Frontiers in Business, Economics and Management
ISSN: 2766-824X | Vol. 14, No. 3, 2024

A Comprehensive Evaluation of Common Wealth Level in 30 Provinces Based on Factor Analysis-Cluster Analysis

Yi Wang, Yuqi Zhou

School of Government, University of international Business and Economics, Beijing, 100029, China

Abstract: This paper takes the development level of common prosperity of 30 provinces, autonomous regions and municipalities directly under the Central Government of China as the research object, selects 18 economic indicators that can reflect the development (including the degree of wealth and sharing), innovation and sustainability of each province, and uses the principal component factor analysis (FA) and system cluster analysis to comprehensively evaluate the common prosperity level of 30 provinces and municipalities.

Keywords: Factor analysis method; Cluster analysis method; Common wealth level; Comprehensive evaluation that.

1. Introduction

General Secretary emphasized that "common prosperity is the essential requirement of socialism and the common aspiration of the people. We promote economic and social development, in the final analysis, to realize the common prosperity of all people." As one of the basic features of Chinese-style modernization, "common prosperity" is the fundamental goal of China's economic and social development, as well as the concrete embodiment of the CPC's original mission.

This paper tries to take into account the overall strategic layout of the 20th Party Congress, and constructs an indicator system from four dimensions, namely, economic development, scientific research and innovation, public product availability and environmental sustainability, to comprehensively assess the degree of common wealth development of each province (excluding Tibet) in 2019. It aims to put forward feasible suggestions for the further development of some provinces, autonomous regions and municipalities directly under the central government.

2. Data Sources and Selection of Indicators

Limited to the availability of data in some provinces and cities, this paper selects 17 indicators that can reflect the common wealth level of 30 provinces, autonomous regions and municipalities directly under the Central Government (excluding Tibet) (hereinafter referred to as the 30 provinces) in China, in combination with the scientific and operational principles of relevant data: Theil index, urban-rural income differential, urbanization rate, per capita disposable income of residents (yuan), per capita GDP (yuan) Per capita years of education (years), number of beds in medical institutions per 10000 people (pcs/person), public transport vehicles per 10000 people (pcs/person), proportion of public finance expenditure for people's livelihood (%)[2][3], number of domestic patent applications authorized (pcs), number of legal entities in scientific research and technical services industry (pcs), number of domestic effective patents (pcs)[1], proportion of scientific and technological expenditure in budget expenditure (%), per capita nitrogen oxide emissions (t/person) Per capita particulate matter emissions (ton/person), per capita carbon dioxide emissions (ton/person), carbon dioxide emissions intensity per capita park green space area (square meters/person)[2]. The 17 indicator variables are represented as X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X12, X13, X14, X15, X16, X17, X18.

3. The Process of Comprehensive Analysis of The Level of Common Prosperity In 30 Provinces and Cities Based on The Factor-Systematic Cluster Analysis Method

3.1. Introduction to the theoretical model

Factor analysis model is the extension of principal component analysis, the basic idea is to study the dependence relationship within the correlation matrix of the original variables, and to attribute some variables with complex relationships to a few comprehensive factors of multivariate statistical analysis methods.

Cluster analysis is a process of grouping and categorizing a large amount of data based on the qualitative or quantitative characteristics of the experimental data itself in order to understand the inner structure of the data set and to describe each data set. Its basic principle is to group objects with greater similarity into the same class, and group individuals with greater differences into different classes, so as to maximize the homogeneity of the objects within the class and maximize the heterogeneity between the classes.

3.2. Data Preprocessing

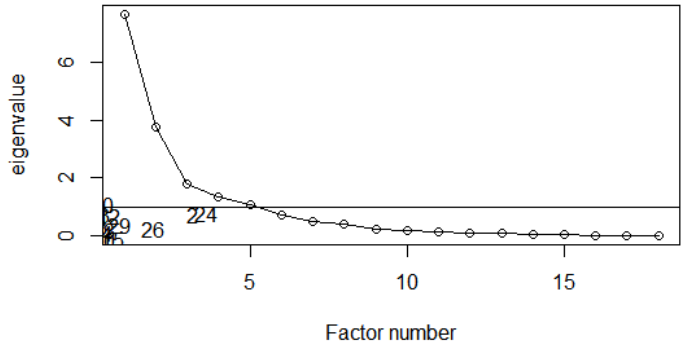
The raw data of the 18 indicators were standardized and centered to eliminate the influence of different scales of each indicator on the assessment effect. Among them, "Tel index", "income multiplier of urban and rural residents", "Engel's coefficient", "per capita emission of nitrogen oxides (ton/person) ", "particulate matter emissions per capita (tons/person)", "carbon dioxide emissions per capita (tons/person)", and "carbon dioxide emission intensity" are negative variables. Negative variables are normalized.

3.3. Suitability tests for factor analysis, the

This paper uses KMO test statistics and Bartlett spherical test to test whether there is correlation between variables. When the KMO value is close to 1 and the P value of Bartlett spherical test is less than or equal to 0.01, it is suitable for principal component analysis. It can be seen from Table 1 that the KMO value is 0.69>0.6, and the Bartlett sphericity test P value is less than 0.001, indicating that the selected index data is suitable for factor analysis.

3.4. Factor extraction

The R software is used to conduct factor analysis (extraction method: principal component analysis) on the pretreated index data selected from the target area. The explanation of total variance and its broken stone diagram are as follows.



The cumulative contribution ratio of each factor reflects the explanatory power of each factor to the original variable, and the higher the cumulative contribution ratio, the stronger its explanatory power. The eigenvalues of the first five factors in the table are all greater than 1, and their contribution to the original variables can be recognized, and the cumulative contribution rate reaches 87%. Therefore, the first five factors are extracted in this paper.

3.5. Factor loading matrix

The load coefficient of common factor 1 on X3, X4, X5, X6 and X7 is larger; The load coefficient of common factor 2 is larger on X15, X16, X17 and X18; The load coefficient of common factor 3 on X11, X12 and X13 is larger; The load coefficient of common factor 4 on X1 and X2 is larger; The load coefficient of common factor 5 on X8 and X9 is larger. Therefore, the five public factors are named as economic development affluence, environmental sustainability, innovation ability, urban-rural development coordination and public goods availability in turn.

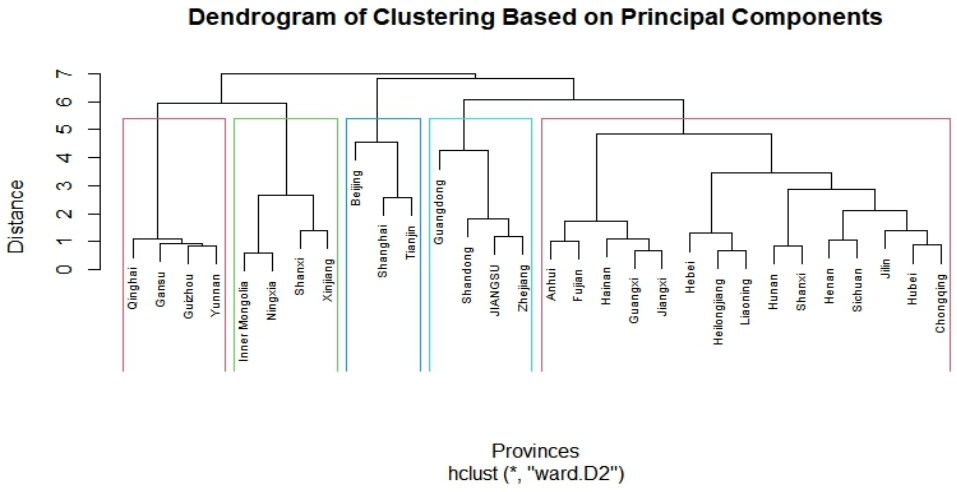
3.6. The weighted scores of the factor for the level of common prosperity in each province, the

Considering the accuracy of the scoring results, the amount of sample information and the practical effect of the sample system, this paper weighted the proportion of the contribution rate of each factor variance as a weight. The factor scores F1, F2, F3, F4, and F5 represent the scores of each province in terms of economic development affluence, environmental sustainability, innovation ability, urban-rural development coordination, and public goods availability, The comprehensive weighted score represents the common wealth level of the province (as shown in the table below). For reasons of space, only the top five provinces in terms of overall score are shown.

Provinces	F
Beijing	1.864007373
Shanghai	1.665157387
Tianjin	0.774333858
Zhejiang	0.438621954
Jiangsu	0.347657289

4. Cluster Analysis

In this paper, based on the scores of the five public factors, using systematic cluster analysis, we obtained the following spectrum of common wealth level in 30 provinces.



5. Conclusions

(1) Beijing, Shanghai, Tianjin, Zhejiang and Jiangsu occupy the top five places in the overall score, and are typical representatives of economic development affluence-led common prosperity; Shanxi, Inner Mongolia and Ningxia are common prosperity hindered by resource development or environmental sustainability caused by geography and climate; Sichuan, Chongqing and Hainan are the opposite; Guangdong, Jiangsu and Zhejiang are representatives of innovation-driven common prosperity; meanwhile, in terms of urban-rural development coordination, Tianjin, Heilongjiang and Liaoning are typical representatives; Meanwhile, the availability of public goods is high in Beijing, Hunan, Heilongjiang, and Liaoning.

(2) It can be seen from the comprehensive cluster pedigree that the agglomeration of regions with common prosperity level is highly consistent with the division of economic regions in China. The level of common prosperity in coastal areas is significantly higher than that in other regions, of which the level of common prosperity in the eastern coastal economic zone is the highest.

(3) There is a certain degree of similarity in the scores of different regions in the five public factors, and differentiated policies should be implemented on the basis of each region's resource endowment, development conditions, comparative advantages and other actual circumstances. For example, Inner Mongolia and Ningxia should continue to focus on ecological environment construction to meet the growing needs of the people for a better life.

(4) At present, for most regions, what limits the level of common prosperity is still the level of economic development, which is closely related to the level of innovation, and how to promote the innovative development of the economy and at the same time improve the coordination, sharing and sustainability of economic development is an important issue reflected in the factor scores and clustering results of this paper, which also mirrors the key concerns of the 14th Five-Year Strategic Plan.

References

[1] Chen Jing, Yue Haiou, Wu Zhangliang. Evaluation of innovation competitiveness of six national innovative cities in Shandong Province based on principal component analysis and set pair analysis [J]. Information Engineering, 2019, 5 (01): 84-97

[2] Han Liangliang, Peng Yi, Meng Qingna. Digital Inclusive Finance, Entrepreneurship Activity and Common Prosperity: Empirical Research Based on China's Inter provincial Panel Data [J]. Soft Science, 2023,37 (03): 18-24. DOI: 10.13956/j.ss.1001-8409.2023.03.03

[3] Li Rui, Kou Yuting. Dynamic Evolution of China's Common Prosperity Level and Obstacle Factor Analysis [J]. Statistics and Decision Making, 2023,39 (15): 5-10.DOI: 10.13546/j.cnki.tjyjc.2023.15.001