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Comparative Study of Regional Urban Competitive based on Factor Analysis

Yinghong Huang

School of Economics, Fujian Normal University, Fuzhou 350108, China

Abstract

Urban competitiveness is the concentrated embodiment of regional comprehensive development ability. Focusing on the evaluation of urban competitiveness is of great significance to grasp the law of urban development and scientifically explore the construction of innovative cities. In nine cities in Fujian province for the research sample, to capture the economic development, social undertakings, public infrastructure construction, ecological environment four dimensions of statistics to establish urban competitiveness evaluation system, using the factor analysis of the 24 variable index evaluation system factor extraction and rotation, and to measure the relevant public factors, and the final empirical analysis of the research samples.The study found that the indexes of 9 prefecture-level cities in Fujian province showed significant intercity differences, and the siphon effect of Fuzhou, Xiamen and Quanzhou was more obvious, among which Xiamen was the most obvious. The ranking of the ecological environment level and the calculation results of the other levels is inverted. In terms of spatial distribution, the ecological environment quality of the northern cities in the province is generally better than that of the southern cities. In the future, the coordinated development mechanism of urban agglomeration with "combining points and combining points and areas" is a more appropriate modern urban agglomeration governance model.

Keywords

Urban Governance; Urban Competitiveness; Regional Urban Research; Factor Analysis.

1. Introduction

City is an important spatial carrier in the national governance system. As a spatial position rich in resource endowment advantages, it has great practical significance in promoting economic development, providing public services, responding to emergencies, activating the mechanism of coordinated urban and rural development, and promoting the construction of smart society. Therefore, the city competitiveness is also the concentrated embodiment of the comprehensive development ability of its region.

According to the existing literature, the academic research on urban competitiveness is mainly conducted from three perspectives: the connotation, index construction and evaluation method of urban competitiveness. Establishing the connotation of urban competitiveness is often the starting point of relevant research. According to American scholar Webster, urban competitiveness refers to the ability of urban areas to produce and sell higher value products and services than other urban areas. According to the characteristics of cities as the subject of competition, Xu Kangning, a domestic scholar, believes that urban competitiveness refers to the ability of cities to gather, absorb and utilize various civilized elements to promote economic and social development through a natural, economic, cultural and institutional environment. In the process of constructing the evaluation index of urban competitiveness, Creel et al proposed the two-factor model including "economic" and "strategic", believing that the urban competitiveness should be evaluated based on this model; Wang

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Guixin et al divided the urban competitiveness into three-dimensional competitiveness such as economic development competitiveness, social development competitiveness and environmental development competitiveness. At the practical level, Li Na et al. discussed the advantages of SWOT analysis in urban competitiveness evaluation; Huang Guoyan et al. compared the competitiveness of major cities at home and abroad based on complex network analysis; Han Xuejian used DEA model to evaluate the urban competitiveness of domestic resource-based cities. Urban competitiveness, as a concentrated embodiment of regional comprehensive development ability, is a holistic and systematic concept.

In the constantly emerging research results, we note that: first of all, the existing studies mostly discuss the issues of urban competitiveness from the economic perspective, while the academic lack of urban competitiveness research based on the perspective of urban governance exists; secondly, the existing studies lack a detailed comparative analysis of urban samples in the urban agglomeration group. Therefore, in the process of promoting the development of urban areas, only by objectively and comprehensively analyzing the urban competitiveness, and focusing on the new phenomena and new problems in the process of urbanization, can we truly bring the governance efficiency of urban agglomeration into full play and reform its disadvantages.

Based on this, this paper tries to take 9 prefecture-level cities in Fujian Province as the analysis sample, use the factor analysis method to calculate the statistical data, and then conduct an empirical analysis of the competitiveness of urban agglomeration in the province, in order to see the broad picture of urban public governance.

2. Data, Indicators, and Models

2.1 Data Source

Fujian province has jurisdiction over 9 prefecture-level cities, 11 county-level cities, 42 counties and 31 municipal districts.The governance regulations of municipal and county-level units under municipal and provincial jurisdiction are significantly different from prefecture-level cities, and the analysis of the data of matching cities at the same level is more scientific and rigorous. Therefore, according to the research needs, nine prefecture-level cities, including Fuzhou, Xiamen, Quanzhou, Zhangzhou, Putian, Longyan, Sanming, Nanping and Ningde, were selected as the research samples. The statistical data involved in the sample are mainly derived from the Fujian Provincial Statistical Yearbook 2020, the Fujian Provincial Environmental Governance Status 2020, and the 2020 statistical Yearbook and statistical bulletin of the relevant cities.

2.2 Indicator Construction

The index construction in this paper is mainly based on the following principles: (1) scientific, which fully reflects the essential connotation of urban competitiveness; (2) operability, that is, relevant data can be obtained through official channels with high credibility; (3) representativeness, that is, variable selection must fully reflect the key elements at all levels; (4) comparability, that is, the selected variable indicators must be the sample city for later empirical comparison.

Based on this, on the basis of the existing research practices, this paper selects 22 variables from four levels of economic development, social undertakings, public infrastructure and ecological environment to form the urban competitiveness evaluation system. Specific composition is as follows: (1) the economic development level consists of 9 variable indicators, including the city GDP X_1, GDP per capita X_2, general public budget revenue X_3, general public budget expenditure X_4, permanent residents per capita disposable income X_5, total retail sales of social consumer goods X_6, financial institutions RMB deposits X_7, fixed assets investment X_8, the added value of high and new technology industry X_9 ; (2) the social undertaking level consists of seven variable indicators, including the number of health institutions X_{10}, the number of health practitioners X_{11}, education

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expenditure X_{12}, the number of students X_{13}, science and technology expenditure X_{14}, general public service expenditure X_{15}, and the number of schools X_{16}; (3) Public infrastructure is composed of four variable indicators, including the electricity consumption of the whole society X_{17}, the number of Internet broadband users X_{18}, road freight volume X_{19}, and road operating mileage X_{20}; (4) The ecological environment level consists of two variables, including the number of days with good air quality X_{21} and the air quality comprehensive index X_{22}.

2.3 Model Selection

A total of 22 variables were collected, including local GDP and GDP per capita, etc. There was a strong correlation between the variables. Data should be simplified, data should be fully and effectively used, and new indicators through enrichment and purification should be used instead of old indicators with multicollinearities. Therefore, this paper uses the factor analysis model to measure the data, and this method can extract the variable information and reduce the analysis dimension, thus making the research process more efficient.

Factor analysis is a research method that studies the internal dependence of the correlation matrix between multiple variables, and finds out several random factors that can synthesize the key information across all variables. The calculated factors are not correlated with each other, and all the variables can represent a linear combination of common factors.

With n samples and p indicators, $X=\left(X_1,\ X_2,\cdots,\ X_p\right)^T$ as random vectors, the model expression is as follows:

$$
\begin{aligned}
&X_1=a_{11}F_1+a_{12}F_2+\cdots+a_{1m}F_m+\mu_1\\
&X_2=a_{21}F_1+a_{22}F_2+\cdots+a_{2m}F_m+\mu_2\\
&\cdots\\
&X_p=a_{p1}F_1+a_{p2}F_2+\cdots+a_{pm}F_m+\mu_p
\end{aligned}
$$

In the equation, the matrix $A=\left(a_{ij}\right)$ is called the factor load matrix, a_{ij} is a factor load (loading), μ is a special factor, representing the variable variation that cannot be explained by the common factor, and is negligible in the actual analysis. During the operation, the measurement statistical analysis software, and the Bartlett's sphere and the KMO statistics measured the main factor and the maximum factor comprehensive score was finally determined.

3. Variables Description Was Associated with the Factor Treatment

3.1 Descriptive Statistics of the Variables

To grasp the overall characteristics of the sample, the extreme value, mean and standard deviation of the 22 variables were statistically described before the formal analysis. The results of the variables are listed in Table 1. From Table 1, we can conclude that there are indeed great differences in terms of economic development, social undertakings, public infrastructure and ecological environment.

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Table 1. Descriptive statistics for each variable group

Descriptive statistics of the "economic development" variable groups					
	Number of cases	**least value**	**crest value**	**average value**	**standard error**
GDP / 100 million yuan	9	1991.57	9946.66	4710.557	3092.953
GDP per capita / yuan	9	74036	142739	102167.2	20974.17
General public budget revenue / 100 million yuan	9	96.17	768.2983	304.7165	259.8001
General public budget expenditure / 100 million yuan	9	235.8168	949.7604	498.2878	273.4693
Per capita disposable income of permanent residents / yuan	9	26266.5	41910	31308.78	5139.175
Total retail sales of consumer goods / 100 million yuan	9	730.6224	5351.868	2099.648	1624.847
RMB deposit / 100 million	9	1890.59	15367.47	5258.166	4988.934
Fixed assets investment / RMB 100 million yuan	9	1502.73	7155.2	3374.316	1695.009
Add value of high-tech industry / 100 million yuan	9	844.82	5034.84	2135.227	1582.693
Descriptive statistics for the "social undertakings" variable group					
	Number of cases /	**least value**	**crest value**	**average value**	**standard error**
Number of health institutions / number	9	1339	5039	3087.556	1235.901
Number of health practitioners / person	9	15960	64645	28616.56	15400.74
Education expenditure / 100 million yuan	9	57.0662	181.9641	97.25531	48.7458
Number of students in school / person	9	13829	340330	96267.11	107440.9
Science and technology expenditure / 100 million yuan	9	2.426	38.4332	13.45954	12.57792
General public services expenditure / 100 million yuan	9	23.6478	89.6747	45.55931	24.61772
Number of schools /	9	2	36	10	11.52172
Descriptive statistics of the "public infrastructure" variable groups					
	Number of cases /	**least value**	**crest value**	**average value**	**standard error**
Electricity consumption / 100 million kwh	9	116.5297	517.324	261.5275	154.7843
Number of Internet broadband users / ten thousand households	9	110.2	1250.41	408.8156	344.0419
Road freight volume / ten thousand t	9	3984	23159	10971.22	7208.054
Highway operating mileage / km	9	6553.83	22382.29	14368.26	4409.273
Descriptive statistics of the "ecoenvironment" variable groups					
	Number of cases /	**least value**	**crest value**	**average value**	**standard error**
Days with good air quality / d	9	352	363	358.3333	4.092676
The Air Quality Composite Index	9	2.61	3.57	3.027778	0.2605176

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3.2 Model Suitability Test

Factor analysis requires some correlation between variables in order to extract common factors for analysis. In this paper, Bartlett's spherical test and KMO test statistics test the data. When the P-value of the spherical test is less than 0.05 and the KMO statistical value is greater than 0.5, it means that there is a correlation between variables and the degree of coupling with the model is high.

Table 2. KMO versus Bartlett's spherical test for 4 groups of variables

The "Economic Development" variable group			"Social cause" variable group		
Number of KMO sampling		0.710	Number of KMO sampling		0.692
Bartlett's sphericity test	Approximate chi square	104.030	Bartlett's sphericity test	Approximate chi square	75.485
	free degree	28		free degree	21
	conspicuousness	0.000		conspicuousness	0.000
The Public Infrastructure variable group			The Eco-Environment variable group		
Number of KMO sampling		0.565	Number of KMO sampling		0.501
Bartlett's sphericity test	Approximate chi square	15.177	Bartlett's sphericity test	Approximate chi square	3.367
	free degree	6		free degree	1
	conspicuousness	0.019		conspicuousness	0.067

As can be obtained from Table 2, all the 4 groups of variables have passed the Bartlett's spherical test and the KMO test, and the factor analysis method is fully applicable to this data.

3.3 Variables of the Factors Were Extracted with the Varimax Rotation

Table 3. Factor extraction and rotation of the "economic development" variable group

Factor 1 (Urban macroeconomic level)	postrotatory Factor load	explain amount of variability	Cumulative variance Contribution rate	Factor 2 (Economic level of residents)	postrotatory Factor load	explain amount of variability	Cumulative variance Contribution rate
General public budget revenue	0.887	83.990%	83.990%	GDP per capita	0.895	8.579%	92.569%
General public budget expenditure	0.841						
RMB deposits in financial institutions	0.798						
investment in the fixed assets	0.781			inhabitant Per capita disposable income	0.851		
Value-added value of high and new-tech industries	0.657						
total output value	0.452						
Total retail sales of social consumer goods	0.304						

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The urban comprehensive competitiveness evaluation index system has four sets of data scales, focusing on the four dimensions of economic development, social undertakings, public infrastructure and ecological environment, with 9,7,4 and 2 items respectively. The principal component analysis method extracts the variables combined with professional knowledge and eigenvalues, and the direct rotation axis is rotated by the maximum variance method (Varimax). The absolute load value of the factor component selection number is greater than 0.5, and the cumulative contribution rate of the principal component factor number should be higher than 85%, so as to improve the accuracy and explanatory power of the model. Calculated by the measuring tool:

(1) In the original 8 items of the "economic development" variable group, two main component factors of "urban macroeconomic level" and "resident economic level" were extracted. The two variance percentage was 83.99% and 8.579%, respectively, and the contribution rate of the cumulative variance was 92.569%, which has a certain explanatory power. The specific data are shown in Table 3.

Table 4. Factor extraction and rotation of the "social cause" variable group

<table>
<tr><th>Factor 1 (Education and Health input)</th><th>postrotatory Factor load</th><th>explain amount of variability</th><th>Cumulative variance Contribution rate</th><th>Factor 2 (Technology and General Public Services)</th><th>postrotatory Factor load</th><th>explain amount of variability</th><th>Cumulative variance Contribution rate</th></tr>
<tr><td>Number of health institutions</td><td>0.901</td><td rowspan="4">77.707%</td><td rowspan="4">77.707%</td><td rowspan="3">Expenditure on science and technology</td><td rowspan="3">0.958</td><td rowspan="6">15.571%</td><td rowspan="6">93.278%</td></tr>
<tr><td>education spending</td><td>0.756</td></tr>
<tr><td>Number of students in school</td><td>0.741</td></tr>
<tr><td>Number of health practitioners</td><td>0.673</td><td rowspan="3">General public service expenditure</td><td rowspan="3">0.918</td></tr>
<tr><td>Factor 3 (Number of schools)</td><td>0.863</td><td>3.910%</td><td>97.188%</td></tr>
</table>

(2) The original 7 items of "social undertakings" extracted the three principal component factors of "education and health input", "science and technology and general public service investment" and "school number". The variance percentage of the three was 77.707%, 15.571% and 3.910% respectively, and the contribution rate of cumulative variance was 97.188%, which has certain explanatory power. The specific data are shown in Table 4.

(3) The original three questions of the "public infrastructure" variable group extracted the two main components of "power, Internet and road freight volume" and "road mileage". The variance percentage of the two was 61.313% and 26.397% respectively, and the contribution rate of the

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cumulative variance was 87.710%, which has certain explanatory power. The specific data are shown in Table 5.

Table 5. Factor extraction and rotation of the "Public Infrastructure" variable group

Factor a (Power, Internet and road freight volume)	postrotatory Factor load	explain amount of variability	Cumulative variance Contribution rate
Electricity consumption in the whole society	0.910	61.313%	61.313%
Number of Internet Broadband users	0.891		
highway freight volume	0.798		
Factor 2 (Highway mileage in operation)	0.958	26.397%	87.710%

(4) The original two items of the "ecological environment" variable group extracted the main component factor of "air quality level", and the variance percentage of this factor is 81.8%, which has a certain explanatory power. Only one common factor is extracted, without factor rotation. Specific data are shown in Table 6.

Table 6. Factor extraction for the "ecological environment" variable group

Factor a (Air quality level)	postrotatory Factor load	explain amount of variability	Cumulative variance Contribution rate
Days with good air quality	0.904	81.791%	81.791%
The Air Quality Composite Index	-0.904		

3.4 Factor Expressions are Presented

In addition to the factor extraction and conversion of four variable groups: economic development, social undertakings, public infrastructure and ecological environment, the within-group factor coefficient matrix also needs to be calculated. Using the regression method, the public can be calculated according to the factor score coefficient matrix.

The linear equation between the factors and the individual variables. Equation (1) ~ (8) presents the common factor expression for each variable group separately.

$$\text{Factor formula of economic development variable group}\begin{cases} F_1 = -0.242X_1 + 0.353X_2 + 0.256X_3 + 0.194X_4 + 0.282X_5 - 0.355X_6 + 0.143X_7 + 0.240X_8 - 0.046X_9 \cdots (1) \\ F_2 = 0.505X_1 - 0.263X_2 - 0.119X_3 - 0.039X_4 - 0.169X_5 + 0.631X_6 + 0.025X_7 - 0.126X_8 + 0.270X_9 \cdots (2) \end{cases}$$

$$\text{Factor formula of social cause variable group}\begin{cases} F_3 = -0.114X_1 + 0.199X_2 + 0.186X_3 - 0.173X_4 + 0.506X_5 + 0.443X_6 - 0.269X_7 \cdots (3) \\ F_4 = -0.614X_1 - 0.254X_2 + 0.193X_3 + 0.553X_4 - 0.153X_5 - 0.342X_6 + 1.109X_7 \cdots (4) \\ F_5 = 1.171X_1 + 0.386X_2 - 0.110X_3 - 0.055X_4 - 0.239X_5 + 0.126X_6 - 0.592X_7 \cdots (5) \end{cases}$$

$$\text{Factor formula of public infrastructure variable group:}\begin{cases} F_6 = 0.503X_1 + 0.544X_2 + 0.112X_3 - 0.252X_4 \cdots (6) \\ F_7 = -0.058X_1 - 0.200X_2 + 0.445X_3 + 0.699X_4 \cdots (7) \end{cases}$$

$$\text{Group factor formula of ecological environment variables:} \quad F_8 = 0.553X_1 - 0.553X_2 \cdots (8)$$

Note that the factor expression X_i is not the original variable, but the normalized variable. The score of each factor can be calculated by substituting the normalized variables into Eq. According to the factor score, the variance contribution rate of each common factor is weighted, and then the factor score is weighted. The comprehensive factor score of each variable group can be calculated for the analysis, and then analyzed.

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4. Empirical Analysis

This part will measure the comprehensive factor scores of the economic development, social undertakings, public infrastructure and ecological environment in the 9 prefecture-level cities respectively, and make an empirical analysis based on the data results.

4.1 Analysis of the Competitiveness of Economic Development

According to equation (1) and (2), the economic development comprehensive factor score expression is obtained: the economic development comprehensive factor score = 83.99/92.57×F1+8.58/92.57× F2.

Through the comprehensive factor score expression, the economic development indicators of 9 prefecture-level cities were sorted out and empirically analyzed, and the calculation results are shown in Table 7.

Table 7. Comprehensive factors of 7 9 prefecture-level cities

area	score	sort
Xiamen	1.964405952	1
Fuzhou	1.106560165	2
Quanzhou	-0.200968872	3
Zhangzhou	-0.263806747	4
Sanming	-0.29057855	5
Longyan	-0.475138211	6
Putian	-0.493334062	7
Nanping	-0.664000255	8
Ningde	-0.683130347	9

As can be seen from Table 7, there are obvious differences in the economic development level of the 12 major prefecture-level cities in Fujian Province. The calculation results show that Xiamen's economic development level is 1.964, far ahead in the province, and its economic development level is far beyond that of other cities in the province. Economic development level of the top three cities is Xiamen, Fuzhou and Quanzhou, score is 1.964,1.107,0.201, but at the average level of economic development (economic development comprehensive factor score more than 0) of the city only in the province at a higher level of Xiamen and Fuzhou, conform to most provinces of our country "one main two vice" urban planning and development path. In addition to the "one main and two secondary" cities, Zhangzhou and Sanming are also the cities with scores above-0.3, and the economic development level of the two cities is in the middle level. The comprehensive factor score of Longyan, Putian, Nanping and Ningde cities in the sample was below-0.3, which belongs to the cities with a low level of economic development.

Xiamen city, Fuzhou city and Quanzhou city, as the core planned cities in the development strategy of Fujian Province, have obvious advantages in economic development, which have also been well confirmed from the data. The analysis of the observed indicators shows that Xiamen's economic aggregate is huge, far exceeding other cities in the province in terms of GDP per capita, general public budget revenue and expenditure, and disposable income. In terms of GDP per capita index, Xiamen, Fuzhou, Quanzhou, Zhangzhou and Sanming cities all exceeded 100,000 yuan, ranking at the forefront in the province. In the field of the added value index of high-tech industry, Fuzhou exceeded 500 billion yuan, Xiamen and Quanzhou exceeded 300 billion yuan, and other cities in the province were below 200 billion yuan, reflecting the characteristics of Fuzhou, Xiamen and Quanzhou with

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rich scientific research resources, outstanding industry-university-research transformation efficiency, and remarkable achievements in innovation and development strategy. In general, the economic development level of the 9 prefecture-level cities is obvious, the scores differ different, showing a clear differentiation.

4.2 Analysis of the Competitiveness of Social Undertakings

According to equation (3), (4), (5), the social cause comprehensive factor score expression can be obtained: the social comprehensive factor score = 77.71/97.20×F3+15.57/97.20×F4+3.91/97.20×F5

Through the comprehensive factor score expression, the social undertakings indicators of 9 prefecture-level cities were sorted out and empirically analyzed, and the calculation results are shown in Table 8.

Table 8. comprehensive factors of 8 9 prefecture-level cities

area	score	sort
Xiamen	1.528276655	1
Fuzhou	1.269924573	2
Quanzhou	-0.01110966	3
Longyan	-0.267133958	4
Ningde	-0.373563241	5
Zhangzhou	-0.417780744	6
Sanming	-0.543676992	7
Nanping	-0.585234406	8
Putian	-0.599702227	9

As can be seen from Table 8, there are significant differences in social undertakings levels among 9 major prefecture-level cities in Fujian Province. The calculation results show that Xiamen city's social undertakings level score is 1.964, in the leading position in the province. In terms of indicators, Xiamen leads the lead in education, science and technology, and general public services. In terms of social undertakings, the cities above the average level (factor score greater than 0) are Xiamen and Fuzhou, respectively, with scores of 1.528 and 1.270, respectively, which are at a higher level in the province, and the gap is small. The cities scoring at-0.5~0 are Quanzhou, Longyan, Ningde and Zhangzhou respectively, and the social undertakings level of the four cities is in the middle level. The comprehensive factor scores of Sanming, Nanping and Putian in the sample were all below-0.5, which belongs to the cities with a low development level of social undertakings.

In general, in terms of social cause competitiveness, the differences between the cities are obvious, and the polarization is more prominent.

4.3 Competitiveness Analysis of Public Infrastructure

According to equation (6), (7), the public infrastructure comprehensive factor score expression can be obtained: the public infrastructure comprehensive factor score = 61.31/87.71×F6+26.40/87.71 F7

Through the comprehensive factor score expression, the public infrastructure indicators of 9 prefecture-level cities were sorted out and empirically analyzed, and the calculation results are shown in Table 9.

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Table 9. the score of the public infrastructure comprehensive factors of the 9 9 prefecture-level cities

area	score	sort
Quanzhou	1.622301098	1
Fuzhou	0.660701278	2
Xiamen	0.307132652	3
Zhangzhou	0.051077518	4
Sanming	-0.357300714	5
Ningde	-0.420881637	6
Longyan	-0.558849089	7
Putian	-0.6325842	8
Nanping	-0.671603896	9

It can be concluded from Table 9 that there are still significant differences in the public infrastructure service capacity of the nine major prefecture-level cities in Fujian Province. The calculation results show that there are four cities above the average level (the factor score is greater than 0), namely Quanzhou, Fuzhou, Xiamen and Zhangzhou. The public infrastructure of these cities is relatively perfect, including Quanzhou far ahead, Fuzhou and Xiamen is relatively at the same level, it is worth noting that Zhangzhou public infrastructure comprehensive factor score is 0.051 (greater than 0), but at the bottom of the average and significant fault with other cities.

In the sample, two cities scored between-0.5 and 0, respectively, Sanming and Ningde, and their public infrastructure service capacity is at the medium level. There are three cities with a score of below-0.5, namely Longyan, Putian and Nanping, which have a weak public infrastructure service capacity. The comprehensive factor score level is very obvious, the highest score between Quanzhou city and the lowest score between Nanping City, the polarization phenomenon is more serious.

The analysis of the observed indicators shows that Xiamen city is in the leading position in terms of the total highway mileage, which is significantly related to Xiamen's strategic position in Fujian and even the whole country.China's special economic zone approved by Xiamen State Council, an important central city, port and scenic tourism city along the southeast coast, is of great strategic significance. Therefore, Xiamen's transportation infrastructure planning should not only focus on the needs of the province, but also take the initiative to carry the traffic "pressure" from the whole country. The analysis of the road freight volume index found that Xiamen city still ranked first in the number of road freight volume of 231.59 million t, and the data results are enough to reflect the importance that Xiamen municipal government attaches to its road transportation. In terms of the number of Internet broadband users, Quanzhou city is in the first place with 12.5041 million households, so the popularization of Internet broadband in Quanzhou city is extremely high; In the whole social electricity consumption index, Fuzhou city occupies the first place among 9 prefecture-level cities with 51.732 billion kwh.

Through the observation of the administrative division map of Fujian Province, it is found that Putian is located between Fuzhou city and Quanzhou City and has a small area. It can be reasonably speculated that the geographical location and area factors affect the competitiveness of the public infrastructure of Putian to some extent.

4.4 Analysis of Ecological Environment Competitiveness

According to the equation (8), the ecological environment comprehensive factor score expression is obtained: the ecological environment comprehensive factor score = 81.80/81.80 F8.

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Through the comprehensive factor score expression, the ecological environment indicators of 9 prefecture-level cities were sorted out and empirically analyzed, and the calculation results are shown in Table 10.

Table 10. 9 prefecture-level cities

area	score	sort
Nanping	1.517	1
Longyan	0.92279	2
Sanming	0.58324	3
Ningde	0.29756	4
Fuzhou	0.14901	5
Putian	-0.21381	6
Zhangzhou	-0.37012	7
Quanzhou	-1.28469	8
Xiamen	-1.60098	9

As can be seen from Table 10, the ecological environment comprehensive factor scores between the nine prefecture-level cities are still significant, but the ranking results showed inverted ranking patterns compared with the previous analysis. The calculation results show that there are five cities with more than the average ecological environment comprehensive factor score, namely Nanping, Longyan, Sanming, Ningde and Fuzhou. Among them, the comprehensive factor score of Nanping, Longyan and Sanming is more than 0, and the comprehensive factor score of the remaining two cities is between 0 and 0.5..5The calculation results of Putian and Zhangzhou are between-0.5~0, and the ecological environment level belongs to the second echelon of the sample. However, Quanzhou and Xiamen, which have shown outstanding performance in economic development, are relatively weak in the ecological environment comprehensive factor score, and belong to the last echelon of the sample cities.

Observing the spatial characteristics of the sample distribution, we found that among the top 6 cities with the ecological environment comprehensive factor score ranking, four cities were located in the north of Fujian Province, namely Nanping, Ningde, Fuzhou and Putian. According to the data calculation results and the spatial distribution of the sample, it can be reasonably inferred that the comprehensive factor score of the sample urban ecological environment presents the spatial characteristics of better in northern cities than southern cities. In addition, in the context of China's current ecological civilization construction, it is very important to strengthen the environmental quality improvement of the important strategic cities in Fujian province, especially Xiamen.

5. Conclusions and Enlightenment

This study is based on empirical evidence from nine prefecture-level cities in Fujian Province, Building the index system of the four levels of economic development, social undertakings, public infrastructure and ecological environment to effectively analyze the competitiveness of each city, The study conclusions are as follows: First, The competitiveness of 9 prefecture-level cities in Fujian province shows significant intercity differences among various levels; next, From a spatial level, Urban development in the province presents the spatial pattern of "one super and two strong", Fuzhou, Xiamen and Quanzhou siphon effect is obvious, Among them, Xiamen siphon effect is the most obvious; once more, The competitiveness of ecological environment and economic development of the 9 cities is inverted, The air quality of northern cities in the province is obviously better than that

of southern cities. This paper analyzes the analysis of the development status of prefecture-level cities in Fujian Province.

The empirical research with urban competitiveness as the entry point can further deepen the understanding of urban governance in the theoretical and practical circles. According to the research in this paper, the development of strategic cities within the urban agglomeration in Fujian Province is relatively mature, while the urban competitiveness of other cities in the same region is generally relatively weak, and the dissipation effect of the resources in the central cities in the urban agglomeration in the radiation process is more obvious. The competitiveness of urban agglomeration mainly depends on the competitiveness of the constituent cities within the urban agglomeration, rather than the competitiveness of some of them.

Therefore, it is necessary to re-examine and construct the governance mechanism of urban agglomeration within the region from the perspective of collaborative governance. In the future, we should explore the collaborative governance mechanism of urban agglomeration that "taking points with areas and combining points and areas", give attention to the resource endowment advantages of strategic cities in urban agglomeration, and eliminate the asymmetric effect between cities of different sizes by radiating other cities. Establish and improve the public participation guidance and operation mechanism through information means, which can positively affect the performance of urban governance. At the same time, we should echo the top-level design, build an urban agglomeration environmental governance system with multiple governance subjects, clear levels, clear division of labor and efficient operation, and put high-quality development at the core of the urban development strategy.

At present, urban agglomerations in different regions will be affected by regional distribution and policy factors and present different governance boundaries. The road of urban governance cannot be separated from comprehensive national policy guidance and active exploration of local governments, which also leaves room for further academic research.

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