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Evaluation of Development Ability of Fujian Province——Based on principal Component Analysis

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Abstract: *The current global economic development is stagnant due to the impact of COVID-19. The formulation of an active and reasonable economic development plan that seeks to make progress in stability can promote high-quality economic growth. As a gateway to the opening up of my country's southeast coast, Fujian is an important province with rapid economic development in recent years. Therefore, studying the influencing factors of Fujian's GDP is of great significance to the implementation of various policies. This paper uses the principal component analysis method, based on the data of Fujian Province from 2010 to 2018, and selects 16 indicators in four dimensions to construct an economic development indicator system to measure and evaluate the comprehensive development level of Fujian Province. Research has shown that the economic situation of Fujian Province is changing from high-speed growth to high-quality growth, and there has been a significant improvement in economic development, scientific research and innovation, and there is still room for improvement in cultural education and sanitation. This article starts with the degree of influence, and puts forward a series of suggestions on the more influential aspects, so as to provide a theoretical basis for the future economic development of Fujian Province.*

Keywords: *Fujian Province, GDP, principal component analysis, policy suggestion*

1. Introduction

The "14th Five-Year Plan" period is the first five years after my country has built a moderately prosperous society in an all-round way and marched towards the second centenary goal. This year is the first year of the "14th Five-Year Plan", and it is particularly important to continue to promote high-quality economic development. During this period, Fujian Province has always centered on the main goal of building a strong province with advanced manufacturing, focusing on the development of multiple industries, and at the same time putting forward common problems that need to be resolved in response to current mission goals, and continuing to move towards the goal of high-quality and high-level development.

Fujian is located on the southeast coast of China, with a superior geographical location, and is an important window and gateway for China to interact with the world. With the implementation of special policies and the continuous improvement of the level of opening to the outside world, Fujian's economic development has also moved towards the "fast lane" and its GDP has grown steadily, making it the seventh largest economic province in China. The development speed and trend cannot be underestimated. At present, the main tasks of the "13th Five-Year Plan" of Fujian Province have been fully completed, and the economic strength has jumped to a new level, laying a solid foundation for the further realization of the set goals of the "14th Five-Year Plan". As Fujian's development tasks and problems are consistent with the overall situation of the current domestic economy. Therefore, this article takes Fujian Province as an example and uses principal component analysis.The influencing factors are divided into multiple dimensions, and combined with the data from 2010 to 2018, a comprehensive assessment of the development level in recent years is carried out, and reasonable suggestions are put forward.

2. Literature Review

In recent years, evaluating the economic development capabilities of provinces and cities has become a topic of concern to many scholars. Rui Ziqiu [1] (2021) and others used principal component analysis to analyze the data of various dimensions in Nanjing, and the conclusion showed that Nanjing still has a lot of room for improvement in ecological governance. Zhang Jingrui [2] (2021) et al. through entropy weight

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method and principal component analysis method, the conclusion shows that the economic development level of various counties in Hebei Province is not balanced. Zhao Xuan [3] (2021) used cluster analysis and other methods to study the development status of 17 cities in Shandong Province, and the conclusion showed that the economic gap between Shandong cities is obvious.

In summary, at present, there are many domestic measures on the economic development level of some provinces and cities, and there are few relevant studies on Fujian Province. Therefore, this article studies the influencing factors of the economic development of Fujian Province, conducts empirical analysis in the four dimensions, comprehensively evaluates the development status of various dimensions in Fujian Province in recent years, and provides a feasible solution for future development.

3. Data Selection

This article takes the development status of Fujian Province in recent years as the research object, and constructs an index system for evaluating the comprehensive economic development level of Fujian Province in view of several main aspects of economic development. The five aspects of Permanent population, per capita GDP growth rate, Engel coefficient, total import and export and per capita disposable income of residentsare are used as indicators to measure economic development. Three aspects: the number of invention patents per 10,000 people, the full-time equivalent of R&D personnel, and the proportion of research and experimental development expenditure equivalent to the GDP are selected as indicators to measure scientific research innovation.Select four aspects: the proportion of the population with a college degree or above to the total population, the number of institutions of higher learning, the number of book publications, and the total collection of books in public libraries as indicators for measuring cultural education.The number of health institutions, forest coverage, and afforestation area of the year are selected as indicators to measure the sanitary environment. A total of 16 indicators are selected from four dimensions for measurement.The data comes from the "Fujian Statistical Yearbook" 2010-2018.

As shown in Figure 1, the horizontal axis represents the indicators in different dimensions, and the vertical axis represents the de-unitized value of each indicator item.It can be seen from the figure that the number of permanent residents and the total import and export volume are on the rise, indicating that Fujian's economy is developing continuously and the living standards of residents are constantly improving. Related indicators such as the number of invention patents per 10,000 people have been increasing year by year, indicating that Fujian Province has developed significantly in the dimension of scientific research and innovation. Educational indicators such as the proportion of the population with a college degree or above in the total population have been increasing year by year, indicating that the government is increasing its investment in education. Both the number of health institutions and the forest coverage rate are on the rise, indicating that Fujian Province has achieved remarkable results in health and environmental protection. At the same time, the per capita GDP growth rate and Engel's coefficient declined overall, reflecting the slowdown in economic growth and the improvement in the consumption structure of residents.

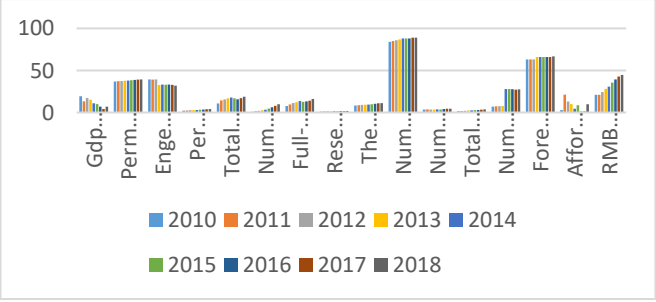

Figure 1: Data table of different economic indicators

4. Model Selection

This article uses the principal component analysis method to evaluate the characteristics of the economic development of Fujian Province, and comprehensively analyzes it from the four dimensions of economic development, scientific research innovation, cultural education, and sanitary environment.

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The principal component analysis method is based on the idea of dimensionality reduction, and realizes data compression and interpretation through a few principal components. The specific steps are as follows:

1) Use SPSS23.0 software to standardize the original p indicators, so as to eliminate the influence of scalar on the level and dimension.

2) Find the correlation coefficient matrix according to the standardized data matrix R

3) Find the eigenvalues and eigenvectors of the correlation coefficient matrix

4) Determine the principal components, usually according to the first few principal components whose cumulative variance contribution rate reaches 80% or the few principal components whose eigenvalues are greater than 1.

5) Properly explain the information contained in each principal component and calculate the comprehensive score.

5. Empirical Analysis

First, use SPSS 23.0 software to standardize the index with z-score to eliminate the influence of different index dimensions.

Second, carry out the principal component analysis applicability test

KMO and Bartlett's sphericity test are used to determine the correlation between the indicators. When the KMO statistic is closer to 1, the significance value in the Bartlett sphericity test is smaller (generally, the KMO statistic is greater than 0.5 and the significance is less than 0.05. Standard), the principal component analysis method is reasonable.

The KMO and Bartlett sphericity tests were performed on the data of the four dimensions.The results are as follows

Table 1: KMO and Bartlett test results of economic development dimensions

KMO And Bartlett Test		
KMO Sampling Appropriateness Number		0.622
Bartlett Sphericity Test	Significance	0.000

Table 2: KMO and Bartlett test results of cultural and educational dimensions

KMO And Bartlett Test		
KMO Sampling Appropriateness Number		0.690
Bartlett Sphericity Test	Significance	0.000

Table 3: KMO and Bartlett test results of the dimensions of scientific research innovation

KMO And Bartlett Test		
KMO Sampling Appropriateness Number		0.608
Bartlett Sphericity Test	Significance	0.000

Table 4: KMO and Bartlett test results of the dimensions of hygiene

KMO And Bartlett Test		
KMO Sampling Appropriateness Number		0.632
Bartlett Sphericity Test	Significance	0.035

According to the SPSS factor analysis test results, the selected four dimensions conform to the principle of principal component analysis.

Third, it can be seen from the table below that the variance percentages of the first three principal components are large and the eigenvalues are all greater than 1, so the first three are determined as principal components from the table. It can not only explain most of the original information, but also realize data dimensionality reduction.

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Table 5: Analysis table of explanatory variables

Total variance explained						
Element	Initial eigenvalue			Extract the sum of squares of the load		
	total	The percentage variance	accumulation %	total	The percentage variance	accumulation %
1	13.227	82.668	82.668	13.227	82.668	82.668
2	1.116	6.975	89.643	1.116	6.975	89.643
3	1.019	6.372	96.015	1.019	6.372	96.015
4	0.299	1.869	97.883			

Forth, it can be obtained from the principal component factor loading matrix. Except for the afforestation area and the number of book publications in the current year, other indicators have higher factor loadings on the first principal component, so it can be named as "Comprehensive Economic Development Level";The afforestation area of the year has a higher factor loading in the second principal component, so it can be named as the "hygienic environment development level";The number of book publications has a higher factor loading in the third principal component,so it can be named "cultural education development level".

Table 6: Principal component factor loading matrix

Component matrix			
	Element		
	1	2	3
GDP Per Capita Growth(%)	-0.916	0.063	-0.145
Permanent Population(Million People)	0.992	-0.030	0.103
Engel Coefficient	-0.876	-0.033	0.421
Per Capita Disposable Income Of Residents(Ten thousand yuan)	0.982	0.027	0.162
RMB deposits of financial institutions	0.985	-0.119	0.073
Total Import And Export(Million Dollar)	0.811	0.515	-0.221
Number Of Invention Patents Per 10,000 People	0.960	-0.049	0.248
Full-Time Equivalent Of R&D Personnel	0.946	0.259	-0.072
Research And Experimental Development Expenditures Are Equivalent To The Proportion Of GDP	0.985	0.104	0.078
The Proportion Of The Population With a College Degree Or Above To The Total Population	0.978	-0.057	0.173
Number Of Institutions Of Higher Learning	0.971	0.101	-0.167
Number Of Books Published(Thousand kinds)	0.784	-0.140	0.575
Total Collection Of Books In Public Libraries(Million volumes)	0.992	-0.018	0.005
Number Of Health Institutions(Thousand)	0.874	-0.189	-0.177
Forest Cover Rate	0.901	0.039	-0.377
Afforestation Area Of The Year	-0.429	0.824	0.310

6. Conclusions and Recommendations

This article analyzes and evaluates the quality of economic development in Fujian Province in recent years, and the conclusions of the study are as follows:

In terms of time, the level of comprehensive economic development in Fujian Province has been increasing year by year. From the perspective of economic growth, Fujian Province is gradually optimizing the economic structure and promoting industrial upgrading, and the economic situation is changing from high-speed growth to high-quality growth. From different perspectives, Fujian Province has made significant improvements in economic development, scientific research and innovation, and there is still room for improvement in culture, education, and sanitation.

Regarding the above conclusions, this article believes that the economic development level of Fujian Province can be further improved from the following aspects:

(1) Improve urban construction and improve people's well-being.

The urban construction of Fujian Province should focus on solving long-term concerns such as medical care, education, and employment, and continuously strengthen infrastructure construction and

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improve the level of social services.

(2) Attach importance to cultural education and actively cultivate high-quality talents.

Only by continuously improving the quality of teaching and vigorously developing education can the overall quality and cultural literacy of the people be improved and truly serve the development of the economy and system of Fujian Province.

(3) Promote technological innovation and actively implement relevant policies.

In the future, Fujian Province can give full play to the first-mover advantages of its own districts, promote the introduction of technology and talents, continue to optimize the scientific research evaluation system, and achieve major breakthroughs in science and technology projects.

(4) Promote opening up and strengthen cooperation and communication.

Fujian Province should give full play to the advantages of special economic zones, pilot free trade zones and the core area of the "Maritime Silk Road" to provide new vitality for my country's new round of high-level opening up and economic development.

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