Predicting Alumni Giving at Higher Education Institutions

Abstract

Higher education institutions, especially private institutions, are often dependent upon donations from alumni. However, relatively few studies have investigated the characteristics of schools that have alumni who are more likely to donate to their alma maters. To investigate which combination of factors best predicts the percent of alumni who donate to their alma mater, we used data from the 1995 US News Report on Colleges and Universities to build a multiple regression model, and found that variables associated with school selectivity (percent of students from top 25% of high school class), costs (room and board costs and out of state tuition), quality of education (graduation rate), as well as other school characteristics (number of applications) could be used to build a relatively predictive model of alumni giving.

Introduction

Higher education institutions, especially private institutions, are often financially dependent upon monetary donations from alumni. Previous research on the topic of predicting alumni giving has focused primarily on predicting which alumni are most likely to give, rather than what schools are most likely to have alumni who give (Clotfelter 2003; Okunade et al. 1994; Wunnava et al. 2001). However, there is some research indicating that characteristics of an institution can be used to predict alumni giving. This research has suggested that graduation rates, full-time school population, percentage of students living on campus, percentage of part time students, and percentage of students who are involved in Greek systems on campus are useful predictors of alumni giving rates (Harrison et al. 1995; Gunsalus 2004).

To investigate which combination of factors best predicts the percent of alumni who donate to their alma mater, we adapted and used data from the 1995 US News Report on Colleges and Universities to build a multiple regression model using 16 of the 35 variables (Appendix A) and 789 of the 1303 schools in the data set to predict *alumni giving percentage.* We characterized these variables into four categories: school selectivity, costs, quality of education, and other school characteristics, such as the percent of students who attended part-time and whether it was public or private. As schools continue to devote resources to soliciting alumni donations, we believe that this research can be used to help determine which characteristics of schools can improve alumni giving rates, and may be helpful for administrators seeking to improve alumni giving at their own institutions.

Methods

Model creation

To get a sense of which variable combinations were most effective in predicting the percentage of alumni giving, we first performed a best subsets analysis using our 16 explanatory variables and the response variable, *alumni giving percentage*. After examining residual plots and correlations between variables in a few preliminary models, we investigated possible variable transformations that could improve the quality of the model. Based upon this information, we transformed '*number of applications*' to log(*number of applications*)[1], and performed a best subsets analysis including this new, transformed variable with our original 16 explanatory variables. We saw an increase in the adjusted R^2 value from 42.7% to 43.1% and and noticeably improved residual plots (Appendix B) of new models with log(*number of applications*) included. Based on a combination of residual plots, R^2 values, and simplicity, we chose our final model.

[1] After preliminary analysis of our data, we found an extreme outlier in the variable "Number of applications" which was Rutgers at New Brunswick, which has 66,000 students enrolled (2014) and received 48094 applications in 1995. After we log transformed the 'Number of Applications' variable, we found that the model did not change significantly with or without this data point, so we left it in our analysis.

Results

We found that the five-variable model (below) had the best combination of a high adjusted R^2 value, a small number of variables (Table 1), and appropriate residual plots (Appendix B).

Final Model:

Alumni giving percentage = 16.119 - 2.543 *(log of number of applications)* + 0.128 *(percent of students from top 25% of high school class)* + 0.0014 *(out-of-state tuition)* - 0.0019 *(room and board costs)* + 0.178 *(graduation rate)*

Table 1. Best subsets regression output using all 17 explanatory variables considered for our model.

Number of variables in model	Variables in model	Model Adjusted R^2
3	log(number of applications), out of state tuition, graduation rate	38.9%
4	log(number of applications), percent of students from top 25% of high school class, out of state tuition, graduation rate	41.6%
5	**log(number of applications), percent of students from top 25% of high school class, room and board costs, out of state tuition, graduation rate**	**43.1%**
6	log(number of applications), percent of students from top 25% of high school class, percent part time students, out of state tuition, room and board costs, graduation rate	43.8%
16	All variables	44.9%

Discussion

Our final model includes variables from all four of our variable categories: school selectivity (percent of students from top 25% of high school class), costs (room and board costs, out-of-state tuition), quality of education (graduation rate) and other school characteristics (log of number of applications). This suggests that there is value in assessing a broad range of school characteristics when predicting alumni giving—a lot of different factors may be in play. While some studies focus on characteristics of individual alumni (Clotfelter 2003; Okunade et al. 1994; Wunnava et al. 2001, Bruggink 1995) we believe that looking at school characteristics is also a valuable way to understand patterns of alumni giving.

In comparison to other similar studies, we have a moderate R^2 value of 43.1%. Harrison et al.'s (1995) similar research on the relationship between school characteristics and alumni giving yielded a much higher adjusted R^2 value of 93.7% for a 9-variable model that included variables

such as expenditures towards alumni relations, endowment size, Greek life and percent of part-time students. However, Bruggink and Siddiqui's (1995) study, which modeled the likelihood of a specific alumnus donating based on alumni characteristics and included 14 explanatory variables such as involvement in Greek life, current income, and major, yielded a far lower R^2 value of 22%. The differences between the R^2 value for our model and those found by Harrison, Bruggink, and Siddiqui lie mainly in variables. Unlike Bruggink and Siddiqui, our variables were describing institutional characteristics rather than characteristics of individual alumni. And while the Harrison et al. study did focus on institutional characteristics, they included many other explanatory variables that we did not have in our data set.

Although our research yielded an effective model, it is not highly predictive. Additionally, it is important to keep in mind that the coefficients describing these relationships are subject to change based on what other variables are in the model. Our analysis is limited since there are many other variables that may be used to help predict alumni giving that we did not include in our analysis. These are variables such as the student to faculty ratio, the presence of the Greek system, and the popularity of school sports teams. In the future, to do a more comprehensive analysis, we would want to include a wider range of variables and also look at a more recent data set to see if factors that can be used to predict alumni giving now are different than those used in 1995. However, despite these limitations, our model can give some sense as to the types of schools that may be more likely to have alumni who donate, and this may be helpful for administrators seeking to improve alumni giving.

Sources

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Appendix A: The Data Set

Our data was gathered from the 1995 US News report on colleges and universities as part of the American Statistical Association's 1995 Data Analysis Exposition, which uses a common dataset as a vehicle for demonstrating innovative approaches to analyzing and displaying data. It provides data using 35 variables describing student admissions, costs, alumni giving, and more for over 1300 colleges and universities.

Our working data set for this project contained 17 total variables and 789 schools. We eliminated variables from the full data set that were redundant or were missing a significant number of data points. We then created three new variables that represented proportions for:

1. Enrollment Rate (total enrollment/total applications)
2. Acceptance Rate (total accepted/total applied)
3. Percentage of undergraduates that were part-time students (total part-time/(total part-time + total full-time))

The following is the full list of variables we selected from the US News report dataset:
Public/private indicator (public=1, private=2)
Number of applications received
New variable: acceptance rate
New variable: enrollment rate
Pct. new students from top 10% of H.S. class
Pct. new students from top 25% of H.S. class
New variable: % of undergrads that are part-time
Out-of-state tuition
Room and board costs
Estimated book costs
Estimated personal spending
Pct. of faculty with Ph.D.'s
Pct. of faculty with terminal degree
Student/faculty ratio
Pct. alumni who donate
Instructional expenditure per student
Graduation rate

For our explanatory variables, we characterized variables from this dataset as providing information in four key areas: school selectivity, costs, quality of education, and school characteristics:

- We used the admittance rate and the percent of students who were in the top 10% and 25% respectively of their high schools for each school to gauge how selective it was.
- We used out of state tuition, room and board costs, estimated book fees, and estimated personal spending to gauge the spending habits of students and the costs of attending the school.

- We used the percentage of faculty with PhDs and terminal degrees respectively, the graduation rate, the money spent per student, and the student/faculty ratio as variables that would indicate the quality of education at the school.
- We used whether the university was private or public, the percent of students that were part time, the number of applications received, and the enrollment rate as other more general descriptors of the school.

Appendix B: Normal Probability and Residual Plots

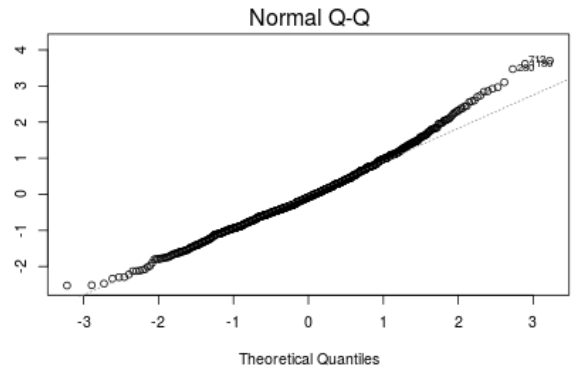

Figure 1. Normal probability plot for our final 5-variable model, including log(number of applications), percent of students from top 25% of high school class, out of state tuition, room and board costs, and graduation rate.

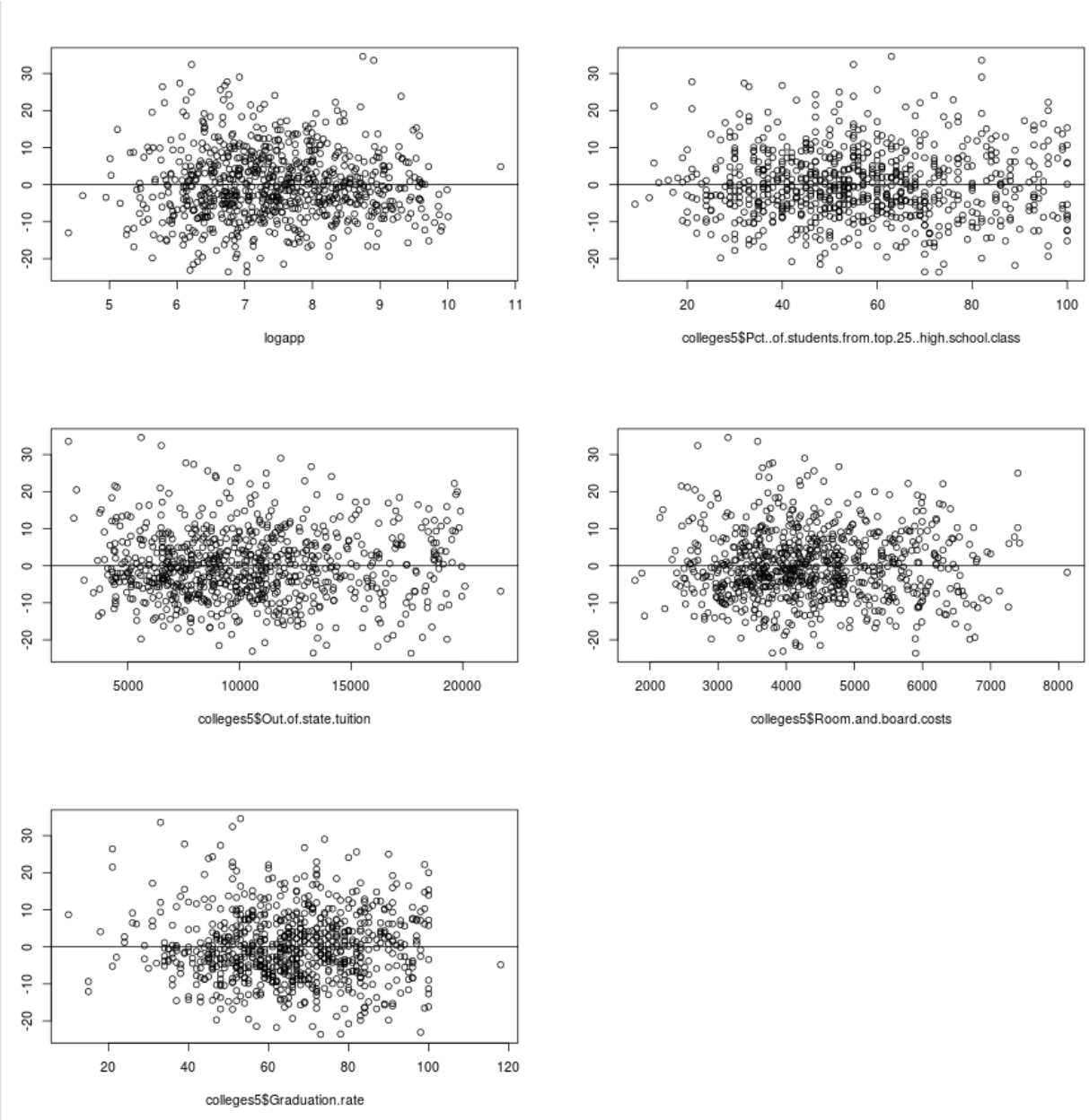

Figure 2. Residual plots for each variable in our final 5-variable model: log(number of applications), percent of students from top 25% of high school class, out of state tuition, room and board costs, and graduation rate.