

A Research on Competitiveness of Guangxi City

—Based on System Clustering Method and Principal Component Analysis Method

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Abstract A total of 10 indices of regional economic development in Guangxi are selected. According to the relevant economic data, regional economic development in Guangxi is analyzed by using System Clustering Method and Principal Component Analysis Method. Result shows that System Clustering Method and Principal Component Analysis Method have revealed similar results analysis of economic development level. Overall economic strength of Guangxi is weak and Nanning has relatively high scores of factors due to its advantage of the political, economic and cultural center. Comprehensive scores of other regions are all lower than 1, which has big gap with the development of Nanning. Overall development strategy points out that Guangxi should accelerate the construction of the Ring Northern Bay Economic Zone, create a strong logistics system having strategic significance to national development, use the unique location advantage and rely on the modern transportation system to establish a logistics center and business center connecting the hinterland and the Asean Market. Based on the problems of unbalanced regional economic development in Guangxi, we should speed up the development of service industry in Nanning, construct the circular economy system of industrial city, and accelerate the industrialization process of tourism city in order to realize balanced development of regional economy in Guangxi, China.

Key words Clustering Analysis Method, Factor Analysis Method, Economic development level, Economic strength, China

Guangxi has the advantage of locating along the coastline, which is also the intersection of the east, central and the west of mainland of China. Guangxi is the junction of South China Economic Circle, West China Economic Circle and ASEAN Economic Circle, the most convenient sea tunnel of the Southwest and even the Northwest and an important aisle connecting Guangdong, Hong Kong, Macao and the western areas^[1]. With the establishment of China – ASEAN Free Trade Area, the exploitation of Pan North Bay, the cooperation of subordinate areas of Mekong and the further development of Pan Pearl Delta Cooperation and six – province – cooperation in Southwest, the economic zone of Pan North Bay in Guangxi is a new step of national development after the Pearl Delta, Yangtze Delta and Bohai Bay Economic Development Zone^[2]. However, the economic development of each zone of Guangxi is not balanced to some degree. With this as the background, the research on the development situations of each city in Guangxi plays an important guiding role in maintaining a continuous, rapid and healthy development of economy of Guangxi.

1 Research methods, index selection and data sources

1.1 Index selection In measuring the development situation of some region, there is a need not only to pay attention to the output of some specific industry, but also to take into consideration all aspects of social production, affording theoretical bases for a balanced development of regions. Based on principles of appropriateness and availability, cities in Guangxi are selected as samples. And the main economic indexes selected include GDP per capita X_1 , the total amount of fixed assets in-

vestment X_2 , total retail sales of social consumption goods X_3 , total amount of import and export X_4 , total amount of Post and Telecommunications business X_5 , the added value of Primary Industry X_6 , the added value of Secondary Industry X_7 , the added value of Tertiary Industry X_8 , the added value of industries X_9 , fiscal revenue per capita X_{10} .

1.2 Data sources Data comes from Statistics Bulletin in 2008 of Guangxi and Government Report. All the related data of economic development of cities of Guangxi is in the following Table 1.

1.3 Research methods

1.3.1 System Clustering Method. System Clustering Method refers to that firstly, viewing each sample as a type, then combining the two which have tiniest differences to form a new type. Secondly, calculating the differences existing between this new type and other types. Thirdly, combining again this new type and another one which has tiniest difference with the new type to form another new type^[3]. The author classifies the local cities of Guangxi according to levels of economic development in order to adopt appropriate methods.

1.3.2 Principal Component Analysis Method. In the research on the economic development, multiple variables involved in Principal Component Analysis Method have some certain correlation among them. The information contained in the measured data may be repeated. Therefore, the existence of the dominating common factors is a must. Based on this, by conducting a research on the relations of the internal structure of the related matrix of the original variables and covariance matrix, the author has several comprehensive indexes by using the linear combination of the original variables (principal components), which plays a part in dimension reduction and problems simplification based on the premise of maintaining major information of the original variables, making it easier to grasp the principal contradictions in research of regional economic development of

Guangxi^[4].**Table 1** The main economic indices of each city in Guangxi Province in 2008

Region	X_1 Yuan	X_2 $\times 10^8$ Yuan	X_3 $\times 10^8$ Yuan	X_4 $\times 10^8$ dollars	X_5 $\times 10^8$ Yuan	X_6 $\times 10^8$ Yuan	X_7 $\times 10^8$ Yuan	X_8 $\times 10^8$ Yuan	X_9 $\times 10^8$ Yuan	X_{10} Yuan
Nanjing City	19 028.90	65.002	63.168	1.871	11.842	20.319	45.612	65.690	22.042	2 763.81
Liuzhou City	24 707.82	43.030	32.616	1.693	7.243	8.781	48.077	29.063	36.000	3 844.44
Guilin City	17 371.34	48.596	27.789	1.011	7.170	17.151	39.945	31.206	35.071	1 682.00
Wuzhou City	12 858.75	19.830	13.640	0.603	3.029	6.107	19.980	11.898	19.100	1 041.30
Beihai City	23 250.37	20.030	8.011	0.711	1.401	7.174	13.486	10.729	7.684	2 002.22
Fangchenggang City	25 160.68	14.605	3.815	2.207	1.701	3.609	10.583	7.026	9.439	2 599.31
Qinzhou City	10 393.55	24.890	12.110	1.270	2.723	10.423	13.990	11.226	7.162	881.28
Yulin City	9 441.98	29.069	21.951	0.442	5.495	15.053	23.129	22.410	20.268	744.08
Baise City	10 608.35	32.545	8.149	0.489	3.642	8.807	21.761	11.056	18.930	1 404.29
Hezhou City	11 703.70	15.920	5.840	0.096	2.128	5.940	12.768	6.165	11.250	741.20
Hechi City	9 079.02	21.103	9.755	0.353	3.804	8.026	16.645	12.060	14.263	994.39
Laibin City	11 853.18	12.652	5.619	0.523	2.329	7.616	11.603	7.940	10.241	1 322.01
Chongzuo City	243 158.86	12.849	4.488	1.599	0.014	0.250	0.522	1.593	0.306	29 449.04

2 Conclusions and analysis

2.1 Macro-classification based on System Clustering Method

Making a clustering analysis on the economic development of local cities of Guangxi with System Clustering Method, the System Clustering Chart is shown in the following Chart 1. In the chart, the vertical axis numbers are the sample numbers, the horizontal axis numbers are the clustering standards. We can see in the chart 1 that Nanning, Guilin and Liuzhou are in the first level, others in the second while classified into second level type, and Nanning, Guilin and Liuzhou are in the first level, Chongzuo in the second level, and others in the third when classified into third level type. It is appropriate to classify these 13 cities into 4 clusters starting from the point marking number 3 on the basis of economic meanings. The specific classification is that Nanning is in the first level, Liuzhou city, Guilin city are in the second, Beihai city, Laibin, Hezhou, Qinzhou, Wuzhou, Hechi, Baise, Yulin, Fangcheng port cities are in the 3rd level, and Chongzuo City is in the fourth level.

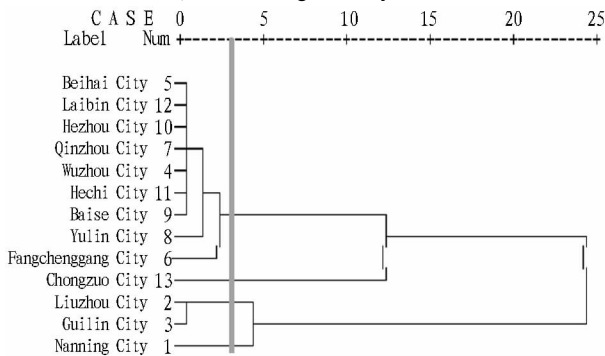


Fig. 1 The hierarchical clustering of the economic development level in each city of Guangxi Province

2.2 Micro-analysis based on Principal Component Analysis Method

Making a factor analysis with SPSS software, we can know that the KMO is 0.616 which suggests that it is appropriate to conduct the factor analysis. While the F by Bartlett is 0.000 which shows that the original data coming from Normal General Distribution. The pluses of squares of factor-load

shows that the accumulated contribution rate has reached to 92.621 when there are 3 components. Therefore, we may replace the original 10 indexes with 3 components to analyze the degrees of economic development.

Based on the load matrix of original factors gained through SPSS, the typical representative variables of each factor are not outstanding, so we cannot make a good explanation of factors. Therefore, we rotate the matrix, and the matrix after rotation is like the following Table 2. From Table 2, we know that the first principal components are composed by 7 indexes. They are the amount of investment in fixed assets, the total retail sales of social consumer goods, total businesses of Post and Tele-communications, the added values of primary industry, the secondary industry, the tertiary industry and the industries. The load of which functioning on the first principal component respectively are 0.966, 0.946, 0.967, 0.865, 0.917, 0.942, 0.772. These 7 indexes more or less reflect the measurable economic strength of the local cities of Guangxi from different aspects, of which we may define as economic strength indexes. The second principal components are composed by GDP per capita and fiscal revenue per capita, the load of which functioning on the second principal component are 0.966 and 0.970. These 2 indexes reflect to some degree the levels of human life. We may name them indexes of living standards. The third principal component is composed mainly by the single index of import and export, the load of which functioning on the third principal component is 0.936. This index reflects the competitiveness of foreign trade, which is also named index of competitiveness of foreign trade.

By the coefficient of factors and variables of matrix, we may get factor scores in the following:

$$F_1 = 0.120X_1 + 0.188X_2 + 0.174X_3 - 0.160X_4 + 0.176X_5 + 0.184X_6 + 0.148X_7 + 0.162X_8 + 0.153X_9 + 0.125X_{10}$$

$$F_2 = 0.555X_1 + 0.090X_2 + 0.091X_3 - 0.218X_4 + 0.037X_5 + 0.029X_6 - 0.019X_7 + 0.051X_8 - 0.001X_9 + 0.559X_{10}$$

$$F_3 = -0.215X_1 - 0.037X_2 + 0.041X_3 + 1.081X_4 - 0.037X_5 - 0.237X_6 + 0.010X_7 + 0.059X_8 - 0.1576X_9 - 0.205X_{10}$$

Having the contribution rates of the 3 principal components

as flexible strategies, combining the coefficient of the 3 principal components and making flexible strategy calculation, we may get the comprehensive scores and ranking. Ranking of levels of economic development of local cities of Guangxi in an order of from the highest to the lowest is Nanning, Guilin, Liuzhou, Yulin, Baise, Wuzhou, Hechi, Qinzhou, North Bay,

Table 2 The rotated factor load matrix

Factor	GDP per capita//Yuan	Volume of investment in fixed assets// ×10 ⁶ Yuan	Total retail sales of consumer goods// ×10 ⁶ Yuan	Total volume of import and export// ×10 ⁶ dollars	Gross import and export// ×10 ⁶ Yuan
1	-0.213	96.6	0.946	21.0	96.7
2	0.966	-7.4	-0.014	26.0	-17.4
3	0.134	15.4	0.229	93.6	12.0

Factor	Increased value of the primary industry ×10 ⁶ Yuan	Increased value of the secondary industry ×10 ⁶ Yuan	Increased value of the tertiary industry ×10 ⁶ Yuan	Increased value of industry// ×10 ⁶ Yuan	Financial income per capita//Yuan
1	86.5	91.7	94.2	77.2	-0.178
2	-30.1	-24.0	-7.8	-29.7	0.970
3	-9.5	1.20	21.9	-6.8	0.150

Table 3 The integrated score and ranking of different cities

Region	F ₁	F ₂	F ₃	Integrated score	Rank
Nanning	2.268 9	0.244 8	1.036 5	1.639 4	1
Liuzhou	0.998 7	-0.091 9	0.870 4	0.722 2	3
Guilin	1.327 7	-0.024 6	-0.513 1	0.788 0	2
Wuzhou	-0.301 3	-0.354 1	-0.394 8	-0.324 9	6
North Bay	-0.646 3	-0.265 7	-0.140 1	-0.495 8	9
Fangcheng Port	-1.240 2	-0.768 3	2.355 4	-0.706 3	13
Qinzhou	-0.537 7	-0.557 1	0.687 2	-0.399 0	8
Yulin	0.507 1	-0.152 1	-1.030 8	0.169 1	4
Baise	-0.047 4	-0.252 4	-0.745 7	-0.178 3	5
Hezhou	-0.613 2	-0.304 2	-1.084 7	-0.594 3	12
Hechi	-0.270 9	-0.298 8	-0.808 0	-0.340 4	7
Laibin	-0.688 9	-0.401 3	-0.458 3	-0.592 9	11
Chongzuo	-0.756 6	-0.401 3	0.225 9	-0.556 4	10

2.3 Conclusion analysis We may get through the above analyses that in analyzing the level of economic development of local cities in Guangxi, the results gained no matter by System Clustering Method or by Principal Component Analysis Method are the same. Through Principal Component Analysis, we may see that the general economic strength of Guangxi is weak. Taking advantages of economic and cultural centers, factors of Nanning have high scores. The comprehensive scores of other regions are averagingly lower than 1, which are far behind Nanning. The main reason why Guangxi is backward nationwide in economy is its inadequate development of industries (especially the backward development of the second industry). Therefore, upgrading the ratio of the added value of industries to GDP is the practical measure of each region strengthening its economic competitiveness. Meanwhile, with the development of regional cooperation at home and abroad, Pan - North Bay economic zone will become a newly growing economic block of China. Therefore, among its general development strategies, Guangxi should pay more attention in accelerating the construction of Pan - North Bay, building a strong logistics system at national levels to meet the needs of the southwest or even the south of

Chongzuo, Laibin, Hezhou and then Fangcheng Port city. The first principal components, with their economic strength, plays an essential part in the development of local economy. Other 8 cities rank the same position with the first principal component in order of economic strength except Wuzhou City, North Bay City, Hezhou, Hechi and Laibin city. (Table 3)

China for energies and raw materials, which has a great meaning in realizing strategies of the Eleventh Five Year Plan of Guangxi. Besides, Guangxi should make a full use of its location, depending on the modern transporting systems to build logistics centers and trading centers linking the south to the north and the mainland to the ASEAN markets.

3 Strategies and recommendations

3.1 Accelerating the development of services of Nanning

Nanning City is the capital of Guangxi with a good economy, developed tertiary industry, a high quality of netizens and high competitiveness of industries. Meanwhile, Nanning is the clusters of government agencies and commercial organizations with a large investment volume in fixed assets, a high employment rate and a stable life and income. Therefore, Nanning tops in the list of Guangxi with its comprehensive strength. ASEAN EXPO locates in Nanning eternally, which brings Nanning a great development chance of commerce economy. Therefore, Nanning should take the advantages of its services to develop greatly the commerce economy, integrating overseas contact resources to open up more foreign exchanging platforms. Meanwhile, accelerate the further innovation of commerce economy on its networking systems, mechanisms, models, adoptions and ways and so on, promoting efficient connection-cooperation of commerce economies of Guangxi and ASEAN to afford helps in shaping Nanning city as a regional international city.

3.2 Constructing recycling economy systems of industrial cities

Liuzhou is a key industrial city in Guangxi or even in the southwest in China. During the process of reform and opening up, Liuzhou had taken the advantage of its regional location to develop the second industry and had got an excellent result. The industrial economy has covered 25% in Guangxi, ranking in list of the modern industrial cities. The industrial development is the important guarantee of Liuzhou topping in the list of economy in Guangxi. As an old industrial basis, Liuzhou has a serious pollution problem after many-year-development. In order to maintain a continuous and rapid development, Liuzhou should

put great effort in developing recycling economy. Dealing well with the problems of environment protection and projects supervision, formulating local regulations controlling the emission of waste and putting into practice of the controlling of CO₂ emission and qualification of waste discharge to build the recycling economy systems in Liuzhou. It should make efforts to solve the problems of industrial development and environmental protection.

3.3 Accelerating the industrialization and commercialization processes of tourism cities Guilin is a city famous worldwide for tourism in Guangxi, which is the pillar industry of Guilin. For a long time, the strategy made by Guilin that having agriculture as the basis and tourism as the leading contributes a lot in promoting the development of economy in Guilin. Therefore, the development of economy of Guilin tops in the list. While the unitariness of industrial structures and the slow development of industries hinder the further development of Guilin to some degree. Guilin City should make full use of the present national Western Development Strategy, in names of accelerating the process of urbanization and industrialization to ask for more beneficial policies, capital and technic services. Guilin should take advantages of its good location and large marketing supply and needs to promote the process of industrialization and urbanization and shape Guilin as an export-oriented industrial and commercial city.

3.4 Promoting the economic development of backward areas Yulin City, Wuzhou City, Hechi City, Qinzhou City, Chongzuo City and other cities are located in remote areas, of which transportation is underdeveloped, backward in industry, dominated by agriculture, the per capita GDP is generally low, the overall economic development level is very low. These cities are in a weak link whether in terms of infrastructure, tech-

nology and education investment, the three major industries development, urbanization, or in terms of enhancing income and living standards of people. Therefore, they need to accelerate the education and training and investment, promote the adjustment of industrial structure, pay attention to the development of regional characteristic economy, steadily push forward the process of urbanization, increase incomes of urban and rural residents based on the development of production.

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service for farmers is the key to constructing the rural informatization.

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