

Evaluation of Fuzhou's Urban Competitiveness Based on the Analysis of the Economic Zone on the West Coast of the Straits

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Abstract: With the increasingly fierce economic competition at home and abroad, the importance of urban competitiveness is constantly emerging. This paper constructs an evaluation index system of urban comprehensive competitiveness from four aspects: economic strength, degree of external development, scientific and educational situation, and infrastructure construction. By using factor analysis method, it analyzes the relationship between public factors and comprehensive factors of 20 cities in the economic zone on the west coast of the Taiwan Strait. Scores are calculated and ranked. From the three levels of social development, regional economic development and urban construction and development, a comprehensive evaluation is made on Fuzhou and other cities in the economic zone on the west coast of the Taiwan Strait, and an analysis is made based on the comprehensive score. Understand and analyze the advantages and disadvantages, and provide suggestions for Fuzhou's urban construction in the economic zone on the west coast of the Taiwan Strait based on the conclusions.

Keywords: Urban competitiveness, Regional economy, Factor analysis.

1. Introduction

The study of urban competitiveness has become an important topic in the study of urban development and orientation. With the transformation, succession and transfer of industries in various cities, the economic zone is based on the level of economic development and development, the characteristics of labor division and the positioning of each city's development plan, to realize the complementary cooperation between the economic zone and each economic zone and each city. Achieve a higher level of openness with the economic zone. The West Coast Economic Zone refers to the west coast of the Taiwan Strait, with Fujian as the main body, including southern Zhejiang, eastern Guangdong and parts of Jiangxi. It is adjacent to Hong Kong and Macao, across the sea from Taiwan, and connects with the two economic zones of the Pearl River Delta and the Yangtze River Delta in the north-south direction. The Economic Zone on the West Coast of the Taiwan Strait is an economic circle formed by relying on the five central cities of Fuzhou, Xiamen, Quanzhou, Wenzhou and Zhangzhou in the coastal core areas and with the five central cities as the center. With the network space development pattern of "one belt, five axes and nine districts", the coordinated development and economic cooperation among the cities in the region are realized. As one of the central cities of the economic zone on the west coast of the Taiwan Strait and the capital city of Fujian Province, Fuzhou is a national historical and cultural city. Fuzhou has a beautiful natural environment and rich historical sites. It is the political, economic and cultural center of the province and the core city of the Fuzhou metropolitan area. Therefore, it is of special significance to study the urban competitiveness of Fuzhou.

Most of the evaluation objects are urban agglomerations within a province or a watershed, or extended to the entire economic zone. Chen Xingyu (2021) analyzed the urban competitiveness of 17 cities in Shandong Province from 2014

to 2018 through the principal component analysis method, and on this basis analyzed the overall urban development situation and development trend in Shandong Province [1]. Wu Shaohua et al. (2021) designed 6 primary indicators and 18 secondary indicators. Conducted factor analysis on 51 cities in the western region, and analyzed and positioned the urban development under the development and construction of the western region [2]. Wu Huarong (2019) compared and analyzed Yichang City and eight prefecture-level cities in Hubei Province, and combined the urban development of Yichang City with the guidance of government construction [3]. Liu Chunyun (2011) compared Hefei with 9 other provincial capital cities through factor analysis, and analyzed the influencing factors of Hefei's economic development [4]. Ni Pengfei (2021) used cluster analysis to analyze and evaluate the urban competitiveness of 1007 cities around the world, and conduct quantitative research on the levels, types and patterns of these cities [5].

In terms of evaluation indicators, domestic scholars have put forward the content of indicators for the evaluation of urban competitiveness from various perspectives. Chen Xingyu (2021) divided urban competitiveness into four levels: economy, external development, science education, and infrastructure. Wu Shaohua et al. (2021) believe that the evaluation indicators of urban competitiveness are composed of economic strength, infrastructure, social security, resources and environment, technological innovation, and external development. Xi Guangliang et al. (2008) scholars divided the evaluation indicators of urban competitiveness into five indicators: urban economic strength, urban financial strength, urban infrastructure construction, urban science and technology culture, and urban ecological environment [6].

From the evaluation and analysis, Xi Guangliang (2008) proposed to strengthen the cooperation with Taiwanese businessmen and strengthen the traffic connection and urban infrastructure construction between the cities on the west coast of the Taiwan Strait according to the urban competitiveness of the economic zone on the west coast of the

Taiwan Strait. Luo Wenqi (2021) believes that Fuzhou should be deeply integrated into the development and construction of the "Belt and Road", and use the advantages of core cities to promote urban construction and development [7]. Wu Huarong proposed to improve the competitiveness of cities in all aspects from the perspective of the government, and promote urban construction and development. Chen Xingyu (2021) proposed that the cultivation of talents plays an important role in the technological level of the city and the development of the city's economy.

2. Study Design

2.1. Research methods

On the basis of summarizing the research results of major scholars, this paper grasps the real data and materials through empirical analysis, and provides data support. Use factor

analysis to determine principal components and factor weights, calculate urban competitiveness scores, and sort them. In the empirical analysis, based on the comparative analysis method, the competitiveness of each sub-city in Fuzhou is compared with other cities in the province.

2.2. Indicator selection and data sources

The sample selected 20 prefecture-level cities in the economic zone on the west coast of the Taiwan Strait, including Fuzhou, Xiamen, Wenzhou, Shantou, Sanming, Putian, Lishui, Shangrao and other 20 cities as research samples. The indicators in the table come from the 2020 China Urban Statistical Yearbook, the 2020 Statistical Yearbook data of Fuzhou and other cities, and the 2020 Statistical Bulletin of National Economic and Social Development of some cities.

Table 1. Evaluation index system of urban comprehensive competitiveness

Primary indicator	Secondary indicators	three-level indicator
city competitiveness	Economic strength	GDP per capita
		Public expenditure
		Amount of RMB deposits in financial institutions at the end of the year
		The total retail sales of social consumer goods
	Degree of openness	Total actual utilization of foreign capital
		Total export of goods
		Science and technology spending
	Science and education situation	Education spending
		Number of students in regular colleges and universities
		The total amount of post and telecommunications per capita
	Infrastructure	Number of buses per 10,000 people
		Urban per capita park green space

3. An Empirical Analysis of Urban Competitiveness

3.1. Feasibility test

This paper extracts and summarizes the index data of 20 sample cities in the economic zone on the west coast of the Taiwan Strait from the statistical yearbook. Data processing and dimensionality reduction were carried out through SPSS

software, and factors were analyzed and tested. The KMO value was 0.739 by KMO and Bartlett's test. According to the measurement standard, the KMO value is greater than 0.7, the approximate chi-square of the Bartlett Sphericity test is 249.586; the significance probability is less than 0.001, indicating that the data in this paper are suitable for principal component analysis. According to the factor analysis results of SPSS, the component loading matrix and explained total variance can be obtained.

Table 2. KMO and Bartlett tests

KMO Sampling Suitability Quantity.		0.739
Bartlett's sphericity test	approximate chi-square	249.586
	degrees of freedom	66
	salience	0.000

3.2. Determination of the main factor

Using SPSS to analyze the data, we obtained the characteristic root and factor contribution rate. According to the principle that the cumulative contribution rate exceeds 50% and the eigenvalue is greater than 1, 3 main factors can be extracted from the 12 indicators. The cumulative variance

contribution rate of these three main factors reached 82.150%, indicating that the amount of information to be eliminated is very small, and the three main components basically contain the information of all indicators, and the factor analysis results are reliable. By rotating the load matrix, the corresponding factor component matrix can be obtained.

Table 3. Total variance explained

Primary determinants	Initial eigenvalues			Extract the load sum of squares			Rotational load sum of squares		
	Total	Percent variance	Accumulation %	Total	Percent variance	Accumulation %	Total	Percent variance	Accumulation %
1	6.962	58.017	58.017	6.962	58.017	58.017	4.977	41.475	41.475
2	1.737	14.478	72.495	1.737	14.478	72.495	3.110	25.915	67.390
3	1.159	9.655	82.150	1.159	9.655	82.150	1.771	14.760	82.150
4	0.893	7.439	89.589						
5	0.508	4.232	93.821						
6	0.298	2.487	96.308						
7	0.173	1.445	97.753						
8	0.124	1.036	98.789						
9	0.064	0.537	99.325						
10	0.056	0.468	99.793						
11	0.014	0.116	99.910						
12	0.011	0.090	100.000						

Note: Extraction method: principal component analysis

3.3. Principal Component Interpretation

The number of principal factors in the factor analysis conclusion determines the number of principal components in the principal component analysis. According to the principle that the eigenvalue is greater than 1 and the cumulative explained variance is about 85%, three common factors are obtained. Divide the values in the component matrix by the initial eigenvalues corresponding to the two principal components. Then take the square root to get the eigenvector value, and finally calculate the eigenvector matrix in turn.

The contribution rate of the variance of the first component is 41.475%, including the public financial expenditure, the amount of RMB deposits in financial institutions at the end of the year, and the total actual utilization of foreign capital,

which are heavily loaded on factor 1. It mainly reflects the social development status, and F1 can be considered as a social development factor.

The variance contribution value of the second component is 25.915%, including the per capita GDP, the export value of goods and the total retail sales of social consumer goods, which have a large load on factor 2. It mainly reflects the regional economic situation, and F2 can be considered as an economic development factor.

The third component variance contribution value is 14.760%, including the total amount of post and telecommunications per capita, the number of buses per 10,000 people, and the urban per capita park green space has a larger load on factor 3. It mainly reflects the construction of urban infrastructure. It can be named the base building factor.

Table 4. Rotated composition matrix The rotated component matrix a

	Principal component		
	1	2	3
GDP per capita	0.013	0.906	0.140
public expenditure	0.967	0.175	-0.007
The total retail sales of social consumer goods	0.537	0.682	-0.221
Amount of RMB deposits in financial institutions at the end of the year	0.750	0.605	0.059
Total actual utilization of foreign capital	0.871	0.050	0.211
Goods exported	0.573	0.664	0.403
science and technology spending	0.829	0.322	0.246
education spending	0.944	0.211	-0.108
Number of students in regular colleges and universities	0.633	0.667	0.006
The total amount of post and telecommunications per capita	0.165	0.233	0.806
Number of buses per 10,000 people	0.297	0.564	0.666
Urban per capita park green space	-0.092	-0.131	0.570

Note: Extraction method: principal component analysis. Rotation method: Caesar's normalized maximum variance method. The rotation has converged after 4 iterations.

3.4. Calculate the principal component matrix

The raw data involved in factor analysis were standardized

using SPSS. The principal component analysis analytical expression can be obtained from the eigenvector matrix, and the formula is as follows.

Table 5. Component Score Coefficient Matrix

	Principal component		
	1	2	3
GDP per capita	-0.248	0.510	-0.061
public expenditure	0.283	-0.163	-0.042
The total retail sales of social consumer goods	-0.003	0.293	-0.262
Amount of RMB deposits in financial institutions	0.089	0.141	-0.070
Total actual utilization of foreign capital	0.283	-0.247	0.121
Goods exported	0.009	0.167	0.145
science and technology spending	0.193	-0.080	0.098
education spending	0.266	-0.118	-0.113
Number of students in regular colleges and universities	0.032	0.219	-0.113
The total amount of post and telecommunications per capita	-0.015	-0.043	0.481
Number of buses per 10,000 people	-0.060	0.140	0.334
Urban per capita park green space	0.000	-0.148	0.392

Note: Extraction method: principal component analysis. Rotation method: Caesar's normalized maximum variance method.

$$F1 = -0.248X_1 + 0.283X_2 - 0.003X_3 + 0.089X_4 + 0.283X_5 + 0.009X_6 + 0.193X_7 + 0.266X_8 + 0.032X_9 - 0.015X_{10} - 0.060X_{11} + 0.000X_{12} \quad (1)$$

$$F2 = 0.510X_1 - 0.163X_2 + 0.293X_3 + 0.141X_4 - 0.247X_5 + 0.167X_6 - 0.080X_7 - 0.118X_8 + 0.219X_9 - 0.043X_{10} + 0.140X_{11} - 0.148X_{12} \quad (2)$$

$$F3 = -0.061X_1 - 0.042X_2 - 0.262X_3 - 0.070X_4 + 0.121X_5 + 0.145X_6 + 0.098X_7 - 0.113X_8 - 0.113X_9 + 0.481X_{10} + 0.334X_{11} + 0.392X_{12} \quad (3)$$

By weighting the variance contribution rates of the three factors, we can finally get the comprehensive score formula for the 20 cities in the economic zone on the west coast of the Taiwan Strait:

$$F = (41.475 \times F1 + 25.915 \times F2 + 14.760 \times F3) / 82.150$$

3.5. Principal component score, comprehensive score and ranking of the West Coast Economic Zone

According to the factor analysis method, the comprehensive scores of the 20 sample cities in the economic zone on the west coast of the Taiwan Strait were calculated and ranked from the factors of social development, economic development and infrastructure construction.

Table 6. City Comprehensive Competitiveness Scores and Rankings

Area	F1 score	F1 ranking	F2 score	F2 ranking	F3 score	F3 ranking	overall score	total ranking
Fuzhou	1.28328	3	2.13070	1	-0.42944	15	1.24	2
Xiamen	1.25910	4	1.47094	3	3.21516	1	1.68	1
Putian	-1.05837	20	0.49080	4	0.31992	5	0-.32	15
Sanming	-0.99366	19	0.41829	5	-0.37150	13	-0.44	17
Quanzhou	0.35762	6	1.68010	2	-1.12683	20	0.51	5
Zhangzhou	-0.36551	11	0.28985	8	-0.35309	12	-0.16	7
Nanping	-0.81234	17	0.09759	9	-0.55947	16	-0.48	18
Longyan	-0.78072	15	0.36300	6	-0.04153	8	-0.29	11
Ningde	-0.71415	14	0.02460	10	-0.19886	11	-0.39	16
Yeosu	-0.22920	8	-0.14668	13	-0.85793	18	-0.32	14
Wenzhou	1.66738	2	0.35491	7	-1.07391	19	0.76	3
Quzhou	-0.39874	12	-0.36900	14	0.05471	6	-0.31	12
Shantou	-0.31048	10	-0.07061	12	-0.03964	7	-0.19	9
Jieyang	-0.43270	13	-0.68718	16	0.68395	3	-0.31	13
Chaozhou	-0.80411	16	-0.44016	15	-0.40468	14	-0.62	20
Meizhou	-0.23017	9	-1.21431	17	1.77547	2	-0.18	8
Fuzhou	0.08107	7	-1.22596	18	0.40703	4	-0.27	10
Shangrao	1.07605	5	-1.52360	19	-0.13439	10	0.04	6
Yingtian	-0.95429	18	-0.03794	11	-0.07633	9	-0.51	19
Ganzhou	2.35996	1	-1.60533	20	-0.78866	17	0.54	4

3.6. Analysis Conclusion

(1) We analyze the urban competitiveness scores in Table 6. From the F1 factor score, it can be seen that Ganzhou, Wenzhou, and Fuzhou; from the F2 factor score, it can be seen that the top three cities are Fuzhou, Quanzhou, Xiamen; from the F3 factor score, it can be seen that Xiamen, Meizhou, and Jieyang rank high. And Fuzhou City ranks sixth from the bottom in this category. In terms of comprehensive factor

scores, Xiamen, Fuzhou and Wenzhou are among the best. At the same time, there are only 6 cities with a comprehensive score higher than 0. The competitiveness of cities in the West Coast Economic Zone has the following characteristics: First, the overall level of urban competitiveness of the cities in the economic zone on the west coast of the Taiwan Strait is not high.

(2) Fuzhou, as one of the core cities of the economic zone on the west coast of the Taiwan Strait and the capital city of

Fujian Province, has not achieved outstanding results in the factor of social development. It only accounts for 75% of Xiamen's scientific and technological expenditures, and the actual utilization of foreign capital only accounts for 49% of Xiamen's and 47% of Ganzhou's. There are still some deficiencies in the social development of the city.

(3) From the factor analysis score of F3, we can see that in terms of infrastructure construction factor, Fuzhou only ranks 15th, and there are certain deficiencies. The total per capita post and telecommunications business only accounts for 15.03% of Xiamen, which is also a core city, and the number of buses per 10,000 people only accounts for 60.86% of Xiamen's, which will affect the city's sustainable development capacity to a certain extent.

(4) The urban competitiveness of most cities in the economic zone on the west coast of the Taiwan Strait is weak. Therefore, as the core city of the economic zone on the west coast of the Taiwan Strait, Fuzhou needs to play a role in driving the economic development and urban construction of the more developed cities and improving the overall urban competitiveness of the economic zone on the west coast of the Taiwan Strait.

4. Urban Development and Conception

By comparing Fuzhou with other cities in the economic zone on the west coast of the Taiwan Strait, we put forward suggestions and development ideas for promoting the development of Fuzhou and the economic zone on the west coast of the Taiwan Strait from four aspects.

4.1. Increase investment in science and education technology

Adequate talent reserve, advanced technology and investment in science and technology are all important conditions to promote the sustainable development of urban construction. In the future, Fuzhou needs to increase the funds invested in scientific and technological research and development to improve the ability of scientific and technological innovation. Accelerate the construction of high-tech zones, increase support for innovative enterprises, and improve the centrality of scientific and technological innovation. Focus on inter-city innovation cooperation and independent innovation, maintain and enhance the importance and competitiveness of cities in the region [8].

The foundation and core of talent training is education. Therefore, Fuzhou should increase the investment in the financial expenditure of college education, and continue to build and improve the school-running level of various colleges and universities. Encourage colleges and universities to develop applied technology, communicate and cooperate with major colleges and universities at home and abroad, and strive to realize the diversification of college education and expand students' horizons. Actively build Fuzhou University City, improve the teaching ability and talent reserve of colleges and universities. The government should encourage universities, scientific research institutions, and enterprises to form a talent training chain and build a new model of talent training and enterprise development for industry-university-research cooperation. Students can better combine theory and practice to promote the realization of technological innovation. The government needs to take incentive measures to increase the attraction of higher education students in Fuzhou and reduce the outflow of talents while increasing the

introduction of innovative talents and technologies.

4.2. Improve the utilization of foreign capital

The wide absorption of foreign capital and the efficient use of funds will have obvious positive benefits to the city's economic development. There is still a certain gap between Fuzhou's actual utilization of foreign capital and the better development of the economic zone on the west coast of the Taiwan Strait. Therefore, Fuzhou should actively promote the "Silk Road Trade" and expand the influence of Fuzhou's characteristic brands at home and abroad with the help of platforms for international economic and trade cooperation such as the Maritime Silk Road Expo. Further deepen the integration of trade and investment, and strengthen foreign cooperation in advantageous fields such as traditional industries, modern agriculture, and project contracting. Deepen international production capacity cooperation, and coordinate the construction and development of economic and trade cooperation zones at home and abroad [9]. In addition, it is necessary to further build and improve the investment policy and service system in Fuzhou City, accelerate the construction of the safety guarantee system for overseas investment, and improve the competitiveness of enterprises and the ability of enterprises to resist risks. Fuzhou should continue to improve the institutional system for overseas economic and trade cooperation zones, continue to promote the construction of the China (Fujian) Pilot Free Trade Zone, extensively absorb foreign and Taiwanese capital, and further strengthen the supply-side reform of financing.

4.3. Speed up infrastructure construction

Urban infrastructure determines the happiness index and convenience of people's life, and complete infrastructure is the basis for the rapid development of cities. Beautiful ecological environment, convenient transportation and public facilities are necessary conditions for attracting talents. Strengthen the construction of traffic and information channels between Fuzhou and Nanping inland cities. Improve the infrastructure construction of Fuzhou, drive the infrastructure construction of surrounding cities, and promote the development of resources, energy, tourism, etc. in cities in the economic zone on the west coast of the Taiwan Strait. Increase investment in Fuzhou's ports, information, culture and other facilities to further improve the city's infrastructure services. Build a multi-functional city, promote the smooth operation of various functional areas in the city, and improve the operational efficiency of Fuzhou.

4.4. Actively play a leading role as a hub

(1) As the core of the Fuzhou metropolitan area, promote the economic development and economic construction within Fuzhou. Accelerate the construction of public service facilities and infrastructure in Binhai New City, speed up the new area's undertaking of the functions of the old city and the progress of the new area's economic development. Further adjust the industrial structure and land distribution in the old urban area, transfer and attract industries, and promote the coordinated development of various urban areas in Fuzhou. Promote the construction of city groups such as Sanjiangkou, Minjiangkou, and Fuqing Bay, deepen and improve the multi-level division of labor and cooperation system, and build a higher-level Fuzhou metropolitan area. Further strengthen and improve the road construction and subway construction in Fuzhou, speed up the operation of subway lines 3 and 4 as

soon as possible, and realize the convenience of traffic between urban areas in Fuzhou. Promote the free flow of production factors and achieve higher-level coordinated development among various industries. Form a satellite or group city development model with the central urban area as the core and gradually spread outward. Each city should rely on its own advantages to adjust the industrial structure, expand the scope of influence, and actively implement supply-side structural reforms. In the development planning and construction of the city, the regional positioning of each urban area shall be clarified and differentiated development shall be implemented. Give full play to the functions and advantages of each region, improve the level of urban competitiveness of Fuzhou, and drive the economic development among the urban areas in the Fuzhou metropolitan area.

(2) The central city of the Haixi Economic Zone, promoting the urban development of the Haixi Economic Zone. Fuzhou is located on the Fuzhou – Ningde – Nanping – Yingtan - Shangrao development axis in the "one belt, five axes and nine districts" network space development pattern of the economic zone on the west coast of the Taiwan Strait. In the coordinated development of cities and the development of urban agglomerations on the west coast of the Taiwan Strait, we will continue to promote industrial exchanges and cooperation with Nanping, Yingtan and other places. While protecting the environment and building an ecological civilization, it will transfer mid- and downstream enterprises to inland cities to help them develop resources and expand economic scale, while accelerating the speed of industrial transformation in Fuzhou. Promote the construction of expressways and high-speed railways between cities. With Fuzhou as the core, it will radiate the surrounding inland cities, drive the economic development of the surrounding cities and the improvement of urban competitiveness, and accelerate the industrial transformation and economic development of Fuzhou.

5. Conclusions

By constructing the index system and evaluation model of Fuzhou's urban competitiveness and comparing it with nineteen cities in the economic zone on the west coast of the Taiwan Strait, this paper studies and analyzes the comprehensive competitiveness of Fuzhou's cities. Under the background of leading the development of national regional central cities, the countermeasures and suggestions to enhance the competitiveness of cities are put forward based on the government level. The main conclusions of this paper are as follows:

(1) From the empirical analysis results, Fuzhou's urban competitiveness ranks at the forefront among the economic zones on the west coast of the Taiwan Strait, ranking second only to Xiamen. It shows that Fuzhou, as the core city of the economic zone on the west coast of the Taiwan Strait, has certain economic strength and the ability to drive other cities

to improve the competitiveness of the city.

(2) Fuzhou has achieved good results in economic construction and economic development. The per capita GDP, total export of goods, total retail sales of consumer goods and other indicators ranked first among the 20 cities in the Haixi Economic Zone. It shows that Fuzhou's economic development and people's quality of life are relatively high, and the city's openness and economic scale are further expanding.

(3) The infrastructure construction of Fuzhou is the disadvantage of Fuzhou's urban competitiveness. In terms of per capita post and telecommunications business volume, per capita park green space and other indicators, Fuzhou's ranking is relatively low. This shows that it is an important aspect that restricts the realization of Fuzhou's urban construction goals, and it is also one of the focuses of Fuzhou's future urban planning. In the development direction of Fuzhou City, in terms of sustainable development competitiveness, strengthening infrastructure construction and ensuring the development of ecological civilization will be the strategic goal and core content of urban development and construction.

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