

Research on evolution of regional logistics hub in Beijing-Tianjin-Hebei based on time series

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Abstract: The collaborative development of Beijing-Tianjin-Hebei region is a major development strategy of the country. This paper takes the annual freight volume of 13 cities in Beijing, Tianjin and Hebei Province from 1997 to 2017 as the basis, introduces the Herfindahl index model and amend it to research the evolution process of the three logistics regions in Beijing, Tianjin and Hebei. The results show that the development trend of the dual core hub-and spoke regional network centered on Beijing-Tianjin is relatively obvious. It is proposed that making Beijing-Tianjin-Hebei collaborative management as an opportunity to focus on the construction of core hub city, within the scope of radiation driven by logistics area space restructuring form city to city logistics industry development, to provide the new development ideas for the future Beijing-Tianjin-Hebei regional logistics network construction.

Key word: Regional logistics Network; Herfindahl index; Hub and spoke

1. Introduction

The coordinated development has now been a hotspot in all walks of life, and so far, our country has been developing a sound and coordinated development of the region's economy, and it has been gradually improving the economic coordination of the region. The development of regional integration can lead to the distribution of logistics in the region and in the region, and adapt to the structure of the industry. Regional logistics hubs, produced on the basis of regional economic cooperation, are important links to the production and consumption of the whole zone, while also accelerating the economic development of the whole region.

Regional logistics hub is an important product of the development of logistics network by classifying the logistics nodes in the logistics network, reasonably constructing and distributing the logistics nodes, forming the logistics organization nodes that guide and gather the logistics within the region, and leading and coordinating the logistics within the scope of the hub radiation. "Building a large logistics hub and developing a regional logistics center" is not only a response to national policies, but also an important goal of building an urban logistics network. Now, there's a lot of research into the development of regional logistics hubs, and the idea of a logistics hub,^{[1][2][3]} analyzing the influence of the logistics hub city^[4], the mechanism of formation and the correlation between each other. However, most of them are theoretical researches, lack of quantitative analysis and have low practical value. There are few special researches on the evolution of Beijing-Tianjin-Hebei regional logistics hub^[5]. Some scholars apply the Herfindahl index to the evolution process of computing the regional distribution junction, which is innovative^[6]. According to previous studies, the Herfindahl index measurement system is a power function^[7]. Due to the problems of high mutation point of correction rate and high non-repeat space ratio of multiple solutions, there will be some errors in measuring market concentration. Therefore, on the basis of previous studies, this paper combines qualitative analysis with quantitative analysis, and uses the modified HHI index to judge the development of Beijing-Tianjin-Hebei regional logistics hub, which is of great significance for the construction of Beijing-Tianjin-Hebei logistics network and integrated collaborative management in the future.

2. Methodology: Time series evolution model

The federated-hilman index, referred to as the Herfindahl index, is a composite index used to measure the concentration of the industry. The definition is to calculate the sum of the squares of the competitors in each market of an industry in the total revenue (or total assets) of the industry, so as to analyze the change of market share and judge the dispersion degree of the scale of manufacturers in the market. From a macro perspective, node of logistics network can be considered in the logistics market to provide logistics services

each competition main body, can use each node through put accounted for the proportion of the total logistics network to determine the formation of logistics hub. Therefore, the Herfindahl index can be used for reference in studying the evolution trend of logistics node aggregation and dispersion in the region.

$$HHI = \sum_{i=1}^k \left(\frac{s_i}{s}\right)^2 = \sum_{i=1}^k R_i^2 \tag{1}$$

HHI is a quadratic power function on the whole. According to relevant literature research, the larger the index is, the greater the contribution rate of high index in the total index value is, and the greater the degree to which the contribution rate of low index in the total index value is reduced, the more significant the absolute concentration function of the index measurement system is. The range of the metric is not uniform, and the volume of the freight in this paper is a single index, and it has no special meaning in the interval. Therefore, the power index correction method is adopted to modify the index according to the market structure, and the original power index is revised to 1.5, so as to reduce the error of the measurement system.

$$HHI' = \sum_{i=1}^k \left(\frac{s_i}{s}\right)^{1.5} = \sum_{i=1}^k R_i^{1.5} \tag{2}$$

In the above formula: s_i is the through put of each node city, s is the total through put of regional logistics network, R_i ($0 < R_i < 1$) is a node of city I through put of area in proportion to the total amount of logistics network, k is the number of urban logistics node in logistics network. Although logistics is a very important concept, it has not yet been clearly defined. Logistics refers to the circulation of goods. Therefore, when we count the flow of goods in Beijing-Tianjin and Hebei, we use freight volume as the flow of goods to calculate. From that formula, $0 < HHI' < 1$. When $s_i \ll s$, when $R_i^{1.5} \rightarrow 0$, $HHI' \rightarrow 0$, show that the urban logistics node through put smaller, logistics scale tends to spread, logistics hub city has not been formed; $s_i \rightarrow s$, exist when a node city $R_i^{1.5} \rightarrow 1$, $HHI' \rightarrow 1$, show that the regional logistics network through put in to the node cities gathered themselves together, and the city is gradually become a regional logistics nodes in a network of logistics hub.

3. Results and Discussion

According to the model, the logistics of the Beijing-Tianjin-Hebei region are divided into several areas: Logistics area around Beijing (Beijing ,Chengde ,Zhangjiakou ,Baoding ,Langfang); Logistics area around Tianjin(Tianjin,Tangshan,Qinhuangdao,Cangzhou);Logistics area around Shijiazhuang(Shijiazhuang ,Hengshui ,Xingtai ,Handan).

3.1 Data analysis

By referring to the annual statistical yearbook of urban statistics of Beijing, Tianjin and Hebei provincial statistics bureaus (1997-2017), the annual freight volume of 13 cities in Beijing, Tianjin and Hebei is sorted out and counted, as shown in table 1 below.

Table 1

years	BJ	ZJK	BD	CD	LF	SIJZ	HS	HD	XT	TJ	TS	QHD	CZ
1997	32298	5356	5735	2706	4218	2093	4373	10864	5097	23509	15515	1255	4530
1998	30120	5370	6403	2821	3463	1899	2526	11298	5347	21489	15135	1335	4380
1999	28306	5269	6547	2944	3587	1911	2591	10367	5450	26313	14519	1608	4519
2000	30714	5417	6513	3087	4901	11384	2473	9952	5566	26026	14582	5898	5080
2001	30608	5680	6666	3108	4928	12415	2448	10021	5894	27988	14522	6366	5263
2002	30799	5859	6555	3349	5033	11583	3005	10397	5500	30052	14285	7174	7334
2003	30729	5730	5716	3181	4960	10008	2706	9706	3805	32014	13630	5442	6354
2004	31321	6195	6503	3240	5274	11751	3760	10505	3828	36237	13916	6643	8453
2005	32113	6520	6888	3666	5353	11942	3691	10673	3826	39219	14641	7576	11962
2006	33008	6858	7738	4190	5517	12142	3542	11649	4499	41939	15006	7795	14147
2007	19877	7170	8921	4422	6051	12615	3789	12616	4810	50261	14942	7191	15885
2008	20525	5384	8772	4545	7162	12513	3372	17403	8472	34114	21862	7573	15373

Table 1, cont.

2009	20470	5199	11711	4796	7951	15151	3429	19135	8544	42324	25187	6007	18445
2010	21762	6982	14788	5775	9415	19689	4377	25506	10253	40013	29829	6459	19952
2011	24663	8872	18967	7121	9440	24273	5366	29266	12752	43601	37081	6819	26003
2012	26162	9310	22685	8150	11175	28755	6038	34384	14333	46015	41649	7170	30803
2013	25748	9780	26879	9154	12821	35893	7045	36956	15425	45233	47879	7835	35406
2014	26551	7122	21726	7865	10513	24538	5660	37209	11614	49753	38207	7611	29219
2015	20078	7528	9300	7218	10256	27981	4379	40921	14740	48779	38792	6196	32472
2016	20734	7166	9900	6486	10384	40639	4770	18744	15216	50506	41379	6972	34980
2017	23879	8730	11000	4528	10737	46000	5262	20867	13970	52992	41000	7300	33641

3.2 Calculate the HHI' in all areas

Table 2

years	Logistics area around Beijing	Logistics area around Tianjin	Logistics area around Shijiazhuang
1997	0.62430	0.62059	0.56011
1998	0.61344	0.61419	0.58906
1999	0.60030	0.62756	0.57773
2000	0.59876	0.57821	0.54536
2001	0.59462	0.58125	0.54820
2002	0.59176	0.57113	0.54096
2003	0.60084	0.59764	0.54932
2004	0.59154	0.59148	0.54657
2005	0.58619	0.57863	0.54843
2006	0.57773	0.57760	0.54721
2007	0.50128	0.59881	0.54654
2008	0.50742	0.54567	0.54737
2009	0.50005	0.56207	0.55304
2010	0.48802	0.55231	0.55792
2011	0.48701	0.54919	0.55372
2012	0.48516	0.54755	0.55679
2013	0.48275	0.54523	0.55767
2014	0.49429	0.54952	0.57167
2015	0.47684	0.55187	0.57584
2016	0.48172	0.54924	0.57983
2017	0.49538	0.55068	0.59030

According to the data in Table 2, draw the Beijing-Tianjin-Hebei three logistics area in 1997-2017 Herfindahl index trend Figure 1.

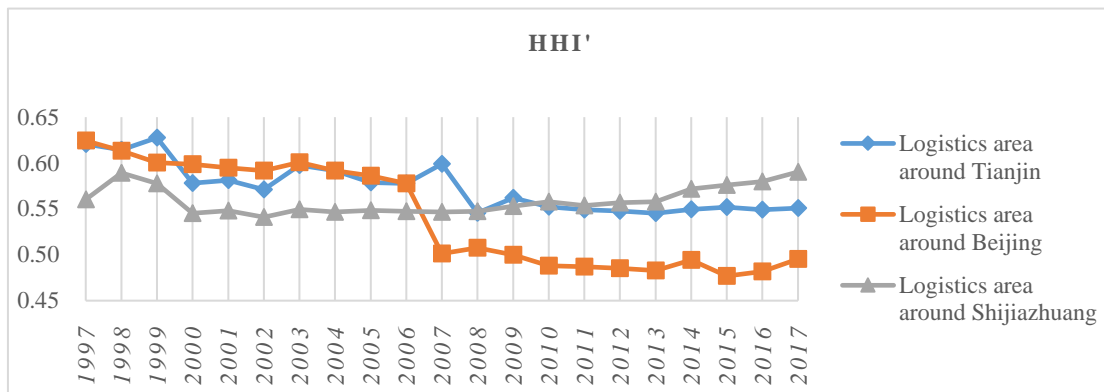


Fig.1

3.3 Analysis of model evolution and Discussion

3.3.1 Logistics area around Beijing

From 1997 to 2004, the HHI' index in the logistics area around Beijing was relatively stable. From 2005 to 2007, the HHI' index fluctuated greatly, and then leveled off again.

Based on the economic conditions and geographical advantages of Beijing as a megacities, the logistics circle can release a large amount of logistics and capital flow to Chengde, Zhangjiakou, Langfang and Baoding within the radiation range, reduce the economic cost and time cost of transportation, and form the Bohai rim and international-oriented logistics circle. At the same time, with the proposal of Beijing vice center and Xiongan New Area and the construction of Beijing's great outer ring and one-hour living circle, the logistics links between Beijing and these four cities will be significantly strengthened, and the logistics connection between each city and Beijing will be greatly improved^[8]. In this case, the Zhangjiakou and Chengde are the important ecological barriers and the main source of water in the Beijing-Tianjin area, and the Langfang is in the heart of the city, but it's a good way to develop agricultural logistics, to develop agricultural logistics, to develop the produce, processing and transportation of agricultural products, to transform the traditional agricultural product logistics into the modern agricultural logistics system, to create the unique agricultural and logistics system, and to ensure the demand of raw produce in the Beijing-Tianjin-Hebei region. In this way, that city of Beijing. the capital of the capital is the main part of the capital of the capital, which is the main part of the capital, and is the important node for contacting the three city in Beijing, Tianjin and Shijiazhuang and the important nodes in Beijing, which can focus on the development environment of the logistics, the new development of the new development of the male safe in Hebei province, the new "two wing" in Beijing, the new "wing" of Beijing city, the new space in the hinterland of north China, the new space of the developing region and the construction of the spatial pattern of "one core and two wings".

3.3.2 Logistics area around Tianjin

From 1997 to 2017, the HHI' of the logistics network of Tianjin area showed a steady downward trend, and became stable after 2009. This shows that the logistics network of Tianjin area is evolving from the condensation development stage to the radiation diffusion development stage, and its network evolution is obvious.

There are many seaport cities in this logistics circle, which can give full play to the function of distribution and distribution of various ports and pay attention to improving the three-dimensional logistics system centering on the seaport. It is suggested to take Binhai New District as an opportunity to seize the opportunity of approval of Tianjin free trade zone and build the logistics city into a shipping center of northern China and an international logistics center to play a leading role. At the same time, the logistics circle is connected with the capital economic circle, which can improve the capacity of regional logistics cooperation. Tianjin is adjacent to the Bohai sea in the east, Yanshan in the north, and the capital city in the north. Tianjin is the nearest port for Beijing ocean shipping ,and since the Binhai New District was incorporated into the national overall development strategy after deployment, and Tianjin port is seeking to become more of the same type of Shanghai international shipping center. Therefore, Tianjin will continue to implement the existing "two cities and two ports" strategy. The new port zone, which has been built on the southeast coast of Tianjin, which is currently 20 kilometers from the eastern seaboard, has prompted the two main ports to drive the

entire port of Tianjin. Cangzhou is located in the southeast of Hebei province, east is near Bohai sea, and the Shandong peninsula and Liaodong peninsula across the sea, is important to the petroleum chemical industry base and the north sea transport hub. At the later stage, the speed of Tianjin and Cangzhou branch logistics channel construction should be accelerated to promote Tianjin's radiation power to Cangzhou. As a sub-central city of Hebei province, Tangshan has the policy conditions to develop regional logistics hubs. It can rely on its strong industrial foundation and economic strength to build Tangshan into a future international comprehensive trade port. This logistics circle can also promote the rapid development of northeast economy by radiating "three north" from Qinhuangdao. The port of Qinhuangdao has been transformed by a multi-purpose modern port.

3.3.3 Logistics area around Shijiazhuang

In 1997-2017, the HHI' index of the Shijiazhuang logistics area was generally floating around 0.55, which was very stable. It indicates that the four cities including Shijiazhuang are relatively balanced and the pivotal role is not outstanding.

The later construction of this logistics circle can be focused on Shijiazhuang, the provincial capital, to strengthen its comprehensive strength and improve the transportation system, so as to improve its own logistics agglomeration capacity. Meanwhile, other cities in the region can develop characteristic logistics according to their own advantages. Shijiazhuang as the coordinated development of Beijing-Tianjin-Hebei is an important part of, should not only adhere to the coordinated development, and to highlight its own characteristics, in the development of Beijing-Tianjin-Hebei space for their own development and gradually expand. Shijiazhuang has a variety of resources with unique advantages of the provincial capital. It is necessary to accelerate the transformation of the economic development pattern and the pace of industrial restructuring, and vigorously develop strategic emerging industries and modern service industries. To work with Jing Jin to connect with the industry, to avoid the industrial chain, to make the stone house a major hub for modern trade and logistics, to increase the power and power of the capital city. Handan and Xingtai should not only strengthen the traditional logistics industry, but also intensify the upgrading and transformation of traditional industries on this basis. Handan has been formed national highway railway crossing, intersection, high-speed vertical and horizontal and airport navigation transport network, to make full use of the integration of the Beijing-Tianjin-Hebei region coordinated development strategy and the central plains economic zone in northern gateway city strategic advantage, it can play positive role as the national iron and steel production and distribution base, enhance logistics industry advantages, to speed up the construction of Handan international land port logistics park, polarization of Handan city status in the center of the Shanxi-Hebei-Shandong-Henan area bordering area. Xingtai is one of the important node link Bohai sea economic circle of the modern logistics industry, as a comprehensive transportation hub, with advanced manufacturing, can the construction, including Qinghe cashmere, ren county machinery accessories such as characteristic of industrial cluster, targeted the development of equipment manufacturing logistics, etc., in the process of connecting with the central plains economic zone of the Beijing-Tianjin-Hebei region, accelerate the development of Xingtai logistics. Hengshui is located in the central position of Beijing-Tianjin-Hebei and other four metropolises. It is a 2-hour drive away from these four cities. In the future, if it is connected by rail, it can reach the destination within one hour ,at this stage should actively enhance their own economic strength, perfect logistics development environment, giving full play to the advantages of unique hub, makes the Beijing-Tianjin-Hebei important node in the city.

The analysis and the GIS state chart shows that, as the color deepens, the city's flow is more substantial, and the structure of the hub network in the Beijing-Tianjin-Hebei region has shown the evolution of the point - ax-net, and it's a radiological extension of the Beijing-Tianjin two cities, and it focuses on the development of the hub city, and the logistics network of the region.

4. Conclusion

The Beijing-Tianjin-Hebei region is an important urban agglomeration in the logistics economic circle around the Bohai sea. The development of urban logistics requires the support of the logistics network system, and the rationalization of logistics network structure directly affect the link Bohai sea economic and overall strength of ascension. Taking Beijing-Tianjin-Hebei regional logistics network as the research object, this paper studies the evolution rule of nodes in the network according to the time series, and uses the modified Herfindahl coefficient to determine the core logistics hub in the region, so as to analyze the influence of aggregation and diffusion on the evolution of logistics network structure during the evolution

and growth of logistics nodes. The research shows that the development trend of the double-core axial spokes regional network structure with Beijing-Tianjin as the hub is relatively obvious, and the polarization of the two cities should be given full play to, so as to promote the development of surrounding cities, including Shijiazhuang, Tangshan and Baoding, based on the development of Beijing-Tianjin cities, cultivate multiple growth poles, and enhance the attraction and radiation of axis cities in various regions to surrounding cities.

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