

Evaluation of Regional Economic Vitality Based on Grey Correlation Method

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Abstract: With economic development and social progress, regional economic vitality has gradually become an important part of our national economy. How to better evaluate the vitality of the regional economy has become a question that is being explored by sociologists and mathematicians. And this article establishes four major evaluation indicators of per capita GDP, permanent population, corporate vitality, and annual savings balance of urban and rural residents, and establishes a corresponding model through the gray correlation method. We collected relevant data of 19 cities and calculated the corresponding relevance and ranking of Shanghai as the city with the best economic vitality through MATLAB. Finally, we calculated the corresponding relevance and ranking of the cities with the best economic vitality in Chengdu, Suzhou, Ningbo, and Kunming, and found that for this method, the selection of the default city (the best or the worst) directly affects the results Good or bad.

1. Introduction

"Vitality" refers to the degree of support of a city, region or country for life functions, ecological environment, and economic society. Economic vitality is the degree to which a city, region or country supports its economy and society, and it is the ability to sustain economic growth. With the progress and development of society, people gradually have higher pursuits and expectations for how to improve the economic development of cities, so as to further improve the happiness coefficient of people's lives. This not only pervades the individual level, but is also an important indicator of the country's strength. Highlight one. Therefore, studying the factors affecting regional economic vitality can better decorate life and make people enjoy life more. However, the research on regional economic vitality in our country is mainly based on qualitative research or specific area research, and a few quantitative researches are mainly based on analytic hierarchy process, and the impact of analytic hierarchy process on the judgment of its subjective will on the outcome Large, and the quantitative method of research on a specific area may only be applicable to that area, but the grey correlation method can solve these two problems very well.

2. Choice of indicator system

Regional economic vitality refers to the ability of a region to sustain economic growth. According to the availability of data and the relevant research of relevant experts, the evaluation index of regional economic vitality can be constructed from four aspects.

2.1 GDP per capita

The total economic volume (GDP) is the economic foundation of a region, which to a certain extent reflects the economic scale and economic factors of a region, which in turn affects the efficiency of economic output. So economic aggregate is an essential factor in economic evaluation. The total economic volume is closely related to the scope of a region and population, especially population. Therefore, to more accurately reflect the economic quality of a region, per capita GDP is more appropriate.

2.2 Permanent population

The permanent population refers to those who have lived at home for more than 6 months, and also includes the population of floating population living in the city where they work. The economic development of a region (increasing economic vitality) cannot be separated from the development of the enterprise, and the development of an enterprise cannot be separated from the general labor force and a large number of high-quality talents. Assuming that the ratio of general labor to high-quality talents is constant, economic vitality The development of China is inseparable from the permanent population.

2.3 Corporate vitality

Enterprise vitality refers to the internal driving force that can drive the rapid development of enterprise production and operation activities. It is also the foundation of a vibrant economy. And business is the foundation of economic life. Enterprises can attract foreign investment and have the inflow of high-quality talents. Therefore, to a certain extent, economic development depends on the number of local enterprises, and the speed of economic development, that is, economic vitality, also depends on the growth rate of the number of local enterprises, that is, corporate vitality.

2.4 Annual savings of urban and rural residents

The total savings of urban and rural residents at the end of the year refers to the total annual savings of urban and rural residents in banks or other financial institutions. It can characterize the relationship between disposable income and consumption in a region. A region has high disposable income, low consumption, and large total savings of urban and rural residents at the end of the year. Conversely, the total savings of urban and rural residents at the end of the year is small. Of course, it is subject to population and geographical restrictions, but to a certain extent it can also affect the economic vitality of a region.

3. Establishment of grey relational method model

3.1 Data preprocessing (standardization)

Data standardization refers to the scaling of each data so that each data falls into a specific cell. This method can remove the influence of the data unit, shield the effect of the dimension on it, and transform it into dimensionless data. Make it possible to analyze and compare data under conditions of different dimensions or magnitudes. And we pass the ratio of the difference between each data and the average of each data to its standard deviation, namely:

$$U_i = \frac{\mu_i - \bar{\mu}_i}{\sigma_i}$$

3.2 Model establishment

First use dimensionless data to construct a vector

$$X_q = (z_q, M_q, \Delta k_q, Y_q)$$

X_q is a vector of data on per capita GDP, permanent population, corporate vitality, and year-end savings of urban and rural residents in the qth city in 2018. q is the city number.

Then by determining a reference vector, namely

$$X_1 = (z_1, M_1, \Delta k_1, Y_1)$$

Then build the contrast matrix

$$(X_1^T, X_2^T, \dots, X_q^T) = \begin{bmatrix} z_1 & z_2 & \dots & z_q \\ M_1 & M_2 & \dots & M_q \\ \Delta k_1 & \Delta k_2 & \dots & \Delta k_q \\ Y_1 & Y_2 & \dots & Y_q \end{bmatrix}$$

Then calculate the absolute difference between the comparison sequence in the comparison matrix and the reference sequence, and get a new matrix and find the maximum and minimum values of the matrix, namely

$$\min X = \min_{q=1}^4 \min_{r=1}^4 |X_q(r) - X_1(r)|$$

with

$$\max X = \max_{q=1}^4 \max_{r=1}^4 |X_q(r) - X_1(r)|$$

r refers to the rth index of X_q , and $X_q(r)$ is the data of the rth index of the qth city. $\min X$ The minimum value of the new matrix.

Then we use the correlation coefficient formula to calculate, namely:

$$\xi_q(r) = \frac{\min X + \rho \max X}{|X_q(r) - X_1(r)| + \max X}$$

$$C_q = \frac{\sum_{r=1}^4 \omega_r \xi_q(r)}{4}$$

C_q is the degree of relevance of the qth city.

4. Results and analysis

We take the relevant data of 19 cities such as Beijing and Shanghai as examples, and calculate the correlation degree and its ranking in these cities through the gray correlation method and default Shanghai as the city with the best regional economic vitality, and get the following information about the city's economic vitality ranking Form, namely:

Table 1 Correlation and ranking of regional economic vitality of each city

City	Correlation	Rank
Shanghai	1	1
Beijing	0.7702	2
Tianjin	0.5707	3
Wuhan	0.5385	4
Guangzhou	0.5281	5
Ningbo	0.5213	6
Qingdao	0.5145	7
Chongqing	0.5106	8
Shenzhen	0.5048	9
Hangzhou	0.5030	10
Chengdu	0.5024	11
Changsha	0.4907	12
Nanjing	0.4817	13
Suzhou	0.4687	14
Dongguan	0.4513	15
Zhengzhou	0.4455	16
Xi'an	0.4284	17
Shenyang	0.4048	18
Kunming	0.3890	19

For this data, we found that 7 of the top 10 cities in economic vitality are Linhai, that is, prosperous in foreign trade, and are ports of foreign trade, while the other three cities, Beijing, Chongqing, and Wuhan, are well-known metropolises in China. Even Beijing is the capital of our country and the financial and political center of our country. Therefore, the economy of these cities has a strong ability to sustain growth, that is, strong economic vitality. If divided by region, 9 cities belong to the eastern region, that is, the region with the strongest economic vitality among the 4 regions, which is in good agreement with reality.

In order to verify the stability and advantages and disadvantages of this method, we selected the default cities of Kunming, Chengdu, Suzhou and Ningbo respectively, and calculated and ranked according to the previous method. We found that the result trend is quite different from the trend in Table 1. According to the order of cities in Table 1, the relevance of cities with and without the default points are respectively made, as shown in the figure below:

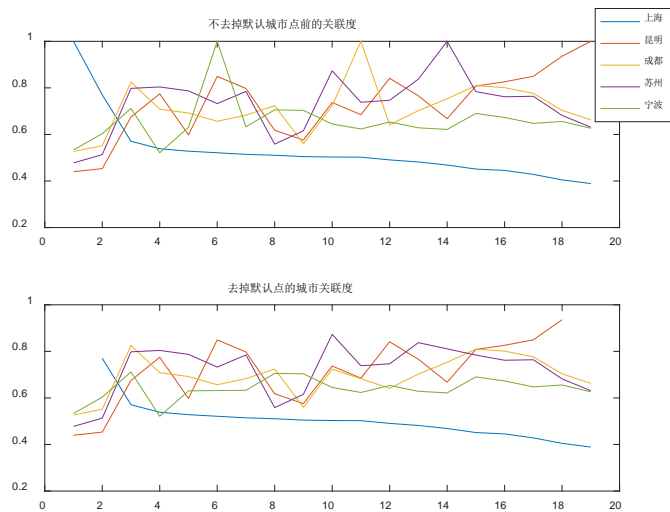


Figure 1

As for Kunming, according to the figure above, although Kunming has a certain ups and downs, the overall trend is rising. It is the opposite of Table 1. That is, we assume that Kunming is the city with the lowest urban vitality among these cities. Good fit. For the other three cities, the degree of agreement is not high. However, according to the data, we found that for the default ranking of Suzhou city vitality, Hangzhou and Nanjing ranked 2nd and 3rd are ranked 10 and 13 respectively in Table 1, while Suzhou is ranked 14 in Table 1. no big difference. Similarly, for Chengdu, Dongguan, Zhengzhou, and Xi'an ranked No. 3, No. 4, and No. 5 are ranked 15, 16 and 17 in Table 1, and Chengdu ranks 11 in Table 1, which is not much different. Taking Ningbo as an example, Tianjin, Chongqing, and Shenzhen, which are ranked 2nd, 3rd and 4th, are ranked 3, 8 and 9 in Table 1, while Ningbo is ranked 6th in Table 1. The same rankings are not far apart. .

And through different analysis of the default point selection, the most important step for using the gray correlation method to evaluate the vitality of the city is to choose the default city (the best or the worst), and the quality of the default city selection determines the quality of the result, so If you use the gray correlation method to evaluate the vitality of the city, first determine a good default city.

5. Conclusion

This paper conducts a detailed analysis on the evaluation of regional economic vitality indicators, and establishes four evaluation indicators of per capita GDP, enterprise vitality, permanent population, and annual savings balance of urban and rural residents. Then, the corresponding model was established by using the gray correlation method. In addition, we used the relevant data of 19 cities, 4 major evaluation indicators and corresponding models, and calculated the relevance and corresponding ranking of the city with Shanghai as the default city with the best vitality through

MATLAB. And in order to understand the advantages and disadvantages of this method, we also calculated that the default cities are Kunming, Suzhou, Chengdu, Ningbo and other cities, and found that the quality of the default cities (the best or the worst) directly determines the results. Of course, local governments can choose a target city, and use this method to analyze the gap with the target city, so as to promote the rapid development of the city.

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