Advances in Social Science, Education and Humanities Research, volume 176

2nd International Conference on Management, Education and Social Science (ICMESS 2018)

Research on Industrial Superiority of China's Central Cities

-Take 35 Large Cities in China as an Example

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***Abstract*—The industry is the backbone of the city. Based on the industrial data of 35 central cities in China from 2005 to 2014, this paper studies the dominant industries of China's central cities by means of regional entropy analysis, and combines their industrial structures to provide guidance for the transformation of the central city into a global technology innovation center. In accordance with the experience of innovative cities in the United States, the conclusions are summed up as following: (1) Industries such as accommodation and catering services, transportation, storage and post services, finance intermediation, wholesale and retail trade, and other service industries in China's central cities have significant comparative advantages over other cities; (2) While China's central cities are vigorously developing the financial industry, accommodation and catering services, and other advantageous industries, they should also appropriately increase technological innovation in the industry sector; (3) Cities such as Beijing, Shanghai, Guangzhou and Shenzhen should maintain the advantages of finance intermediation, information transmitting, software and information technology services and other service industries, and draw on the experience of the United States in constructing innovative cities to build global technology innovation centers.**

Keywords—Central City; Industrial Structure; Location Entropy

I. INTRODUCTION

The central city is the product of a certain period of socio-economic development, and is the growth center of the regional economy; and the global science and technology innovation center is a new form of the city. It is an inevitable choice for economic globalization, knowledge economy, technological change, and transformation of urban functions. It plays a key role in the production and lifestyle changes. In general, the global science and technology innovation center comes from the central city, but not all central cities can become global technological innovation centers. Therefore, researching the characteristics of the industrial structure of the central city is a necessary proposition for China's economic transformation, and it can provide guidance for the transformation of the central city into a global technological innovation center. According to the National Urban System Planning (2016-2030), Beijing, Guangzhou, Shanghai, and Shenzhen are planned to be recognized as global cities, and Tianjin, Chongqing, Shenyang, Nanjing, Wuhan, Chengdu, Xi'an, Hangzhou, Qingdao, Zhengzhou, and Xiamen will be added. These 11 cities are identified as national central cities. These cities are generally the gathering place of the political and economic elements of the country. They have the function of leading, radiating and distributing in the overall urban competition of the country, but there is still a certain gap with the global science and technology innovation center.

In addition, according to the top 100 innovative cities in the 2thinknow's "Innovation CitiesTM Index 2015", there are 26 in the United States, and only 5 in China (including Hong Kong, Macau and Taiwan). Therefore, it is of great significance to study the characteristics of the industrial structure of the central cities of our country, and to explore the conditions for the construction of global science and technology innovation centers in China's central cities based on the experience of the development of innovative cities in the United States. Based on the above, this paper will focus on the following issues: 1) Connotation of central cities and global science and technology innovation cities (2) Advantage industries and industrial structure characteristics of China's central cities (3) References of research on innovative cities in the United States to China's central cities.

The central city and the global science and technology innovation center are two completely different concepts. The research on the central city originated earlier, and the research on the global science and technology innovation center belongs to a completely new field. Related research and discussion have also emerged in recent years.

Western countries do not have a reference to a central city. Similar concepts include “world cities” such as Chicago, San Francisco, and Los Angeles in the United States; Tokyo, Osaka, and Nagoya in Japan; and megalopolises such as Frankfurt and Munich in Germany. The function and role. The originator of this concept was Gothe at the end of the 18th century. He pointed out that Rome and Paris can be called as the world cities. Patrick Geddes (1915) explicitly proposed the concept of the world city. Petter Hall (1966) quoted this view, and in The World Cities conducted seven world cities on politics, trade, finance, culture, technology, and education. Specific study. [1] In the 1980s, Friedmann [2] and Sassen [3] established a theoretical framework for world urban studies and guided this field to become a hot topic of international research. It was during this period that my country proposed to come to a

"central city" concept. The advancement of urbanization in China in the 1990s also promoted the development of this research field and re-established the concepts and standards of the central city. Ma Hong (1986) [4] and Ma Ye (1986) [5] proposed that economic management system reform should be carried out in a timely manner to give full play to the functions of the central city. Ning Yuemin (1991) [6] pointed out that the most important function of the world's cities is the international financial center, and the status of the manufacturing industry is declining day by day. At the same time, she pointed out that the reform of the urban economic system, the degree of labor division of the industry, and the weakening of the technical advantages of the central city. It will affect the development of the central city. Wang Zhuqin (2004) [7] believes that the central city has a strong attraction and radiation function and can drive the development of surrounding cities. Therefore, it is necessary to make full use of the location advantage of the central city.

The research of the Global Technology Innovation Center started late. Du Debin (2015) [8] proposed that the most important factor in the growth and development of the global science and technology innovation center is location, and pointed out that the global science and technology innovation center has a spatially shifted trend in the Asia Pacific region, and China, as the world's second largest economy, is The country that has the most nuanced global technology innovation center.

II. SAMPLE CITIES

In order to study the characteristics of the industrial structure of the central city, the sample cities are selected based on the National Urban System Planning (2016-2030) and 2017 China City Innovation Rankings. The National Urban System Plan (2016-2030) plans to recognize Beijing, Guangzhou, Shanghai, and Shenzhen as global cities; Tianjin, Chongqing, Shenyang, Nanjing, Wuhan, Chengdu, Xi'an, Hangzhou, Qingdao, Zhengzhou, and Xiamen as the national central cities. . The "2017 China's Urban Innovation Rankings" is the latest ranking of urban innovation. The ranking adopts four dimensions, including the hot money index, the Unicorn index, the rental index, and the partner index, resulting in the final innovation of Chinese cities. The force rankings were: 19 cities in Beijing, Shenzhen, Shanghai, Guangzhou, Hangzhou, Tianjin, Chengdu, Wuhan, Suzhou, Chongqing, Nanjing, Xi'an, Changsha, Qingdao, Ningbo, Wuxi, Xiamen, Dalian, and Shenyang. In addition, in order to expand the capacity of the sample cities and comprehensively obtain the availability of city statistical yearbooks, Shijiazhuang, Hohhot, Changchun, Xuzhou, Nantong, Lianyungang, Wenzhou, Hefei, Fuzhou and Jinan were added according to the ranking of other central cities' comprehensive development of the tertiary industry. The 16 cities of Zhengzhou, Luoyang, Zhuhai, Nanning, Sanya, and Urumqi. In summary, 35 innovative cities were finally selected as sample cities. The selected sample cities are roughly distributed along the eastern coastline, including the four old industrial bases, which are concentrated in the Beijing-Tianjin-Hebei, Yangtze River Delta, and Pearl River Delta regions.

III. RESEARCH METHODS AND DATA PROCESSING

A. Research Methods-- Location Entropy

Location entropy is an index that reflects the degree of specialization of a certain industrial sector and is used to measure the spatial distribution of elements in an area. In terms of industrial structure research, location entropy indicators can be used to analyze the status of leading specialized industries in a certain area. Experience shows that when the location entropy of an industry in a region is greater than 1, the industry in that region has a comparative advantage in the country; when the location entropy is less than 1, it is considered that the industry in the region has a disadvantage in the country. Location entropy can be simplified to the following formula:

$$LQ_{\mathrm{ik}} = \frac{q_{ik} / q_i}{q_k / q}$$

Among them, i represents the industry, k represents the industry. Shows the location entropy of the i-city k industry in the country; the output value of the i-city k industry; the output value of all the industries in the i-city; the output value of the k-industrial industry in the country; and the GDP of all industries in China.

B. Sources of data

According to "National Economic and Trade Industry Classification" (GB/T4754-2002),

- Primary industry refers to farming, forestry, animal husbandry and fishery
- Secondary industry refers to mining, manufacturing, production and distribution of electricity, gas and water, construction
- Tertiary industry refers to transport storage and post, information transmission, computer services and software, wholesale and retail trade, hotel and restaurants, financial intermediation, real estate, leasing and business services, scientific research, technical services and geologic prospecting, management of water conservancy, environment and public facilities, services to households and other services, health social securities, and social welfare, culture, sports and entertainment and public management and social organization

This article selects the value-added by industry as a measure. However, the value-added of the sub-industries in cities needs to be found in the statistical yearbooks of each city, and there is a slight difference in the statistical caliber of each city. Therefore, the availability of comprehensive data has selected nine indicators as research objects, followed by transport storage and post, information transmission, computer services and software, wholesale and retail trade, hotel and restaurants, financial intermediation, real estate, and other services. Thus, this article selects the value-added by above nine industry as a measure, and the value-added data of the sample cities is mainly derived from the city statistical yearbooks for cities from 2006 to 2015. The national-level

value-added data comes from the China statistical yearbook (2006 to 2015). The figures involved in the paper are based on the above data. It should be noted that in the Statistical Yearbook of Cities, if the statistical yearbook of 2014 contains data of previous years, the latest statistical yearbook will be the main one.

IV. Empirical Analysis

A. *Industrial Structure Analysis*

In order to understand the characteristics of the industrial structure of the sample cities, the output values of the sample cities are summed to obtain the ratio of the three industrial output values to the regional GDP and the proportion of the sample urban areas to the total GDP of China. The industrial structure is analyzed and the results are shown in the figure.

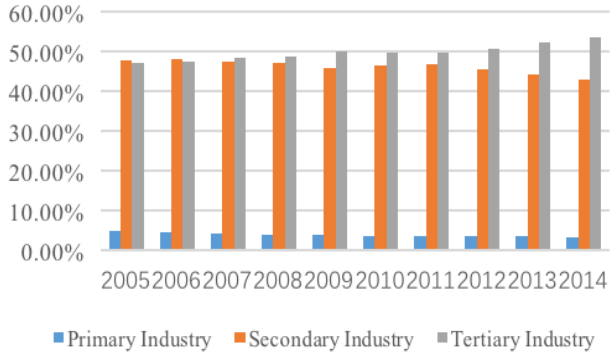

Fig. 1. Industrial structures of sample cities from 2005 to 2014

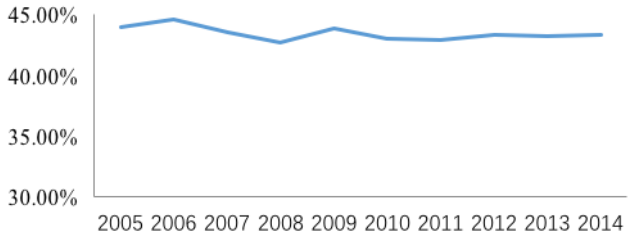

Fig. 2. The proportion of the GDP of the sample cities in the total GDP of China in 2005-2014hree industrial structures of sample cities from 2005 to 2014

As can be seen from Figure 1, the overall industrial structure of the sample cities is close to the "three-one to one" structure. Among them, from 2005 to 2008, the contribution rate of the secondary industry and the tertiary industry in the industrial structure of the sample cities is comparable; after 2008, the proportion of the tertiary industry exceeds the proportion of the secondary industry, and gradually reaches more than 50% of the contribution rate. . It can be seen that the development level of the tertiary industry in the selected 35 large sample cities is getting higher and higher. Figure 2 shows that the sample cities have made great contributions to China's economic development. In the ten years, the sum of the GDP of the sample cities in the total GDP of China remained at the level of 43%. Except that there was a downward trend in 2008, the overall trend was relatively stable. For China, which has 664 cities, the GDP of these 35 sample cities accounts for a high proportion of GDP and a large contribution to the economy. Sample cities are undoubtedly the boosters of China's economic growth.

B. *Location entropy analysis*

According to the year-by-year calculation of the industry location entropy matrix for sample cities, it is not difficult to find that the regional entropy values in the industry location entropy matrix have not changed much from 2005 to 2014. Therefore, the location entropy matrix in 2014 is used as an example to analyze as table 1.

TABLE I. LOCATION ENTROPY MATRIX OF INDUSTRIES IN SAMPLE CITIES IN 2014

	A	I	C	W	T	S	F	R	O
Bejing	0.08	0.48	0.61	1.17	1.00	0.98	2.17	1.06	2.07
Tianjin	0.14	1.24	0.63	1.28	1.04	0.85	1.25	0.59	1.00
Shijiazhuang	1.04	1.15	0.74	0.95	1.89	0.90	0.82	0.73	0.76
Huhehaote	0.46	0.63	0.90	1.22	2.80	5.19	1.34	0.74	1.04
Shenyang	0.51	1.23	0.78	0.92	1.03	1.53	0.86	0.73	1.01
Dalian	0.62	1.15	0.34	1.15	1.39	0.47	1.03	0.87	1.05
Changchun	0.68	1.25	1.10	0.99	1.10	1.06	0.52	0.38	1.00
Shanghai	0.06	0.86	0.51	1.60	1.00	0.88	1.99	1.10	1.22
Nanjing	0.27	0.97	0.82	1.13	0.77	1.02	1.53	1.13	1.23
Wuxi	0.20	1.26	0.61	1.72	0.55	1.44	0.81	0.79	0.88
Suzhou	0.18	1.27	0.56	1.47	0.72	1.56	1.02	1.05	0.79
Xuzhou	1.06	1.04	1.05	1.44	1.80	1.06	0.58	0.61	0.73
Nantong	0.70	1.12	1.29	1.13	0.84	1.21	0.78	1.10	0.80
Lianyungang	1.51	0.99	1.34	0.97	1.08	0.73	0.57	0.98	0.83
Hangzhou	0.32	1.02	0.67	0.88	0.68	0.94	1.32	1.03	1.44
Ningbo	0.39	1.28	0.85	1.21	1.02	0.86	0.80	0.85	0.84
Wenzhou	0.29	1.09	1.08	1.43	0.78	2.23	0.60	1.09	0.98
Hefei	0.53	1.21	1.60	0.78	0.87	0.75	0.83	0.90	0.86
Fuzhou	0.86	0.97	1.50	0.99	1.00	0.87	1.08	0.80	0.99
Xiamen	0.08	1.05	0.99	1.11	1.52	1.38	1.30	1.49	0.88
Jinan	0.55	0.87	1.10	1.24	1.43	1.81	1.30	1.08	1.00
Qingdao	0.45	1.09	0.76	1.27	1.61	1.22	0.83	0.86	1.00
Zhengzhou	0.24	1.25	0.89	0.77	1.24	1.91	1.15	0.93	0.89
Luoyang	0.81	1.21	1.06	0.79	1.01	1.15	0.72	0.89	0.91
Wuhan	0.37	1.08	1.20	0.94	0.98	1.85	0.96	0.98	1.07
Changsha	0.43	1.26	1.23	0.82	0.70	1.51	0.57	0.48	1.15
Shenzhen	0.00	1.09	0.42	1.26	0.71	1.15	1.89	1.40	0.98
Guangzhou	0.16	0.85	0.47	1.51	1.48	1.55	1.13	1.44	1.30
Zhuhai	0.27	1.24	0.78	1.22	0.44	1.27	0.87	1.29	0.92
Nanning	1.26	0.81	1.50	0.93	1.01	1.54	1.35	0.81	0.97
Sanya	1.52	0.13	2.41	0.77	0.90	6.37	1.45	2.89	0.78
Chongqing	0.81	1.00	1.36	0.89	1.12	1.30	1.19	0.97	0.90
Chengdu	0.39	1.06	1.01	0.77	0.98	1.89	1.47	0.97	1.06
Xi'an	0.46	0.75	1.90	1.19	0.97	1.51	1.34	1.01	1.16
Wulumuqi	0.12	0.86	0.82	1.00	3.20	1.55	1.11	0.80	1.24

(Comments: A-Agriculture, I-Industry, C-Construction,W-Wholesale Trade and Retail Trade, T- Transportation,Storage, Posts and Telecommunications, S- Stay Place and Catering, F-Finance, R- Real Estate Trade, O- other service industries)

According to Table 1, the number of cities in 35 sample cities with industrial location entropy greater than 1 has the following characteristics:

- Industries, transportation, postal service, accommodation, catering, and finance have obvious comparative advantages in central cities. The number of cities with more than one location entropy in four industries exceeds 20, which indicates that the sample cities are more developed in these four industries. High, the largest contribution to GDP. The location entropy of Beijing's financial industry is 2.17, which shows that Beijing has a significant comparative advantage in the financial industry; the location entropy of accommodation and catering industry in Hohhot is as high as 5.19, which has a significant comparative advantage.
- The number of cities where the location entropy is greater than 1 in the four industries of construction, wholesale, retail, real estate and other service industries is greater than 10. And the number of cities where the location entropy is greater than 1 in the construction industry and wholesale and retail trades exceeds 15, indicating that these two industries have comparative advantages in China. Relatively

speaking, the comparative advantages of the latter two industries in China are weak.

- The agricultural location entropy of only 5 cities in the sample cities is greater than 1, indicating that the sample cities do not have comparative advantages in terms of agriculture. Overall, the contribution rate to China's GDP is the lowest.
- Overall, the rankings of the comparative advantage industries of the sample cities in 2014 are roughly as follows: accommodation and catering industry (25)> industry (22)> transportation and postal service (21)> financial services (20)> wholesale and retail trade (19) > Construction (16)> Real Estate (14), Other Services (14)> Agriculture (5).

C. Analyze sample cities as a whole

First, the sample cities will be divided into industrial output values and regional GDP. Based on the overall analysis of the changes in the location entropy of the sample cities, the location entropy of each industry in the sample cities from 2005 to 2014 can be obtained. From this, the overall entropy change trend map for each industrial location of the sample cities during 2005-2014 is plotted (Figure 3). The entropy of each industrial location has the following characteristics:

- Considering the sample cities as a whole, the location entropy of five of the nine industries selected has always been greater than one, showing a clear comparative advantage. Of the remaining four industries, the location entropy of the industrial, construction, and real estate industries fluctuate around 1 and the industrial comparative advantage is not significant.
- The location entropy of the financial industry is the largest, with an average value of 1.32. The average entropy of the location of the wholesale and retail trades and the accommodation and catering industry is higher than 1.2, indicating that the financial industries, wholesale and retail trades of the sample cities and the accommodation and catering industry are located in China. Has a clear comparative advantage. As a whole, from 2005 to 2014, the location entropy of the financial industry and the wholesale and retail industry showed a declining trend; while the location entropy of the accommodation and catering industry showed a state of fluctuation and increase, indicating that this comparative advantage became more and more obvious.
- The location entropy stability of transportation, warehousing and postal services and other service industries is maintained at a level greater than 1, indicating that these three industries have a relatively stable dominance in China. The location entropy of the construction industry and real estate industry has been hovering around 1, and dropped below 1 in 2006 and 2010 respectively, indicating that the advantages of these industries in China are weakening and need further development.
- The regional entropy of agriculture is always much less than 1, indicating that the central city's agriculture is in a disadvantageous position in China, the overall development level is not high, and the contribution rate to GDP is also the lowest.

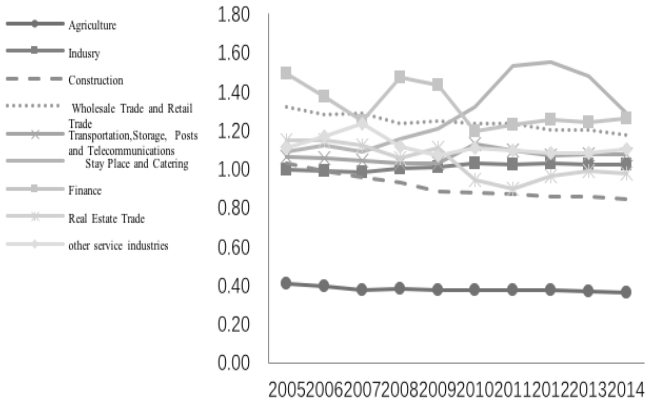

Fig. 3. Overall Location Entropy Change Trend of Sample Cities from 2005 to 2014

D. Analyze sample cities as individuals

From the perspective of industry, through the sample of 35 cities, we examined the trend of the number of cities with advantageous industries from 2005 to 2014. Through the statistics of location entropy calculation, we can see that the number of cities with advantageous industries in sample cities has changed significantly in the decade, among which the industrial, construction, wholesale and retail industries, and accommodation and catering industries are prominent. In general, the number of advantageous industries in the construction industry and the wholesale and retail industry is gradually decreasing, and the trend of shifting to the industrial, accommodation and catering industries is showing. The number of cities with advantages in agriculture, finance, real estate, transportation, warehousing and postal services, and other service industries did not change much, and the number of cities was basically stable in a certain amount, indicating that these industries were dominant in the central cities. More stable.

From the perspective of cities, the number of advantageous industries in each city will also show different trends over time. Among them, cities with major changes in the number of advantageous industries include Changchun, Hefei, Zhengzhou, Nanning, and Urumqi. Most of these cities show a decreasing trend in the number of advantageous industries; besides this, Wuxi, Suzhou, and Xiamen have the advantage. The number of industries has also undergone major changes and has been concentrated in the increase in the number of advantageous industries. It should be pointed out that there are more than 5 dominant industries in four global cities and 14 out of 11 central cities as a whole. Only Tianjin has four advantageous industries, indicating that there are many advantageous

industries in the central city and it belongs to multi-industry linkage innovation city.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Main conclusions

Based on the above analysis, the industrial structure of the sample cities has the following characteristics:

- Considering the sample cities as a whole, the second and third industries have the highest contribution to the sum of the regional GDP of the sample cities, and the industrial structure gradually evolved from "231" in 2005 to "2014". Trinity. In individual analysis of 35 sample cities, it was found that in 2005, the number of cities in which the tertiary industry accounted for more than 50% of the regional GDP was only 10, and in 2014 it had increased to 15. Cities such as Beijing, Shanghai, Nanjing, Hangzhou, Shenzhen, Guangzhou and Xi'an, which have a high contribution to GDP, account for even more than 55% of the total tertiary industry. In 2014, the proportion of the tertiary industry in Beijing and Guangzhou was 77.45% and 77.14% respectively, and the tertiary industry in Shanghai accounted for 64.7%, far higher than the national average. It shows that the service industries in these cities have developed rapidly, the real economy is in a state of depression, and the mode of economic growth has undergone major changes. The traditional mode of economic growth is difficult to sustain.
- As a whole, the sample cities always have comparative advantages in wholesale and retail trade, transportation, warehousing and postal services, accommodation and catering, financial services and other service industries. Among them, the wholesale and retail trades and the financial industry have comparative advantages. The most obvious advantage. The location entropy of industry has increased year by year and exceeded 1 in 2009, while the location entropy of real estate industry has decreased year by year and is less than 1 in 2010. This shows that the comparative advantage of industry is gradually increasing while the comparative advantage of the real estate industry is gradually losing.

B. Recommendations

The results obtained from the study of 35 sample cities in this paper are similar to those of previous studies of 34 metropolises in the United States. In addition to the lack of comparison of missing data industries, the central cities of China are similar to the US innovation cities in terms of the number of cities with advantageous industries and the similarities of industrial structures between different industries and cities. The place but there is still a gap. Therefore, in the process of building a brand-new innovative technology center in China, there is still a need to learn from innovative cities in the United States, specifically the following points:

- From the perspective of the industrial structure, the central city of China as a whole has already achieved the transition from "21 January" to "321". This is the inevitable result of economic development. However, from the perspective of U.S. development experience, not all cities should focus their shift on the tertiary industry. For example, the location entropy of Houston's manufacturing and construction industry alone is greater than 1; the manufacturing, construction, and information industries in Dallas-Fort Worth Location entropy is greater than 1, indicating that the dominant industries in these two cities are still concentrated in the secondary industry and have not blindly shifted to the tertiary industry. It is noteworthy that the urban innovation rankings of the two cities are still within the top 20. Corresponding to China's central cities, many cities in China's old industrial bases cannot achieve this, such as Shenyang, Dalian, Tianjin, Shanghai, Guangzhou, and Shenzhen.
- From a city perspective, the economic development momentum of the plans for integrating Shanghai, Beijing, Guangzhou, and Shenzhen into global cities is very optimistic. According to the statistics of 2014, the four cities have the highest contribution rate of GDP, and their tertiary industry accounts for more than 50% of the regional GDP, of which the proportion of the tertiary industry in Beijing and Shenzhen even reaches 70%. Therefore, these global cities have the most advantage in building a global science and technology innovation center. They should continue to maintain their position as an advantageous industry, encourage innovation, and train technical talents for the construction of a global science and technology innovation center. The national central cities should base themselves on their advantageous industries and learn from the development experience of global cities to increase investment in technological innovation. At the same time, the central city industry must also carefully measure whether the vigorous development of the tertiary industry has led to the continued downturn of the real economy to adapt to economic growth.

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