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Research on Competitiveness of County Economy Based on Factor Analysis and Cluster Analysis

—Taking 88 Counties in Guizhou as Samples

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Abstract 17 indices are selected, such as the growth rate of total regional output value, the proportion of tertiary industry in GDP, per capita financial expenditure, and soil erosion rate of Guizhou Province in 2009. According to the relevant indices data of statistical yearbook and governmental website, by using the method of factor analysis and the method of cluster analysis, we assess the competitiveness of county economy in 88 counties of Guizhou Province. The results show that the competitiveness of county economy in Guizhou Province is impacted by factors of location and economic foundation. In addition, the resources environment, economic structure, economic developmental speed and other factors also impact the competitiveness of county economy in Guizhou Province. Based on these, in the light of the developmental characteristics of different counties in conjunction with different developmental advantages in different regions, we should adopt different developmental strategies according to local conditions, which is significant to rapid, healthy and sustainable development of county economy in Guizhou Province.

Key words County Economy, Competitiveness, Factor Analysis, Cluster Analysis, China

The competitiveness of county economy, the ability of attracting resources and market in big region of county economy in comparison with the same type of regions, namely, is the ability of optimizing and allocating resources in comparison with the same kind of regions. This research began from the 1980s, the early form of which is the analytical research on competitiveness of enterprise. And then it is applied and extended to the fields of industrial competitiveness and regional comprehensive competitiveness gradually^[1]. By the systematic analysis on the status quo of the development of ecology, society and economy in 88 counties of Guizhou Province, we conclude the economic competitiveness of all counties, which is conducive to assessing the status of regional competitiveness of all counties, formulating regional developmental strategy for decision-makers, crystallizing the developing focus, and providing theoretical reference for the healthy and sustainable development of regional ecology, economy and society.

1 Data source, research method and establishment of indices system

1.1 Data source The research data is mainly from *Statistical Yearbook of Guizhou Province* in 2009, the data regarding soil erosion rate index is from the updated communiqué data of Department of Water Resources of Guizhou Province, and part of the missing data is obtained from governmental websites of all cities and regional statistical yearbook in 2009.

1.2 Research method

1.2.1 Factor analysis method. The factor analysis method is a kind of multiplex statistical analytical method of descent by choosing several aggregate variables from many variables, so as to attain the goal of simplifying data. When analyzing and dealing with the problem of many variables, there is extreme correlation among variables which makes the information reflected by the observed data overlap. Consequently, by using the factor analysis method, we can use few impertinent aggregate variables to reflect the information of former variables as far as possible. These unobservable several aggregate variables are called common factors. There are many indices in the thesis, and we select the factor analysis according to the characteristic of samples. We firstly simplify the original indices into several common factors, then put the contribution rate of common factor as weight, and finally conduct the appraisal and ordering of county economic competitiveness of Guizhou Province by taking data of 88 counties as samples. The factor analysis is completed by using the statistical software SPSS13.0.

1.2.2 Cluster analysis method. The cluster analysis is the multiplex statistical analytical method of researching ordering of things according to the principle of birds of a feather flocking together. In the light of the similarity and correlation among indices and many observed data, many indices of samples and determining samples quantitatively, the samples or indices boil down to clusters. The thesis uses the systematic cluster method which does not need the given ordering standard, to conduct ordering of data objectively^[2].

1.3 Establishment of indices system Due to the particularity of subjective category, the county economic competitiveness has its own characteristics in comparison with the national or provincial competitiveness. Consequently, when constructing the indices system of economic competitiveness of different regions, we should take the particularity of the region into full

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consideration^[3].

1.3.1 The principles of constructing the indices of county economic competitiveness of Guizhou Province.

1.3.1.1 Comprehensiveness and conciseness. Selecting indices not only considers that it can reflect the economy, society, environment and other aspects of counties comprehensively, but also can not use the excessively big index system. Because county is the region between micro level and macro level, so if we establish excessive indices, it will make the indices overlap, and in the meantime, in the process of assessment of all counties in Guizhou Province, it is difficult to collect some indices.

1.3.1.2 Availability and scientificity. In order to ensure the scientificity and effectiveness of data, the selected indices of analytical data are mainly the quantitative indices and the data source needs the official quantitative indices data released by governmental authority.

1.3.1.3 Systematicity and regionality. The regional economic competitiveness, in itself, is a system of reflecting county economy, society, politics, culture, ecology and so on, so in the process of constructing indices, we should consider the systematicity of county economy, while the system of county economic competitiveness of Guizhou Province should also reflect the regional characteristics of minorities, fragile ecological environment and underdeveloped economy of Guizhou Province.

1.3.1.4 Up-to-date-state and perspectiveness. Establishing the indices system of county economic competitiveness should not only include the indices reflecting the current county economic competitiveness, but also include the indices reflecting the developmental potential of county economy, such as the index of "per capita financial expenditure" reflecting the level of county public accommodation expenditure, and the index of "soil erosion rate" reflecting local ecological environment and so on.

1.3.2 Selection of county economic competitiveness indices of Guizhou Province. According to the foregoing principles, taking 88 counties of Guizhou Province as samples, in terms of county economic comprehensive strength and county economic developmental potential, 17 statistical indices are selected to reflect the county economic strength and the corresponding statistical indices system is established (Table 1).

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Table 1 Index system of county economic competitiveness in Guizhou Province

Primary indicator	Secondary indicator	Tertiary indicator
Index system of county economic competitiveness in Guizhou Province	Indicator of comprehensive strength of county economy	Regional total output value $X_1 // \times 10^4$ yuan Total output value of industries of agriculture, forestry, husbandry and fishing $X_2 // \times 10^4$ yuan Total output value of industries $X_3 // \times 10^4$ yuan Total output value of service industries $X_4 // \times 10^4$ yuan Financial general budget income $X_5 // \times 10^4$ yuan Investments of fixed assets $X_6 // \times 10^4$ yuan Total sales of social consumption goods $X_7 // \times 10^4$ yuan Urban – rural residents' savings $X_8 // \times 10^4$ yuan Farmers' per capita net income $X_9 // \text{yuan / year}$
	Indicator of county economic developmental potential	Growth rate of regional total output value $X_{10} // \%$ Proportion of tertiary industry in GDP $X_{11} // \%$ Per capita financial expenditure $X_{12} // \text{yuan / year}$ Urbanization rate $X_{13} // \%$ Growth rate of financial general budget income $X_{14} // \%$ Proportion of industrial added value in GDP $X_{15} // \%$ Proportion of educational expenditure in GDP $X_{16} // \%$ Soil erosion rate $X_{17} // \%$

2 Results and analysis

2.1 Factor analysis

2.1.1 Feasibility test of factor analysis. By using SPSS13.0, and selecting indices system, we conduct factor analysis. Firstly, by the KMO test and Bartlett's sphericity test, we test whether the samples are feasible to factor analysis. The test result of KMO is that $0.729 > 0.6$; the test result of Bartlett's sphericity is that $0.000 < 0.05$, indicating that the data is feasible to factor analysis.

2.1.2 Establish factor variables. By using the statistical software SPSS13.0, we adopt 4 common factors with the Eigen value bigger than 1, to explain 17 original indices. The cumulative variance contribution rate of 4 common factors is bigger than 80%, indicating that it can cover the indices system and

the samples can be applied to factor analysis.

Table 2 Cumulative contribution rate of variances

Factor	Eigen value	Contribution rate // %	Cumulative contribution rate of variances // %
1	7.846	46.154	46.154
2	2.267	13.335	59.490
3	2.057	12.100	71.589
4	1.534	9.026	80.615

2.1.3 Factor component matrix. From the rotated factor component matrix in Table 3, we can find that the first common factor has big load (the coefficient with big absolute value) on the indices of $X_1, X_4, X_3, X_6, X_5, X_7, X_8, X_9, X_{13}$ and X_{16} which can be defined as county scale factors. The higher score on the factor, the more prominent the county scale economy, and

the greater the county total output and urban market; the second common factor has big load on the indices of X_2 , X_{17} and X_{12} , which can be defined as county public environment factors. These factors can predict the developmental potential of county. The third common factor has big load on indices of X_{11} and X_{15} , indicating that the county economic structure is good or bad, which can be defined as county economic structure factors; the fourth common factor has big load on the indices of X_{14} and X_{10} , which can be defined as county developmental speed factors.

2.1.4 Scoring and ordering of factors. By using SPSS13.0, the scores about 4 common factors of all cities can be seen in Table 4. In terms of the first common factor, Yunyan District and Nanming District score higher than other counties, which indicates that the scale economy of them excels that of the other counties, and their economic foundation is good; in terms of the second common factor, Wanshan Special Zone with the lowest overall ranking gets the highest score, indicating that although this type of regions are backward on economic aggregate and foundation, they have the benign impact on economic development in terms of public environment; in term of the third common factor, Nanming District and Yunyan District get the highest scores, indicating that their economic structure is rational; in terms of the fourth common factor, it indicates that they have fastest economic growth speed. We put the variance contribution rate of eigenvalue of all common factors as the weight to reflect the overall appraisal and score of economic competitiveness of 88 counties of Guizhou Province, the mea-

suring model is as follows:

$$F_{\text{Total}} = 46.154F_1 + 13.335F_2 + 12.100F_3 + 9.026F_4$$

In the formula, F_1 , F_2 , F_3 and F_4 are the scores of common factors of 1, 2, 3 and 4 of all counties respectively by using regression analytical method and spss13.0; F total is overall score^[4], and we calculate the overall scores and ordering of economic competitiveness of 88 counties of Guizhou Province, which can be seen in Table 4.

Table 3 Rotated component matrix

Indicator	Factor			
	1	2	3	4
X_1	0.954			0.167
X_4	0.892		0.346	
X_3	0.884		-0.240	0.234
X_6	0.882		-0.104	
X_5	0.866	-0.161		0.214
X_7	0.857	0.120	0.351	0.110
X_8	0.845	0.202	0.169	-0.146
X_9	0.823	0.353		-0.141
X_{13}	0.823	0.377	0.122	-0.119
X_{16}	-0.793		0.379	
X_2		-0.905		
X_{17}	-0.214	-0.716	-0.303	
X_{12}	-0.137	0.669	-0.398	-0.223
X_{11}	0.271	0.218	0.865	
X_{15}	0.503	0.246	-0.740	
X_{14}				0.825
X_{10}				0.755

Note: omit the absolute value of data results smaller than 0.1.

Table 4 Scores, order and cluster classification of common factor of counties (excerpt)

Counties and Cities	F_1		F_2		F_3		F_4		F total score	Total order	Category of clusters
	Score	Order	Score	Order	Score	Order	Score	Order			
Nanming District	3.37	2	1.35	5	3.04	1	0.18	34	211.89	2	I
Yunyan District	4.28	1	1.20	6	2.42	2	1.01	14	251.83	1	I
Honghuagang District	2.33	3	0.13	50	1.80	3	-0.88	76	123.25	3	I
Renhuai City	1.24	11	-0.36	64	-2.85	88	1.57	7	32.14	17	II
Pan County	2.00	5	-1.99	84	-2.31	86	2.39	1	59.34	10	II
Zhongshan District	2.14	4	0.21	43	-0.58	65	1.65	6	109.34	4	II
Huaxi District	0.92	14	1.06	7	0.92	11	0.06	41	67.95	6	III
Wudang District	1.47	8	0.96	12	-0.77	71	-0.57	70	66.22	8	III
Baiyun District	1.62	7	1.51	4	-0.82	75	-4.71	88	42.37	14	III
Xiaohe District	1.40	10	2.23	2	-1.21	78	-0.35	64	76.39	5	III
Huichuan District	1.17	12	0.52	26	-0.35	62	0.53	22	61.37	9	III
Wanshan District	-0.95	83	2.64	1	-2.48	87	-1.76	86	-54.72	88	III
Xingyi City	1.78	6	-1.06	73	-0.28	60	0.22	31	66.70	7	III
Kaili City	0.78	16	0.41	32	0.53	28	0.48	24	52.37	12	III
Duyun City	0.57	19	0.55	22	0.75	17	-0.27	58	40.48	15	III

2.2 Cluster analysis By conducting clusters analysis of system on the indices samples of 88 counties by using SPSS13.0, we conclude the clusters relations among counties of Guizhou Province, and list the cluster classification in Table 4. From the cluster classification, we know that the clusters of county economic competitiveness of Guizhou Province are classified as 3 types: the first type is Yunyan District, Nanming District and Honghuagang District; the second type is Renhuai City, Pan County and Zhongshan District; the third type includes other 82 counties. It indicates that Yunyan District, Nanming Dis-

trict and Honghuagang District of Guizhou Province have formed the economic strength and developmental level which preponderate over that of other counties of Guizhou Province by the natural advantages of location; Renhuai City, Pan County and Zhongshan District form the strong industrial basis by virtue of unique resources and relatively advantageous location, so as to effectively promote the development of other industries and other social aspects; the third type of 82 counties should have the county characteristics and seek further development.

3 Conclusion and discussion

By the aforesaid quantitative analytical methods of factor analysis and cluster analysis, we get the conclusion as follows: the comprehensive strength of county economic competitiveness of Guizhou Province depends on the accumulated basis of county since a long time. They are generally in excellent locations with good environment, and many regions with profuse resources, industrial advantage and strong county economic competitiveness cluster, such as Jicheng District of Guiyang City, Honghuagang District, Xingyi City, Kaili City, Duyun City and so on; in addition, some regions use scarce resources, such as mining, energy, speciality product and tourism resources; some counties also make dramatic development, such as Renhuai City, Pan County, Zhongshan District, Qianxi County and so on.

According to the two quantitative analytical results, coupled with the practical primary function area planning of Guizhou Province currently, the regions with profuse water energy resources and mining resources, should not merely develop short-sighted economy by energy, and they should also pay attention to developing local resources industrial clusters, saving energy and protecting environment, and effectively promoting regional socio-economic development; the regions with unique minorities cultural resources, moderate climate resources, profuse natural resources of animals and plants, and unique Karst natural landscape resources and other reusable resources, should convert this advantage of resources endowed the nature into developmental advantage; develop the infrastructure vigorously; change the developmental concept of the public; protect the reusable resources with long sight; develop the local tourism development integrating ecological agri-

culture, sightseeing, minorities folklore and natural ecological landscape. Consequently, developing county economy of Guizhou Province is the key to sustainable development of tourism of Guizhou Province, and protecting and improving ecological environment. So we should advocate the concept of "saving energy and reducing emission, and circular development" in three industries in order to make backward Guizhou Province develop rapidly.

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distinctive agriculture. The application of high technology in circulation domain of distinctive agriculture is displayed on the fully use of computer and information technology, as well as completely improve the weakness of spatial situation of Guangxi distinctive agriculture. The relevant departments should overcome the obstacles to getting information through database technology, network technology and information service, and effectively supervise, predict and manage the production situation, natural and biological disasters by using remote sensing, geographical information system and global position system.

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