

# Based on the Principal Component Analysis of Our Country's Regional Economic Development Level of Comprehensive Evaluation

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**Abstract:** China has a vast territory, but due to the influence of historical development, resource endowment, natural conditions, population, policy and other factors, there are great differences in the level of economic development in different regions. In this paper, through the establishment of China's provinces, municipalities, autonomous regions of social and economic development research, the use of principal component analysis method, the level of economic development in China's various regions to make analysis, put forward the corresponding suggestions.

**Keywords:** Economic development, Principal component analysis, Comprehensive evaluation, Cluster analysis.

## 1. Introduction

The economic development of various regions in China is affected and restricted by the natural conditions, resource sharing, resource development, utilization, population quality, economic policy and so on. Regional economic development refers to the process of a region's development from poverty and backwardness to the modernization of economic and social life, which is affected by various factors, the level of economic development in the thirty-one provinces, municipalities and autonomous regions of our country differs greatly, and the level of regional economic development is unbalanced. In response to the problem of unbalanced regional economic development, the state has successively formulated a series of regional development strategies, including: Western Development, revitalizing old industrial bases in northeast China, promoting the rise of central China and supporting the economic opening of eastern China. In order to promote the coordinated development of different regions. In recent years, the state has carried on the elaboration and the adjustment to the regional development strategy. Set up a number of national-level comprehensive reform pilot zones, set different strategic objectives, functions and tasks. With the support of national policy and the continuous efforts of local governments, the economic growth rate of our Western, central and northeastern regions exceeds that of the eastern regions. But the east still has a big advantage over the rest of the country, thanks to its Base and large economic base. Specific to each province, municipalities, autonomous regions there are also obvious differences. In order to comprehensively evaluate the economic development level of every province, municipality and autonomous region in our country, this paper establishes a set of comprehensive index system, and adopts the corresponding index sample data of every province, municipality and autonomous region, using principal component analysis method to calculate the economic development of provinces, municipalities and autonomous regions and the existing differences.

## 2. The Establishment of Evaluation Index System and The Selection of Evaluation Methods

### 2.1. The selection of Evaluation Index

In accordance with the principle that indicators can objectively, systematically and comprehensively reflect the level of economic development of the region, taking into account specific research issues and taking into account the availability of data, in this paper, the following indexes are selected:  $x_1$  -gdp per capita (billion yuan) ,  $x_2$  -urban population ratio (%) ,  $X_3$  -tertiary sector of the economy value added in GDP;  $X_4$  -- fiscal revenue as a proportion of GDP (billion yuan) ,  $X_5$  -- per capita disposable income (yuan) ,  $x_6$  -- per capita consumption expenditure (yuan) ,  $x_7$  -- per 100 households (number of computers) ,  $X_5$  -- per capita consumption expenditure (yuan) ,  $x_6$  -- per capita consumption expenditure (yuan) ,  $x_7$  -- per 100 households (number of computers) ,  $X_5$  -- per 100 households (number of computers) ,  $X_5$  -- per 100 households (number of computers) ,  $X_6$  -- per 100 households (  $X_8$  -- retail sales of consumer goods (billion yuan) .

### 2.2. Introduction of the Evaluation Method

Principal component analysis was put forward by Hotllin in 1933. This method tries to recombine the original indicators into a new set of unrelated composite indicators to replace the original indicators, and at the same time, according to the actual needs, a few fewer composite indicators can be obtained from them to reflect the information of the original indicators as much as possible. The new index variables are small in number and independent of each other, keeping the main information of the original index variables. This method has many advantages: first, it eliminates the correlation between the samples of evaluation indicators; second, the extracted principal components keep the main information of the original indicators, reducing the workload; third, the analysis process objectively generates the weight of indicators, which can distinguish the role of each indicator in the comprehensive evaluation. It avoids the influence of subjective factors.

### 3. Principal Component Analysis Process

Data were first normalized with Stata software, followed

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Determinant of the correlation matrix
Det          =      0.000

Bartlett test of sphericity

Chi-square   =      239.741
Degrees of freedom =      28
p-value      =      0.000
H0: variables are not intercorrelated

Kaiser-Meyer-Olkin Measure of Sampling Adequacy
KMO          =      0.705
    
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Figure 1. KMO inspection

Using Stata software, we can get the correlation coefficient matrix table of the index sample, such as Figure 2, the eigenvalues and eigenvectors of the correlation coefficient

by a KMO test with the normalized data to probe for correlations between variables, as shown in Figure, where the value of the KMO statistic equals 0.705 < 1, the fitting effect is good and principal component analysis can be used.

matrix, the contribution rate of each eigenvalue, and finally get the variance contribution analysis table, figure 3:

	zx1	zx2	zx3	zx4	zx5	zx6	zx7	zx8
zx1	1.0000							
zx2	0.8156	1.0000						
zx3	0.3826	0.3833	1.0000					
zx4	0.3781	0.4365	0.8354	1.0000				
zx5	0.9490	0.8744	0.5106	0.5220	1.0000			
zx6	0.2426	0.1810	-0.0169	-0.0615	0.1681	1.0000		
zx7	0.8712	0.8853	0.3837	0.3974	0.9325	0.2403	1.0000	
zx8	0.4927	0.3426	-0.1175	-0.2707	0.3916	0.1372	0.4870	1.0000

Figure 2. Correlation coefficient matrix table

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	4.43064	2.65467	0.5538	0.5538
Comp2	1.77598	.863368	0.2220	0.7758
Comp3	.912608	.4528	0.1141	0.8899
Comp4	.459809	.27705	0.0575	0.9474
Comp5	.182758	.0545955	0.0228	0.9702
Comp6	.128163	.0343506	0.0160	0.9862
Comp7	.0938123	.0775811	0.0117	0.9980
Comp8	.0162312	.	0.0020	1.0000

Figure 3. Contribution to variance

From the graph above, we can see from Table 1 that the cumulative contribution rate of the former eigenvalues has reached 77.58% , which indicates that the first three factors can reflect more than 77.58% of all information, the eigenvalue of the third component is less than 1, so take the

first two factors as the principal component to calculate the principal component score coefficient matrix, and calculate the principal component coefficients of each index according to the score coefficient data matrix.

Table 1. Principal Component Score

Variable	Comp1	Comp2
X1	0.4418	0.1457
X2	0.4304	0.0633
X3	0.2765	-0.5153
X4	0.2759	-0.5712
X5	0.4646	0.0238
X6	0.1096	0.2610
X7	0.4480	0.1389
X8	0.1962	0.5431

As shown in Figure 4, the greater the absolute value of the load coefficient, the greater the effect on the principal component and the stronger the interpretation of the principal component. The first principal component has a nearly equal positive load on all variables, which can be called the level of comprehensive economic development, while the second

principal component has a larger positive load on per capita consumption expenditure (x 6) and retail sales of social consumer goods (x 8), it reflects the economic development orientation mainly affected by the resident consumption, which can be called the level of consumption-oriented economic development.

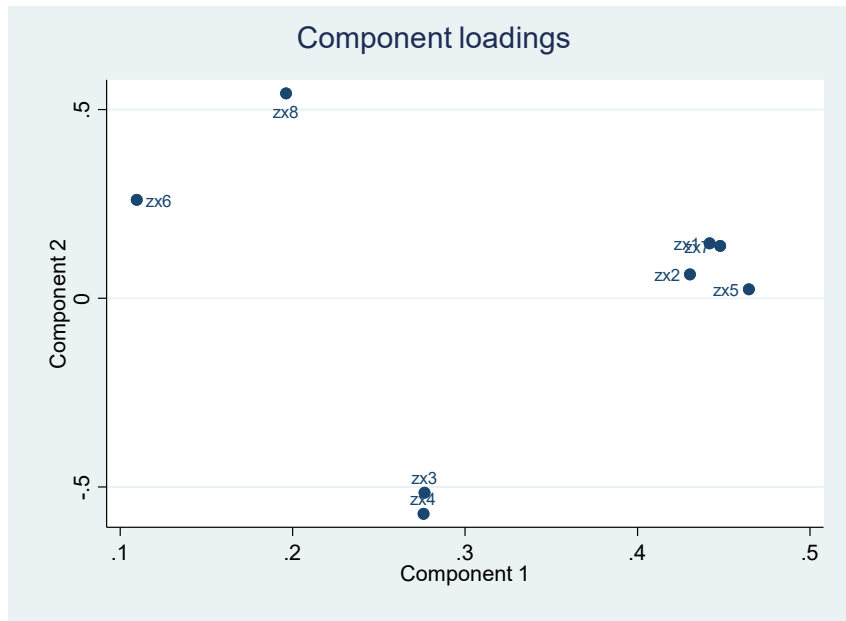


Figure 4. Principal component interpretation

The principal component expression is obtained from the coefficient matrix:

$$F1=0.4418x1+0.4304x2+0.2765x3+0.2759x4+0.4646x5+0.1096x6+0.4480x7+0.962x8$$

$$F2=0.1457x1+0.0633x2-0.5153x3-0.5712x4+0.0238x5+0.2610x6+0.1389x7+0.5431x8$$

From the calculation of the score and the final ranking can be seen that our 31 provinces, municipalities, autonomous regions of the level of economic development there are great differences. The provinces and municipalities directly under the central government in the eastern region all have high scores and the top ranking. Shanghai and Beijing are undoubtedly the two most developed cities in the overall level of economic development, ranking No. 1 and No. 2 respectively, it is worth mentioning that the consumption-oriented economic development components of these two cities ranked lower, at 26th and 28th respectively, so there is still potential for development to further enhance the economic development of developed cities, creating a world-class city could spur consumer spending in Beijing and Shanghai. And far ahead of other cities, while the western provinces, municipalities, and autonomous regions all scored lower, especially Yunnan, Guizhou, Gansu, and Tibet, the first principal component score and the second principal component score are both negative, ranking low, the economic development situation is not optimistic. The cities with the highest scores of the second principal component were Hubei, Fujian, Jiangsu and Guangdong, where consumption had a significant impact on economic development, especially Hubei, which ranked first in the second principal component score, the first principal component is the 27th, so we should improve the comprehensive development level of Hubei, increase basic investment and construction. The principal component scores of Zhejiang, Guangdong, Jiangsu and Fujian are all positive, and their development prospects are good. This result accords with the level of economic development of our country and reflects the unbalanced development of regional economy of

our country.

In order to analyze the difference of regional economic development level in the whole country more intuitively and accurately, using Stata software to cluster the two principal component scores of 31 provinces, autonomous regions and municipalities directly under the central government, there are four categories of cities with different levels of economic development. Class 1: Shanghai, Beijing. The level of comprehensive economic development is far ahead, but the level of consumption-oriented economic development is not significant; the second category: Hubei. The third category is: Tianjin, Zhejiang, Guangdong, Jiangsu, Fujian, Shandong. The total economic development level of these cities is at a higher level in the country, and the composition of consumption guide is more balanced. The fourth category: Liaoning, Inner Mongolia, Xinjiang, Qinghai, Gansu and so on. These cities have low scores of both principal components and backward economic development.

#### 4. Policy Recommendations

In view of the unbalanced development of regional economy and the main problems existing in the process of regional economic development, this paper puts forward the following suggestions: first, we will continue to promote the development of the west, revitalize the old industrial bases in the northeast, promote the rise of the central region, and support the economic opening-up of the eastern region. According to the characteristics of economic development in different stages, the regional economic development strategy is refined and adjusted so as to promote the economic development of backward areas more effectively. Second, according to the comparative advantages of different regions, different policy preferences and technical support should be given. Guide different regions to develop advantageous and characteristic industries. Accelerate the economic development of backward areas. The relevant government departments should perfect the supporting policies and strengthen the policy support so as to attract more investment for the central and western regions. Third, increase investment and promote infrastructure construction in the

western region. The lack of economic growth in the western region leads to the lack of sufficient financial resources, the inability to provide good and convenient infrastructure, and the difficulty in improving the investment environment, which restricts economic growth. Therefore, the central and local governments should increase investment in infrastructure construction in the western region, so that the western region can greatly improve its health, transportation, energy and Water Conservancy, airports, oil and gas pipelines, and so on, improve the investment climate to attract more investment and better achieve industrial upgrading.

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