Methodology for Testing the Effect of Federal Aid On Tuition Costs at US Universities

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## Introducing the Model

The model below is used to estimate the effect of federal student aid on tuition costs. It states that tuition costs will be determined by: Average Pell Grant Amount, Average undergraduate Federal Student Loan Amount, Quality Control Factor, and Private Status. The first two variables: Average Pell Grant Amount and Average undergraduate Federal Student Loan Amount are the intervention variables and the main focus of this study. The remaining 3 variables are controls for other sources of variation in tuition prices across the country over an eight-year period from 2009 to 2016.

*Tuition Costs*i, j *= + MPGA*i,j *+ MUFSLA*i,j *+ Ranking*i, j *+* +*+*

The availability of data on this subject has strongly influenced the method of evaluating the hypothesis. In a perfect world a lab-like experiment would be performed where different groups of universities were given different amounts of aid and their tuitions were compared after a predetermined number of years. For obvious practical and moral reasons this is not possible. Alternatively, variations in these variables have occurred naturally over time and the relationship between them can be estimated.

The data used in this study is publicly available from the United States Department of Education and US News and World Reports.The scope of this study is both cross sectional: including variation between universities, and time series: including variation over time. The subscripts following each variable name in the model equation indicate the dimensions in which they vary. The subscript “i,” represents years, and the subscript “j,” represents universities. For example, Ranking i, j represents the quality control factor at the jth school, on the ith year. Not all variables vary in both dimensions, Public Status is constant over time and varies between universities. In the model used for testing, inflation is not an independent variable. Rather, the response and two intervention variables are scaled to represent their value in constant 2016 dollars. This change is represented in the model with the prefix “Constant\_,” attached to the adjusted variables.

The model of Tuition Costs will attempt to test the Null Hypothesis: Increases in the maximum federal student aid amounts are not related to cost of attendance at US Post-Secondary Education Institutions. The Alternative Hypothesis is: Increases in the maximum federal student aid amounts are positively related to cost of attendance at US Post-Secondary Education Institutions. If sufficient evidence is found against it, the Null Hypothesis may be rejected in favor of the Alternative Hypothesis:

## Variable Descriptions

The Response variable “Tuition Costs,” will be measured as the list price of tuition and fees. Another commonly used measure is Net Tuition, which is the list price of tuition and fees less any federal aid in the form of Pell grants or federal loans. This measure can be averaged to give: Average Net Cost of Attendance, which is commonly used as a measure of average out of pocket cost to the student. While this measure is important because it represents the cost facing the student at the time of enrolment decisions, it would fail to answer the central question of this study: are universities raising rates in response to increases in federal aid? Because of this, List price of tuition and fees is the best measure of Tuition Costs.

The treatment variables, *Average Pell Grant Amount for First Time Freshmen* and *Maximum Undergraduate Federal Student Loan Amount for First Time Freshmen*, vary over time and cross sectionally between universities. Based on the Literature review increases in both of these forms of aid may have led to increases in tuition costs. Data for the average Pell Grant Amount for First Time Freshmen and the Maximum Undergraduate Federal Student Loan Amount for First Time Freshmen is available going back to 2009.

Quality Control Factor in the general model is a label given to two variables used to measure University Quality: The US News and World Reports Annual National University Rankings, and the number of Applicants. Each school in the data set will have a ranking for each year, these vary between schools and over time. Because this list is a well-known ranking of schools, a lower spot on the list could lead to more demand for a particular university which may have a positive effect on list price of tuition. Based on this, the variable should have a negative effect on list price of tuition. The number of Applicants similarly measures the demand for that university’s education. Because these variables seem to measure the same phenomenon, demand for a particular university, they may be highly correlated and therefore introduce multicollinearity to the model. This will be measured in the *Data Exploration* section below.

The last control variable is Private Status. The data used in this study contains both public and private schools and this variable will attempt to control for variation between the two groups. The inclusion of this variable may not sufficiently control for all of the variation between the two groups because there could be an interaction effect with another variable. Given enough data, it may be ideal to run two separate regressions for the two groups and compare estimated coefficients of each group.

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| **Variable Name** | **Definition** | **Role** | **Estimated Effect(+/-)** | **Data Source** |
| List Tuition |  | Response |  | Integrated Postsecondary Education Data System |
| Average Pell Grant Amount | Average Pell Grant amount per first time Freshman student | Intervention | + | Integrated Postsecondary Education Data System |
| Average undergraduate Federal Student Loan Amount | Average Federal Student Loan amount per first time Freshman student | Intervention | + | Integrated Postsecondary Education Data System |
| University Ranking | National Ranking of each university per year. | Control | - | US News and World Reports |
| Number of Applicants | Number of potential students applied to each university per year. | Control | + | Integrated Postsecondary Education Data System |
| Public Status | 0 = Private  1 = Public | Control | - | Integrated Postsecondary Education Data System |

References

"Trends in College Pricing." Trends in Higher Education. Accessed October 24, 2018. https://trends.collegeboard.org/college-pricing/figures-tables/tuition-fees-sector-state-over-time.