Adult and Higher Education (2024)
Clausius Scientific Press, Canada

DOI: 10.23977/aduhe.2024.060216
ISSN 2523-5826 Vol. 6 Num. 2

The Secrets of Higher Education

Wang Zhiteng

School of Statistics and Applied Mathematics, Anhui University of Finance and Economics, Bengbu, 233030, China
1025565627@qq.com

Keywords: Higher education; Entropy method; Ridge regression; Grey prediction; Matlab

Abstract: A healthy and sustainable higher education system is the pulse of a country. In the post-epidemic era, the adjustment of higher education policies in various countries has triggered wide public concern. This article combines qualitative and quantitative methods to construct a comprehensive system which can measure the level of the higher education system. Using Entropy weight and the Topsis method, we constructed nine indicators from the three perspectives of academic level, research funding, and talent construction to describe the higher education system. We compared the health values between nine countries, including the United States, China, and Australia. It is concluded that the level of higher education in the United States and China is much higher than the world average; In 2008, the scores of higher education systems in nine countries were relatively low; Australia, which has a lower score, is used as a country to be improved for in-depth research. After simplifying the data, we got the ideal value of the Australian higher education system based on the Entropy weight and numerical simulation, by using Matlab as a realistic and reasonable vision for Australia. The results showed that the ideal value of Australia’s higher education health status of is 2.5. In order to verify the sustainability and rationality of the system, Ridge regression is used to estimate the system, and then gray prediction is used to predict Australia’s higher education level in eight years. The results show that the level is expected to be close to ideal by 2028.

1. Introduction

Higher education is based on the completion of secondary education as the highest level of education. From a micro point of view, higher education is the last stage of formal learning in our lives. From a macro point of view, it represents the highest level of the entire education circle and plays a role in navigating the education of a country [1]. But what kind of higher educational system is healthy and sustainable? What would it mean if a country had such a system?

In response to this problem, James N.Johnstone (1981) [2] and others proposed a “background-input-process-result” model (CIPP) to evaluate the education level; EUSI researchers [3] adopted a concept-driven approach to establish effective education thirty indicators such as sex, regional differences in education, and gender differences in educational opportunities are used to measure education levels. Liu Yan [4] proposeed a construction of a comprehensive evaluation index system for the internationalization of higher education.Xu Hongyi [5] raised a construction of the evaluation index system for the quality and level of higher education based on the perspective of building a strong country in higher education. Zhang Hui [6] proposed a idea about the management interpretation of the classified development of colleges and universities. Liang Qian [7] proposed three major challenges of today's higher education quality assurance and their countermeasures. Wang Zhihuan [8] performed a comparative research on the internationalization index system of higher vocational education at home and abroad. Zhou Quan [9] proposed a theoretical exploration and construction of college undergraduate education quality evaluation in response to the needs of corporate talents. Yu Xiaojun[10]raised some thoughts on the construction of the teaching quality evaluation system of private colleges and universities.Therefore, on the basis of predecessors, the level of higher education can be measured in terms of quantity and quality, and it can be subdivided into three levels: academic level, research funding, and talent construction.

2. Materials and Methods

1) First of all, after careful analysis of the relationship between relevant factors, we have established a health system for the higher education system in the Figure 1.

2) In order to make the model as accurate as possible, we describe our higher education evaluation system at three levels.

3) Determine its internal logical relationship through relevant literature, and then use the Entropy weight and Topsis comprehensive evaluation method to score.

4) In order to help the ICM-F committee determine the level of evaluation of the higher education system, we used Australia as an example to predict the model and give a simple budget table.

5) Finally, we conducted a sensitivity analysis on the model to prove the validity of the model.

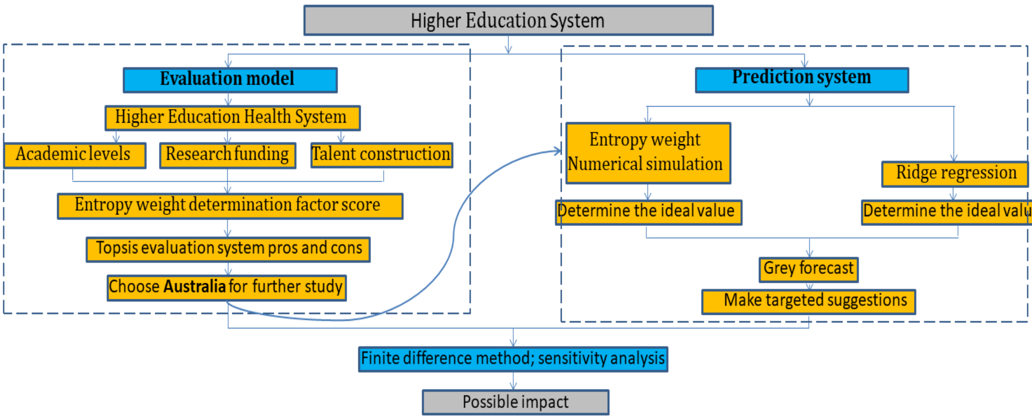

Figure 1: Research ideas

2.1 Assumptions

To simplify the problem, each of our assumptions are reasonable and consistent with the basic facts. Our model is reasonable in theory, however, if it contradicts reality, it should be weighed. Therefore, we propose the following assumptions:

The relevant data and information found are all accurate and true information.

Since our task needs to obtain it from different websites, so it is assumed that the data we obtained this time have sufficient authenticity.

• The future social economy will develop steadily, regardless of the impact of emergencies.

We consider that emergencies will affect the forecast results, such as economic crises, epidemics, etc. So assume that our future economy will not experience major fluctuations.

• Each country will always formulate policies that benefit it.

In order to simplify the problem, we assume that the criterion for evaluating a higher education system is to maximize benefit.

• When the external environment changes, developing countries are more affected than developed countries.

Studies have shown that developing countries are more vulnerable to greater shock in the face of emergencies. Therefore, we assume that when developing countries are subjected to external influences, the shocks are more severe than those of developed countries.

• Ignore the impact between the indicators.

Since the model may be endogenous, it will have a certain impact on the results. In order to simplify the problem, we assume that there is no mutual influence between the indicators and data we selected this time.

Additional assumptions are made to simplify analysis for individual sections. These assumptions will be discussed at the appropriate locations.

2.2 Symbols

The variable symbols used in the article are shown in the following Table 1.

Table 1: List of Parameters and Notations

Symbol	**Explain**
S_{1j}	Academic level factor
S_{2j}	Research funding factor
S_{3j}	Talent construction factor
A_{ij}	Academic level factor secondary index
B_{ij}	Research funding factor secondary indicators
C_{ij}	Talent construction factor secondary index
R	Educational level health status evaluation value
e_i	I-th index entropy
P_{ij}	The weight of the j index and the i evaluation index
v_j	Comprehensive evaluation value under the j index

2.3 Data Sources

• Government expenditure of each country

https://ourworldindata.org/grapher/government-expenditure-education?stackMode=absolute&region=World

• National Bureau of Statistics of China

http://www.stats.gov.cn/tjsj/ndsj/

• United Nations Statistics Office

http://unstats.un.org/unsd/default.htm

2.4 Model establishment

First, we use the following factors to characterize a higher education system in Figure 2:

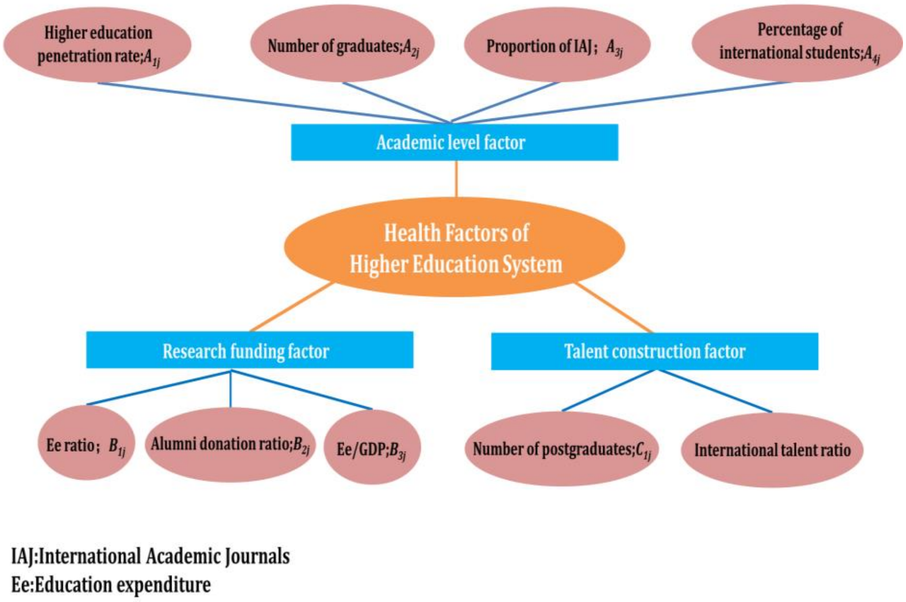

Figure 2: Indicator Settings

- **Academic level factor**

The academic level includes the systematic results and theories formed by people in scientific research and teaching and learning activities. We take the annual average ratio of A_{2j} as its estimated ratio and introduce a correction coefficient to obtain the final academic level factor estimate.

$$A_{2j} = \frac{A_{2j}}{\sum_{j=1}^{n} A_{2j}}$$

$$S_{1j}=\alpha_1 A_{1j} + \alpha_2 A_{2j} + \alpha_3 A_{3j} + \alpha_4 A_{4j} \quad (1)$$

- **Research funding factor**

Research funding refers to the expenses incurred for the development of science and technology. We introduce correction coefficients to obtain the estimated value of the research funding factor.

$$S_{2j}=\alpha_1 B_{1j} + \alpha_2 B_{2j} + \alpha_3 B_{3j} \quad (2)$$

- **Talent construction factor**

The construction of the talented team is the key content of the construction of the Open University. We combine the concept and take the annual average ratio of C_{1j} as the estimated ratio and then combine the correction coefficient to realize the definition of the talent constructive factor.

$$C_{3j} = \frac{C_{3j}}{\sum_{j=1}^{n} C_{3j}}$$

$$S_{3j}=\alpha_1 C_{1j} + \alpha_2 C_{2j} \quad (3)$$

2.5 Model solution

- **Construct an index system——Entropy weight**

(1) Build a judgment matrix

Use X_{ij} to represent the index performance value of the i first-level index factors in the jth year (*i=1,2,...n; j=1,2,...,k*). The judgment matrix composed of k years of n first-level indicators is as follows:

$$R=\begin{pmatrix} X_{11} & X_{12} & X_{13} & \cdots & X_{1k} \\ X_{21} & X_{22} & X_{23} & \cdots & X_{2k} \\ X_{31} & X_{32} & X_{33} & \cdots & X_{3k} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ X_{n1} & X_{n2} & X_{n3} & \cdots & X_{nk} \end{pmatrix} \tag{4}$$

(2) Normalization

After normalizing the indicators and the following normalized matrix is obtained:

$$\begin{pmatrix} Y_{11} & Y_{12} & Y_{13} & \cdots & Y_{1k} \\ Y_{21} & Y_{22} & Y_{23} & \cdots & Y_{2k} \\ Y_{31} & Y_{32} & Y_{33} & \cdots & Y_{3k} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ Y_{n1} & Y_{n2} & Y_{n3} & \cdots & Y_{nk} \end{pmatrix} \tag{5}$$

(3) Calculated according to the theory of information entropy

Calculate the average score of the year corresponding to the first-level indicator, and finally use the following formula to calculate the entropy weight:

$$w_i=\frac{1-E_j}{k-\sum_{j=1}^{k}E_j} \tag{6}$$

When all the primary indicators have the same value on this indicator, it means that the less information provided by this indicator, the smaller the weight it takes.

Evaluate the pros and cons of the system——TOPSIS method

(1) Construct a first-level index weighted decision matrix

$$\begin{pmatrix} r_{11} & r_{12} & r_{13} & \cdots & r_{1k} \\ r_{21} & r_{22} & r_{23} & \cdots & r_{2k} \\ r_{31} & r_{32} & r_{33} & \cdots & r_{3k} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ r_{n1} & r_{n2} & r_{n3} & \cdots & r_{nk} \end{pmatrix}=\begin{pmatrix} W_1Y_{11} & W_2Y_{12} & W_3Y_{13} & \cdots & W_kY_{1k} \\ W_1Y_{21} & W_2Y_{22} & W_3Y_{23} & \cdots & W_kY_{2k} \\ W_1Y_{31} & W_2Y_{32} & W_3Y_{33} & \cdots & W_kY_{3k} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ W_1Y_{n1} & W_2Y_{n2} & W_3Y_{n3} & \cdots & W_kY_{nk} \end{pmatrix} \tag{7}$$

(2) Find the best value

Write the maximum value of each index of the object to be evaluated in the decision matrix as the optimal solution vector and the worst vector.

$$\begin{aligned} R^+ &= \{max(r_{i1}), max(r_{i2}), \cdots, max(r_{ik})\} \\ R^- &= \{min(r_{j1}), min(r_{j2}), \cdots, min(r_{jk})\} \end{aligned} \tag{8}$$

(3) Calculate the maximum distance

Finally, we find each object to be evaluated and the optimal solution and the worst solution in the decision matrix.

According to the Entropy weight and the TOPSIS method, we can get the health factor table of the higher education system as shown in the figure after we bring the cleaned raw data into Matlab programming. The results are shown in the following Table 2

Finally, we find each object to be evaluated and the optimal solution and the worst solution in the decision matrix.

According to the formula $C_i = D^-/(D^+ + D^-)$, C_i represents the closeness of each evaluation object to the optimal solution. The larger the C_i, the more optimized the evaluation object index.

Table 2: Table of health factors of higher education systems in various countries

Year	America	Australia	Brazil	Canada	China	Japan	Vietnam	France	South Africa
2009	2.57	1.99	2.14	2.74	2.14	2.30	1.66	2.14	1.28
2010	2.43	1.77	2.17	2.53	2.21	2.36	1.72	1.99	1.29
2011	2.49	1.80	2.23	2.46	2.36	2.50	1.83	2.03	1.31
2012	2.40	1.84	2.15	2.52	1.94	1.89	1.50	1.96	1.22
2013	2.45	1.78	2.19	2.63	2.04	1.98	1.57	2.00	1.23
2014	2.58	1.81	2.31	2.68	2.49	2.54	1.90	2.10	1.32
2015	2.62	1.90	2.35	2.71	2.58	2.62	1.95	2.14	1.33
2016	2.71	1.94	2.42	2.75	2.74	2.78	2.07	2.21	1.36
2017	2.77	2.00	2.48	2.84	2.84	2.83	2.15	2.27	1.37
2018	2.85	2.05	2.55	2.91	2.97	2.97	2.26	2.33	1.39

From the above table, we can see that the health of the higher education system led by the United States and China is much higher than the average, while the higher education system of Vietnam and other countries is much lower than the average.

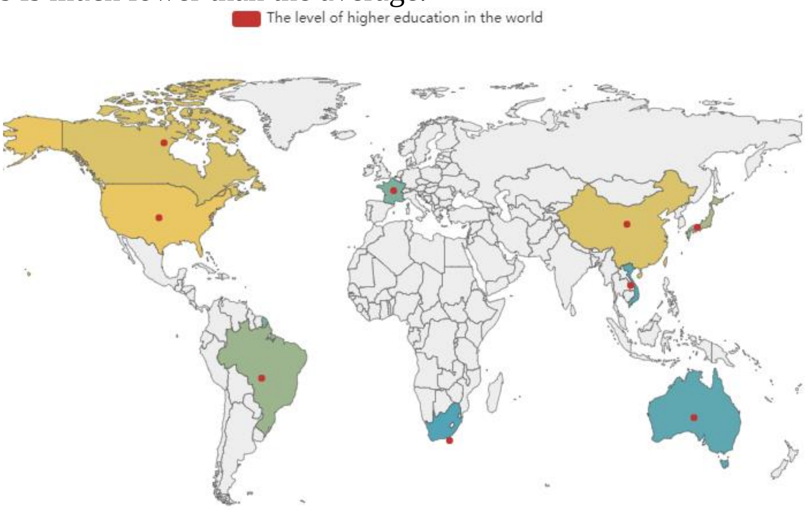

Figure 3: Target heatmap

We compare the levels of the various countries as following. The more yellow the higher the level of higher education, the more blue the lower the level from Figure 3. We conclude that the higher education level in the United States, Canada, and China, while South Africa and other countries lag behind

2.6 Conclusion of the question

According to the previous model analysis, we can draw the following conclusions, as shown in the Figure 4.

(1) From a macro perspective, the education level of the United States is much higher than that of other countries. Capitalist countries such as the United Kingdom, France and Japan followed suit and developed steadily, while developing countries including China have improved since the 2010s, but their development momentum has been slightly slower.

(2) From the perspective of time and vertical, around 2008, with the impact of the overall world economic fluctuations and the overall internationalization, all countries in the world have a decadent trend. However, with the subsequent recovery of the financial environment, the overall

higher education system is back on track of steady development.

(3) From the horizontal analysis of the nature of the country, capitalist countries have won the competitiveness of their own educational resources by virtue of their economic prosperity and the open and inclusive educational environment. However, as a developed country, Australia's higher education health factor level lags far behind other developed countries, so we choose Australia to analyze and improve.

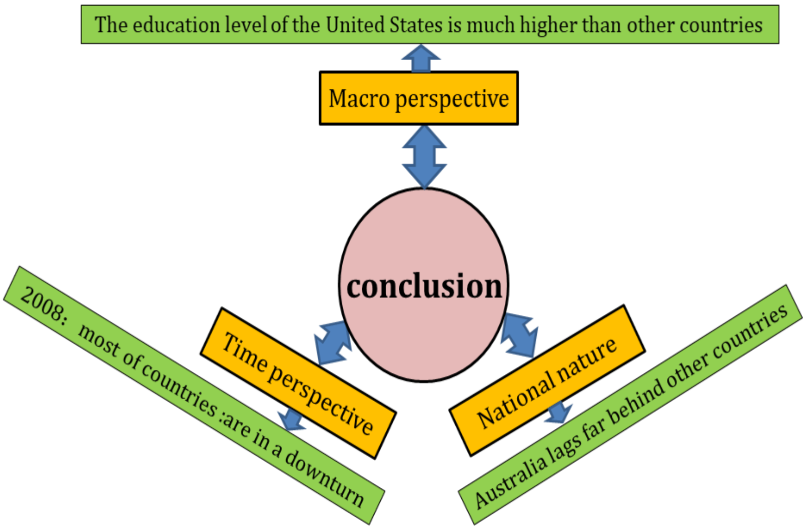

Figure 4: Conclusion of the evaluation model

2.7 Model establishment

Entropy weight and numerical simulation—determine ideal value

Since the level of higher education in Vietnam has been increasing in recent years, while Australia has been at a low level throughout the year, we choose Australia for further research. In order to propose an achievable vision, we have to find the ideal value of Australian higher education under different conditions through numerical simulation.

According to the foregoing conclusions and related literature, we find that the weight of research funding has a small effect on the level of higher education. Therefore, for follow-up research, we remove the research funding factor and choose talent hypothesis and academic level as explanatory variables to construct the functional relationship. .

When processing data, we need to simplify the data first. Therefore, we use the Entropy weight to process the data. Specific steps are as follows:

(1) Standardize the data of various indicators

$$x_i = \frac{s_i - s_{min}}{s_{max} - s_{min}} \tag{9}$$

(2) Calculate the entropy value of each indicator

$$k = 1/\ln(n)$$
$$e_i = -k\sum p_{ij}\ln(p_{ij}) \tag{10}$$
$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} = \frac{1}{n}$$

Where $e_i \in [0,1]$.

(3) Calculate the comprehensive evaluation value

$$v_j = \sum_{i=1}^{m} w_i p_{ij} + \sum_{k=1}^{m} w_k \left(1 - p_{ij}\right) \tag{11}$$

• Ridge regression——Analyze the impact of indicators

(1) Data preprocessing

In the process of partial regression of the higher education level factor on the above 9 indicators, first take the logarithm of the value of each indicator, that is $x_i=ln(x_i)$.

Then use the higher education level factor to perform partial regression on each logarithmic index value. This treatment can make the actual meaning become, when X increases by 1%, Y increases by 0.01 coefficient units, making the regression equation more clear for the actual guiding significance. People feel intuitively.

At the same time, when considering the cross effect, take, as an example, the ordinary regression is $x_1 \times x_2$, which needs to be treated as a new variable. After doing logarithmic transformation, it becomes $ln(x_1x_2)=ln(x_1)+ln(x_2)$ after processing at this time. If you consider the cross effect between two variables, only $ln(x_i)$ is amplified by the same multiple, There will be no impact on the corresponding decision-making choices.

(2) Modeling

Make:

$$J(\beta) = \sum (y - x\beta)^2 + \lambda \parallel \beta \parallel_1 = \sum (y - x\beta)^2 + \sum \lambda |\beta|^2 \tag{12}$$

Where $| \lambda \parallel \beta \parallel_1$ is the penalty term of the objective function, λ is the penalty term coefficient, and $\parallel \beta \parallel_1$ is the regularity of the regression coefficient β, which represents the sum of the absolute values of all regression coefficients.

In order to solve the final Ridge regression coefficient, it is necessary to combine the component derivative functions of $ESS(\beta)$ and $\lambda l2(\beta)$, and make the derivative function 0:

$$\frac{\partial ESS(\beta)}{\partial \beta_j} + \frac{\partial \lambda l_1(\beta)}{\partial \beta_j} = \begin{cases} -2m_j + 2\beta_j n_j + \lambda = 0 \\ \left[-2m_j - \lambda, -2m_j + \lambda\right] = 0 \\ -2m_j + 2\beta_j n_j - \lambda = 0 \end{cases}$$

$$\hat{\beta}_j = \begin{cases} \left(m_j - \frac{\lambda}{2}\right)/n_j, m_j > \frac{\lambda}{2} \\ 0, m_j \in \left[-\frac{\lambda}{2}, \frac{\lambda}{2}\right] \\ \left(m_j + \frac{\lambda}{2}\right)/n_j, m_j < \frac{\lambda}{2} \end{cases} \tag{13}$$

Finally, the model coefficients of the Ridge regression are obtained, and the coefficients can be obtained by different values of λ to obtain three different results.

2.8 Model solution

• Solution of model 1

We substitute the filtered index data into the model to obtain the final plan and three-dimensional diagrams of the benefits of higher education health status, as shown in the Figure 5:

From the figure, we can see that the ideal value of the health status of Australian higher education development is 2.5, and the position is near the coordinates (0.9, 0.8), that is, the standardized talent construction is 0.9 and the academic level is 0.8. Australia's higher education development level has reached the ideal maximum.

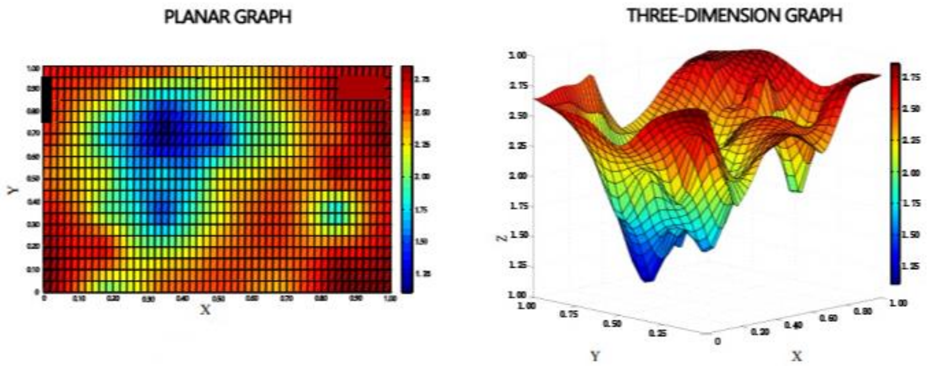

Figure 5: Benefits of Higher Education

Solution of model 2

For solving the Ridge regression method, we use the following methods to show our calculation results.

(1) Visualization method

We draw a line graph of different values and regression coefficients to finally determine a reasonable value. As shown below in the Figure 6:

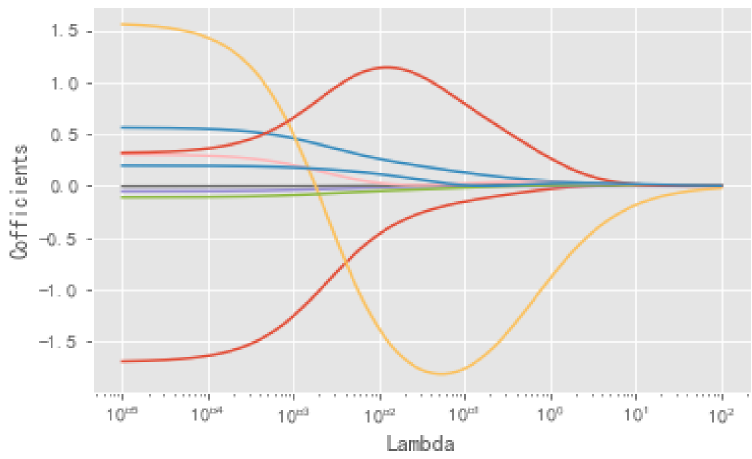

Figure 6: Determine the value of λ

(2) Cross-validation

Through iterating the value of λ and combining with the cross-validation method, the smallest mean square error is selected, and finally a reasonable λ value is 0.074. According to the best λ value, the Ridge regression model is rebuilt, and the mean square error is 0.661. for:

$$\begin{aligned} R = {} & 0.1068\ln(X_1) - 0.435\ln(X_2) + 0.15\ln(X_3) + 0.364\ln(X_4) + 0.329\ln(X_5) \\ & + 0.67\ln(X_6) + 0.248\ln(X_7) + 0.608\ln(X_8) + 0.779\ln(X_9) - 33.27 \end{aligned} \tag{14}$$

(3) Auxiliary regression

Among the nine variables, the variables that the government can control are the two first-level indicators of research funding and talent construction. From the government's point of view, we believe that the improvement of education level is the main factor affecting the health of the higher education system. To initially assess the degree of mutual influence between the 9 variables in Figure 7, we create a correlation coefficient diagram considering the interdependence of the variables.

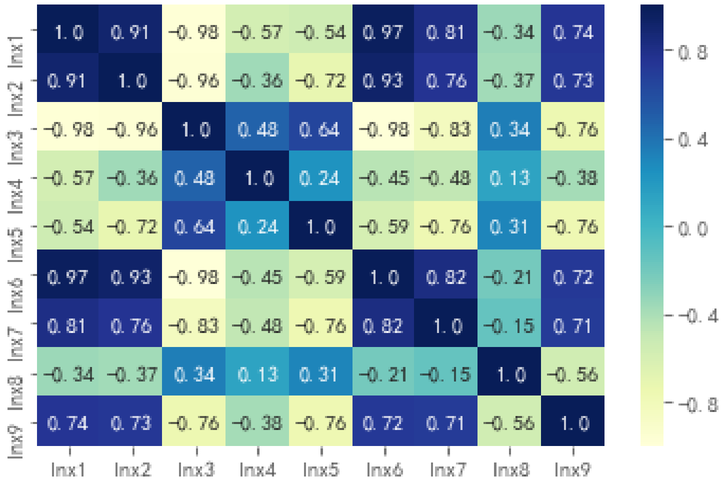

Figure 7: Correlation coefficient heat map

Take the ratio of education expenditure to the total government expenditure under the research funds that the government can control (x_5 as an example: the index that can be adjusted with a high correlation coefficient is x_7: the ratio of education expenditure to GDP, x_8: Number of postgraduates, x_9: The proportion of the country attracting international talents to enter colleges and universities each year, and the auxiliary regression of x_5 on x_7, x_8, x_9, is as follows:

$$\ln(X_5) = 0.324\ln(X_7) + 0.174\ln(X_8) + 4.773\ln(X_9) - 63.067 \quad (15)$$

Regarding *ln*(x_5) as an independent variable, an increase of x_5 by 1% can increase x_7 alone by 1/0.324%=3.086%. The same goes for x_8: 5.747%, x_9: 0.209%.

Under the government's regulation, the proportion of education expenditure in total government expenditure increased by 1%. In addition to the direct impact on the evaluation value R, it can also be achieved by applying the proportion of education expenditure to total government expenditure on different projects. As a result of the combined auxiliary regression expression, we can finally know that when education expenditure accounts for a 1% increase in total government expenditure, all of which are applied to x_7: Education expenditure as a proportion of GDP, the evaluation value will increase by 7.65×10^{-3}, Similarly, $x_8=34.9\times10^{-3}$, $x_9=1.628\times10^{-3}$.

Therefore, when the government wants to improve the level of higher education by increasing the level of research funds, it should give priority to increasing the ratio of education expenditure to the total government expenditure so that the level of higher education can be improved.

2.9 Making plans

Gray predictioning finds the law of system changes by generating and processing the original data, so as to predict the future development trend of things. It has high accuracy when making short-term forecasts. Therefore, we use this method to make short-term forecasts based on Australia's original indicator data from 2009 to 2018.

Finally, we used the Gray prediction model to predict the Australian higher education indicators in the Figure 8:

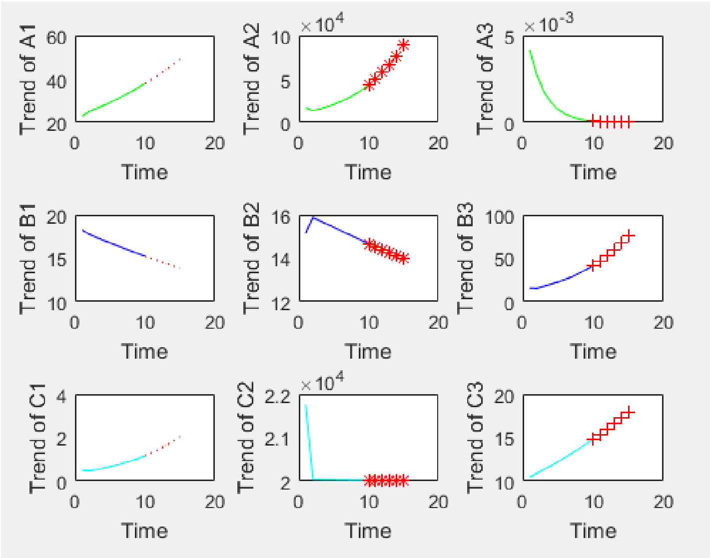

Figure 8: Trends of various indicators

Finally, based on the dimensionality reduction processing and gray prediction results, we can obtain the index values of talent construction and academic level in Australia in the following years. From the expressions of Ridge regression and auxiliary regression, we obtain more accurate and dynamic index values, so that according to the changes of index values, we can know when the health status of higher education can migrate to the ideal level.

$$\begin{pmatrix} x_{11} & x_{12} & \cdots & x_{19} \\ x_{21} & x_{22} & \cdots & x_{29} \\ \vdots & \vdots & \vdots & \vdots \\ x_{91} & x_{92} & \cdots & x_{99} \end{pmatrix} \xrightarrow{\text{Dimensiona}} \begin{pmatrix} x_{11} & x_{12} & x_{13} \\ \vdots & \vdots & \vdots \\ x_{91} & x_{02} & x_{93} \end{pmatrix} \tag{16}$$

In the end we get the prediction result as shown in the Table 3:

Table 3: Australian higher education indicator trend chart

Time	**Academic levels**	**Talent construction**	**Combined value**	**Evaluation value**
2019	Up	Up	(0.74,0.68)	2.24
2020	Up	Down	(0.79,0.66)	2.27
2021	Up	Up	(0.84,0.69)	2.32
2022	Down	Up	(0.80,0.71)	2.32
2023	Down	Down	(0.78,0.69)	2.31
2024	Up	Up	(0.82,0.71)	2.34
2025	Up	Up	(0.83,0.72)	2.36
2026	Up	Up	(0.86,0.75)	2.39
2027	Up	Up	(0.89,0.76)	2.44
2028	Up	Up	(0.91,0.78)	2.49

So we make the following plan (See Appendix).

3. Sensitivity analysis

In order to evaluate the effectiveness of the policy, we removed some of the default indicators with minimal impact and then performed local sensitivity analysis of variables. When calculating, the parameters will be slightly disturbed, such as ±5% change, and the response fluctuation caused by the model output to a single input is the sensitivity index. In the local sensitivity analysis, we use the finite difference method to calculate the sensitivity of each indicator. Calculated as follows:

$$\frac{\partial y}{\partial x_i} = \frac{y(x^i)-y(x)}{\Delta x_i} + 0(\Delta x) \approx \frac{y(x^i)-y(x)}{\Delta x_i} \tag{17}$$

According to the above formula, we conducted a sensitivity analysis on the model, and the results are as follows Figure 9:

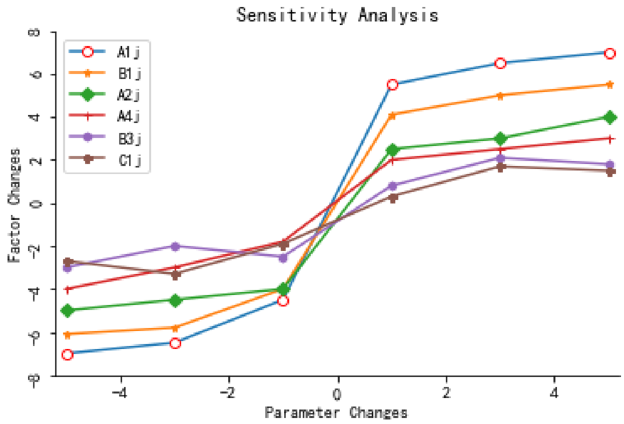

Figure 9: Sensitivity Analysis

According to the calculation of the range of change, it can be determined that the penetration rate of higher education in each country, A_{1j}, has the most obvious impact on the model, followed by education expenditure/total government expenditure B_{1j}, and the number of advanced students C_{1j} has the weakest impact. The fluctuation of the selected parameters has more influence on the model output value.

This shows that the indicators selected by our model have good representativeness, and have good sensitivity and effectiveness.

4. Conclusions

By solving the model,we can initially propose a healthy and sustainable higher education system for Australia:

(1) First, through Entropy weight and numerical simulation, we determined that the ideal value of the Australian higher education health system is 2.5. Among them, Australia's talent development value is 0.9, academic level is 0.8, and the current health value of Australia's higher education system is 2.05.

(2) Secondly, in order to measure Australia's current system health, we use Ridge regression to show Australia's current status in three forms. Through iteration and cross-validation, we have obtained the ideal value of 0.074. Finally, from the perspective of the government, we constructed Australia's current higher education model through auxiliary regression. The results show that when the government needs to use research funds to improve the country's higher education level, increasing the proportion of education expenditure can be the largest increase in education level.

(3) Finally, in order to reach the ideal level of higher education in Australia as soon as possible, we use Gray predictions to estimate. At the same time, it has formulated a timetable for Australia's future development. It is expected that Australia's higher education level will reach its peak in 2027.

References

[1] Ding Hongwei, Tang Ying, Cao Tiantian. A comparative study on the quality evaluation mechanism of higher education in China and Japan [J]. Journal of Southwest Jiaotong University (Social Science Edition), 2020, 21(03): 46-52.

[2] James N. Johnstone. Indicators of Education Systems [Z]. Paris: UNESCO, 1981.

[3] Chen Xuejun. Inquiry into the rationale: Educational indicators in Western social indicators [J]. Foreign Elementary and Secondary Education, 2007(04): 33-37

[4] Liu Yan, Li Na. The construction of a comprehensive evaluation index system for the internationalization of higher education [J]. Higher Education Management, 2019, 13(05): 52-60.

[5] Xu Hongyi, Zhou Qunying. The construction of the evaluation index system for the quality and level of higher education—Based on the perspective of building a strong country in higher education [J]. Modern Education Management, 2010(05): 43-46.

[6] Zhang Hui. The management interpretation of the classified development of colleges and universities [J]. Higher Education Exploration, 2005(01): 40-42.

[7] Liang Qian. The three major challenges of today's higher education quality assurance and their countermeasures [J]. Educational Research of Tsinghua University, 2020, 41(01): 142-148.

[8] Wang Zhihuan. Comparative research on the internationalization index system of higher vocational education at home and abroad [J]. Journal of Tianjin Vocational College of Business, 2019, 7(04): 87-92.

[9] Zhou Quan. Theoretical exploration and construction of college undergraduate education quality evaluation in response to the needs of corporate talents [J]. Modern Marketing (Business Edition), 2019(11): 232.

[10] Yu Xiaojun, Zhang Jianfang. Thoughts on the construction of the teaching quality evaluation system of private colleges and universities [J]. Science and Technology Vision, 2020(30): 116-11