Chapter 97
The Selection of the Regional Center City Under the Policy of Expanding Domestic Demand

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Abstract From the perspective of region economics, this paper makes the comparison on regional advantages and the selection of the regional center city between sixteen provincial capital cities in the Central, Northwest and Southwest Region in China, by exploiting AHP and constructing the index system with twelve secondary indexes on the five factors of geography location, traffic facilities, economics, population and human capital. The following research conclusions are drawn. First, in Central Region, Wuhan, having the highest composite score, should be selected as the regional center city. Second, although it is not located the geographical center in the Northwest Region, Xi'an has the highest composite score and each secondary index is highest, which should be selected as the regional center city. Third, in Southwest Region, Chongqing should be selected as the regional center city.

Keywords City · Region center · Expand domestic demand · AHP

97.1 Introduction

With the development of the Chinese economy, Chinese government has been transforming the mode of economic growth and expanding domestic demand. In the twelfth five-year guideline for national economic and social development of the People's Republic of China, it is stated clearly to improve the pattern of regional development and expand inland development. For example, "Build long-term mechanism to expand domestic demand, rely on consumption, investment and exports, and promote economic growth." "Take the expansion of consumer

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demand as a strategic focus to expand domestic demand, further release the consumption potential of urban and rural residents, and gradually realize the domestic market scale to be one of the largest sizes of in the world" (The twelfth five-year guideline for national economic and social development of the People's Republic of China). Under this macroscopic environment, inland region having the resources, labor and other advantages will actively undertake international and coastal industrial transfer. In recent years, the domestic consumption level has risen greatly. Per capita consumption expenditure of urban residents has increased from 4998 yuan in 2000 to 13471 yuan in 2010, while that of rural residents has increased from 1670 yuan in 2000 to 4382 yuan in 2010. Under the policy of expanding domestic demand, consumer demand in China will be greatly improved. The inland cities have more advantages of geography location over coastal cities such as shorter transportation distance and lower logistics cost so that they can better meet the increasing consumer demand after expanding domestic demand. Moreover, Chinese government has accelerated the development of Central and Western regions, which put forward the strategy of "The Rise of Central China" and "China Western Development". The regions of central and western will have more policy support. Therefore, in the new economic situation, the cities in the regions of central and western will have great development.

97.2 Research Situations and Problems

Many scholars have made a lot of researches on the development of the cities and regions. Linneker and Spence (1996) concluded the positive relationship of transport infrastructure with regional economic development. Lawson (1999) researched the competence theory of the region. Siegfried (2002) presented that it has closer economic associations in adjacent regions.

The comparative researches between the cities are made mainly from the perspective of urban competitiveness. Hao and Ni (1998) researched empirically seven cities' competitiveness of Beijing, Tianjin, Shanghai, Dalian, Guangzhou, Xiamen, and Shenzhen from the 21 subdivision indexes by using principal components analysis method. Ning and Tang (2001) designed a city competitiveness model, based Michael E. Porter and IMD national competitiveness model. Li and Yu (2005) presented that city competitiveness is the sustainable development capacity of a city to attract, acquire, control and convert resources, and then create value and wealth and improve the living standard of the presidents. Wei-zhong Su, Lei Ding, Peng-peng Jiang and Qi-yan Wang made the empirical study for the tourism competitiveness between different cities (Ding et al. 2006; Su et al. 2003; Jiang and Wang 2008; Wang and Wang 2009). Cheng-lin Qin and Jun-cheng made the researches on the polycentric urban-regional structure (Qin and Li 2012; Zhu et al. 2012). However, the studies are mostly made from the city's current situation. There are few studies from the perspective of Regional Economics, from the basic potential factors, such as geographical location, transport and radiation.

According to the "Growth pole theory" by Francois Perroux, regional economic development depends mainly on the minority regions or industries with better conditions, which should be fostered to the growth pole of region economic. The surrounding areas or related industries will be affected and promoted through the polarization and diffusion effect of the growth pole (Luan 2008). Therefore, under the present circumstances, to obtain the rapid development of the central and western region, China should put limited funds into the cities with the regional advantages in the central and western region to realize polarization and diffusion effects so as to promote the development of the whole region. However, the central and western regions have vast territory, in which there are so many different cities. It is an urgent problem which city has more geography location advantages so as to have faster development, and has the role of regional centers to radiate surrounding areas. This paper tries to solve this problem. From the perspective of region economics, this paper makes the selection research on the regional center city for three regions, based on the empirical data of the central, northwest and southwest region in china.

In Central, Northwest and Southwest Region, their provincial capital cities are selected as the research object in this paper since they are the largest city of their provinces with the greatest policy advantage and economic advantage. According to the national statistical standards, the provincial capital cities in Central Region are Taiyuan (Shanxi), Zhengzhou (Henan), Wuhan (Hubei), Changsha (Hunan), Hefei (Anhui), Nanchang (Jiangxi). The provincial capital cities in Northwest Region are Xi'an (Shaanxi), Lanzhou (Ganshu), Xining (Qinghai), Yinchuan (Ningxia), Urumqi (Xinjiang). The provincial capital cities in Southwest Region are Chongqing, Chengdu (Sichuan), Guiyang (Guizhou), Kunming (Yunnan), Lhasa (Tibet).

97.3 Index selection

According to the regional economics theory, such as "agricultural location theory" by J.H.Thünen, "industrial location theory" by Alfred Weber, "transport location theory" by Edgar M. Hoover, Market Location theory by August Losch, "Central Place Theory" by Walter Christaller and "growth pole theory" by Francois Perroux, a regional center must consider the geographical location, population, capital, labor cost, transportation, marketing and other factors. Through comprehensive analysis, this paper presents that a regional central city should have the following factors. First, it is located in the geographical center. Second, it has convenient transportation and logistics facilities, which can form great polarization and diffusion effect. Third, it has good economic base, which not only reflects a region economic strength, competitiveness and consumption ability, but also a regional market environment and commercial atmosphere. Fourth, it has certain population. The place with numerous populations can provide a large number of labor forces as well as potential consumers. Fifth, it has the advantage of human

Table 97.1 Influence index of the selection of regional center city

First index	Secondary index	Symbols
Geography location	Distance sum between the city and other cities	X_1
Traffic facilities	Railway mileage per ten thousands square kilometers in the province	X_2
	Highway mileage per ten thousands square kilometers in the province	X_3
Economics	City GDP	X_4
	Total retail sales of consumer goods	X_5
	Per capita disposable income of urban residents	X_6
	Per capita net income of rural residents	X_7
Population	Total population number of the province	X_8
	Employment number of the province	X_9
Human capital	Total number of college student in the province	X_{10}
	Average number of people having the higher education per ten thousands persons	X_{11}
	Average number of the college student per ten thousands persons	X_{12}

capital. In the knowledge economy era, human capital is the main factor reflecting competition ability. In this paper, considering the above five factors and the data collection, twelve secondary indexes are selected, shown in Table 97.1.

As shown in Table 97.1, Geography location is compared by calculating the distance sum between the city and other cities. The city with the smallest distance sum is located relatively in the center, which can bring the polarization and diffusion effects. The city area is small.

Railroad and highway is distributed in a mesh structure in the surrounding area. The railway and highway conditions within the city can not reflect a city traffic convenience. Moreover, the population and human capital have mobility. The quantity within city can not reflect the city's regional competitive advantage. Therefore, the traffic facilities, the population and the human capital select the province data as the index. In order to eliminate the influence of provincial area, the railway mileage and the highway mileage per ten thousands square kilometers are selected as the index reflecting a city traffic convenience. The total population number and the employment number of the province are selected as the population index. Relatively, the total number of college student in the province is selected to reflect the total situation of human capital. The average number of people having the higher education per ten thousands persons is selected to reflect the average situation of human capital, as well as the average number of the college student per ten thousands persons. The GDP, total retail sales of consumer goods, per capita disposable income of urban residents and per capita net income of rural residents of that city are selected as the index of economics.

97.4 Model Selection and Data Comprehensive Processing

97.4.1 Index Weight

Weight is the coefficient of index importance. Calculating the weights of the indexes commonly uses these methods, such as the subjective weighting method, the objective weighting method and the Analytic Hierarchy Process. Analytic Hierarchy Process (AHP) is proposed in the mid 1970s by TL Saaty, a professor of the University of Pittsburgh. It decomposes the complex question into several component factors, which is divided further into the target layer, rule layer and index layer so as to form a model with multi-objective and multi-level and ordered hierarchical structure. The comparison of each factor is made to determine the relative importance of the factors. The steps are the establishment of the hierarchical structure, constructing judgment matrix, hierarchical ranking and consistency check (Peng et al. 2004).

AHP is used to determine the index weigh in the paper. The index comparison values of judgment matrix are determined after comprehensive consideration of the theoretical analysis, statistics data and expert score. Target layer A, rule layer B and index layer P are made as shown in Table 97.2. In order to facilitate comparison and reduce the occupied space, the analysis result after calculating is attached to the last two columns in Table 97.2.

According to AHP, the largest eigenvalue $\lambda_{\max}$ and the corresponding eigenvector ω can be calculated by constructing the judgment matrix. For the judgment matrix A-B, shown in Table 97.3, we can conclude that $\lambda_{\max}$=5.0304, $\omega = (0.375, 0.215,\ \ 0.215, 0.121, 0.074)^T$, $CI = \frac{\lambda_{\max} - n}{n-1} = 0.0076$. And the judgment coefficient $CR = \text{CI/RI} = 0.0068 < 0.10$, which means that the consistence of judgment matrix is satisfied. Therefore, we get that the weight value of B_1, B_2, B_3, B_4, and B_5 for A are 0.375, 0.215, 0.215, 0.121, 0.074, in which B_1, geographical location index, is the greatest. Similarly, we can construct the judgment matrix B_3-P (Table 97.4) in which the judgment coefficient $CR = 0.0045 < 0.10$ and the consistence of judgment matrix is satisfied. The weight value of B_{31}, B_{32}, B_{33} and B_{34} for B_3 are 0.423, 0.227, 0.227, 0.123. The judgment matrix $B_5 - P$ (Table 97.5) can be constructed, in which the judgment coefficient $CR = 0.0083 < 0.10$ and the consistence of judgment matrix is satisfied. The weight value of B_{51}, B_{52} and B_{53} for B_5 are 0.539, 0.297 and 0.164.

B_2 and B_4 have only two secondary indexes, which are given that the weight values are both 0.5. So $CI = RI = 0$ .We make a consistence test for the total hierarchy, which is the weight value of the lowest index for the overall target. The judgment coefficient $CR = \sum_{i=1}^{n} \alpha_i CI_i / \sum_{i=1}^{n} \alpha_i RI_i = 0.0052 < 0.10$, in which $\alpha_i$is the weight value of B_i for A and CI_i is the consistence coefficient of B_{ik} for B_i, so the consistence of judgment matrix is satisfied. The final result is shown as Table 97.2, of which the last column is the weight value of each index for A.

Table 97.2 Index weight value by AHP

Target layer A	Rule layer B	Weight value of B for A	Index layer P	Weight value of P for B	Weight value of P for A
Composite score A	Geography location B_1	0.375	B_{11} for distance sum X_1	1.000	0.375
	Traffic facilities B_2	0.215	B_{21} for railway mileage X_2	0.500	0.108
			B_{22} for highway mileage X_3	0.500	0.107
	Economics B_3	0.215	B_{31} for city GDP X_4	0.423	0.091
			B_{32} for total retail sales X_5	0.227	0.049
			B_{33} for disposable income X_6	0.227	0.049
			B_{34} for net income X_7	0.123	0.026
	Population B_4	0.121	B_{41} for total population X_8	0.500	0.061
			B_{42} for employment number X_9	0.500	0.061
	Human capital B_5	0.074	B_{51} for total number of college student X_{10}	0.539	0.040
			B_{52} for average number of people having the higher education X_{11}	0.297	0.022
			B_{53} for average number of the college student X_{12}	0.164	0.012

Table 97.3 Judgment matrix A-B

A	B_1	B_2	B_3	B_4	B_5	ω
B_1	1	2	2	3	4	0.375
B_2	1/2	1	1	2	3	0.215
B_3	1/2	1	1	2	3	0.215
B_4	1/3	½	1/2	1	2	0.121
B_5	1/4	1/3	1/3	1/2	1	0.074

$\lambda_{\max} = 5.0304,\ CI = 0.0076,\ RI = 1.12,\ CR = 0.0068 < 0.10$

Table 97.4 Judgment matrix B_3-P

B_3	B_{31}	B_{32}	B_{33}	B_{34}	ω
B_{31}	1	2	2	3	0.423
B_{32}	1/2	1	1	2	0.227
B_{33}	1/2	1	1	2	0.227
B_{33}	1/3	½	1/2	1	0.123

$\lambda_{\max} = 4.0123,\ CI = 0.0041,\ RI = 0.9,\ CR = 0.0045 < 0.10$

Table 97.5 Judgment matrix B_5-P

B_5	B_{51}	B_{52}	B_{53}	ω
B_{51}	1	2	3	0.539
B_{52}	1/2	1	2	0.297
B_{53}	1/3	1/2	1	0.164

$\lambda_{\max} = 3.0096,\ CI = 0.0048,\ RI = 0.58,\ CR = 0.0083 < 0.10$

97.4.2 Data Dimensionless Processing

Because each index has different units and dimensions, dimensionless processing for these indexes must be done in order to compare and summarize. The normal methods of index standardization are range transformation method, linear proportional method, normalized method, standard sample transformation method, vector normalization method and taking reciprocal. In the paper, linear proportional method is used on the standardization and summation of these indexes.

In the decision matrix $X = (x_{ij})_{m\times n}$,

For the positive index, given $x_j^* = \max\limits_{1\le i\le m} x_{ij} \neq 0$, then

$$y_{ij} = \frac{x_{ij}}{x_j^*},\ (1 \le i \le m,\ 1 \le j \le n) \tag{97.1}$$

For the reverse index, given $x_j^* = \min\limits_{1\le i\le m} x_{ij} \neq 0$, then

$$y_{ij} = \frac{x_j^*}{x_{ij}}, (1 \le i \le m, 1 \le j \le n) \tag{97.2}$$

$Y = \left(y_{ij}\right)_{m\times n}$ is called as the linear proportional standard matrix.

In the twelve indexes, the distance sum is the reverse index, which means the higher the distance sum is, the lower the transform score is. So the index of distance sum should be standardized by the Eq. (97.2). The other eleven indexes are the positive index, which should be standardized by the Eq. (97.1). It must be noted that the maximum and minimum values are the respective region value within central, southwest and northwest regions, not the total value.

97.4.3 Evaluation Model

Linear weighting method is used as the evaluation model of.

$$Y_j = \sum_{i=1}^{12} \beta_i \times X_{ij} \qquad (i = 1, 2, \ldots 12;\ j = 1, 2, \ldots 16)$$

In which Y_j is "j" city's composite score, β_i is the weight value of "i" index, X_{ij} is the dimensionless value of "i" index of "j" city. According to the weight value in the Table 97.2, the final formula is:

$$\begin{aligned} Y =& 0.375X_1 + 0.108X_2 + 0.107X_3 + 0.091X_4 + 0.049X_5 + 0.049X_6 \\ &+ 0.026X_7 + 0.061X_8 + 0.061X_9 + 0.040X_{10} + 0.022X_{11} + 0.012X_{12} \end{aligned}$$

97.4.4 Calculation Results and Description

Considering the data consistency, all the data are in 2010. The data of X_1, X_2, X_7, X_8, X_9, X_{10} and X_{12} are from the "2011 China Statistical Yearbook". The data of X_3, X_4, X_5, and X_6 are from Statistical Communiqué on the 2010 National Economic and Social Development on these 16 cities. The original data are not listed for saving the space. By calculating, the final result is shown on the Table 97.6, in which the Y column is the final composite score.

As shown in Table 97.6, by considering and calculating comprehensively the twelve secondary indexes, it is concluded that the composite score rank of the six cities in Central Region are Wuhan (87.52), Zhengzhou (85.75), Changsha (74.83), Hefei (73), Nanchang (64.03) and Taiyuan (54.38), which means Wuhan, the highest score city, has the greatest advantages to become the regional center city in Central Region. But the gap between Zhengzhou and Wuhan is very small, only 1.77. After analysis of various secondary indexes, Both of Wuhan and Zhengzhou have five indexes being the highest score (100). By comparing the secondary respectively, Wuhan has the advantages of better geography location and economics, while Zhengzhou has the advantages of better traffic and more population and labor force. Zhengzhou is predominant on the total number of human capital.

Table 97.6 The composite scores of sixteen cities

Region	City	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	Y
Central region	Taiyuan	52.3	93.4	57.2	32.2	32.7	75.6	71.5	38.0	27.6	38.6	91.5	73.4	54.38
	Zhengzhou	79.1	100.0	100.0	72.5	66.5	82.8	86.7	100.0	100.0	100.0	67.1	63.3	85.75
	Wuhan	100.0	70.5	75.6	100.0	100.0	91.2	78.0	60.9	51.6	89.0	100.0	100.0	87.52
	Changsha	72.9	68.0	73.3	82.4	71.8	100.0	100.0	69.9	66.3	71.9	79.7	70.6	74.83
	Hefei	85.5	79.6	72.9	49.0	33.3	83.5	66.9	63.3	63.7	64.5	70.3	63.4	73.00
	Nanchang	80.0	66.2	57.4	40.0	30.3	80.1	67.6	47.4	38.2	56.0	71.8	74.4	64.03
Northwest region	Xi'an	69.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.3	100.0	88.58
	Lanzhou	100.0	28.9	39.0	33.9	33.8	63.2	59.2	68.5	73.4	41.1	70.7	58.7	66.74
	Xining	95.9	13.0	12.0	19.4	14.4	63.3	71.2	15.1	15.1	4.8	81.0	34.9	50.33
	Yinchuan	89.6	94.9	47.3	23.5	14.0	76.8	79.5	16.9	16.7	8.6	86.1	58.2	62.54
	Urumqi	39.0	12.8	12.8	40.4	35.0	64.7	96.3	58.5	43.7	27.1	100.0	45.7	38.50
Southwest region	Chongqing	99.4	100.0	100.0	100.0	100.0	91.1	64.3	35.9	38.3	48.1	100.0	100.0	88.77
	Chengdu	100.0	43.2	38.7	70.3	84.0	100.0	100.0	100.0	100.0	100.0	77.2	74.2	83.11
	Guiyang	95.6	67.1	60.6	14.2	16.8	79.7	72.8	43.2	48.1	29.8	61.2	46.0	66.17
	Kunming	90.5	37.1	37.4	26.9	36.8	90.6	70.8	57.2	56.3	40.4	66.9	57.7	63.18
	Lhasa	48.6	2.6	3.6	2.3	3.1	79.6	61.0	3.7	3.5	2.9	63.7	56.9	27.35

Wuhan is predominant on the average situation of human capital. Compared comprehensively the six cities in Central Region, it can be concluded that the scores was hierarchy distribution and the overall development of the Central Region is relatively balanced.

The composite score rank of the five cities in Northwest Region are Xi'an (88.58), Lanzhou (66.74), Yinchuan (62.54), Xining (50.33), Urumqi (38.50). Xi'an is not located on the center of the Northwest Region, but its composite score is far higher than the second city, Lanzhou, and it has ten indexes to be the highest score (100). Xi'an has the greatest advantages to become the regional center city in Northwest Region. Similarly, compared comprehensively the five cities in Northwest Region, it can be concluded that the scores was of great difference. The development gap between the cities of the Central Region was very large.

The composite score rank of the five cities in Southwest Region are Chongqing (88.77), Chengdu (83.11), Guizhou (66.17), Kunming (63.18), Lhasa (27.35), which means Chongqing has the greatest advantages to become the regional center city in Southwest Region. But the gap between Chengdu and Chongqing is small, only 5.66. From each secondary index, Chongqing and Chengdu have both six indexed being the highest score. Chongqing has the great advantage of traffic facilities. Correspondingly, Chengdu has the advantage of population and labor force. Similarly, compared comprehensively the five cities in Southwest Region, it can be concluded that the scores was also of great difference. The overall development of the Southwest Region is obvious uneven.

97.5 Conclusion and Suggestion

Under this macroscopic environment of expanding domestic demand, the cities in Central and West Region are facing tremendous development opportunity. From the perspective of region economics, this paper makes the comparison on regional advantages and selection of the regional center city between sixteen provincial capital cities in the Central, Northwest and Southwest Region in china, by constructing the index system with twelve secondary indexes on the five factors of geographical location, traffic facilities, economics, population and human capital and exploiting AHP. The following conclusions are drawn.

Wuhan, Xi'an, Chongqing have the more regional advantages to meet increasing consumer demand. Chinese government should position Wuhan as the regional center city in Central Region, Xi'an as the regional center city in Northwest Region, and Chongqing as the regional center city in Southwest Region, giving the three cities more policy and funds support. The three cities should be built to be the regional growth pole so as to enlarge the polarization and diffusion effect and drive the three regional developments.

At the same time, Wuhan should take full advantages of its economic and human capital, and concentrate on capital industry and science and technology industry. Xi'an has long distance with the other cities in the Northwest Region.

The traffic of the Northwest Region and the regional gap is worst in the three regions, which means the polarization and diffusion effect of Xi'an for Northwest Region is weaker. Xi'an should strengthen the connection so as to build the Northwest growth pole in Asia-Europe continental bridge and drive the development of Northwest Region. The composite scores of Chongqing and Chengdu are both on the top in the southwestern region, much greater than other provincial capital cities in the Southwest Region. Furthermore, the two cities are much close on the geographical location, Chongqing and Chengdu should reinforce the cooperation and become the regional growth dual pole so as to drive the development of Southwest Region.

Acknowledgments Based on empirical data of the Central, Northwest and Southwest Region in China

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