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Establishing and evaluation of the diversified university charge models

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ABSTRACT

Firstly, this article builds an estimation model of the average cost of one student, on the basis of which the pluralistic charge model is built. According to different regions, schools, majors, education levels, we calculate to get the tuition of a kind of university and some majors and a kind of education level of one area with the formula in the process of which pluralistic views are utilized. We can know there are differences between the higher education cost and the current tuition by the comparative measurement of the model optimization, which we can know the current university tuition is irrational.

KEYWORDS

Education cost; Model; Pluralistic analysis.

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INTRODUCTION

Higher education emphasizes on cultivating high quality talents. The core index of measuring talent cultivation is cultivating the quality of them. Any discipline and major of higher education needs to be guaranteed by the corresponding funding. The main source of the school funding is the tuition handed by university students for many local universities. In recent years, the tuition issues of higher education caused quite a lot of criticism. Therefore, it is essential to study and scientifically measure on different university funding status.

MATERIALS AND METHODS

Model assumptions

1) All university teacher's salaries in the whole country are only related to the local areas.
2) The education cost of the same majors of a kind of a university of one area is the same.
3) Ignoring military academies, targeted-area students, and universities to which other schools and the government provides education cost.

Establishing and solving of the model
(A) The model of the average cost of one student
(b) Symbol description

The average cost of one student— R ;

The average personnel expense of one student — R_1 ;

Subsidy expense for individuals and families of one student — R_2 ;

Public expense of one student — R_3 ;

Fixed asset depreciation expense of one student — R_4 ;

Teacher's average annual salary of one area— S .

(b) The establishing of mathematical model of higher education average cost of one student

The measurement of higher education average cost of one student should be carried out by levels[1]. According to the ministry of education documents, the referring factor of undergraduates, master students and doctor students is . According to the fifth article of The Higher Education Cost Supervision and Examination Methods(Trial), the average cost of one student measured by this article includes the cost of average personnel expense of one student, the cost of public expense of one student, the cost of subsidy expense for individuals and families of one student, the cost of fixed asset depreciation expense of one student[2].

(1) The average personnel expense of one student ;

(2) Subsidy expense for individuals and families of one student $R_2 = R_1 \cdot \sum_{i=3}^{4} a_i$;

(3) Public expense of one student R_3 ;

(4) Fixed asset depreciation expense of one student $R_4 = \sum_{i=1}^{4} A_i$;

(5) Mathematical model of the average cost of one student R .

According to the above parameters, it is not difficult for us to obtain the average cost of one student of higher education.

$$R = \sum_{i=1}^{4} R_i = \frac{S}{r}(1 + \sum_{i=1}^{2} a_i) + R_1 \bullet \sum_{i=3}^{4} a_i + R_3 + \sum_{i=1}^{4} A_i$$

$$= \frac{S}{r}(1 + \sum_{i=1}^{2} a_i) + R_1 \bullet \sum_{i=3}^{4} a_i + R_3 + t \bullet a_5 \bullet 2\% + s \bullet a_6 \bullet 2\% + u \bullet 10\% + m \bullet n$$

In light with the cost model, we carry out preliminary estimates. It is not difficult for us to obtain the average cost of one student of higher education in Henan province. According to the ministry of education teaching files, we draw the table which is about the undergraduate teaching level evaluation standard of regular institutions of higher learning. Like Table 1.

Table 1 : The table of the undergraduate teaching level evaluation standard of regular institutions of higher learning

	Undergraduate course				
	The ratio of students and teachers	The teachers with graduate degree account for full time teachers	Teaching and administrative building of one student (Square / student)	The value of teaching and research equipment of one student (¥ /student)	Book of one student (book/student
Comprehensive,normal, national universities.	18	30	14	5000	100
Engineering, agricultural, forest universities.	18	30	16	5000	80
Medical universities.	16	30	16	5000	80
Chinese, financial, politics and law universities.	18	30	9	3000	100
Sports universities.	11	30	22	4000	70
Art universities.	11	30	18	4000	80

In light with the table 1, the relevant data in the above formula is as follows.

$$r =[18,18,16,18,11,11] \text{ ; } t =[54,59,54,59,88,88] \text{ ; } s =[14,16,9,16,22,18]$$

$$u =[5000,5000,3000,5000,4000,4000] \text{ ; } n =[4,3,4,3,3,4]$$

Pay more attention to

$$S = [23307 \times 2 \times 0.8, 23307 \times 2 \times 1.2]$$

$$a_1 =0.25 \text{ ; } a_2 =0.15 \text{ ; } a_3 =0.2+0.3 =0.5 \text{ ; } a_4 =0.28 \quad Matlab$$

We can get the calculation results utilizing the mathematical software *Matlab* [3].

$$R_1 = \begin{pmatrix} 2796.8 & 4195.3 \\ 2796.8 & 4195.3 \\ 2796.8 & 4195.3 \\ 3146.4 & 4719.7 \\ 4576.6 & 6865.0 \\ 4576.6 & 6865.0 \end{pmatrix} \quad R_2 = \begin{pmatrix} 2181.5 & 3272.3 \\ 2181.5 & 3272.3 \\ 2181.5 & 3681.3 \\ 2454.2 & 3681.3 \\ 3569.8 & 5354.7 \\ 3569.8 & 5354.7 \end{pmatrix}$$

$$R_3 = \begin{pmatrix} 1498.9 & 2248.4 \\ 1498.9 & 2248.4 \\ 1498.9 & 2248.4 \\ 1498.9 & 2248.4 \\ 1498.9 & 2248.4 \\ 1498.9 & 2248.4 \end{pmatrix} \quad R_4 = \begin{pmatrix} 1544.5 & 2010.1 \\ 1627.5 & 2095.1 \\ 1246.9 & 1712.5 \\ 1627.5 & 2095.1 \\ 2015.8 & 2669.0 \\ 1957.8 & 2641.0 \end{pmatrix}$$

$$A_1 = \begin{pmatrix} 691.2 & 1036.8 \\ 755.2 & 1132.8 \\ 691.2 & 1036.8 \\ 755.2 & 1132.8 \\ 1126.4 & 1689.6 \\ 1126.4 & 1689.6 \end{pmatrix} \quad A_2 = \begin{pmatrix} 273.28 & 273.28 \\ 321.32 & 312.32 \\ 175.68 & 175.68 \\ 312.32 & 312.32 \\ 429.44 & 429.44 \\ 351.36 & 351.36 \end{pmatrix} \quad A_3 = \begin{pmatrix} 500 & 500 \\ 500 & 500 \\ 300 & 300 \\ 500 & 500 \\ 400 & 400 \\ 400 & 400 \end{pmatrix} \quad A_4 = \begin{pmatrix} 80 & 200 \\ 60 & 150 \\ 80 & 200 \\ 60 & 150 \\ 60 & 150 \\ 80 & 200 \end{pmatrix}$$

$$R = \begin{pmatrix} 8022 & 11726 \\ 8105 & 11811 \\ 7724 & 11428 \\ 8727 & 11745 \\ 11661 & 17137 \\ 11603 & 17109 \end{pmatrix} \quad R \times 25\% = \begin{pmatrix} 2005.4 & 2931.5 \\ 2026.2 & 2952.8 \\ 1931.0 & 2857.1 \\ 2181.8 & 3186.1 \\ 2915.3 & 4284.3 \\ 2900.8 & 4277.3 \end{pmatrix}$$

Table 2: The education charge table of Henan province

Liberal arts	¥ 3400 / student / year
Science departments	¥ 3700 / student / year
Medicine	¥ 4500 / student / year
Arts	¥ 5700 / student / year
Sports	¥ 8000 / student / year

We can know from the Table 2, which is the education charge table of Henan province that the charge standards of the comprehensive, normal, national universities, engineering, agricultural, forest universities and the above mentioned universities are unified. Comparing the above data with the previous results, we can find that university charge of Henan province goes beyond 25 percent, regulated by the state, which is the highest standard that students can understand.

We will put forward a diversified university charge method and further study the relationship between education cost and tuition standards.

(B) The diversified university charge model

We will establish a reasonable diversified charge price model starting from the main factors of affecting higher education price and the diversity of higher education itself.

(a) Symbol description

Different types of universities$-a_h$;

Different types of majors $- b_i$;

Different levels of education $-c_j$;

Different types of origins of students $- d_k$;

The training sample matrix of higher education $-\lfloor TS_{hijk} \rfloor$;

The total training cost$-ca_h b_i c_j d_k$;

The total number of students$- Qa_h b_i c_j d_k$;

The average training cost of one student $- Sa_h b_i c_j d_k$;

The training sample $-a_h b_i c_j d_k$;

The fees $- Pa_h b_i c_j d_k$.

(b) Establishing of model

According to the real situations of different kinds of universities and majors, they can be divided into $h, i, j = 3, k$ respectively. Namely, $\{a_1, a_2, \cdots a_h\}$ represents different kinds of universities; $\{b_1, b_2, b_3 \cdots b_i\}$ represents different kinds of majors; $\{c_1, c_2 c_3\}$ represents different levels of education; $\{d_1, d_2, d_3 \cdots d_k\}$ represents the economic situation of different origins. Therefore, the sample space of the training sample models (represented by $\lfloor TS_{hijk} \rfloor$) of university students has $h \times i \times 3 \times k$ sample points, which can be represented by the matrix:

$$\lfloor TS_{hijk} \rfloor = \lfloor a_h, b_i, c_j, d_k \rfloor_{h \times i \times 3 \times k} \tag{1}$$

In order to facilitate understanding, now,the training sample model matrix of university students can be represented by

$$\lfloor TS_{hijk} \rfloor = a_1 \times \begin{Bmatrix} A \\ B \\ C \end{Bmatrix}_{3 \times (i \times k)} \tag{2}$$

Now, in light with the investment of training sample models, expected return, the economic development of the origins and social equity, we will determine the weight that every training sample should share in the cost.

$qa_h b_i c_j d_k$ can represent the weight that is the sample $a_h b_i c_j d_k$ in the training sample matrix $\lfloor TS_{hijk} \rfloor$ in the total higher education cost, which the relationship with

$qa_h b_i c_j d_k$ is

$$qa_h b_i c_j d_k = qa_h \times qb_i \times qc_j \times qd_k \tag{3}$$

It is easy to know $qa_h b_i c_j d_k$ can meet $\sum qa_h b_i c_j d_k = 1$

Namely, the sum of the weights of every training cost is one.

$Ca_h b_i c_j d_k$, $Qa_h b_i c_j d_k$, $Sa_h b_i c_j d_k$ represent the total training cost of higher education training sample $a_h b_i c_j d_k$, the total number of students and the average training cost of one student respectively. According to the third formula, the total training cost and the average training cost of one student is respectively:

$$Ca_h b_i c_j d_k = C \times qa_h b_i c_j d_k \tag{4}$$

$$Sa_h b_i c_j d_k = \frac{Ca_h b_i c_j d_k}{Qa_h b_i c_j d_k} \tag{5}$$

Therefore, we can know the total training cost of higher education training sample model and the matrix of the average training cost of one student is respectively :

$$\lfloor Ca_h b_i c_j d_k \rfloor_{i \times [3 \times (j \times k)]} = C \times \lfloor qa_h b_i c_j d_k \rfloor_{i \times [3 \times (j \times k)]} \tag{6}$$

$$\lfloor Sa_h b_i c_j d_k \rfloor_{i \times [3 \times (j \times k)]} = \left[\frac{Ca_h b_i c_j d_k}{Qa_h b_i c_h d_k} \right]_{i \times [3 \times (j \times k)]} \tag{7}$$

Higher education does not belong to compulsory education. According to the principle of market economy that is "who benefits, who pays", the government, society and students should share the cost of cultivating students. In accordance

with the provisions of the Ministry of Education, the tuition fees charging to students should be 25 percent of training cost. If we use $Pa_h b_i c_j d_k$ presenting the price of higher education training sample $a_h b_i c_j d_k$,we can know:

$$Pa_h b_i c_j d_k = Sa_h b_i c_j d_k \times 25\% \tag{8}$$

The price matrix of higher education training sample matrix is :

$$\left\lfloor Pa_h b_i c_j d_k \right\rfloor_{i\times[3\times(j\times k)]} = \left\lfloor Sa_h b_i c_j d_k \right\rfloor_{i\times[3\times(j\times k)]} \times 25\% \tag{9}$$

RESULTS

Simulation calculation

The total education cost of the national universities is ¥214.2 billion in some year. The number of students in ordinary university is 18849300. If we are according to the above model, we can simulate and calculate the price of higher education training sample in our country this year. In accordance with the first and second formulas, we can divide 18849.3 thousand students into $h \times i \times j \times k$ training samples[4]. Making the symbol w_{hijk} , q_{hijk} representing the number and weight of the training samples respectively, according to the fourth, sixth, eighth and ninth formulas, we can work out the price of the samples this year. It can be represented by P_{hijk} :

$$P_{hijk} = \frac{2142 \times q_{hijk}}{w_{hijk}} \times 25\% \quad \text{(one thousand million)} \tag{10}$$

In accordance with the hypothesis, the kinds of training cost $a_h b_i c_j d_k$ are 3^4. Now, we choose one sample $a_2 b_1 c_2 d_2$ representing these students who come from the d_2 regions (assuming the weight is 0.3059). Taking the b_1 majors(assuming the weight is 0.5103) of the a_2 universities (assuming the weight is 0.3057)for examples and according to the seventh formula, we can work out the sample weight:

$$q_{2223} = 0.3059 \times 0.3057 \times 0.5103 \times 0.2743 = 0.01309 \tag{11}$$

According to the hypothesis of the model, the students (18849.3 thousand people) of ordinary universities should be distributed equally in 3^4 kinds of training samples. The number of people of sample $a_2 b_2 c_2 d_3$ is:

$$q_{2223} = \frac{1884.93}{81} = 23.27 \text{ (ten thousand people)} \tag{12}$$

According to the fourteenth, fifteenth and sixth formulas, we can get the price of sample $a_2 b_2 c_2 d_3$:

$$P_{2223} = \frac{2142 \times 0.01309}{23.27} \times 25\% = 3012.33 \text{ (RMB)}$$

The model of the average cost of one student takes every details into consideration and calculates fully and accurately, whose result is a varied range. Since the measurement of the model of the average cost of one student, we recognize the current charging is unreasonable. Therefore, we assume the diversified university charge model, which is priced by making the differences among different kinds of universities, different kinds of majors and different levels of education, and which is taken the regional differences into account to fully reflect the diversity of higher education price. We can get the reasonable results by using the related data, which conforms to the current reality. It fully takes into account the various factors. It not only makes universities make full use of the limited educational resources, which is conducive to the development of higher education itself, but also provides education opportunities for individuals, which gives consideration to the quality of education and social justice. Therefore, we can get a conclusion that is diversified model is feasible.

DISCUSSION

With the development of economy, the price of commodities is rising. Some reasons, for example, the college expansion plan, result in the rising of the training cost of universities. Simultaneously, the tuition fee will rise. The opportunity that students can go to school in better economic regions is bigger than those in worse economic regions, which must lead to the students, who are in poor regions, cannot generally receive higher education.

The two models are examined by each other in this article, which well check the diversified university charge model is reasonable. The diversified university charge model is a model that is made aiming at all factors affecting university charge, which solves the problem of education charge resulting by the development of the social changes.

However, the diversified university charge model does not reflect the influences of awards, grants and loans to the average training cost of one student. The results have a certain deviation.

ACKNOWLEDGMENTS

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