

The Evaluation Model of American Universities Based on Education Performance

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Abstract: In recent years, there are more and more Chinese students going abroad for studying, and within them, the most students decided to study in the United States. But although in general the academic resource and quality of American universities is better than Chinese, the cost of studying abroad is much higher than studying in domestic colleges. Therefore, in order to get the best profit from studying abroad, students should better try to admit to the universities with higher academic evaluation. But until now, there's no official ranking system for universities. Although some organizations have done several different ranking lists, there is still no "best" ranking for students to select schools. And due to cultural differences, the ranking lists done by foreign organizations may not suit for Chinese students. This paper try to use regression model to evaluate the universities in the United States, and try to model the best universities list based on academic resource, quality of teaching and the average quality of students. Although it's just another "nonofficial" ranking, it should be useful for students to know more about American universities.

Key words: ranking of universities; ranking system; study abroad; academic resource

1. Introduction

In recent years, there're more and more Chinese students going abroad for studying. Within them, the most students go to United States.

Generally speaking, the academic resource and research environment of United States are better than that of China, and students could get better English ability as well. However, the tuition and cost of living in American universities are much higher than in Chinese universities. Therefore, in order to get the best profit from studying abroad, students should better try to admit to the universities with higher academic evaluation.

But until now, there's no official ranking system for American universities. Although some media and organizations such as US NEWS (general ranking and professional rankings)^[1], Business Week, Fortune and Financial Times (MBA ranking) have done several different ranking lists, there is still no "best" ranking for students to select schools. And due to cultural differences, the ranking lists done by foreign organizations may not suit for Chinese students. Since 2003, Shanghai Jiao Tong University started to rank the 500 best universities in the world, which has been known and accepted broadly as "Academic Ranking of World Universities"^[2]. But its ranking indices focused on researching abilities like Nobel prizes and SCI/SSCI papers, so it's suitable for graduate students especially PhDs. And for undergraduate students, there's still no best ranking of universities as well.

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The purpose of this research is to use statistic method to rank 1300 universities in the United States, based on indices like SAT/ACT mean scores, students accepted rate, students/faculty ratio and academic resource per student. Although it's not better than existing rankings, students could still read and compare it with others.

This research not only has significant meaning for students tend to study abroad, but also a good reference for scholars researching for US and China higher education.

2. Methodology

2.1 Data source and hypothesis

There are two data sources: College USA 1994 survey^[3], and American Association of University Professor (AAUP) 1994 Salary Survey^[4]. Both data are got from Internet. Although the data is a little out-dated, it's still good for analysis and model building. Scholars could easily use current data to test it.

College USA (1994) is a data collection of tuitions, SAT/ACT mean scores, number of applications received, applications accepted, and the number of graduates, student/faculty rate, and spending per student of 1302 Universities in the United States.

On the other hand, AAUP 1994 Salary Survey is a data collection of average salary of Assistant/Associate/Full professors, and number of faculties of 1161 universities in the United States.

The purpose of this research is to use objective data to evaluate and rank American universities. Frankly speaking, there's no "best" ranking system, but people could still find the most suitable ranking system for themselves based on the indices used. Therefore, this research is not trying to build an evaluating system surpassing the rankings done by US NEWS, Business week or Shanghai Jiao Tong University, but just build another ranking system based on objective indices, which is comparable for scholars and students.

Based on the purpose, the hypothesis of this research is: it is possible to rank universities in the United States based on objective indices like SAT/ACT mean scores, faculties with PhD degree, Student/faculty ratio, acceptance rate and resource per student.

2.2 Method and tool for analysis

This research used SAS (Statistical Analysis Software) version 9.1 as analysis tool.

The process of analysis is: analyzing all factors in College USA and AAUP, finding the factors correlated to the academic performance and difficulty of entrance. Second, by using multi-variable regression, an equation of universities in the United States is built. Finally, the model is used to rank the top universities in the United States.^[5]

3. Data Analysis

This research used subjective judging to select several indices about academic and teaching performance from College USA and AAUP, as the variables of ranking.

First, the SAT/ACT mean scores are important factors to evaluate the performance of universities, but the mean scores in College USA and AAUP have too many null data. Therefore, the first quartile (lower quartile) and the third quartile (upper quartile) of SAT math and SAT verbal scores are selected. In the function, the four scores are divided by the highest scores of the variables (first quartile SAT math: 740, third quartile SAT math: 785, first quartile SAT verbal: 630, third quartile SAT verbal: 720). The sum of these four scores is then divided by four.

Second, there's one more factor which is important to judge the quality of college freshmen: the rate of students from top10/top25 senior high schools. These two variables are divided by 100, sum up then divided by two.

To evaluate the quality of teaching, some important factors like rate of faculties with PhD degrees, rate of faculties with professional degrees, and student/faculty ratio are counted in. Within these factors, faculties with PhD degrees and faculties with professional degrees are divided by 100, and then the two variables are sum up and divided by two. Due to student/faculty ratio has negative relation with the academic performance, it's calculated as $1 - (\text{student/faculty ratio})/42.6$, while 42.6 is the highest student/faculty ratio in all universities. Besides, spending per student is also an important factor, which is divided by 62469 (the highest spending per student in all universities). The scores of student/faculty ratio and spending per student are sum up and then divided by two.

Finally, rate of acceptance, rate of enrollment, rate of full time students, and rate of graduation are also important to evaluate the performance of each university. Within them, rate of acceptance has negative relation with academic performance, which is calculated by $1 - (\text{acceptance rate})/100$. The other three variables are divided by 100. The four scores are sum up and then divided by four.

After all calculation, there're five variables (the highest score of each variable is 1). The sum of five scores is the performance index of each university (the highest score is 5). Finally, all universities could be ranked by this performance index.

Briefly, the equation of University Performance Index (UPI) is:

$$\text{University Performance Index} = (\text{first quartile SAT math} / 740 + \text{third quartile SAT math} / 785 + \text{first quartile SAT verbal} / 630 + \text{third quartile SAT verbal} / 720) / 4 + (\text{rate of students from Top 10 senior high schools} / 100 + \text{rate of students from Top 25 senior high schools} / 100) / 2 + (\text{rate of faculties with PhDs} / 100 + \text{rate of faculties with professional degrees} / 100) / 2 + [(1 - \text{student/faculty ratio} / 42.6) + \text{spending per student} / 62469] / 2 + [(1 - \text{acceptance rate}) / 100 + \text{enrollment rate} / 100 + \text{graduation rate} / 100 + \text{rate of full time students} / 100] / 4$$

According to this model, all universities in the United States could be ranked. The Top 20 universities and their scores are listed as Table 1.

Table 1 UPI of Top 20 Universities in the United States

Rank	School	Score
1	Yale University	4.13
2	Johns Hopkins University	4.11
3	Harvard University	4.08
4	Massachusetts Institute of Technology	4.06
5	Dartmouth College	4.00
6	Duke University	3.96
7	Columbia University	3.93
8	Princeton University	3.92
9	University of Chicago	3.91
10	California Institute of Technology	3.91
11	Wake Forest University	3.90
12	University of Pennsylvania	3.89
13	Washington University	3.86
14	Williams College	3.86
15	Emory University	3.85
16	Pomona College	3.82
17	Wellesley College	3.73
18	University of California at Los Angeles	3.71
19	Claremont McKenna College	3.70
20	Vanderbilt University	3.69

Data source: this research

As the table shows, this research uses factors such as quality of students, resource of education, and acceptance rate, to build a ranking system for universities in the United States.

4. Conclusion and Discussion

4.1 Conclusion and contribution

This research uses College USA and AAUP 1994 Salary Survey as data sources to briefly study and explore the higher education system of the United States. As the conclusion, University Performance Index (UPI), a ranking model for American universities is proposed. The data source and methodology of this research are pretty limited, but due to there's still no "best" ranking system of universities right now, this research still has some significance. Further studies could refer to the rankings by US NEWS, Business Week, or Shanghai Jiao Tong University, to adjust the model and make it better.

4.2 Research limitations and suggestions

4.2.1 The source of data is limited: the data of this research are all based on two sources—College USA 1994 and AAUP 1994 Salary Survey, and it's hard to test the reliability and validity of these two data collections. Therefore, the result of this research should be explained carefully. Scholars could refer to other data sources to test and compare the result in the future.

4.2.2 The research is just for a unique period of time—1993 to 1994, and the data is a little out-dated as well. Further studies could gather longitude data to complete the cross-period comparison.

4.2.3 Some variables have too many null data. For example, SAT/ACT mean scores are one of the most significant indices for academic performance. But in College USA and AAUP 1994 Salary Survey, there're too much null data in these two variables. Scholars should refer to other data sources to complete these data.

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