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Research and Difference Analysis of Regional Economic Development in Southern Anhui

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Abstract

In this paper, six cities, Wuhu, Maanshan, Xuancheng, Huangshan, Chizhou and Tongling, are selected as research objects, and the economic evaluation system of South Anhui region is established by considering six aspects of economy: scale, foundation, structure, input, output and benefit. Then, the EWM method and TOPSIS model are combined to process the raw data of the main economic indicators of each city in 2019 to objectively and fairly analyze the phenomenon of unbalanced regional economic development and put forward validity suggestions for the high-quality development within South Anhui region for reference.

Keywords

Southern Anhui Region; Regional Economy; EWM Method; TOPSIS Model.

1. Introduction

South of the Yangtze River in Anhui, collectively known as South Anhui, belongs to the construction area of the demonstration zone for undertaking transfer along the river city belt in Anhui, covering six cities, Wuhu, Maanshan, Xuancheng, Huangshan, Chizhou and Tongling [1]. Adjacent to southern Jiangsu and northern Zhejiang, southern Anhui inherently possesses rich water and land transportation resources and unique geographical advantages, which provide superior conditions for regional economic development. However, there are significant differences in economic development among the regions in South Anhui due to natural, human and historical factors, and the cities in South Anhui are in the stage of "high speed and high quality" economic development. It has become an important research direction for domestic scholars.

In this paper, we will seek the causes of the uneven economic development within the southern Anhui region by constructing a regional economic index system, and explain the differences between the economic levels of six cities in the southern Anhui region, and put forward suggestions to meet the development of the southern Anhui region.

2. Literature Review

Regional economic differences refer to the existence of differences in geographic landscape, industrial structure, political environment, social culture, production factors, etc. within a certain country or economic organization, and thus different regions have different economic strengths, and developed and less developed regions coexist in space. At present, regional economic development has become a relatively popular research direction in academia.

Tu (2018) indicates that there is a close correlation between city size and urban development, with large differences in the level of development between cities of the same size level, and as

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cities become larger, the level of economic development may not be as high and the economic differences may not be the same; Wu Xingmei (2009) points out that the economic development in southern Anhui today is slow, due to the lack of sufficient information leading to weak market orientation, narrow financing channels are not conducive to a long On the basis of comparative analysis of geographic, historical and policy backgrounds, South Anhui should, on the basis of its own advantages, draw on the development path of the "Sunan model" to form a development model with its own characteristics and promote regional economic development in order to improve Wang Zeqiang (2020) selects targeted policy measures and effective paths based on the problems of unbalanced and insufficient regional economic development, and focuses on establishing a new mechanism for more effective coordinated regional economic development to accelerate the high-quality coordinated development of Anhui's regional economy.

To sum up, the research on regional economic differences at this stage is more inclined to select regions with relatively large differences in economic development for theoretical research comparison and static analysis, and the existing literature mainly focuses on empirical analysis using principal component analysis, cluster analysis and factor extraction method. To this end, this paper will effectively combine the EWM method and TOPSIS model to process the raw data of the main economic indicators of each city in 2019 to elaborate the comparison of the differences in the economic level of six cities in South Anhui region, so that the development of South Anhui region can be further optimized.

3. The Current Situation of Urban Economic Development in Southern Anhui

The economic development of Wuhu city used to be mainly based on industry, but with the continuous influx of the wave of social modernization, the tertiary industry came onto the stage in a timely manner. Obviously, it is not wise to focus only on industrial development, so in recent years, Wuhu started to develop strategic new industries by relying on the background advantage of rapid development of modern science and technology, and the development of modern service industry gradually became another important direction of economic development in Wuhu region. Ma'anshan City deeply implements industrial transformation and upgrading, focuses on the transformation and upgrading of traditional industries, intelligent manufacturing, constantly optimizes the real economy, improves the economic structure, and promotes the development of high-quality industrial economy. Xuancheng city area is still more traditional industries, the development of tertiary industries such as tourism and other new industries is not ideal, but also need to strengthen the reform of traditional industries, using their own advantages to promote the development of tertiary industries. Huangshan City's current economic development is mainly tourism economy, using its own unique natural scenery, humanities and historical resources, and constantly create and promote the special tourism industry model, which has played a major role in promoting the economic development of Huangshan City. Chizhou City, science and technology investment continues to increase, the development of high-tech industries gradually accelerated, the economy of high-quality development trend is good. Tongling City's economic development is slow, the characteristic copper industry advantage is not obvious, the industrial economic situation is grim.

4. Research Methodology

4.1. Entropy Method

The entropy weight method (EWM) refers to the quantification of the importance of research indicators in an objective environment, which systematically reflects the importance degree between multiple evaluation objects and indicators in the evaluation system, and can enhance

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the differentiation meaning and difference status of indicators. The information entropy belongs to the measure of uncertainty or disorder, and its size only depends on the dispersion of the index data itself, and the calculation formula of the entropy weight method is as follows:

$$W_i = \frac{1 - E_i}{k - \sum_1^k E_i}$$

The decomposition term of the above equation is as follows:

$$①\mathrm{E_i} = -\mathrm{h}\sum_1^{\mathrm{f}} \mathrm{g_{ij}}\mathrm{lng_{ij}}\,;②\mathrm{h} = \frac{1}{\mathrm{lnn}};③ = \frac{\mathrm{Y_{ij}}}{\sum_1^{\mathrm{f}} \mathrm{Y_{ij}}};④\mathrm{Y_{ij}} = \frac{\mathrm{X_{ij}} - \min(\mathrm{X_i})}{\max(\mathrm{X_i}) - \min(\mathrm{X_i})}$$

where$\mathrm{E_i}$ is the information entropy, andh is the Boltzmann constant, and$\mathrm{g_{ij}}$ is thei evaluation index under the firstj the weight of the standardized value of the evaluation object indicator in the whole evaluation object space, and$\mathrm{Y_{ij}}$ denotes the standardized data of the original index data matrix [2]. In addition, the $\mathrm{X_{ij}}(\mathrm{i} = 1,2,\cdots,\mathrm{k};\mathrm{j} = 1,2,\cdots,\mathrm{f})$ denotes the standardized data of thei of the firstj data of the evaluation object, thek is the evaluation index, andf is the number of evaluation subjects, and$\mathrm{W_i}$ is the weight of thei the weight of the first index, and satisfy$0 \leq \mathrm{W_i} \leq 1$ and$\sum_1^{\mathrm{k}} \mathrm{W_i} = 1$.

4.2. Improved TOPSIS Model

TOPSIS method [3] can measure the research object close to the "ideal solution" and far from the "negative ideal solution", and quantify the level of superiority and inferiority to the optimal target, and the optimal evaluation object must be both close to the "ideal solution" and far from the "negative ideal solution". The optimal evaluation object must be close to the "ideal solution" and far from the "negative ideal solution". In this paper, in order to comprehensively and objectively reflect the difference and change trend of the economic development level in southern Anhui, the evaluation criteria are improved by combining the entropy weight method. In this paper, we combine the entropy weight method and TOPSIS model with the relevant theoretical and mathematical formulae, and the specific operation steps of TOPSIS model after improvement are mainly as follows:

① Construct a standardized evaluation matrix. For f cities and k regional economic development level difference analysis problem of the evaluation indexes, the judgment matrix is

$$\mathrm{X_{ij}} = \begin{bmatrix} \mathrm{x_{11}} & \mathrm{x_{12}} & \cdots & \mathrm{x_{1f}} \\ \mathrm{x_{21}} & \mathrm{x_{22}} & \cdots & \mathrm{x_{2f}} \\ \vdots & \vdots & \ddots & \vdots \\ \mathrm{x_{k1}} & \mathrm{x_{k2}} & \cdots & \mathrm{x_{kf}} \end{bmatrix}$$

And the judgment matrix applied in this paper is calculated in the entropy weight method of standardized evaluation matrix$\mathrm{Y_{ij}}$.

② Construct the normalized weighted evaluation matrix. With the indicator entropy weightsw constitute the weight vector$\mathrm{W_i}$ and combine the regularization standardization matrix$\mathrm{Y_{ij}}$ to obtain the weighted normalized matrix $\mathrm{V} = \mathrm{W_i} \cdot \mathrm{Y_{ij}} = \left(\mathrm{v_{ij}}\right)_{\mathrm{kf}}$ The calculation process is as follows:

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$$V = \begin{bmatrix} v_{11} & v_{12} & \cdots & v_{1f} \\ v_{21} & v_{22} & \cdots & v_{2f} \\ \vdots & \vdots & \ddots & \vdots \\ v_{k1} & v_{k2} & \cdots & v_{kf} \end{bmatrix} = \begin{bmatrix} w_1 \cdot v_{11} & w_1 \cdot v_{12} & \cdots & w_1 \cdot v_{1f} \\ w_2 \cdot v_{21} & w_2 \cdot v_{22} & \cdots & w_2 \cdot v_{2f} \\ \vdots & \vdots & \ddots & \vdots \\ w_k \cdot v_{k1} & w_k \cdot v_{k2} & \cdots & w_k \cdot v_{kf} \end{bmatrix}$$

③ Combining the weight matrixV that calculatesV^+ andV^- . LetV^+ be the firsti evaluation index under the firstj the optimal value of the data in the first city, i.e., the positive ideal solution [4].V^- is thei evaluation index of thej is the worst value of the data in the first city under the evaluation index, i.e., the negative ideal solution, and the calculation steps for both are as follows:

$$V^+ = \left\{ \max_{1 \le i \le k} v_{ij} | i = 1,2,\cdots,k \right\} = \{v_1^+, v_2^+, \cdots, v_k^+\}$$

$$V^- = \left\{ \min_{1 \le i \le k} v_{ij} | i = 1,2,\cdots,k \right\} = \{v_1^-, v_2^-, \cdots, v_k^-\}$$

④ Euclidean distance calculation. Determine separately for each city the economic level evaluation vector toV^+ the distance betweenD^+ andV^- the distance ofD^- as follows:

$$D^+ = \sqrt{\sum_{i=1}^{k} \left(v_{ij} - v_i^+\right)^2} \ (i = 1,2,\cdots,k)$$

$$D^- = \sqrt{\sum_{i=1}^{k} \left(v_{ij} - v_i^-\right)^2} \ (i = 1,2,\cdots,k)$$

$v_{ij}$is thei under the evaluation indexj weighted normalized value of the first city.v_i^+ , , andv_i^- are the highest and lowest values of thei are the highest and lowest values of the first indicator in the evaluation system.

⑤ Calculate and analyze the closeness of each cityQ_j .

$$Q_j = \frac{D_j^-}{D_j^+ + D_j^-}$$

OrderQ_j be the relative case of the firstj the relative case where the first city is close to the optimal value and its value ranges between$[0,1]$. In this paper, the closenessQ_j indicates the degree of economic development, and according to theQ_j The ranking order of each city can be determined based on the size of each city.

5. Indicator Establishment and Data Sources

5.1. Economic Evaluation Index System of Southern Anhui Region

In order to effectively measure and analyze the differences of economic development levels in southern Anhui, this paper selects the economic level as the system layer, and six aspects of the economy: scale, foundation, structure, input, output and benefit as the sub-system layer, and the whole index system covers 20 indicators, which are shown in Table 1.

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Table 1. Economic Development Evaluation System of Southern Anhui Region

System layer	Subsystem layer	Indicator layer
Economic level	Economic Scale	GDP/billion Yuan (G_1)
		Total imports and exports/US$ billion (G_2)
		Domestic retail sales of consumer goods / billion yuan (G_3)
		RMB deposit balance/billion RMB (G_4)
	Economic Base	Total population / 10,000 people (G_5)
		Land area / million square kilometers (G_6)
	Economic Structure	Share of secondary sector GDP % (G_7)
		Share of tertiary sector GDP % (G_8)
	Economic input	Industrial electricity consumption/billion kWh (G_9)
		Actual use of foreign direct investment/US$ billion (G_{10})
		Total fixed investment/billion yuan (G_{11})
		Financial expenditure / million Yuan (G_{12})
	Economic output	Fiscal revenue / million yuan (G_{13})
		GDP per capita/$($G_{14}$)
		Urban per capita disposable income/yuan (G_{15})
		Rural per capita disposable income/yuan (G_{16})
		Consumer Price Index (G_{17})
	Economic benefits	GDP growth rate % (G_{18})
		Strategic industry output value growth rate % (G_{19})
		Above-scale industrial value-added growth rate % (G_{20})

5.2. Data Source

This compiles the raw data of each city in 2019 according to the above selected indicator variables from the "Main Data Statistics of Socio-Economic and Development in 2019" published on the official website of each city in South Anhui region, and the evaluation data of each city adopts the meaning of indicators specified in national laws.

6. Empirical Results

According to the above steps, this paper used MATLAB scientific software to evaluate and rank the economic development level of cities in South Anhui region, and the specific results are shown in Table 2 and Table 3.

Table 2. Entropy weights of each index

Indicator variables ($G_{1\sim10}$)	G_1	G_2	G_3	G_4	G_5	G_6	G_7	G_8	G_9	G_{10}
Specific Gravity	0.0804	0.0543	0.0502	0.0594	0.0642	0.0409	0.0215	0.0452	0.0331	0.0636
Indicator variables ($G_{11\sim20}$)	G_{11}	G_{12}	G_{13}	G_{14}	G_{15}	G_{16}	G_{17}	G_{18}	G_{19}	G_{20}
Specific Gravity	0.0199	0.0722	0.0702	0.0876	0.0197	0.0594	0.0157	0.0205	0.0113	0.0183

As can be seen from Table 2, GDP and GDP per capita are more important in the overall evaluation of urban economic development level, both of which are greater than 0.08, while total fixed investment, urban per capita disposable income and consumer price index affect the

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overall economic level to a lesser extent. Therefore, the government should increase the growth of total economic volume while improving the aspects with smaller weight such as return on fixed investment, increasing national income and improving residents' consumption level in order to enhance the overall competitiveness of southern Anhui.

Table 3. Analysis of the results of EWM-TOPSIS

City	v_{ij}	D^+	Q_j	Rank
Wuhu	0.8411	0.3762	0.4848	1
Ma On Shan	0.5632	0.2519	0.4770	2
Xuancheng	0.3702	0.1656	0.4643	3
Huangshan	0.2006	0.0897	0.4312	5
Chizhou	0.1592	0.0712	0.4112	6
Tongling	0.2235	0.1000	0.4388	4

As can be seen from Table 3, the economic development level of the six cities in South Anhui region presents a situation that the overall level is low while the gap between cities is relatively obvious. The relative closeness of Wuhu, Maanshan and Xuancheng exceeds 0.46, which is greater than other cities in South Anhui region, indicating that these three cities have a relative advantage in South Anhui region. The relative closeness of Huangshan, Chizhou and Tongling is less than 0.44, which indicates that the economic development level of these three cities is relatively backward. In order to promote the comprehensive strength of regional economy, this paper puts forward several suggestions:

First, we should innovate the regional economic development model, improve the economic strength of regional cities by promoting the new regionalization process in Anhui, achieve the equalization of public income and expand the total economic volume. Promote the popularization of digital technology, drive the economic development of backward regions, strengthen inter-regional cooperation, and promote the coordinated economic development of southern Anhui.

Secondly, we should thoroughly implement the central government's economic proposition, formulate economic policies that are in line with the situation in southern Anhui, speed up reforms in industrial structure and technological innovation, and continuously improve the protection system for economic development in southern Anhui to promote high-quality economic development in the region.

Thirdly, the southern Anhui region should adjust and optimize its economic structure, and rely on the demonstration zone of undertaking transfer along the river city belt in Anhui to strengthen the effectiveness and science of macro-control of the regional governments at all levels. Innovate and improve support policies to accelerate the comprehensive revitalization of southern Anhui.

Fourth, we should combine the historical and humanistic environment, cultural resources and other aspects of the integrated construction of South Anhui cultural tourism network system, to create an exclusive brand, planning a feasible route, the development of South Anhui tourism and cultural routes. Take the urban area as the core, connect other towns and streets nodes, fully exploit the advantages of cultural resources, according to local conditions, with high-quality leading projects as the core attraction, highlight the "leading benefit", open the electronic information platform, so that tourists are up to date with the latest information, improve the museum service system, and constantly increase the collection of cultural relics, expand diversified channels to obtain the success of the cultural brand tourism in southern Anhui.

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Fifth, strengthen economic development exchanges with other provinces and cities, especially neighboring provinces and cities, and promote regional integration in the Yangtze River Delta region. Study and learn from the development models of regions with good economic development, compare the shortcomings in their own development process, then gradually form a better economic development system according to their own regional, resource and other advantages, and develop the economy according to local conditions.

Sixth, pay attention to the development of education and the training and introduction of high-tech talents. The level of education is an important indicator of a region's economic development and an important driving engine. Paying attention to and strengthening the development of education is tantamount to providing sufficient backup for future development. Particular attention should be paid to the training and introduction of high-tech talents to promote the restructuring and optimization of various industries, especially the tertiary industry, to provide more talents to improve the regional economic structure and promote regional economic development.

7. Conclusion

From the perspective of regional economy, this paper constructs a scientific evaluation index system of economic development differences in South Anhui region, and uses the entropy TOPSIS method to comprehensively evaluate the economic level of six cities in South Anhui region, and analyzes the situation and causes of regional economic differences based on the evaluation results. The evaluation method in this paper is still limited, and can only conduct a horizontal comparative study on the economic development level of cities in South Anhui region from a static perspective. Therefore, in the future, we will conduct a longitudinal comparison from a dynamic point in time, as well as strengthen the research on the growth changes of economic development level of each city, in order to put forward more practical and systematic policy opinions.

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