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Study on the Growth Potential of Hunan City Group

Zhiwei Li[1,2,*]

[1]Building F, HuoliKangcheng Community, Yuhua District, Changsha 410007, Hunan Province, China

[2]School of Mathematics and Statistics, Central South University, Changsha 410006, Hunan Province, China

*1206634368@qq.com

Abstract

By referring to the Statistical Yearbook of Hunan Province, this paper collected the data of ten economic indicators of five urban agglomerations in Hunan Province from 2008 to 2019.Then, the development potential of each urban agglomeration was evaluated and determined. First, the evaluation index system of urban agglomeration development potential was established, and the evaluation model of urban agglomeration development potential was established by using principal component analysis method. The final results showed that Changsha-Zhuzhou-Xiangtan urban agglomeration had the largest growth potential, while the western Hunan urban agglomeration had the lowest growth potential. Finally, according to the analysis results, the paper puts forward some relevant suggestions for the development of Hunan urban agglomeration.

Keywords

Urban Agglomeration; Growth Potential; Determination; Comprehensive Evaluation.

1. Introduction

This paper selects five urban agglomerations in Hunan Province: Changsha-Zhu-Xiangtan Urban Agglomeration, Loushao-Leng Urban Agglomeration, Yueyi-Chang Urban Agglomeration, Hengcheng-Yong Urban Agglomeration and Xiangxi Urban Agglomeration, selects some indicators through data inquiry, studies the influence of factors on economic development of each urban agglomeration, and evaluates the development potential of each urban agglomeration.The analysis of development potential can provide scientific guidance and decision-making basis for the development of urban agglomerations in Hunan Province.

2. Research Background

At present, the research on the growth potential of urban agglomerations is not in-depth enough, which leads to the lack of understanding of their own potential in most urban agglomerations, the failure to clarify their own development strategies, and the lack of scientific research on the region and its own development stage.Moreover, the experience of other successful urban agglomeration construction is blindly copied, which leads to the phenomenon of industrial isomorphism and convergence of development orientation in urban agglomeration.

3. Evaluation Index System for Development Potential of Urban Agglomeration

We were able to objectively reflect the index of urban agglomeration development potential of five aspects, respectively for the scale of urban agglomeration, urban structure, urban resources and environment, urban agglomeration, innovation ability, including at the end of the total

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population, regional GDP (GDP) and 10 key indicators such as industrial production value, construct the evaluation index system of urban agglomeration development potential.

3.1. Principal Component Analysis (Pca)

3.1.1. Overview of Principal Component Analysis

Principal component analysis (PCA) is a commonly used method for variable dimensionality reduction. It can transform multiple indexes into several comprehensive indexes by orthogonal rotation transformation under the premise of losing little existing information by means of compressed rotational projection of variables. These comprehensive indicators are usually called the main components, and each principal component is a linear combination of the original variables, and the principal components are not correlated with each other. Assume that the research on a certain thing involves P indicators, respectively denoted by, and the data matrix constituted by is$X_1 , X_2 , \ldots , X_p$

Firstly, the data is standardized, and then a linear transformation is carried out on X to form anew comprehensive variable, which is represented by Z, satisfying the following formula:

$$\begin{cases} z_1 = a_{11}x_1 + a_{12}x_2 + \cdots + a_{1p}x_n \\ z_2 = a_{21}x_1 + a_{22}x_2 + \cdots + a_{2p}x_n \\ \cdots \\ z_m = a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mp}x_n \end{cases}$$

$$X = \begin{pmatrix} x_{11}\, x_{12} \cdots x_{1p} \\ x_{21}\, x_{22} \cdots x_{2p} \\ \vdots \quad \vdots \quad \ddots \quad \vdots \\ x_{n1} x_{n2} \cdots x_{np} \end{pmatrix}$$

We constrain the linear transformation under the following principle:a_{ij}

(1) Linear independent.$z_i z_j$

(2) with all the linear combination of the Chinese side is the biggest difference; $z_1 X_1 , X_2 , \ldots , X_p z_2$ Is independent of the first principal component of all linear combination of the Chinese side is the biggest difference;$X_1 , X_2 , \ldots , X_p$And so on,z_mIs with the $z_1, z_2, \cdots , z_{m-1}$It's all irrelevant$x_1, x_2, \cdots , x_p$There is a linear combination of the largest difference.

Indicators of new variables determined according to the above requirements$z_1, z_2, \cdots , z_m$ The first, second, and... indexes of the original variable, respectively., the MTH principal component. Among them,z_1Is the largest percentage of the total variance,$z_2, \cdots , z_{m-1}$The variance of omega decreases. Usually refers to the selection of the first few principal components with the largest variance, which not only reduces the number of variables, but also captures the main contradiction.

3.1.2. Principal Component Analysis Results and Analysis

The collected data were analyzed and processed by SPSS, and the KMO value was calculated and Ballite spherical test was carried out.

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Table 1. KMO values and Barret test results

KMO and Bartlett tests		
KMO sampling fitness measure.		817.
Bartlett's test for sphericity	The approximate chi-square	2487.552
	Degrees of freedom	45
	significant	000.

KMO test statistics are indicators used to compare simple correlation coefficients and partial correlation coefficients between variables, which are mainly used in multivariate factor analysis.Here, the KMO value is 0.817, which is around 0.8, indicating that the correlation between variables is strong and suitable for factor analysis.Barlitt spherical test is used to test the correlation between variables, whether they are identity matrix, that is, to test whether the variables are independent of each other. Here, the P value of Barrett's test is less than 0.05, indicating that there is correlation among variables, and factor analysis is effective.

Then, draw the gravel diagram, as shown in the figure below:

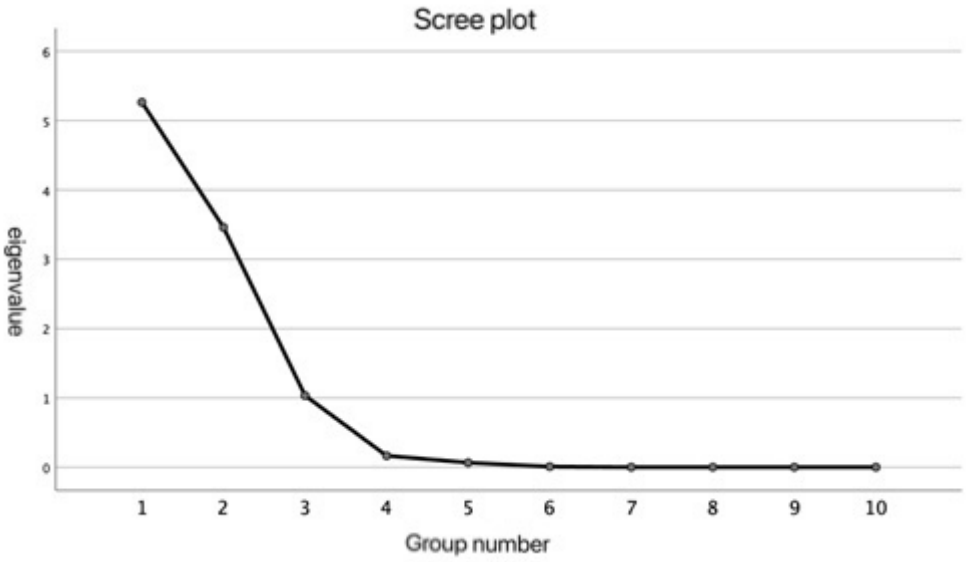

Fig 1. Principal component analysis gravestone diagram

It can be seen that the eigenvalues tend to be stable after 4, and a total of 3 principal components can be preliminarily determined.

Next, principal component analysis was carried out, and the analysis results were as follows:

It can be seen from the above results that in the first principal component, the corresponding values of fixed asset investment, year-end permanent population, urban population, green coverage area and total water supply are relatively large. That is to say, the first principal component mainly reflects the indicators of urban agglomeration construction and environment, government investment and urban agglomeration scale. In the second principal component, the corresponding value of gross regional product, total industrial output value, utilized foreign investment and total output value of high-tech products is larger, that is, the second principal component mainly reflects the index of urban agglomeration economy and innovation ability. In the third principal component, the corresponding value of city primacy is

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larger, which can be attributed to the city primacy, that is, the index of urban agglomeration structure.

Table 2. Component matrix of principal component analysis

Component matrix[a]			
	The principal components		
	1	2	3
Gross Regional Product (100 million yuan)	368.	920.	- 105.
Gross industrial output value (100 million yuan)	559.	738.	- 178.
Utilization of foreign investment (ten thousand US dollars)	381.	882.	087.
Investment in fixed assets (100 million yuan)	983.	- 173.	033.
Permanent resident population at year-end (10,000)	949.	- 314.	026.
Urban population (ten thousand)	950.	- 311.	031.
Gross Output Value of High-tech Products (ten thousand Yuan)	297.	928.	093.
Green Coverage Area (Ha)	948.	- 316.	044.
Total water supply (10 000 m3)	952.	- 303.	046.
City primacy	- 097.	118.	984.

Table 3. Principal Component Analysis Variance Interpretation Table

Total variance interpretation						
composition	Initial eigenvalue			The sum of squares of the extraction load		
	A total of	Percentage of variance	Cumulative %	A total of	Percentage of variance	Cumulative %
1	5.264	52.637	52.637	5.264	52.637	52.637
2	3.460	34.600	87.237	3.460	34.600	87.237
3	1.034	10.344	97.582	1.034	10.344	97.582
4	166.	1.660	99.242			
5	066.	659.	99.901			
6	009.	085.	99.987			
7	001.	011.	99.998			
8	000.	002.	100.000			
9	8.365 e-6	8.365 e-5	100.000			
10	6.758 e-6	6.758 e-5	100.000			

It can be seen that the cumulative contribution rate of the three principal components is 97.582%, which already includes all the information of the original indicator variables and realizes the dimensionality reduction of the variables.According to the "component score coefficient matrix", a linear expression between the component and each variable can be obtained.Calculate the weight value of each principal component, namely variance interpretation rate.The weights of the three principal components are:

$$52.637\% / 97.579\% = 53.94\%$$

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34.602% / 97.579% = 35.46%
10.339% / 97.579% = 10.60%

The final evaluation model is as follows:

$$Score = 0.5394 * z_1 + 0.3546 * z_2 + 0.106 * z_3$$

Among them, Score represents the development potential Score value of each urban agglomeration.The higher the score of development potential, the greater the development potential of urban agglomeration.

The scores of development potential of each urban agglomeration in recent years were calculated, and part of the calculated results were shown in the table below:

Table 4. Score of development potential of urban agglomeration from 2015 to 2019 (PCA)

Urban agglomeration Development potential	2015	2016	2017	2018	2019
Changsha-Zhuzhou-Xiangtan city cluster	1.049888006	1.21322871	1.381250488	1.43795315	1.43795315
Loushaoleng Urban Agglomeration	0.393404854	0.244416014	0.215354846	0.183593912	0.183593912
Yueyi chang city group	0.134336304	0.056814574	0.022885298	0.04080275	0.04080275
Hengchen Yongcheng City Group	0.01043292	0.057928532	0.088250494	0.14685022	0.14685022
West Hunan City Group	0.376676724	0.371395656	0.354554516	0.344187676	0.344187676

Draw a line chart to show the above calculation results more intuitively:

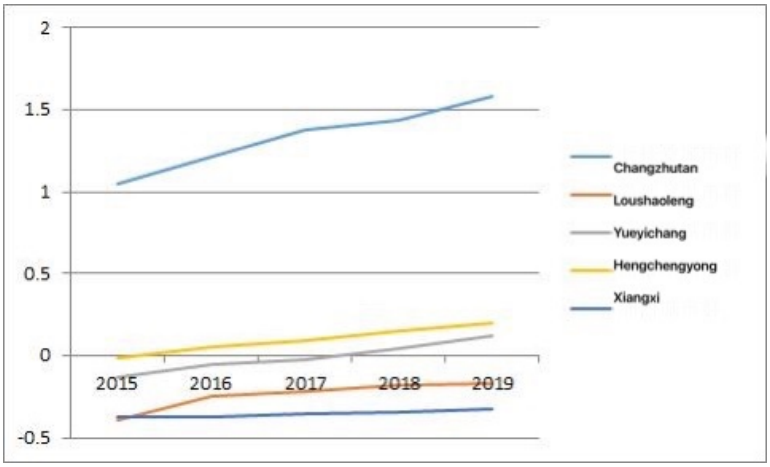

Fig 2. PCA line chart of development potential scores of urban agglomerations

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According to the above development potential Score value, the development potential of Changsha-Zhuzhou-Xiangtan urban agglomeration is the highest, much higher than other urban agglomerations, followed by Yueyichang, Hengchengyong and Loushaoleng. The development potential of western Hunan urban agglomeration is the lowest, and the development potential is getting higher and higher in general from the past to the present. It accords with the development status of hunan city group.

4. Suggestions on Hunan City Agglomeration Development Planning

According to our evaluation model, the Changsha-Zhuzhou-Xiangtan urban agglomeration has the most development potential, followed by Yueyichang, Hengchengyong and Loushaoleng urban agglomerations, and the western Hunan urban agglomeration has the least development potential. Therefore, we can focus on the cultivation of Changsha-Zhuzhou-Xiangtan city group, which will drive the overall economic development of Hunan Province; For the other four city groups, it is suggested to give full play to the advantages of each city, and to strengthen the support for the city group in western Hunan, so as to achieve common prosperity.

References

[1] Song Xiaoqing, Chen Jianyu, Study on the Change of Ten Land Use in Changsha-Zhuzhou-Xiangtan Urban Agglomeration [J].China 10 Resources Science and Technology Management, 2007(5) : 12.17.

[2] Wang Fazeng, Wang Xintao, Integration of Land Resources Comprehensive Utilization in the Central Plains Urban Agglomeration [J]. Resources Forum, 2008(10) : 14.15.

[3] Wang Xuejun, Geographical Environment and Population Carrying Potential and Intermedical Differences [J].Scientia Geographica Sinica, 1992,12 (4) : 322-327.

[4] Zhou Guohua, Shu Qian, Li Hongxia.Research field of ecological security construction in Changsha-Zhuzhou-Xiangtan city cluster. Natural Science, Hunan Normal University To quote. 2005, 12 (4) : 75-79.

[5] Yang Shimin, Liu Bing, Li Yuwen. Analysis on the ecological security system of urban agglomeration [J]. Forest Science, 2006,1 (1) : 100.104.