Coordinated Development of Beijing-Tianjin-Hebei City Group from the Perspective of Regional Economics —Comparative Analysis Based on the Gravity Model

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ABSTRACT

Promoting the coordinated development of Beijing-Tianjin-Hebei, adjusting the regional economic structure and spatial structure, and promoting the construction of Hebei Xiong'an New District and Beijing's urban sub-centers are one of China's three major national strategies. From the perspective of regional economics, this paper quotes a gravity model, and analyzes the strength of the economic connection between the Beijing-Tianjin-Hebei urban agglomeration and the Yangtze River Delta city agglomeration. The cluster is obviously weaker than the Yangtze River Delta city cluster. To develop the Beijing-Tianjin-Hebei urban agglomeration into a world-class urban agglomeration, it is necessary to take advantage of the opportunity to build the Xiong'an New District, to defuse Beijing's non-capital functions, solve "big city diseases", improve the functions of surrounding cities, and build a good-level, close-knit economic cluster pattern.

Keywords: Beijing-Tianjin-Hebei urban agglomeration, economic linkage strength

1. INTRODUCTION

Looking at the world urbanization process, urban agglomerations are the main form and space carrier of urbanization development. Since entering the 21st century, the domestic economy has developed rapidly, the level of urbanization has continued to accelerate, and the size of urban agglomerations has gradually expanded. The total area of Beijing, Tianjin and Hebei is 215000 square kilometers, with a GDP of 8.5 trillion yuan in 2018.It is an important economic growth pole in North China, as well as China's ability to participate in economic globalization and improve international exchanges. In April 2017, the CPC Central Committee and the State Council decided to establish xiong'an New Area in Hebei Province. In November 2018, the Central Committee of the Communist Party of China and the State Council clearly requested that the goal is to ease the non capital functions of Beijing, promote the coordinated development of Beijing, Tianjin and Hebei, and adjust the regional economic structure and spatial structure. The construction of world-class urban agglomerations in Beijing, Tianjin and Hebei is conducive to enhancing its influence and driving force on the whole country. This paper will analyze the Beijing Tianjin Hebei Urban Agglomeration and the Yangtze River Delta urban agglomeration from the perspective of regional economics, so as to provide useful reference for Beijing Tianjin Hebei to build a world-class urban agglomeration.

1.1. Related Work

According to the research content, this article divides the literature into three categories.

1.1.1. City group construction

The formation of world-class urban agglomerations first requires the existence of world-class big cities as the core. For example, in 2012, the 2010 China Urban Agglomeration Development Report stated that the Yangtze River Delta urban agglomeration with Shanghai as its core has ranked among the six world-class urban agglomerations. Beijing's international influence is increasing, and consensus has been reached on building a world-class city [1]. The motivation for Beijing, Tianjin and Hebei to build a world-class urban agglomeration is not only the need to build a new economic growth pole and promote economic development in China, but also the need for coordinated development of Beijing, Tianjin and Hebei and the need to solve urban diseases in the capital [2]. And Chunbin Liu compared the urban agglomeration of Boshua with the Beijing-Tianjin-Hebei urban agglomeration in terms of its macro-status, spatial structure, and carrying capacity ,and found that the main problems of Beijing-Tianjin-Hebei city group are the concentration of the bearing function of the city and the disharmony of the urban development relationship[3].

1.1.2. Regional Synergy Development

Xijun Zhao believes that regional coordinated development is the premise to ensure the stable, healthy and efficient operation of regional economy[4]. The development level and positioning of Hebei Province are far lower than those of Beijing and Tianjin, while many indicators of Tianjin and Beijing are at the same level, The three regions have not formed a good development gradient level. It is difficult for Beijing, Tianjin and Hebei to find common interest demands to promote regional coordinated development in the current position. The cooperation momentum is obviously insufficient, let alone regional integration. Zhang Shuo, Yan Zhao and others believe that regional economic cooperation has become the main means for the continuous improvement of China's market economy system, and will become a new trend and new power for China's future social and economic development. The economic development of Beijing, Tianjin and Hebei shows inconsistent phenomenon, which seriously affects the comprehensive economic development of Beijing-Tianjin-Hebei[5].

1.1.3 Intensity of economic ties

The process of regional economic linkage is actually a process of interaction in the economic field. The emergence and development of regional economic links is the result of the division of labor in regions [6]. In order to measure the degree of regional economic linkage, the indicator of the strength of economic linkage has been produced. It reflects both the ability of the economic center to radiate (diffuse and polarize) the surrounding area and the ability of the surrounding area to accept the radiative potential of the economic center [7]. Further, the amount of economic contact is used to measure the strength of the economic connection between regions. It can reflect both the central city's radiation ability to the surrounding area and the degree of acceptance of the central city's radiation ability [8].

1.2. Our Contribution

This article will introduce the gravity model to quantify the total amount of economic links and the strength of economic links between different cities in the Beijing-Tianjin-Hebei region, and compare and analyze with the relevant data of the Yangtze River Delta city group to find out the development of the Beijing-Tianjin-Hebei city group. Problems and make some enlightenments.

1.3. Paper Structure

The rest of the paper is arranged as follows. The second section introduces the theoretical model and measurement model used in this paper, and introduces the data source.

The third section is empirical analysis. Finally, the sixth part summarizes the thesis and puts forward the future research direction.

2. THEORETICAL MODEL AND ECONOMETRIC MODEL

2.1. Theoretical model

It is generally believed that the strength and quantity of interregional economic ties are important indicators to measure the process of regional coordinated development. The essence of the process of interregional economic connection is the process of interaction in the economic field. This is undoubtedly closely related to their economic development level and population scale. Therefore, the level of economic development and population size are important indicators to calculate the strength of regional economic ties. At the same time, according to the theory of distance attenuation[9], the spatial distance between regions is another important index that affects the intensity of regional economic ties. Based on the above analysis, this paper selects regional population, GDP, spatial distance and other indicators to measure the intensity of economic ties between certain regions.

2.2. Econometric model

Through the introduction of gravity model[8], we can measure the amount and intensity of economic ties between urban agglomerations. According to the above concept of economic connection quantity and connection strength, 13 major cities in Beijing Tianjin Hebei region and 26 cities in the Yangtze River Delta region are taken as the main objects, and the spatial gravity model is used to calculate the economic connection quantity and connection strength between major cities in Beijing Tianjin Hebei Urban Agglomeration in 2015-2017. The specific formula is as follows:

$$R_{ij} = \frac{\sqrt{P_i V_i} * \sqrt{P_j V_j}}{D_{ij}^2} \qquad (1)$$

$$F_{ij} = \frac{R_{ij}}{\sum_{i=1}^{n} R_{ij}} \qquad (2)$$

Among them, R_{ij} represents the economic connection between cities; P_i、V_i、P_j、V_j represents the total urban population and GDP of I and j respectively; F_{ij} represents the economic connection strength between I and j respectively.

3. EMPIRICAL ANALYSIS

3.1. An analysis of the quantity and intensity of economic connection in Beijing Tianjin Hebei Urban Agglomeration

Based on the relevant literature and data, according to the comprehensive strength of each city in the Beijing Tianjin Hebei Urban Agglomeration, the core cities are Beijing and Tianjin, and other cities are secondary cities. Firstly, according to the gravity model, the total amount of economic ties between secondary cities and core cities in Beijing Tianjin Hebei region in 2015-2017 is calculated, and the intensity of economic ties is further calculated on this basis. (Table 3-1)

Based on the comparative analysis, the following phenomena are found:

First, the distance between the secondary cities and the core cities has a more significant impact on the amount and intensity of economic ties. The four cities closest to Beijing and the four cities with the strongest economic ties in Beijing are exactly the same. Langfang, Tianjin and Beijing have even more than 30% economic ties. Geography is the primary factor for the coordinated development of Beijing Tianjin Hebei Urban Agglomeration.

Second, according to the time trend, on the one hand, the economic links between the secondary cities and Beijing and Tianjin are increasing year by year, and the speed of the increase reflects the development speed of the local economic level. On the other hand, the intensity of economic connection between most cities and Beijing is decreasing year by year, which may be conducive to a more reasonable distribution of radiation effect of Beijing. Thirdly, Tianjin, as the core city of Beijing Tianjin Hebei Urban Agglomeration, has not played its role. Beijing is the leader of Beijing Tianjin Hebei Urban Agglomeration, but its position is not the economic center. The existence of this phenomenon will not only squeeze the development of Tianjin, but also is not conducive to the coordinated development of Beijing Tianjin Hebei Urban Agglomeration.

To sum up, the Beijing Tianjin Hebei Urban Agglomeration is more inclined to Beijing single core model, the economic connection between each secondary city and the core city is increasing year by year, indicating that the regional coordinated development is good. However, the connection strength has obvious geographical characteristics, which greatly affects the economic connection quantity and connection strength, which leads to the imbalance of the connection strength distribution of each secondary city, the greater dependence on Beijing, the adverse impact on the development of Tianjin, Shijiazhuang and other large cities, and the coordinated development of the whole city cluster.

Table 3-1 The amount and intensity of economic ties between major cities in Beijing Tianjin Hebei Urban Agglomeration in 2015-2016

| Region | Beijing（2015） | | Tianjin（2015） | | Beijing（2016） | | Tianjin（2016） | |
	Contact quantity	Contact strength	Contact quantity	Contact strength	Contact quantity	Contact strength	Contact quantity	Contact strength
Tianjin	2184.5947	30.8345%	/	/	2324.1993	30.7918%	/	/
Shijiazhuang	194.3102	2.7426%	122.5123	4.6818%	207.2194	2.7453%	127.3616	4.7032%
Tangshan	529.3033	7.4709%	674.2457	25.7662%	560.5342	7.4261%	696.0489	25.7036%
Qinhuangdao	57.3651	0.8097%	44.5819	1.7037%	63.1931	0.8372%	47.8745	1.7679%
Chengde	105.7923	1.4932%	41.2437	1.5761%	111.5484	1.4778%	42.3926	1.5655%
Zhangjiakou	160.1821	2.2609%	39.7965	1.5208%	165.1021	2.1873%	39.9860	1.4766%
Langfang	2760.5913	38.9645%	605.9595	23.1567%	2967.8541	39.3191%	635.0502	23.4510%
Baoding	584.8106	8.2543%	332.7580	12.7163%	608.5372	8.0621%	337.5394	12.4646%
Handan	67.2901	0.9498%	46.5384	1.7785%	70.4900	0.9339%	47.5238	1.7550%
Xingtai	56.2674	0.7942%	38.8439	1.4844%	60.4669	0.8011%	40.6918	1.5027%
Hengshui	81.2352	1.1466%	65.3219	2.4963%	87.8899	1.1644%	68.8934	2.5441%
Cangzhou	303.1534	4.2789%	604.9777	23.1192%	321.0820	4.2538%	624.6215	23.0659%

3.2. An analysis of the quantity and intensity of economic ties in the Yangtze River Delta Urban Agglomerations

According to the <2016 national development and Reform Commission's Yangtze River Delta Urban Agglomerations development plan>, the cities under its jurisdiction include Shanghai, Suzhou,and other 26 cities. Shanghai is one of the worthy core cities. In addition, because the distance between Suzhou and Shanghai is the same as that between Tianjin and Beijing, the total GDP of Suzhou is the same as that of Tianjin. As a comparison with the urban agglomeration of Beijing, Tianjin and Hebei, Suzhou is selected as the second core city, and other cities are secondary cities.

This paper selects the relevant data of cities in the Yangtze River Delta Based on the ESP data platform from 2015 to 2017. The calculation results are as follows (Table 3-2)：

Table 3-2 The amount and intensity of economic ties among major cities in the Yangtze River Delta in 2016-2017

Region	Shanghai(2016)		Suzhou(2016)		Shanghai(2017)		Suzhou(2017)	
	Contact quantity	Contact strength	Contact quantity	Contact strength	Contact quantity	Contact strength	Contact quantity	Contact strength
Shanghai	/	/	3305.5327	24.1334%	/	/	3635.8468	23.9197%
Suzhou	3305.5327	32.1732%	/	/	3635.8468	31.9909%	/	/
Nanjing	274.2018	2.6688%	262.0851	1.9135%	302.1508	2.6585%	289.7003	1.9059%
Wuxi	1161.7380	11.3073%	5682.5886	41.4880%	1289.6351	11.3472%	6327.8763	41.6302%
Changzhou	444.9924	4.3312%	790.3193	5.7700%	495.0108	4.3555%	881.8966	5.8019%
Nantong	1149.5115	11.1883%	847.9651	6.1909%	1276.0608	11.2277%	944.2546	6.2121%
Yancheng	158.8743	1.5463%	111.6833	0.8154%	174.3369	1.5339%	122.9355	0.8088%
Yangzhou	147.0212	1.4310%	146.8402	1.0721%	163.3376	1.4372%	163.6456	1.0766%
Zhenjiang	146.6900	1.4278%	163.4023	1.1930%	155.8842	1.3716%	174.1858	1.1459%
Taizhou	210.3196	2.0471%	171.2403	1.2502%	235.0895	2.0685%	192.0050	1.2632%
Hangzhou	750.8364	7.3080%	453.1309	3.3083%	839.8534	7.3897%	508.4345	3.3449%
Ningbo	359.2128	3.4963%	167.5570	1.2233%	402.4026	3.5406%	188.2889	1.2387%
Jiaxing	980.4391	9.5427%	727.5855	5.3120%	1099.9726	9.6784%	818.8388	5.3870%
Huzhou	283.5491	2.7598%	281.4694	2.0550%	309.8850	2.7266%	308.5721	2.0301%
Shaoxing	310.2018	3.0192%	184.0247	1.3435%	335.2268	2.9496%	199.4911	1.3124%
Zhoushan	34.5263	0.3360%	16.3520	0.1194%	35.8075	0.3151%	17.0117	0.1119%
Taizhou	88.3485	0.8599%	48.3160	0.3528%	98.4245	0.8660%	53.9944	0.3552%
Jinhua	100.8352	0.9814%	55.8061	0.4074%	108.3972	0.9538%	60.1784	0.3959%
Hefei	81.1296	0.7896%	60.0575	0.4385%	90.5433	0.7967%	67.2353	0.4423%
Chuzhou	49.9891	0.4866%	41.8864	0.3058%	55.5950	0.4892%	46.7290	0.3074%
Maanshan	44.9227	0.4372%	40.1984	0.2935%	50.3316	0.4429%	45.1790	0.2972%
Wuhu	67.9640	0.6615%	57.9934	0.4234%	74.5713	0.6561%	63.8300	0.4199%
Xuancheng	55.6443	0.5416%	38.9441	0.2843%	61.6898	0.5428%	43.3098	0.2849%
Tongling	22.4853	0.2189%	14.3473	0.1047%	25.5109	0.2245%	16.3286	0.1074%
Chizhou	13.6190	0.1326%	8.4520	0.0617%	14.6825	0.1292%	9.1404	0.0601%
Anqing	31.6103	0.3077%	19.1575	0.1399%	35.0142	0.3081%	21.2867	0.1400%

It is found that the following phenomena exist:

First, geographical factors still have a great influence on the amount of economic ties between cities, but not absolutely, which shows that the leading role of core cities in the Yangtze River Delta is not only dependent on geographical factors, which will be more conducive to coordinated development.

Second, the secondary core cities have played a significant role in promoting the overall development of regional urban agglomerations. Take Suzhou as an example. There are four secondary cities that have more connections with Suzhou than Shanghai, including Wuxi, which is very close to Shanghai. Its economic connection with Suzhou is five times that of Shanghai.

Thirdly, from the perspective of time, the amount of economic ties between secondary cities and Shanghai is increasing, and the standard deviation of ties is gradually narrowing, which shows that the overall economic level of Shanghai is improving and the development trend is reasonable.

3.3. A comparative analysis of the empirical results of Beijing Tianjin Hebei Urban Agglomeration and Yangtze River Delta Urban Agglomeration

Through the introduction of gravity model, the empirical analysis results of the collected data of Beijing Tianjin Hebei Urban Agglomeration and the Yangtze River Delta urban agglomeration are as follows:

Echelon structure: according to the data in 2017, after removing the influence of extreme values, the average value of the difference between the secondary cities of Beijing Tianjin Hebei Urban Agglomeration and Tianjin and Beijing is 54.07, and that of the Yangtze River Delta urban agglomeration is 39.61, which shows that compared with the Yangtze River Delta, the leading role of other core cities of Beijing Tianjin Hebei Urban Agglomeration is not significant, and the secondary cities are more dependent on Beijing, The echelon structure is weaker

than the Yangtze River Delta urban agglomeration, which is not conducive to coordinated development. **Development trend:** Generally speaking, compared with Shanghai, Beijing is not an economic center. Therefore, the Beijing Tianjin Hebei Urban Agglomeration shares Beijing's non capital functions through the construction of xiong'an new area, and develops steadily. However, there are some cities that are excessively dependent on Beijing's development and the degree of dependence is gradually strengthened, which is not conducive to the independent development of these cities and the development of other core cities, and is not conducive to the overall coordinated development.

4. CONCLUSION AND ENLIGHTENMENT

4.1.Conclusion

By introducing gravity model, this paper makes quantitative and comparative analysis on the quantity and intensity of economic ties between Beijing Tianjin Hebei Urban Agglomeration and Yangtze River Delta urban agglomeration：

First, although the overall economic volume of Beijing Tianjin Hebei Urban Agglomeration is large and developing rapidly, there is still a certain gap with the world-class urban agglomeration;

Second, compared with the Yangtze River Delta urban agglomeration, Beijing's single core polarization effect is obvious. The surrounding cities are far less dependent on Tianjin and other core cities than Beijing. Beijing's non capital burden is increased, and other core city functions have not been brought into play. This abnormal echelon structure is not conducive to the internal coordinated development of Beijing Tianjin Hebei Urban Agglomeration.

Thirdly, from the perspective of time span, the gap between the secondary cities and Tianjin and Beijing has been decreasing year by year, which means that the internal structure of the development of Beijing Tianjin Hebei Urban Agglomeration is optimizing, and the overall situation is better. But some cities are more and more dependent on Beijing and occupy the development of other secondary cities, which is not conducive to the growth of other core cities.

4.2. Enlightenment

According to the questions raised in the conclusion, the following enlightenment is put forward:

First, speed up the development of Tianjin, Shijiazhuang and other major cities. The root of the problem of Beijing Tianjin Hebei Urban Agglomeration is Beijing's regional strong position, because the essence of factor profit-seeking makes as long as the benefit space obtained in Beijing is higher than the surrounding areas, the factors

will flow in continuously. The results of gravity model analysis show that the influence of geographical factors on the strength of the connection is the largest. Therefore, the primary driving force is to cultivate more new core cities and form a relatively perfect urban development echelon structure, so that the marginal income obtained in Beijing is basically the same as that obtained in other core cities, and the unidirectional flow of elements can stop.

Second, speed up the construction of xiong'an new area. In 2017, xiong'an new area was established to ease the non capital function of Beijing, which has a huge role in promoting the coordinated development of Beijing Tianjin Hebei Urban Agglomeration and is the key to the coordinated development of Beijing Tianjin Hebei Urban Agglomeration.

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