes from the China Industrial Statistics Yearbook 2020 and the 2020 Statistical Yearbook of jiangsu, Shanghai and Zhejiang, the author removed the mining industry, which relies heavily on geographical resources, and the localized supply of electricity, heat, gas and water production and supply industry.

Description of the Study Area:

Measurement of regional industrial gradient coefficient and identification of industries transferred out of Shanghai, Jiangsu and Zhejiang in the Yangtze River Delta

Measurement of industrial gradient coefficient

The industrial gradient coefficient is an indicator used to describe the industrial development advantage of a region, which indicates the competitive position of a specific industry in the region. The larger the industrial gradient coefficient is, the more advantageous the development of the industry in the region is. It is determined by the market factor measured by location quotient and the innovation factor measured by comparative labor productivity, it can be measured by industrial gradient coefficient, which is expressed as:

$$Iij=Qij*Cij$$

Iij is the industry gradient coefficient of industry j in region i, Qij is the location quotient of industry j in region i, and Cij is the comparative labor productivity of industry j in region i. If I is greater than 1, this industry in the region has a competitive advantage among similar industries in the country; on the contrary, the industry is in a low gradient position and lacks competitive advantage.

Location quotient (Qij) is the proportion of the output value of an industry in a certain place compared with the proportion of the output value of that industry in the country, the size of which depends on factors such as resource efficiency, capital efficiency, the number of specialized equipment and technicians compared with the same industry in the country, reflecting the degree of agglomeration of an industry in a certain place, revealing the comparative advantage of an industry and the level of production specialization. Its calculation formula is

$$Qij = \frac{Eij / Ei}{Ekj / Ek}$$

Eij is the added value of industry j in region i, and Ei is the added value of all industries in region i; Ekj is the added value of industry j in the country, and Ek is the added value of all industries in the country.

Q>1 indicates that the degree of specialization of the industry in a region exceeds that of the nation and is a regional specialized industry, and the industry or its products can be expanded or exported to the outside world; Q<1 indicates that the specialization level of the industry in a region is lower than the national average.

Comparative labor productivity measures the proportion of output per unit of labor in a particular industry in a region to the national average output per unit of labor, reflecting the level of innovation in the region, which depends on the quality of workers in that industry in the region, the level of technological innovation and the ability to convert technology into production, and other factors compared to the national average. The formula is.

$$Cij = \frac{Eij/Lij}{Ej/Lj}$$

Cij is the comparative labor productivity of industry j in region i, Eij is the total output value of industry j in region i, Ej is the total output value of industry j nationwide, Lij is the number of employees in industry j in region i, and Lj is the number of employees in industry j nationwide. If C is less than 1, it means that the labor productivity of the industry is lower than the national average, and vice versa, it means that its labor productivity is higher than the average level of the whole region.

The data comes from the China Industrial Statistics Yearbook 2020 and the 2020 Statistical Yearbook of Suzhou, Shanghai and Zhejiang, the author removed the mining industry, which relies heavily on geographical resources, and the localized supply of electricity, heat, gas and water production and supply, and calculated the industrial gradient coefficients of 31 manufacturing sectors in the relevant localities in 2019 to explore the regional shift of manufacturing industries (Table 1).

Table 1: Location quotient and industrial gradient coefficient in Yangtze River Delta

	Shanghai		Jiangsu		zhejiang	
	Q	I	Q	I	Q	I
Agricultural and food processing industry	0.228	0.234	0.562	0.789	0.308	0.251
Food Manufacturing	1.111	1.343	0.397	0.358	0.437	0.341
Wine, beverage and refined tea manufacturing	0.256	0.285	0.425	0.475	0.509	0.543
Tobacco products industry	2.404	9.466	0.754	1.466	1.308	4.835
Textile industry	0.214	0.302	1.816	2.075	2.853	3.026
Textile and apparel industry	0.584	0.992	1.223	1.129	2.192	2.165
Leather, fur, feathers and their products and footwear industry	0.333	0.583	0.252	0.212	1.445	1.098
Wood processing and wood, bamboo, rattan, palm, grass products industry	0.143	0.141	0.780	0.792	0.828	0.608
Furniture manufacturing	1.132	2.036	0.474	0.408	2.129	1.794
Paper and paper products industry	0.591	0.755	0.998	1.470	1.750	1.933
Printing and recording media reproduction industry	0.857	0.970	0.966	0.889	1.171	0.977
Education, industry, sports and entertainment goods manufacturing	1.308	6.004	0.967	0.921	1.538	1.277
Petroleum, coal and other fuel processing industry	0.738	1.183	0.388	0.599	0.597	1.028
Chemical raw materials and chemical products manufacturing	1.316	2.326	1.410	1.995	1.443	2.166
Pharmaceutical manufacturing	1.055	1.458	1.348	1.784	0.958	0.813
Chemical fiber manufacturing	0.073	0.047	2.908	2.697	5.729	7.378
Rubber and plastic products industry	1.021	1.312	1.210	1.234	1.689	1.590
Non-metallic mineral products industry	0.372	0.593	0.721	0.847	0.952	1.323
Ferrous metal smelting and rolling processing industry	0.618	1.405	1.317	1.861	0.429	0.394
Non-ferrous metal smelting and rolling processing industry	0.271	0.361	0.775	0.906	0.813	0.945
Metal products industry	0.805	0.888	1.458	1.642	1.392	1.028
General equipment manufacturing	2.218	3.432	1.878	1.981	2.042	1.548
Special equipment manufacturing industry	1.253	1.701	1.712	1.775	1.074	0.761

Automobile manufacturing industry	2.610	5.199	0.846	0.689	1.023	0.665
Railroad, ship, aerospace and other transportation equipment manufacturing	1.508	2.079	1.663	1.882	0.786	0.600
Electrical machinery and equipment manufacturing	0.987	1.182	1.849	2.292	1.933	1.643
Computer, communication and other electronic equipment manufacturing	1.245	1.729	1.461	1.291	0.710	0.591
Instrument manufacturing	1.511	2.133	2.078	2.467	2.268	2.177
Other manufacturing industries	0.604	0.635	0.569	0.627	1.728	1.294
Comprehensive utilization of waste resources industry	0.261	0.161	0.485	0.357	0.989	0.913
Metal products, machinery and equipment repair industry	5.044	6.121	0.132	0.106	0.829	0.504

Sources： author's calculation and collation

Analysis and Conclusions on table 1

According to Table 1, 17 industries in Shanghai have industry gradient coefficients higher than 1, which means Shanghai has industrial advantages in these industries, including tobacco products industry, metal products, machinery and equipment repair industry, cultural, educational, industrial, aesthetic, sports and entertainment goods manufacturing industry, automobile manufacturing industry, general equipment manufacturing industry, chemical raw materials and chemical products manufacturing industry, instrumentation manufacturing industry, and railroad, ship, aerospace and other transportation equipment manufacturing industry. The coefficients are all greater than 2, with obvious industrial advantages, including the I value of tobacco products industry reaching 9.466.

Jiangsu has a total of 16 industries with industrial gradient coefficients greater than 1, pharmaceutical manufacturing, chemical fiber manufacturing, railroad, ship, aerospace and other transportation equipment manufacturing, computer, communications and other electronic equipment manufacturing, instrumentation manufacturing and other five high-tech industry gradient coefficients are higher than average, instrumentation manufacturing, electrical machinery and equipment manufacturing, chemical fiber manufacturing, textile industry I value exceeds 2, the competitive advantage is obvious.

Zhejiang has a total of 17 industries with gradient coefficients greater than 1, among which the collective advantage of labor-intensive industries is more significant, including tobacco products industry, textile industry, textile and clothing industry, leather, fur, feather and its products and footwear industry, furniture manufacturing, paper and paper products industry, education, industry, sports and entertainment products manufacturing, rubber and plastic products industry and other 8 industries with gradient coefficients higher than 1. Especially the chemical fiber I value of the manufacturing industry reached 7.378, the development advantage is greater. Next is the capital-intensive industry, there are four industrial sectors with industrial gradient coefficients greater than 1.

From the perspective of industrial factor intensity, both Shanghai and Jiangsu advantageous industries are labor-intensive and capital-intensive and technology-intensive industries, while Zhejiang advantageous industries are mainly capital-intensive and labor-intensive.

It is particularly important to note that Shanghai, Jiangsu and Zhejiang generally have higher relative labor productivity, and most industries have higher relative labor productivity forces than the national average, especially Shanghai, where 28 of the 31 industrial sectors included in the survey have comparative labor productivity higher than 1, showing the higher quality of employed workers and technological innovation in the region

Selection of industries to be transferred in Linyi City

Based on the industrial gradient coefficients of the relevant cities, the RI Index (relative industrial gradient coefficient [2]) of the two provinces and cities in the Yangtze River Delta relative to Linyi can be further calculated, see Table 2. Obviously, most of the industries in the two provinces and cities in the Yangtze River Delta have relative industrial gradient coefficients greater than 1 relative to Linyi, forming a certain industrial gradient with Linyi, which is a prerequisite for industrial transfer.

However, the ability to undertake these industries also depends on whether Linyi has the advantage of undertaking them. When the industrial gradient coefficient of the industry in the undertaking place (Linyi) is greater than 1, and the relative industrial gradient coefficient of the industry in the transferring place is also greater than 1, it means that the industry in the transferring place has the tendency to transfer, and the undertaking place has the advantage in undertaking the transfer of the industry, and the industry is most likely to be transferred between the two regions.

[2] Relative Industry Gradient Coefficient refers to the ratio of the industry gradient coefficients of two regions, reflecting the relative gap between the development of an industry in two regions.

	$RI_{shanghai/Linyi}$	$RI_{Jiangsu/Linyi}$	$RI_{Zhejiang/Linyi}$	Q_{Linyi}	C_{Linyi}	I_{Linyi}
Agricultural and food processing industry	0.080	0.268	0.085	3.556	0.827	2.940
Food Manufacturing	5.737	1.531	1.457	0.591	0.396	0.234
Wine, beverage and refined tea manufacturing	2.002	3.339	3.818	0.355	0.401	0.142
Tobacco products industry	6690.368	1036.135	3416.961	0.016	0.087	0.001
Textile industry	0.350	2.409	3.514	0.832	1.035	0.861
Textile and apparel industry	9.867	11.235	21.540	0.214	0.469	0.101
Leather, fur, feathers and their products and footwear industry	3.133	1.139	5.902	0.305	0.611	0.186
Wood processing and wood, bamboo, rattan, palm, grass products industry	0.009	0.053	0.040	14.336	1.052	15.074
Furniture manufacturing	2.810	0.563	2.475	1.002	0.723	0.725
Paper and paper products industry	0.643	1.252	1.646	1.262	0.930	1.174
Printing and recording media reproduction industry	4.161	3.813	4.190	0.344	0.678	0.233
Education, industry, sports and entertainment goods manufacturing	8.949	1.373	1.903	0.805	0.834	0.671
Petroleum, coal and other fuel processing industry	4.553	2.304	3.956	0.478	0.543	0.260
Chemical raw materials and chemical products manufacturing	1.354	1.161	1.261	1.633	1.052	1.718
Pharmaceutical manufacturing	0.647	0.791	0.360	2.162	1.043	2.255
Chemical fiber manufacturing	19.911	1143.495	3127.845	0.191	0.012	0.002
Rubber and plastic products industry	0.898	0.845	1.088	1.445	1.012	1.461
Non-metallic mineral products industry	0.218	0.311	0.486	1.058	2.574	2.724
Ferrous metal smelting and rolling processing industry	1.220	1.616	0.342	1.466	0.786	1.152
Non-ferrous metal smelting and rolling processing industry	1.062	2.663	2.776	0.615	0.553	0.340
Metal products industry	0.473	0.874	0.548	1.281	1.466	1.877
General equipment manufacturing	1.736	1.002	0.783	1.517	1.303	1.977
Special equipment manufacturing industry	5.173	5.398	2.313	0.462	0.712	0.329
Automobile manufacturing industry	116.816	15.472	14.938	0.147	0.302	0.045
Railroad, ship, aerospace and other transportation equipment manufacturing	19.992	18.092	5.765	0.136	0.766	0.104
Electrical machinery and equipment manufacturing	12.913	25.041	17.957	0.138	0.662	0.092
Computer, communication and other electronic equipment manufacturing	342.567	255.746	117.030	0.022	0.233	0.005
Instrument manufacturing	9.821	11.360	10.023	0.334	0.651	0.217
Other manufacturing industries	20.201	19.945	41.180	0.028	1.106	0.031
Comprehensive utilization of waste resources industry	0.934	2.076	5.306	0.313	0.549	0.172
Metal products, machinery and equipment repair industry	——	——	——	0.000	0.000	——

Table 2: Relative industrial gradient coefficients of Shanghai, Suzhou and Zhejiang to Linyi and Linyi's location quotient, relative productivity and industrial gradient coefficient

Combined with Table 2, the types of industries undertaken by Linyi City include chemical raw materials and chemical products manufacturing, ferrous metal smelting and rolling processing industry, and general equipment manufacturing; the types of industries undertaken by Linyi City in Jiangsu include paper and paper products industry, chemical raw materials and chemical products manufacturing, ferrous metal smelting and rolling processing industry, and general equipment manufacturing; the types of industries undertaken by Linyi City in Zhejiang include paper and paper products industry, chemical raw materials and chemical products manufacturing, and ferrous metal smelting and rolling processing industry. The types of industries undertaken by Linyi City include paper and paper products industry, chemical raw materials and chemical products manufacturing industry, rubber and plastic products.

Results and Discussions

To study the problem of transferring the advantageous industries to the less developed regions, we should first identify the advantageous industries in the transferring regions with the help of industrial gradient coefficients, and then judge whether there is an industrial gradient level in the industrial development of the transferring and the transferring regions with the help of relative industrial gradient coefficients, and then judge the transferring industries in the two regions, furthermore, only when the undertaking place has the ability to undertake , the industrial transfer would happen. That is, When the industrial gradient coefficient of the undertaking place is greater than 1, and the relative industrial gradient coefficient of the industry in the transferring place is also greater than 1, it means that the industry in the transferring place has the tendency to transfer, and the undertaking place has the advantage in undertaking the transfer of the industry, and the industry is most likely to be transferred between the two regions.

Since the industrial revolution, all the industrial transfer experiences have objectively confirmed that the late-developing regions can achieve rapid economic development by undertaking industrial transfer. It is noteworthy that each industrial transfer has flowed to areas with comparative advantages in the late-developing regions and formed new economic growth poles with these areas as the center, thus driving the rapid development of the regional economy. There are conditions for the successful implementation of industrial gradient transfer strategy, and the key lies in undertaking suitable industrial transfer and seamlessly connecting with local supply chain to achieve resource sharing and complementary advantages, thus promoting the optimization and upgrading of regional industrial structure. In order to enhance the attractiveness of incoming industries, Linyi should proactively cultivate its dynamic competitive advantages.

REFERENCES

[1] Vernon, R. (1992). International investment and international trade in the product cycle. *In International economic policies and their theoretical foundations. Academic Press*, 415-435

[2] Akamatsu, K. (1962). A historical pattern of economic growth in developing countries. *The developing economies*, 3-25.

[3] Wu, A., Li, G., Sun, T., & Liang, Y. (2014). Effects of industrial relocation on Chinese regional economic growth disparities: Based on system dynamics modeling, *Chinese Geographical Science*, 24, 706-716.

[4] Zhang, X. T., Liu, Y., & Yang, C.. (2019). Location choice of China's labor-intensive industries to transfer to countries along the "Belt and Road" - Based on the perspective of industrial undertaking capacity and factor constraints. *Journal of Social Sciences, Jilin University*, 1.

[5] Zhou W. (2018). Research on the effect of industrial transfer between Beijing, Tianjin and Hebei based on the perspective of technology spillover, industrial agglomeration and industrial upgrading in Hebei. *Hebei Journal*, 38(6), 172-179.

[6] Dale, H., & Miao, Changhong. (2019). *P*rogress of research on the influencing factors and effects of receiving industrial transfer. *Geoscience,* 39(3), 359-366.

[7] Houkai, W. (2014). Regional economic development in China: Agglomeration and relocation. *In The Micro-Analysis of Regional Economy in China: A Perspective of Firm Relocation*, 1-27.

[8] Zhang, J. W., Zhao, J. J., Xiao, W. J., Miao, C. H., Jiang, H. N., & Liu, L.. (2019). Spatial econometric analysis of industrial transfer undertaken by Yu, Anhui and Xiangan. *Geoscience*, 39(1), 140-146.

[9] Chen, Lisha. (2015). Industrial Gradient Transfer, Location Choice and Dynamic Competitive Advantages Cultivation, *Jiangxi Social Science*, (4), 74-78.

[10] Liu, Youjin, & Lv, Zheng. (2012). Gradient trap, upgrading stagnation and innovation of taking over industrial transfer mode. *Economic Dynamics*, 11, 21-27.