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Industrial Structure Optimization of the Pearl River-Xijiang River Economic Belt under the Strategy of Guangdong-Hong Kong-Macao Greater Bay Area

Guifang He[1], Yongyong Tao[2]*

1. Department of Academic Administration, Zhaoqing Medical College, Zhaoqing 526040, Guangdong Province, China.
2. Department of Xijiang Economic Research Institute, Guangdong University of Finance, Guangzhou 510521, Guangdong Province, China.

Abstract: In order to promote industrial structure optimization of the Pearl River-Xijiang River Economic Belt (PR-XREB), the stage, direction and rate of the industrial transformation and upgrading of the PR-XREB from 2010 to 2019 were analyzed. The results showed that the PR-XREB was in the mid-prophase stage of industrialization, the transformation and upgrading of industrial structure was in a slow state. Both of the primary and secondary industry lags behind and the later even more serious. There was unbalance development among the PR-XREB. However, the upgrading rate of industrial structure in Guangdong 4 cities is obviously faster than that of 7 cities in Guangxi, and this economic development imbalance have a worse trend.

Keywords*:* The Pearl River-Xijiang River Economic Belt; Industrial Transformation and Upgrading; Optimization of Industrial Structure

Introduction

The Pearl River-Xijiang River Economic Belt (PR-XREB), which is the strategic hinterland of the economic transformation and development of the Pearl River Delta, it not only provides a channel for connecting the southwest region to the international market, but also a frontier for open cooperation between Hong Kong, Macao and ASEAN.

In order to promote the PR-XREB development, in July 2014, the Central Committee of the Communist party of China (CPC) central committee and the state council issued the PR-XREB development plan, which officially stipulate PR-XREB as a national development strategy. In February 2019, the CPC and the state council issued the development plan for the Guangdong-Hong Kong-Macao Greater Bay Area (GBA), which clearly states that the PR-XREB is the hinterland of the construction of the GBA[1]. As the GBA was positioned as the world-class city group and the international science and technology center, it is a great opportunity for PR-XREB to deepen the industrial structure transformation and upgrading to promote its rapid economic development, while whether the industrial structure transformation and upgrading in PR-XREB appropriate or not will in turn effect the overall situation of national opening reform and regional coordinated development.

To further optimize the economic structure of the PR-XREB, in-depth knowledge of the current status of industrial transformation and upgrading is necessary. Scholars at home and abroad have done many researches on the evaluation of the industrial transformation and upgrading. Kuznets and Cardo (1973) proposed that the rate of industrial transformation and upgrading could be measured by labor transfer between the three major industries[2]. Liu Wei et al. (2008) used the industrial proportion relationship and the productivity of labor productivity to measure the height of China's industrial structure[3]. Tan Rongjing et al. (2012) used the industrial structure Leading Coefficient to measure the rate of industrial transformation and

upgrading in 16 cities in the Changjiang river delta region[4]. Tang Huiliang and Zhang Chunling (2018) used the More value, average annual change of industrial structure and Lilien index to measure the direction and rate of industrial transformation in Jiangxi Province[5]. In this study, we attempt to analyze the stage, direction and rate of industrial transformation and upgrading of the 11 cities in the PR-XREB, which would provide theory support for improving the industrial transformation and upgrading of the PR-XREB.

1. Methodology

1.1 Source of data

The data used in this study are derived from the 2011-2020 Statistical Yearbook of Guangzhou, Foshan, Zhaoqing, Yunfu, Nanning, Liuzhou, Wuzhou, Guigang, Baixian, Laibin, Chongzuo 11 City and the 2010-2019 statistical bulletin on national economic and social development.

2. Industrial transformation and upgrading status measurement

2.1 Calculate the stage of the industrial transformation and upgrading

We used the method reported by Fengge Wang to measure the stage of industrial structure transformation and upgrading [6], which the calculation formula is as following:

$$T = \sum_{i=1}^{3} (y_i \times i) = y_1 \times 1 + y_2 \times 2 + y_3 \times 3$$

Among them, yi represents the proportion of revenue in the i industry. T represents the stage of industrial structure transformation and upgrading, its value ranges from 1 to 3. If T value close to 1, indicating that the city is under a lower level of industrial structure. If T value close to 3, the degree of industrial structure transformation and upgrading high, the economy and society are in a post-industrialized information economy.

2.2 Calculate the direction of the industrial transformation and upgrading

The change of leading industry represents the direction of industrial structure transformation and upgrading, it can be measured by the Leading Coefficient, which can reflect the trend and degree of regional industrial structure evolution. The formula of the Leading Coefficient is as following:

$$E_i = a_i + (a_i - 1) / V_t$$

Among them, E_i represents the Leading coefficient of the i industry. Alphai represents the ratio of the share of industry i to the share of the base period, and Vt represents the average growth rate of the economic system over the same period, and calculates as following:

$$V_t = (\ln(GDP_1) - \ln(GDP_0)) / n$$

Among them, ln is the natural ignimeter symbol, n is the number of years of the time period, GDP_1 refers to the present value of the reporting period, GDP_0 is the present value of the base period.

2.3 Calculate the rate of the industrial structure transformation and upgrading

The rate of industrial structure transformation and upgrading can be measured by the increase of labor productivity. Kuznets and Kaldor believe that the rate of industrial transformation and upgrading can be measured by the transfer of labour between industries, usually calculate by using the Lilien index model, the formula is as following:

$$W_t = \{[\sum_{i=1}^{n} \frac{EMP_{it}}{TEMP_{it}} (\Delta \log EMP_{it} - \Delta \log TMEP_{it})^2]^{1/2}\}$$

Among them, Wt for the Lilien index, the larger the value, indicating that the t-time industry has a faster rate of transformation and upgrading. i represents for one of the three major industries, t represents different time periods, EMPit represents for the t-year i industry employment, TEMPit represents for the total number of employment during t-year.

3. Results

3.1 The PR-XREB is in the mid-prophase stage of industrialization

The T value of 11 cities in PR-XREB from 2010 to 2019 were between 2 and 3 with a small annual growth rate (**Figure 1A**), indicating that the PR-XREB have been committed to industry upgrading and transformation, nevertheless, the PR-XREB is currently in the mid-prophase stage of industrialization. The T value of Guangdong was close to 2.5, indicating that Guangdong was in the early stage of industrialization, and its industrialization level was high. The industry transformation and upgrading stage can reflect economic development level, among those cities in Guangdong, the T value in Guangzhou was close to 3, which was in the late stage of industrialization, industrial structure was transform form the industry-oriented to service-oriented. While in Guangxi, the T value of was close to 2.2, suggesting that Guangxi was in the pre-industrialization stage, the degree of its industrialization was in a low level (**Figure 1B**). Those result reflected that there was unbalance of industrial structure between Guangdong and Guangxi. However, there was a trend that the industry upgrading speed in Guangxi was faster than that in Guangdong during the later period, suggesting that this unbalance industrial structure among PR-XREB might improve in the future.

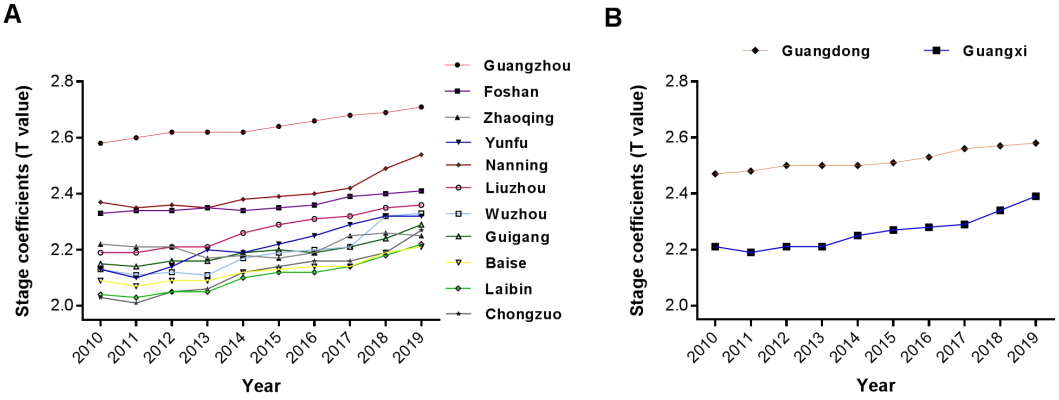

Figure 1. The industrial structure transformation and upgrading stage of the PR-XREB, 2010-2019 (**A**) The industrial structure transformation and upgrading stage in Guangdong (4 cities) and Guangxi (7 cities). (**B**) The industrial structure transformation and upgrading stage of 11 cities in the PR-XREB.

3.2 The development of primary and secondary industry lags behind while the tertiary industry more advance

The Leading Coefficient of three industrial in the PR-XREB (2010-2019) were calculated and showed in the **Table 2**. The Leading Coefficient of primary industry and secondary industry in all PR-XREB cities except Ganzhou, Baixian, Laibin, all less than 1, while the Leading Coefficient of tertiary industry was greater than 1, indicating that the development of primary and secondary industry in PR-XREB lags behind; but the development of the tertiary industry was faster and more advance. Though the Leading Coefficient of secondary industry in Guangxi lags behind compare to Guangdong. However, a higher Leading Coefficient of the tertiary industry was seen in Guangxi, indicating that the service industry is developing more faster in Guangxi, which is probably due to the implementation of the Beibu Bay Special Economic Zone and the China (Guangxi) Free Trade Pilot Zone in Guangxi that promote economic development in these years.

Table 2 The industrial structure transformation and upgrading direction (Leading Coefficient) of 11 cities in the PR-XREB

Area/City	Leading Coefficient (E_i value)								
	T_1=2010-2014			T_2=2015-2019			T_{all}=2010-2019		
	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
Guangdong	**-0.57**	**0.56**	**1.51**	**0.47**	**-1.30**	**2.86**	**-1.53**	**-1.80**	**3.74**
Guangzhou	-3.44	-0.24	1.91	-0.44	-1.68	2.41	-4.66	-3.32	3.90
Foshan	-0.68	0.99	1.10	-0.10	-0.31	3.23	-2.46	-0.93	4.66
Zhaoqing	-1.14	4.19	-1.49	4.51	-4.52	8.30	0.46	0.31	1.99
Yunfu	-1.55	1.98	1.54	1.91	-3.66	5.46	-1.80	-2.35	6.57
Guangxi	**-0.23**	**0.95**	**1.59**	**1.43**	**-3.73**	**6.38**	**-0.49**	**-2.62**	**6.56**
Nanning	-1.10	2.21	0.70	1.53	-5.33	5.91	-1.33	-3.91	5.17
Liuzhou	-0.67	0.10	3.56	0.76	-0.72	3.74	-1.01	-2.16	8.86
Wuzhou	-1.44	1.40	1.37	-19.42	19.78	6.74	6.91	-12.34	26.80
Guigang	1.26	-0.97	3.45	-0.73	-0.08	2.98	-0.92	-1.78	5.76
Baise	0.24	0.68	2.17	3.19	-2.84	6.33	1.96	-2.94	8.34
Laibin	1.03	-3.20	8.00	1.66	-6.51	8.62	2.30	-11.95	21.54
Chongzuo	-2.47	2.90	1.89	0.45	-10.49	13.80	-4.10	-4.64	12.11

3.3 The rate of industrial transformation and upgrading was imbalanced among the PR-XREB

The Lilien index of the area/cities in PR-XREB were calculated and showed in the **Figure 3**, it was varied in difference area and periods. Comparing to the T_1 period, the industrial upgrading rate of Guangzhou, Chongzuo and Yunfu had been greatly improved during the T_2 period, while Wuzhou and Liuzhou has slowed down a little bit during this period. Overall, the rate of industrial transformation and upgrading in Guangxi was slight faster than that in Guangdong, as the industrial upgrading rate in Chongzuo and Wuzhou were significantly faster compared to other cities. The rate of industrial upgrading in Guangdong 4 cities during the T_2 period is faster than that during the T_1 period, this was not the same in the Guangxi 7 cities, as both the highest rate cities (Chongzuo and Wuzhou) and the lowest rate cities (Nanning and Laibin) were in Guangxi, and the rate between the T_1 period and T_2 period is also significant difference in those cities of Guangxi, those result suggest that the industrial upgrading was imbalanced between Guangdong and Guangxi, the industrial upgrading rate in difference periods was not equilibrium in Guangxi.

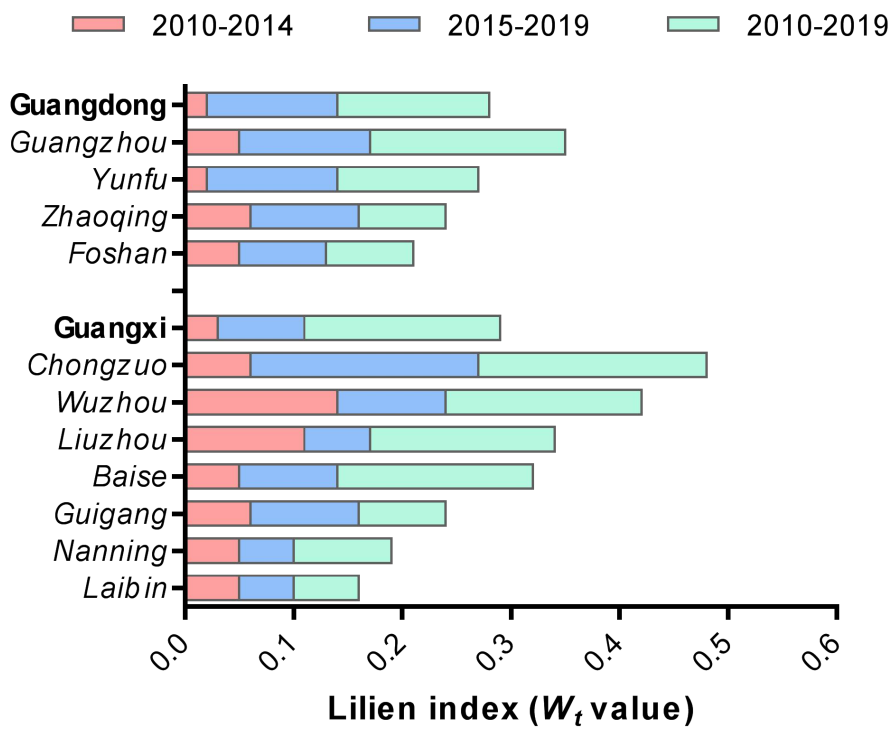

Figure 3. The rate of the industrial transformation and upgrading (Lilien Index) of 11 cities in the PR-XREB

Conclusion

In this study, we measured the stage, direction and rate of industrial structure transformation and upgrading of 11 cities in the PR-XREB from 2010 to 2019. In this period, the PR-XREB is in the mid-prophase of industrialization, the industrial structure is in the process of slow upgrading. During this process, the tertiary industry has achieved rapid development, but the first and second industries lag behind. As the first and second industries are the foundation that contribute the tertiary industry development, the lagging development of the first and second industries will therefore weaken momentum of the industry transformation and upgrading in the PR-XREB.

The Leading Coefficient of the primary industry in Zhaoqing, Yunfu, Nanning, Liuzhou, Guigang, Chongzuo is less than 1. In 2019, the proportion of resident rural population in above cities is 51.4%, 57.1%, 48.3%, 30%, 49%, 60%, respectively, indicating that most cities in PR-XREB still take agriculture as the foundation. Although the primary industry is not the main driving force of economic growth, however, the primary industry in those cities lags behind, the backwardness of primary industry will restrict the industrial structure transformation and upgrading and therefore weaken the contribution of primary industry to industrial transformation and upgrading.

The Leading coefficient of the secondary industry in PR-XREB all less than 1, particularly in Guangxi area, indicating that the development of the secondary industry lags behind. For the developed cities like Guangzhou and Foshan, the lag of the secondary industry means that the industry has hollowed out, as a result, the productive service industry will lose its support, which will restrict the development of modern service industry, while for those underdeveloped cities, industrialization is the core of industrial transformation and upgrading, the development of the secondary industry lags behind will weakens the impetus for the transformation and upgrading of industrial structure.

Compare to T_1 period, the growth rate of industrial transformation and upgrading in Guangdong 4 cities increase more than 1.6 times during the T_2 period, while in Guangxi, Nanning and Laibin have no change, Liuzhou and Wuzhou had a large decline, only Guigang, Baise, Chongzuo appeared a certain increase, indicating the industrial transformation and upgrading in Guangdong are more fast than that in Guangxi, and the economic development imbalance between the Guangdong and

Guangxi has an aggravating trend, this will seriously affect the overall level of economic belt industrial transformation and upgrading.

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