

SENSITIVITY OF STUDENT ENROLLMENT TO TUITION IN HIGHER EDUCATION – THE CASE OF THE CALIFORNIA STATE UNIVERSITY SYSTEM

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ABSTRACT

Changes in tuition and the corresponding impact they possess on enrollment have been a matter of some concern for different institutions of higher education over the last twenty years. Studies of the relationship between tuition and enrollment are relevant for both public and private schools, but schools funded by the state may find the results of such research even more intriguing. The purpose of this paper is to measure the impact of tuition increases at the 23 California State University campuses on enrollment. Results of the research did not find large tuition hikes to have a substantial impact on enrollment.

INTRODUCTION

The study of tuition changes and the corresponding impact on enrollment at different institutions of higher education has drawn attention over the last twenty years. Such research is beneficial, not only to students with their financial planning, but also to the institutions themselves, who must determine whether rising tuition levels affect the flow of funds. This would attract even more attention when, at times of economic recession and budget crunches, the absence of sufficient state and federal funds may force institutions of higher education to consider resorting to higher tuition. While the findings concern both public and private schools, schools funded by the state may find this study even more intriguing.

The purpose of this paper is to measure the impact of tuition increases at the 23 California State University campuses on enrollment. Residential student tuition and enrollment data for all 23 campuses, as well as county-level data pertaining to income and employment, was collected for the years 2000 through 2009. The analysis and findings of the enrollment variable, which is specified as a function of tuition, payroll, and the unemployment rate, will be presented in this paper. Results of the research did not find large tuition hikes to have a substantial negative impact on enrollment.

Review of the Literature

Given the frequent and somewhat large increases in the levels of tuition during the last twenty years, a major concern has been whether access to public higher education has been negatively impacted. At the private level, Vasigh and Hamzaee [2003] found that tuition considerations seem to have very little impact on students' enrollment decisions. Multivariate analyses examining the relationship between tuition and enrollment commonly fall under two categories: cross-sectional and time-series studies. Cross-sectional studies examine individual student behavior in the face of various post-secondary options while time-series studies analyze changes over time in aggregate student enrollment [Heller, 1996].

The United States Government Accountability Office [2007] issued a study on the enrollment levels on schools of various types throughout the country. Their findings indicate that tuition levels continue to rise, but the enrollment patterns vary depending on the type of institution and educational expenditures.

Tuition in private institutions increased the most in dollars, but increased the most in percentage in public institutions. Despite rising tuition levels, more students are enrolling in colleges than ever before.

Heller [2001] used financial aid as a critical factor for determining student enrollment levels. In the summary of the existing research, the paper clarifies that education is considered a normal good. That is to say, as price rises, individuals are less likely to consume more of it, all other things equal, price in this case being the tuition and the good itself being the education offered at a higher institution. The findings however, suggest that although tuition has been rising, public higher education in California is still affordable relative to other states. As such, California is performing well in terms of moving students to enroll and obtain bachelor's degrees.

The empirical findings in Heller [1997] indicated that higher college prices would reduce the probability of enrollment. The following key observations were made in this review:

1. In response to every \$100 increase in tuition, a drop of 0.50 to 1 percent in enrollments might be seen across all types of institutions.
2. Enrollments are more sensitive to grant awards than to work study or loans.
3. In comparison to middle and high-income families, low-income students were more sensitive to tuition and financial aid.
4. Similarly, black students were more sensitive to tuition and aid than were white students.
5. Finally, community college students show more sensitivity to tuition and aid in comparison to students of four-year public colleges and universities.

Using data from the integrated Postsecondary education system, Hemelt and Marcotte (2008) examine trends in tuition at public universities and approximate effects on enrollment. They found no evidence to suggest that especially large increases from one year to the next have a disproportionately large negative effect on enrollment. Similarly, Shim and Milton [2006] conducted a study directly on a public institution, taking wage premiums, financial aid, and unemployment levels into consideration. The results of their research indicate that tuition does not have an effect on the growth of enrollment. The tuition of competing institutions, however, was shown to have a positive, and significant, effect on college enrollment growth.

Data, Data Sources, and Variables

In the current paper, three main variables are used in constructing the model to measure tuition impact on enrollment. Enrollment and tuition data from the years 2000 to 2009 were retrieved from the California State University online archives. Of the twenty-three campuses in the CSU system, only six are quarter based, with the rest being semester based. Additionally, there are missing observations in the records, which lead to significant gaps in the data. Thus, to compensate for the differences and the missing inputs, the data are reorganized to include only Spring and Fall term data to use in the regression analysis.

Given that previous studies incorporated variables that represent some form of income for students, the second variable that is used in this study is annual average payroll. The county locations of all twenty three campuses were identified, and the corresponding annual payroll data was then retrieved from a California financial archive. To estimate, it stands to reason that payroll from the previous year would be

a factor in determining current enrollment levels. Therefore, payroll data from the years 1999-2008 were extracted. The data was then divided by the total county population to generate data on a per capita basis.

Similarly, countywide unemployment levels were retrieved from the Labor Market Information source. As unemployment rates are volatile from month to month, monthly statistics are used in place of yearly statistics. Additionally, it is assumed that students would normally try to predict where unemployment rates are heading by observing a historical trend. As such, the average unemployment rate of the last three months before the beginning of a term is used, instead of adopting the rate for the month that immediately precedes a term.

Framework Model

The calculations in this research include undergraduate students at the twenty three California State University campuses (referenced as CSUj). Based on the demand theory and the previous studies reviewed here, enrollment at colleges and universities can be expressed as:

$$E_{j,t} = f(T_{j,t}, U_{j,t}, Y_{j,t}) \quad (1)$$

which in turn can be expressed as the linear function

$$E_{j,t} = \beta_0 + \beta_1(T_{j,t}) + \beta_2(U_{j,t}) + \beta_3(Y_{j,t}) \quad (2)$$

where:

$E_{j,t}$ = student enrollment at campus j, period t

j = the twenty three California State University campuses (1,2,...,23)

t = the time period measured in Fall and Spring quarters/semesters from 2000-2009 (more specifically 20009 - 20091, where 20009 is the Fall semester/quarter for the year 2000, and 20091 being Spring quarter/semester for the year 2009)

$T_{j,t}$ = tuition per fall or spring quarter/semester at campus j and period t

$U_{j,t}$ = the civilian unemployment rate of the county with school j at period t

$Y_{j,t}$ = the per capita annual county payroll of the location of the corresponding campus j at period t.

B_0 = the intercept

Alternatively, estimations are also conducted based on the widely used log-linear functional form of equation (2), in which the coefficients represent the elasticity estimates:

$$\log[E_{j,t}] = \beta_0 + \beta_1 \log[T_{j,t}] + \beta_2 \log[U_{j,t}] + \beta_3 \log[Y_{j,t}] \quad (3)$$

In order to find the best results, this paper estimates equations (2) and (3) using ordinary least squares (OLS) with the addition of an error term in each. Using hypothesis testing, the notion that tuition did not significantly impact enrollment became the null hypothesis, while the alternative was the notion that it did impact enrollment significantly. To capture possible fixed effects from time-specific and/or cross-section-specific factors, eighteen 0-1 time dummy variables, and twenty three 0-1 campus dummy

variables were created. The time dummies represent the eighteen quarters during the nine year span, while the campus dummies represent the twenty three campuses in the California State University system. Despite the fact that the Channel Islands campus did not open until 2002, the regression was nonetheless conducted with blank entries for the first two years under CalState Channel Islands.

Analysis

A multiple regression analysis was conducted to test the impact of tuition on enrollment levels. For the regression, historical data on enrollment and tuition from the years 2000 to 2009 was retrieved from the main California State University website. While seventeen campuses operate under the semester format and six under the quarter system, the data per year for each school was divided into three academic seasons (Fall, Winter, and Spring). Of these seasons, only the data for Fall and Spring were used. Additionally, the specific county location of each CSU campus was recorded and the corresponding payroll and unemployment data was also retrieved.

The table below presents the estimated coefficients under equation (2), as well as the significance levels for the three main variables using time series data for the period of 2000-2009 (that is, the Fall semester/quarter of 2000 through the Spring semester/quarter of 2009) and across the 23 CSU campuses.

TABLE 1 Regression Results of Equation (2)

	M1	M2	M3	M4
TUI	-1.358 (0.206)	-2.938 (0.051)	-0.006 (0.984)	-1.677 (0.120)
UNEMP	234.819 (0.040)	-733.437 (0.001)	14.084 (0.846)	N/A
PAYROLL	196.822 (0.006)	297.033 (0.000)	268.645 (0.000)	N/A
R²	0.937	0.224	0.933	0.935
F	129.001	5.625	212.996	131.782
N	409	409	409	409

Where

M1: Model 1, the full model with all three main variables and dummy variables

M2: Model 2, the model excluding the campus dummy variables

M3: Model 3, the model excluding the time dummy variables

M4: Model 4, the model using only tuition (no time or campus dummies utilized)

It should be noted that with the exception of Model 4, one time 0-1 dummy and/or one campus 0-1 dummy variable was excluded from the regression in order to provide more accuracy. Additionally, while there should be a sample size of 413 for each model, the data for the first four entries for CSU Channel Islands is missing. Therefore, four entries were deleted from the regression, thus resulting in a smaller than expected sample size.

The results above indicate that tuition, in comparison to unemployment rate and payroll, is an insignificant factor in determining enrollment levels. The coefficients in each model are indeed negative,

indicating a negative relationship, but the reliability of tuition as a factor is questionable as a result of the significance levels. Even Model 4 (in which tuition is the only variable in the model) suggests that tuition is only marginally significant as a predictive variable.

In all four models, payroll possesses the highest level of significance, indicating that it impacts enrollment more heavily than any other factor. The positive coefficients also show a positive relationship; as payroll levels increase, the likelihood of enrollment at a California State University campus also increases.

The same process was repeated under equation (3), the logarithmic model. The conditions for the first set of results also hold for the logarithmic models. The data for CSU Channel Islands still has no records for the first two years, resulting in a gap and a smaller sample size. Time dummy and campus dummy variables were also removed to provide accuracy. The following chart displays the results of the regressions.

TABLE 2 Regression Results of Equation (3)

	M1	M2	M3	M4
TUI	0.002 (0.994)	1.071 (0.053)	0.003 (0.967)	0.007 (0.966)
UNEMP	0.081 (0.134)	0.313 (0.090)	0.100 (0.775)	N/A
PAYROLL	0.483 (0.119)	0.979 (0.000)	0.811 (0.000)	N/A
R²	0.976	0.124	0.975	0.000
F	350.326	2.761	590.605	0.002
N	409	409	409	409

The results of all four models suggest that tuition is positively related to enrollment levels. This runs counter to the belief that rising tuition hurts enrollment. However, this assertion is questionable due to the unusually large significance levels in all four models. The only variable that possesses any reliability is payroll, and while it has a large significance level in M1, it is near zero in M2 and M3. The low R square value in M2 also suggests that M2 is not a very representative model.

The results of this study indicate that tuition consideration seems to have very little effect on students' decisions. Despite the tuition increase adopted in the past 10 years, there has actually been an upward trend in enrollment at all twenty three campuses. Possible justifications that this could be attributed to are several factors such as improvement in CSU reputation, a significant decline in county unemployment rates, and relatively lower tuition rates in the CSU schools as compared to other institutions of higher education. Hence, the upward trend can be explained through rightward shifts in the short-run demand functions.

Conclusion and Summary

The results of this study indicate that CSU tuition is not the most significant determinant of its enrollment levels. Specifically, the framework analysis presented in this report shows that there is virtually no relationship between tuition and enrollment. In reality, enrollments in the past 10 years at CSU have increased despite higher tuition rates. Several reasons to justify this conclusion include the fact that the tuition rates of CSU schools are still significantly lower than that of other California state schools, or the location and operating formats of the schools were most compatible with the students' work lives. This research details a study conducted using the collective data from twenty three

California State University schools, which aimed at measuring the impact of tuition increases and other factors on enrollment. The study was based on historical data to determine the factors important in the college decision of enrollees and non-enrollees. The data were used for the regression estimation as presented in the earlier part of the paper.

The most important finding of this study was that tuition considerations seem to have very little impact on students' enrollment decisions in the CSU system. In the statistical analysis of the tuition rates for all ten years, it is evident that tuition rates do not play an important role in the enrollment decisions of students. Furthermore, for undergraduate enrollees, the cost of attendance was the least important reason for enrolling at any CSU. Payroll levels and countywide unemployment rates were the most important reasons among the undergraduates for enrolling at CSU schools. The sensitivity analysis also reveals that the enrolled undergraduates were likely to enroll at CSU even if the tuition rates were to rise higher.

A key limitation of this work lies with the fact that the variables used in the data may have a multicollinearity issue, particularly with the rate of change models. Decisions could have been justified by other factors perceived to be more attractive at rival institutions than at any CSU school. Future studies may resolve this limitation by drawing upon further avenues of research.

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