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Evaluation of Higher Education System Based on Fuzzy Comprehensive Evaluation

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Abstract: In order to study issues related to the health and sustainability of the national higher education system, establish an assessment system and advise countries where there is still room for improvement in the higher education system, we have established a fuzzy comprehensive evaluation model based on the entropy right law and a smooth time series analysis model. The entropy right method is used to solve the weight of each index from the data itself, and to get the national level of higher education health status. In terms of national higher education sustainability, we have transformed the sustainability of the national higher education system into a mathematical problem for evaluating the rating of the future higher education system, and established a smooth time series analysis model. Taking CLO as an example, the development of the foundation of higher education is put forward, and it is predicted that CLO countries will realize the leap from middle grade to good grade in five years, but there are still challenges to be faced in implementing it. Finally, we analyzed the sensitivity of the model, considered the impact of the sample of selected indicators on the evaluation results, and considered the 10 indicators we selected. At the same time, we also took into account the analysis of the extraction of the main components of the number of evaluation grade errors, through analysis, we selected the four main components of the health assessment contribution rate of up to 96.7%, with a strong credibility. Combining the health evaluation model of higher education system and the sustainability evaluation model of higher education system established in this paper, the selected ARM, CLO, MNG, DEU, RUS, USA. The higher education systems in the S.A. countries were evaluated for: poor, average, excellent, good.

Keywords: Principal Component Analysis; Fuzzy Comprehensive Evaluation; Entropy Weight Method; Time Series Analysis

In the new era, higher education has entered a booming growth stage and is moving toward the universalization stage. The overall improvement of higher education quality and the healthy development of higher education system are inevitable requirements for the modernization of higher education, and thus countries have elevated it to a strong national strategy and launched a series of talent competition. However, there is no comprehensive assessment system to measure the health of the higher education system until now.

1. The solution process and evaluation result of the model are presented preparation before model solving

From the above two steps, each coefficient of the correlation coefficient test is greater than 0.2 and the value of KMO is 0.873, indicating that this ten sub-indicators are suitable for the use of principal component analysis.

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1.1 Solve the correlation coefficient matrix

The data of six countries and ten sub-indicators were normalized by the above sub-indicators and processed by principal component extraction, and imported into SPSS data analysis software, and the correlation coefficient matrix of the sub-indicators was calculated.

1.2 Principal component analysis results gravel plot

In order to make the result analysis more ideal, according to the default principal component analysis result gravel plot , four principal components were selected to extract the number of components, and the resulting common factor variance is shown below:

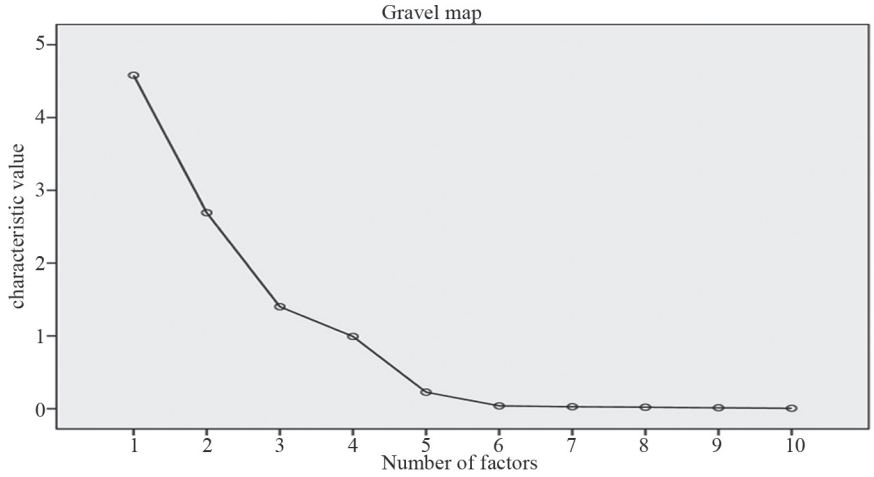

Figure 1. Gravel map.

It can be seen from the Figure 1 above that, after calculation, the variance of the common factors of all the other indicators except the expenditure on higher education is greater than 0.93, indicating that the work variables can be explained to a large extent, and the principal component analysis will also get the best effect.

1.3 Explanatory degree variance

The total variance explained is also called the variance contribution of the factor, and the variance contribution of the factor and the variance contribution rate is a measure of the relative importance of each factor, which is used to reflect the degree of explanation of each extracted factor to the variance of the original index, and the higher the value of the factor variance contribution indicates that the factor is more important. The explanatory variance obtained from the analysis is shown in the following table.

After calculation, the characteristic root four factors are extracted as the main component, and the characteristic value of the four principal components variance contribution rate is opposite bigger, the cumulative variance contribution rate reached 96.671%, can greatly reaction index of original information, the four principal components already contains the original 10 indicators, most of the information, so four principal component extraction is more reasonable.

2. National higher education sustainability assessment model

To predict and evaluate the sustainability of higher education system, we understand it as the evaluation of higher education system in the future period. Then, first of all, we need to predict the future situation of the higher education system, and then evaluate the predicted results after 5 years using the fuzzy integrated evaluation model based on the entropy weight method, and use the predicted evaluation results as the future health quality sustainability of the country's higher education.

By doing the white noise test on the residual series, the test probability corresponding to the maximum time lag in the residual autocorrelation plot can be obtained. The hypothesis that the residual series are independent of each other can be accepted; and the values of the autocorrelation function are not significantly different and are all in the random interval, so the ARIMA(1,1,1) model residual series can be judged as white noise series.

Based on the four principal components of the national higher education health quality assessment model, a smooth time

series forecast for the next five years was made, and the health status forecast results were obtained as shown in appendix xx, and the following graph was made.

From the above graph, we can see that the gap between CLO and U.S.A and DEU developed countries is narrowing, reaching the minimum in 2025, although there is still a big gap compared to USA, but we can see that CLO has more potential.

Converting the above chart into a table, the future rating levels for the sustainability of higher education in each country are as follows.

The evaluation rating shows that the sustainable quality of higher education in CLO countries progresses from medium to good rating in the next 5 years. The higher education evaluation improvement program using CLO as an example.

3. Sensitivity analysis of the influence of indexes on the model

In solving the problem, we set up 10 indicators to evaluate the impact of the health and sustainable development of higher education quality, and then analyze the sensitivity of different impact indicators to evaluate the impact of the final result.

As can be seen from the chart above, when the eight indicators are selected, the data will not fluctuate much and will not change the status level of higher education in the country, but when the six indicators are selected, the health status of higher education in the country will be over scattered and the evaluation level will be reduced, so the number of indicators selected is crucial to the evaluation results.

4. The sensitivity analysis of the number of principal component factors

In solving the problem, we set the main component analysis factor of the indicator to 4, and then analyze the sensitivity of the different factor quantities to evaluate the impact of the final result. Keep other conditions and parameters consistent, change the number of factors for 3 and 5, get the following Figure 2.

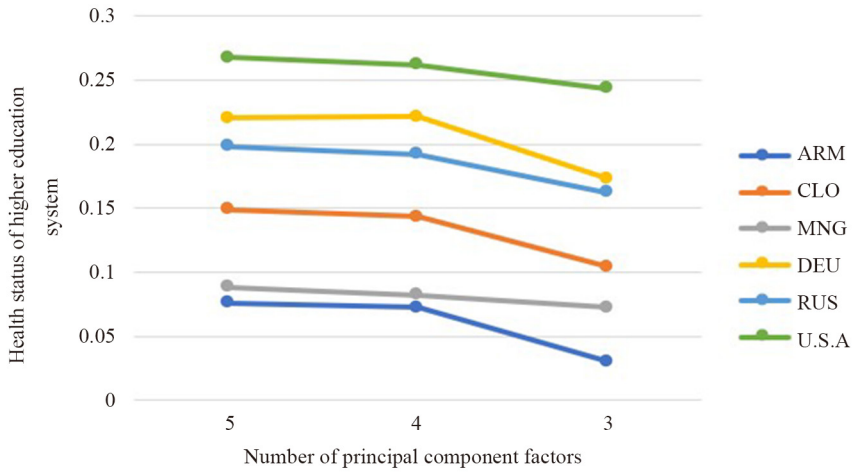

Figure 2. Change factor evaluation chart.

As can be known from the figure above, the result of the elected main component is 5, and the resulting fuzzy comprehensive evaluation value changes slightly, which can be ignored, but when the main component of the elected is 3, the result will produce a general trend of decrease. Therefore, the four main component factors selected in this paper are very persuasive, which not only ensures the simplification of the model, but also ensures the accuracy of the results.

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