

The Empirical Assessment Study on the Quality of Undergraduate Education in Shandong Province

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Abstract. Higher education assessment has always been the focus of research by experts and scholars. Based on this, combined with the previous evaluation index system of undergraduate education quality constructed by using the index loop method, a data envelopment analysis model was constructed to conduct empirical evaluations of ordinary undergraduate colleges, private colleges, and independent colleges in Shandong Province, and visualize the results and discussion.

Keywords: Data Envelopment Analysis, Undergraduate Education, Quality Assessment.

1. Introduction

As for the evaluation of the quality of higher education, the most evaluations focus on output, but there is a large gap between the input of various types of universities. Insufficient investment in higher education institutions is likely to be lower. This article uses this as a starting point, combined with the indicator system that was previously constructed using the indicator loop method, from the perspective of input and output, to construct and improve the indicator system for the evaluation of educational quality in colleges and universities. References and supplements, contribute to the evaluation of the quality of higher education and improve the level.

2. Data Envelopment Analysis

Data envelope analysis was proposed by A. Charnes and W. W. Copper on a linear programming model based on input and output. The traditional DEA model mainly includes CCR, BCC, etc. However, there are cases where the efficiency value of different units is 1 at the same time, which makes it difficult to compare and sort. To this end, Anderson and Petersen have made improvements. Based on this, the traditional model is a super-efficiency DEA model, and the efficiency value is not limited by [0, 1], so that all evaluation units can be ranked and a new efficiency boundary can be formed. This paper studies the evaluation of educational quality of undergraduate colleges and universities in Shandong Province.

Based on this, the project constructs an input-oriented super-efficiency DEA model under the condition of fixed scale returns, see formula (1)

$$\begin{aligned} \min \theta \\ \text{s.t.} \begin{cases} \sum_{j=1, j \neq k}^K x_{ij} \lambda_j + s_i^- = \theta x_0, i = 1, 2, \dots, M \\ \sum_{j=1, j \neq k}^K y_{hj} \lambda_j - s_i^+ = y_0, h = 1, 2, \dots, N \\ s_i^- \geq 0, s_i^+ \geq 0 \\ \lambda_j \geq 0, j = 1, 2, k-1, k, k+1, \dots, K \end{cases} \end{aligned} \quad (1)$$

Among them, θ represents the super efficiency value of the k-th decision unit for the input and output of colleges and universities, x , y , and M and N are the indicators of input and output and the number of variables, and s^+ and s^- are the output and input Slack variable (easy to solve in a larger feasible region). Models were solved using DEAP software.

3. Empirical Assessment and Analysis

3.1 Data Acquisition and Processing

This paper studies the evaluation index system of educational quality of colleges and universities in Shandong Province. In view of the feasibility of data acquisition, this article studies only the cross-sectional values of the input and output super-efficiency of the education quality of ordinary undergraduate colleges and universities in 17 cities in Shandong Province in 2017.

3.2 Empirical Evaluation and Discussion of Results

The DEAP software used to measure the educational quality data of colleges and universities in Shandong Province is also displayed separately from ordinary colleges, private colleges, and independent colleges, as shown in Tables 1, 2, 3.

3.2.1 Ordinary Undergraduate Colleges

Table 1. Super Efficiency Value of Input and Output of Education Quality in General Undergraduate Universities

| ordinary undergraduate colleges | Super efficiency | Rank | ordinary undergraduate colleges | Super efficiency | Rank |
|---|------------------|------|--|------------------|------|
| Shan Dong University | 4.012 | 1 | Shandong Jiaotong University | 1.861 | 23 |
| China Ocean University | 3.895 | 2 | Weifang Medical College | 1.849 | 24 |
| China University of Petroleum) | 3.863 | 3 | Jining Medical College | 1.834 | 25 |
| Qingdao University | 3.432 | 4 | Binzhou Medical College | 1.825 | 26 |
| Jinan Universty | 3.414 | 5 | Shandong Women's College | 1.803 | 27 |
| Shandong Normal University | 3.257 | 6 | Shandong Institute of Business | 1.769 | 28 |
| Shandong Agricultural University | 3.251 | 7 | Shandong Institute of Physical Education | 1.756 | 29 |
| Shandong University of Science and Technology | 3.249 | 8 | Shandong Agricultural Engineering College | 1.721 | 30 |
| Shandong University of Finance and Economics | 3.242 | 9 | Weifang University | 1.715 | 31 |
| Qingdao University of Science and Technology | 3.018 | 10 | Taishan college | 1.707 | 32 |
| Qufu Normal University | 3.002 | 11 | Binzhou College | 1.689 | 33 |
| Shandong University of Technology | 2.921 | 12 | Texas College | 1.684 | 34 |
| Qingdao University of Science and Technology | 2.836 | 13 | Shandong University of Political Science and Law | 1.681 | 35 |
| Yantai University | 2.615 | 14 | Heze College | 1.675 | 36 |
| Liaocheng University | 2.434 | 15 | Jining College | 1.674 | 37 |
| Linyi University | 2.415 | 16 | Zaozhuang College | 1.671 | 38 |
| Shandong University of Traditional Chinese Medicine | 2.332 | 17 | Shandong Institute of Arts and Design | 1.663 | 39 |
| Shandong Jianzhu University | 2.313 | 18 | Shandong Art Institute | 1.564 | 40 |
| Qilu University of Technology | 2.228 | 19 | Qilu Teachers College | 1.428 | 41 |
| Taishan Medical College | 2.121 | 20 | Shandong Youth University of Political Science | 1.421 | 42 |
| Qingdao Agricultural University | 2.015 | 21 | Shandong Police Academy | 1.399 | 43 |
| Ludong University | 1.988 | 22 | Shandong Management Institute | 1.368 | 44 |

The following conclusions can be drawn from Table 1. (1) Shandong University, Ocean University of China, and China University of Petroleum (East China), as "double first-class" universities, have more funding from the Ministry of Education, but the benefits from the investment are also large, that is, the super efficiency value is high, ranking the province Top three. (2) From the perspective of super efficiency, the highest Shandong University is 4.012, and the lowest is Shandong Management College 1.368. It can be seen that the input and output are all greater than 1, indicating that the funding input of each university has produced excess output; of course, from the perspective of input and output, this ranking has theoretical shortcomings for the highly specialized colleges and universities. This is also the direction for continued discussion in the later period; the difference between the super efficiency value of Shandong University and Shandong Management Institute is 2.644, which indicates that from the perspective of the province, the gap between the input and output efficiency of various colleges and universities is large. (3) In terms of regional distribution, the input-output super-efficiency value of universities in Jinan and Qingdao ranks high. From the perspective of input-output, the quality of education is higher than that of universities in other cities. The agglomeration effect of universities has a lot to do with it.

3.2.2 Private Colleges

Table 2. Super-efficiency value of input and output of education quality in private universities

| Private colleges | Super efficiency | Rank | Private colleges | Super efficiency | Rank |
|---------------------------------|------------------|------|---|------------------|------|
| Shandong Yingcai College | 2.417 | 1 | Weifang University of Science and Technology | 1.782 | 7 |
| Qilu Institute of Technology | 2.299 | 2 | Yantai Nanshan University | 1.764 | 8 |
| Shandong Union College | 2.235 | 3 | Qingdao Hengxing University of Science and Technology | 1.529 | 9 |
| Qingdao Binhai College | 2.192 | 4 | Qilu Medical College | 1.437 | 10 |
| Qingdao Huanghai University | 2.121 | 5 | Shandong Modern College | 1.335 | 11 |
| Qingdao Institute of Technology | 2.065 | 6 | Shandong Huayu Institute of Technology | 1.211 | 12 |

Table 2 shows the results of the evaluation of the super-efficiency of education quality of private colleges and universities in Shandong Province from the perspective of input and output. From the analysis of the input-output indicator system, the highest quality of super-efficiency of private education in Shandong province is Yingcai College is 2.417, and the minimum is 1.211 for Shandong Huayu Institute of Technology. It can be seen that the input and output are all greater than 1, indicating that the funding input of each university has produced excess output; the difference in the super efficiency value between Shandong Yingcai College and Shandong Huayu Institute of Technology is 1.206, indicating that from the perspective of private universities in the province, each The gap between input and output efficiency of private colleges and universities is large.

Table 3 shows the results of the evaluation of the super-efficiency of education quality of the independent college of Shandong Province from the perspective of input and output. From the analysis of the input-output index system, the highest quality of super-efficiency of education of Shandong Independent College is Shandong University of Finance and Economics. Yanshan College is 2.659, with a minimum of 1.698 in Haidu College of Qingdao Agricultural University. It can be seen that the input and output are greater than 1, indicating that the funding input of each academic college has produced excess output; the gap between the super efficiency value of Yanshan College of Shandong University of Finance and Economics and Haidu College of Qingdao Agricultural University is 0.961, which is different from that of ordinary colleges and universities, and In terms of institutions, the gap is small; in addition, the ranking of dependent schools should be considered when evaluating the quality of independent college education.

3.2.3 Independent Colleges

Table 3. Super Efficiency Value of Independent College Education Quality Input Output

| independent colleges | Super efficiency | Rank | independent colleges | Super efficiency | Rank |
|--|------------------|------|---|------------------|------|
| Yanshan College of Shandong University of Finance and Economics | 2.659 | 1 | Taishan University of Technology, Shandong University of Science and Technology | 1.829 | 7 |
| Shengli College of China University of Petroleum | 2.571 | 2 | Lishan College of Shandong Normal University | 1.801 | 8 |
| Qindao College of Qingdao University of Technology | 2.362 | 3 | Beijing Film Academy School of Modern Creative Media | 1.759 | 9 |
| Oriental College of Shandong University of Finance and Economics | 2.331 | 4 | Dongchang College of Liaocheng University | 1.732 | 10 |
| School of Literature and Classics, Yantai University | 2.015 | 5 | Haidu College of Qingdao Agricultural University | 1.698 | 11 |
| Quancheng College of Jinan University | 1.988 | 6 | | | |

4. Summary

(1) Jinan and Qingdao have obvious advantages in terms of location and concentration of colleges and universities. There is a large regional disparity in the quality of education of institutions of higher learning in Shandong Province;

(2) In the evaluation of three types of higher education institutions, it was found that the education quality (super efficiency value) of Shandong University, Ocean University of China, and China University of Petroleum (East China) is significantly higher; the gap between the super efficiency values of private colleges and independent colleges is small. From the perspective of the province, the super efficiency values are all greater than 1.

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