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Determinants of Out-of-State Tuition at Public Universities in the United States: A Comprehensive Model

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In size, scope, and quality, the American system of public higher education remains unmatched by any other in the world. Hundreds of state-funded colleges and universities, many founded under federal land-grant programs, educate millions of students and generate massive amounts of original research each year. An impressive number of these institutions are competitive with the most elite private universities in the world, with cutting-edge facilities and faculties that boast multiple Nobel winners. They are distinguished, at least in theory, by financial accessibility: the system was founded upon the ideal that every academically qualified student should have the chance to receive a postsecondary education. Regardless of their state of residence, students are free to attend any public university in any state. Because state governments focus on their own constituents' best interests, all public universities in the United States require out-of-state students to pay higher tuition than in-state students. Nevertheless, they are generally viewed as comparatively affordable alternatives to their private peers, and a high school senior looking to leave his or her home state is likely to consider at least one top-ranked public university.

Because of this, and because public universities have not been excluded from the recent trend of tuition inflation, it is worthwhile to explore the institutional characteristics associated with higher out-of-state tuition levels. This paper represents the determinants of out-of-state tuition at public 4-year universities in the United States utilizing a multiple linear regression model with 21 independent variables. There are two reasons for this abnormally large number of independent variables: first, the literature suggests that a very wide variety of factors are relevant in determining tuition levels. Second, the model incorporates several interaction variables and one multi-level qualitative variable. I estimate the model using cross-sectional data from 383 public 4-year universities in the United States, although I make several adjustments to the data and the model after obtaining my initial results.

My paper builds upon the existing body of research in several ways. First, I draw data from a much larger and more diverse sample than previous researchers. For example, Rizzo and Ehrenberg (2004), who create by far the most comprehensive institution-level model to date, focus only on the largest research universities in each state. Similarly, Mixon and Hsing (1994) draw their sample by random selection from a college guidebook; such guides tend to include only the largest and most well known public universities in each state. By contrast, my sample includes *all* public universities in the United States—large and small, research and non-research, and so forth—for which data on all of my independent variables is available. The resulting variability in the data should both improve the quality of the estimated regression and allow the model to capture effects that are excluded when only "major" universities are considered. For example, because my sample includes both research and non-research universities, I am able to include a variable that will indicate whether research institutions charge higher out-of-state tuition with all other factors held constant. Second, I estimate my model using the most recent data available; by now, even the most recent studies are at least several years old, and some are much older. Over the past few years, high school graduating classes have swollen, leading to an increased demand for higher education in general. Concurrently, the labor market has become

more competitive, presumably making prospective students more conscious of certain institutional characteristics, particularly those having to do with academic quality or reputation. Therefore, certain factors may now have different or more pronounced effects on tuition levels than was the case in previous years or decades. Finally, as mentioned above, my model tests for several effects not considered by previous studies: I include indicators for research universities, schools located in urban areas, and schools located in states in which the legislature sets tuition levels, along with variables for entering class SAT scores, retention rates, and per-student expenses. I also test for a diminishing marginal impact of changes in in-state tuition, and for an interaction between a tuition-setting legislature and the marginal impact of per-student appropriations revenue.

I. LITERATURE REVIEW

Unsurprisingly, much research has already been conducted into the determinants of tuition and enrollment rates at public universities. Researchers take a wide variety of approaches: some conduct state-by-state comparisons by aggregating the data for all public universities within each state, while others utilize institution-level data. Some differentiate between in-state and out-of-state tuition and enrollment in their models, while others simply study the determinants of average tuition and overall enrollment. For the purposes of this review, the literature can be divided into three broad categories, which will be considered in the following order: studies of factors that impact public university enrollment rates (since determinants of enrollment will likely be relevant in determining tuition through demand-side effects); studies that simultaneously model both enrollment and tuition rates; and studies that focus primarily on tuition.

Quigley and Rubinfeld (1993) study state-level per capita enrollment rates in 2- and 4-year public colleges and universities, without distinguishing between in-state and out-of-state enrollment. They find that a state's per-student expenditures on higher education, the percentage of institutions in the state rated as "good" or "excellent" in the 1987 Gourman report, the number of service jobs available per capita, and the percentage of the population aged 18 through 24 all have positive impacts on the demand for public higher education. The state unemployment rate and per capita expenditures on private higher education have negative impacts. Siow (1997) utilizes a probit regression to demonstrate that public and private universities with high research activity (as measured by average faculty salaries and research expenditures per faculty member) attract higher proportions of out-of-state and foreign students relative to total enrollment.

Two studies simultaneously model the enrollment of out-of-state students and the tuition paid by those students. Morgan (1983) does so at the state level, finding that average in-state tuition has a positive effect on average out-of-state tuition at a state's public institutions, as do the surrounding states' out-of-state tuition levels. In addition, the ratio of out-of-state to in-state students at all of a state's public institutions is positively associated with net population migration into the state, the percentage change in employment within the state, and a location indicator for states west of the Rocky Mountains. Mixon and Hsing (1994) perform a similar study utilizing institution-level data from 220 public and private universities; they construct a simultaneous-equation model to predict out-of-state tuition and the percentage of the university's total enrollment represented by out-of-state students. Choosing independent variables based on

the theory that prospective enrollees seek to maximize human capital attainment, they find that out-of-state enrollment and tuition levels are both negatively related to student-to-faculty ratios and ease of admission, and are both positively related to the percentage of full-time faculty holding PhDs. They also isolate the effect of institutional athletic participation: NCAA Division I schools have higher out-of-state enrollment and tuition levels than Division II schools, and so forth. Utilizing a separate single linear regression model for 31 of the institutions from their original sample, they find a positive relationship between the out-of-state enrollment percentage and the university's *US News and World Report* "reputation score."

Finally, four studies focus primarily on the determinants of tuition levels; the first three utilize state-level data, while only the most recent utilizes institution-level data. Greene (1994) finds that average out-of-state tuition is positively associated with the number of private colleges and universities within a state, and negatively associated with the state's "tax price." [1] Hearn, Griswold, and Marine (1996) find that "region is without question the most significant factor in tuition in 4-year institutions": indicators for Northeastern and Midwestern states have positive impacts on average overall tuition levels, while the indicator for Southwestern states has a negative impact (p.262). They also find that states whose universities are governed by a strong central coordinating board tend to have higher overall tuition levels. Koshal and Koshal (2000) find that average overall tuition levels are negatively associated with the state's per-student higher education appropriations and positively associated with the state's median family income. Rizzo and Ehrenberg (2004) survey 91 "primarily Research I and II institutions…chosen because they are the most selective and largest public institutions in each state, and they enroll the largest shares of non-residents" (p.307). After testing 31 variables in total, they find that the state unemployment rate, the share of the state's full-time equivalent first-time freshmen attending private colleges, the log of the university's endowment per student, the log of a composite measure of tuition levels in nearby states, and the weighted Barron's ranking of other universities in the state all have positive impacts on out-of-state tuition. The log of state higher education appropriations per student and the share of the state population eligible for federal Pell grants have negative impacts.

II. THEORETICAL MODEL

I hypothesize that out-of-state tuition at public 4-year universities in the United States is determined by 21 independent variables according to the following multiple linear regression model:

(1) $$OUTOFSTATE = \beta_1 + \beta_2 INSTATE + \beta_3 INSTATE^2 + \beta_4 STUDENTFAC + \beta_5 RESEARCH + \beta_6 SAT + \beta_7 RETENT + \beta_8 PUBLICIVY + \beta_9 STACKELITE + \beta_{10} URBAN + \beta_{11} UNEMP + \beta_{12} MIDA + \beta_{13} NEWENG + \beta_{14} PAC + \beta_{15} SW + \beta_{16} WEST + \beta_{17} MIDW + \beta_{18} ADMITRATE + \beta_{19} EXP + \beta_{20} APPROP + \beta_{21} LEGIS + \beta_{22} LEGIS*APPROP + e$$

Let us begin with the most intuitive relationship: I expect higher out-of-state tuition levels to be associated with higher in-state tuition levels (*INSTATE*), all other variables held constant. However, I also expect the marginal impact of changes in in-state tuition to diminish as the in-state tuition level increases. If this were not the case—that is, if the marginal impact of an increase in in-state tuition remained constant no matter the level of in-state tuition—universities

with higher in-state tuition would become unable to compete for out-of-state students with other public universities. Therefore, in addition to *INSTATE*, I include a polynomial variable $INSTATE^2$ so that the following relationship holds:

(2) $\partial OUTOFSTATE/\partial \text{INSTATE} = \beta_2 + 2\beta_3 INSTATE$.

B_2 is hypothesized to be positive and β_3 is hypothesized to be negative, for a positive but diminishing marginal impact of in-state tuition on out-of-state tuition.

We now turn to variables that affect the appeal of a particular school to prospective out-of-state students. Basic economic theory suggests that when the demand for a scarce good or service increases, the price increases. Therefore, "institutional appeal" factors are expected to influence out-of-state tuition levels insofar as they affect the demand by out-of-state students for a university's enrollment slots (which are assumed to be limited in number). Out-of-state students are expected to be more discriminating than in-state students with regard to such factors, for the following reason: it is likely that, for personal, financial, or academic reasons, a certain percentage of the in-state cohort does not have the option of looking at private or public institutions in another state, and therefore is faced with a decision between a fairly small number of in-state public institutions. By contrast, a student looking to enter a state's university system from another state has already determined that leaving home is a feasible option, and therefore faces a choice between literally thousands of public and private institutions throughout the country. It stands to reason, therefore, that a public university's academics, reputation, and so forth would have a disproportionately large impact on out-of-state demand relative to in-state demand. Consequently, these variables are expected to show marginal impacts on out-of-state tuition over and above their impacts on "general" tuition levels, which would be captured by the coefficient on *INSTATE*. The first such variable to be considered is teaching quality, for which the student-faculty ratio (*STUDENTFAC*) serves as a proxy. A large student-faculty ratio indicates large average class sizes, which means that professors are busier and students receive less individualized attention; in this way, it negatively affects a university's academic quality, reducing its appeal to prospective out-of-state students. Therefore, I expect a negative relationship between out-of-state tuition and the student-faculty ratio. The binary variable *RESEARCH* takes a value of 1 for institutions classified by the Carnegie Foundation as "Very High Research Activity," "High Research Activity," or "Special Focus" universities. Because previous research suggests that "a university that attracts more research and development funds has a higher proportion of non-local students" (Siow 1997, p.274-275), I expect a positive coefficient on this variable. The academic quality of the student body is also relevant, because a student's educational experience is improved by the opportunity to study alongside committed and high-achieving classmates. Therefore, I expect a positive relationship between student body quality, measured by the 75^{th} percentile of the entering first-year cohort's SAT reading and math composite scores (*SAT*), and out-of-state tuition. Of course, prospective students do not only consider an institution's objective academic quality; the subjective factor of reputation is also important, as students assume that attending a well-known and well-regarded university (a "name brand" school) will result in improved career opportunities. Reputation is represented by the binary variable *PUBLICIVY*, which takes a value of 1 if the school is listed in the 2001 edition of a guidebook called *The Public Ivies: America's Flagship Public Universities* (Greene and Greene). The book, according to its description, lists "thirty public colleges and universities at which students can receive an Ivy League education at a fraction of the price." The listed

institutions are presumed to be those that have the most widespread and favorable national academic reputations, and that would therefore appeal to students who wish to obtain a diploma from a name brand school. Among public universities, these schools are also the most likely to be competitive with "elite" private universities on the basis of perceived quality, which means that they face less pressure to compete on the basis of price. Therefore, I expect a positive coefficient on the indicator for "Public Ivies."[2] With regard to non-academic institutional appeal factors, I expect universities with well-regarded athletic programs to charge higher out-of-state tuition relative to others; these programs not only attract potential student athletes, but also tend to improve school spirit, offer enhanced recreational opportunities, and increase state institutions' national visibility. This effect should be captured by a positive coefficient on the binary variable *STACKELITE*, which takes a value of 1 for schools listed in the STACK "Elite 50" and 0 for all other schools. I expect universities located in urban areas to face higher out-of-state demand, and thus charge higher out-of-state tuition, due to the increased availability of employment opportunities and social and cultural activities. Therefore, the binary variable *URBAN*, which takes a value of 1 for schools whose location is classified by the Department of Education as "City: Large" or "City: Mid-Size," should be positively related to out-of-state tuition. Finally, I include a variable for the university's first-year retention rate (*RETENT*). I expect a positive coefficient because the retention rate proxies for the general quality of student life; therefore, a higher retention rate is likely to be associated with greater overall demand for enrollment slots. The retention rate may also have a supply-side effect, since universities with low retention rates would likely offer a correspondingly higher number of enrollment slots in order to compensate for student attrition. Furthermore, universities with low retention rates might hesitate to charge high tuition levels for fear of driving even greater numbers of students away, particularly since these universities are likely to be comparatively lacking in qualities that might make students willing to accept high costs of attendance.

Presumably, out-of-state students consider not just institutional characteristics, but also the characteristics of the state in which the institution is located. Morgan's (1983) study "suggests the possibility that [nonresident] students are contemplating a permanent change of residence and thus seek areas where job opportunities upon graduation are expected to be most plentiful" (p.193). My model therefore incorporates a variable for the unemployment rate (*UNEMP*) in the state where the university is located; higher unemployment rates would be expected to reduce student demand and consequently reduce out-of-state tuition. Following Hearn et al (1996), I also include indicators for the region of the country in which the state is located: Mid-Atlantic (*MIDA*) (DE, MD, NJ, NY, PA, VA, and WV), Midwest (*MIDW*) (IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, and WI), New England (*NEWENG*) (CT, ME, MA, NH, RI, and VT), Pacific (*PAC*) (AK, CA, HI, OR, and WA), Southwest (*SW*) (AZ, NM, OK, and TX), and West (*WEST*) (CO, ID, MT, NV, UT, and WY), with the Southeast as the base region. These variables should capture factors such as weather that make different parts of the country more appealing to potential "student immigrants." They should also capture the effect of composite regional tuition levels, which several studies find to be relevant in determining a state's own average overall tuition levels.

Turning now to supply-side factors, I expect total expenses per student (*EXP*) to have a positive impact on out-of-state tuition. I also include a variable for the percentage of applicants admitted to the university (*ADMITRATE*). A lower admissions rate suggests a more severely

constrained supply of enrollment slots relative to student demand, which should be reflected by a higher price. It is important to note that universities facing such supply constraints generally make admissions decisions based on a student's academic records, including standardized test scores. This may lead to a problem of multicollinearity between *ADMITRATE* and *SAT*, which will be dealt with if it arises.

Finally, it should be noted that public universities are characterized as such due to the fact that they are to varying degrees funded and administered by state governments. As a result, certain "political factors" will likely be relevant in determining out-of-state tuition rates. Budgetary appropriations by local, state, and federal governments reduce the amount of revenue that must be raised from students in the form of tuition; I therefore expect a generally negative relationship between out-of-state tuition and appropriations per student (*APPROP*). On the administration side, I expect that universities located in states where legal tuition-setting authority rests with the state legislature will charge higher tuition to out-of-state students, all other factors held constant. Elected representatives, who operate on a relatively short-term electoral calendar, are likely to be much more sensitive to political pressures than members of university-level boards of directors or state-level central governing boards, who typically are appointed to their posts and serve for long terms (cf. Education Commission 2007). Since raising in-state tuition "is often a politically unpopular move," as is raising taxes to increase appropriations, legislators faced with a need to raise additional revenues for public universities would likely be more inclined to disproportionately increase the burden on out-of-state students rather than spread it equally (Rizzo and Ehrenberg 2004, 304). Therefore, I expect a positive coefficient on the binary variable *LEGIS*, which takes a value of 1 for universities located in states where tuition-setting authority belongs to the legislature, and 0 for universities located in states where the authority rests with some other state- or university-level body. Due to similar considerations, I also expect the value of *LEGIS* to affect the coefficient on *APPROP*: a non-political tuition-setting body would be more likely to spread the tuition-reducing benefits of increased appropriations equally among in-state and out-of-state students. By contrast, a state legislature would be expected to favor in-state students. This effect is represented using an interaction variable, *LEGIS*APPROP*. Thus:

(3) $\partial OUTOFSTATE/\partial APPROP = \beta_{20} + \beta_{22}$ if $LEGIS = 1$, β_{20} if $LEGIS = 0$.

As explained above, β_{20} is hypothesized to be negative, because higher appropriations are generally expected to reduce out-of-state tuition. Because I expect a tuition-setting legislature to work against this effect by using appropriations primarily to reduce the tuition burden on in-state students, β_{22} is hypothesized to be positive. In other words, in states where the legislature sets tuition, the marginal impact of increased appropriations on out-of-state tuition is expected to be "less negative" than in other states.

III. EMPIRICAL RESULTS

I first tested the model utilizing cross-sectional data on 383 public, 4-year, degree-granting postsecondary institutions located in all 50 states.[3] Most institution-level data is derived from self-reported survey data available from the United States Department of Education's Integrated Postsecondary Education Data System (IPEDS). I utilized surveys completed for the

2008-2009 academic year, the most recent for which data on all relevant variables is available. The variables *OUTOFSTATE*, *INSTATE*, *STUDENTFAC*, and *RETENT* are taken directly from IPEDS. I derived *SAT* by summing the 75th percentiles of the incoming first-year cohort's scores on the SAT Math and SAT Critical Reading tests. I derived *ADMITRATE* by dividing the total number of students admitted for the academic year by the total number of applicants for admission. I derived *APPROP* by dividing the sum of local, state, and federal appropriations received by the institution by the total number of students enrolled. Similarly, I derived *EXP* by dividing total expense deductions by the total number of students enrolled. IPEDS reports data on *RESEARCH* and *URBAN* in ordinal form, which I converted to binary form by substituting 1 and 0 for the appropriate values (see previous section).

As noted above, I obtained the list of universities classified as Public Ivies (*PUBLICIVY*) from a college guidebook published in 2001. The list of the Elite 50 (*STACKELITE*) athletic programs is taken from the website of *STACK Magazine*. The list of states in which tuition-setting authority is held by the legislature (*LEGIS*) is taken from Boatman and L'Orange (2006). State unemployment rates are taken from the Bureau of Labor Statistics; in order to better approximate "normal" economic conditions in each state, I utilized data from 2007, prior to the advent of the 2008 financial crisis and recession. For the regional indicators, I divided states in a manner based loosely upon official US Census regions.

Running an ordinary least squares regression on the data, I obtained the following results:

Table 1

outofstate	Coefficient	Standard Error	t	P>|t|
studentfac	9.146	55.739	0.16	0.870
research	1361.803	490.059	2.78	0.006
sat	0.318	2.007	0.16	0.874
retent	112.745	26.137	4.31	0.000
publicivy	3732.010	869.123	4.29	0.000
stackelite	-418.191	768.229	-0.54	0.587
urban	224.908	348.277	0.65	0.519
unemp	-159.594	231.372	-0.69	0.491
mida	-2049.744	512.260	-4.00	0.000
neweng	-9.195	652.172	-0.01	0.989
pac	2933.67	673.101	4.36	0.000
sw	-543.530	737.6077	-0.74	0.462
west	897.768	768.209	1.17	0.243
midw	-2165.272	552.362	-3.92	0.000
admitrate	1.886	10.828	0.17	0.862
exp	0.004	0.014	0.29	0.773
approp	0.0191461	0.0486863	0.39	0.694
legis	-608.504	1141.037	-0.53	0.594
legis_approp	0.053	0.119	0.45	0.654
instate	1.505929	0.2389053	6.30	0.000
instate_sq	-0.0000146	0.0000234	-0.62	0.533

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       _cons |  -1819.953   2702.832    -0.67   0.501
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With an F-test statistic of 38.68, the model is globally significant; and with an adjusted R-squared of .6744, it explains the variation in out-of-state tuition quite well. However, of the 21 independent variables contained in my theoretical model, 14 of them—*STUDENTFAC*, *SAT*, *STACKELITE*, *URBAN*, *UNEMP*, *NEWENG*, *SW*, *WEST*, *ADMITRATE*, *EXP*, *APPROP*, *LEGIS*, *LEGIS_APPROP*, and *INSTATE_SQ*—have coefficients that are not significantly different from 0 at any standard significance level. Many are highly insignificant, with p-values above .5. It is therefore immediately clear that a large number of variables included in the model are likely irrelevant to the determination of out-of-state tuition. Because the inclusion of irrelevant variables tends to raise the standard errors of the estimates, possibly causing variables that are in reality significant to be reported as insignificant, I chose to drop some of the least significant variables from my model and re-run the regression. I also suspected that the 0 values for *INSTATE* and *INSTATE_SQ*, of which there were a fairly large number, were skewing my results for those variables. Thus, I chose to drop institutions that charge no in-state tuition (most of which are part of the California State University system) from my data set. This reduced my sample size to 360. After some experimentation, I settled upon the following adjusted model, in which two variables that were not significant in the original model become significant (although two remain insignificant, one highly so):

(4) $OUTOFSTATE = \beta_1 + \beta_2 RESEARCH + \beta_3 RETENT + \beta_4 PUBLICIVY + \beta_5 MIDA + \beta_6 PAC + \beta_7 MIDW + \beta_8 APPROP + \beta_9 LEGIS + \beta_{10} LEGIS\_APPROP + \beta_{11} INSTATE + \beta_{12} INSTATE\_SQ$.

The estimated regression is as follows:

Table 2

outofstate	Coefficient	Standard Error	t	P>|t|
research	1555.786	445.173	3.49	0.001
retent	113.734	20.711	5.49	0.000
publicivy	3633.092	713.690	5.09	0.000
mida	-2273.575	447.604	-5.08	0.000
pac	2288.943	702.271	3.26	0.001
midw	-2493.297	505.630	-4.93	0.000
approp	0.009	0.038	0.23	0.821
legis	-2335.184	1221.838	-1.91	0.057
legis_approp	0.204	0.150	1.36	0.174
instate	1.912	0.316	6.04	0.000
instate_sq	-0.0000502	0.000028	-1.79	0.074
_cons	-2571.536	1728.86	-1.49	0.138

An F-test statistic of 68.37 and an R-squared of .6736 confirm that this adjusted model, though it contains fewer variables than the original model, retains very strong explanatory

power. The Breusch-Pagan Test shows no evidence of heteroscedasticity. A cursory glance at the cross-variable correlation matrix gives little cause for concern over multicollinearity in the model: the only pairs of variables whose correlation coefficients exceed .9 are *INSTATE* and *INSTATE_SQ* and *LEGIS* and *LEGIS_APPROP*. This, of course, is to be expected given that these are pairs of interaction variables.

RESEARCH is significant at all standard levels. The estimated coefficient indicates that institutions classified as Very High Research Activity, High Research Activity, or Special Focus universities charge approximately $1555.79 more to out-of-state students than other institutions, all other factors held equal. This is consistent with Siow's (1997) finding that research-focused institutions tend to attract greater numbers of out-of-state students, and with my hypothesis that high levels of research activity would therefore lead to a demand-driven increase in the price charged to those students. Similarly, *PUBLICIVY* is significant at all standard levels with a coefficient of 3633.092, which supports the hypothesis that out-of-state students pay a fairly large premium to attend public universities with prominent national academic reputations. It is interesting to note that the proxy for reputation shows a statistically significant impact, while the more objective variables relating to academic quality (*STUDENTFAC* and *SAT*) and employment opportunities (*URBAN* and *UNEMP*) do not. This disparity seems to illustrate the importance of highly subjective "public consensus" judgments in determining the universities to which out-of-state students are most attracted. *RETENT* is significant at all standard levels with a coefficient of 113.734, which indicates that a higher overall quality of life at a university leads to a demand-driven increase in price, that a higher retention rate increases price by constraining the supply of enrollment slots for first-year students, and/or that universities with high retention rates are less concerned that high tuition levels will drive away students. Of the regional variables, *PAC* is significant with a positive coefficient, while *MIDA* and *MIDW* are significant with negative coefficients. This suggests that, all other factors held equal, students are willing to pay a positive "location premium" for schools located in the Pacific region. The opposite, of course, appears to be true for schools in the Mid-Atlantic and Midwest regions.

Turning to the political factors, *APPROP* and *LEGIS_APPROP* remain insignificant at all levels. However, in the adjusted model, *LEGIS* is significant at the .1 level. Interestingly, the sign on the coefficient is negative: all other factors held equal, out-of-state students who attend universities in states where the legislature holds tuition-setting authority can expect to pay $2335.18 less than they would at a university in a state where that authority rests with some other body. This is inconsistent with my hypothesis that state legislatures are inclined to treat out-of-state students unfavorably; indeed, it would appear to support the opposite conclusion. Greene (1994) offers a possible theoretical explanation for this phenomenon:

> One rationale for such subsidies [for out-of-state students] is their use in an attempt to attract students, who if they remain and become relatively high income permanent residents, may create positive fiscal residuals…Another possible benefit from out-of-state students could occur if they increased the quality of the educational experience. Presumably if a state has a relatively poorly qualified pool of high school graduates, it might reap more benefits from attracting outsiders and would charge lower out-of-state tuitions (p.233-234).

The negative coefficient on *LEGIS* suggests that tuition-setting legislatures may be cognizant of these longer-term fiscal and educational benefits of relatively low out-of-state tuition, and willing to prioritize these benefits over the short-term political benefits of favoring in-state students.

Finally, results for *INSTATE* and *INSTATE_SQ* support the theory set forth in the previous section. *INSTATE* is statistically significant at all standard levels with a coefficient of 1.910669, indicating that higher in-state tuition levels are generally associated with higher out-of-state tuition levels. However, *INSTATE_SQ* is significant at the .1 level with a coefficient of -.0000502, consistent with a diminishing marginal impact of in-state tuition on out-of-state tuition. For a university initially charging in-state tuition of $5000, an increase of $1 in in-state tuition would be expected to raise out-of-state tuition by approximately $1.70, all other factors held equal.

Of greater interest, perhaps, than interpretations of the variables found to be significant in the adjusted model is the question of why so many seemingly relevant variables—including variables found by previous researchers to be significant—were found to be insignificant in the original model. The insignificance of *URBAN* may indicate that the factors that would make an urban setting appealing to students—employment opportunities, cultural and social activities, etc.—are counterbalanced by factors such as increased crime and the lack of open space that would make such a setting less appealing. The insignificance of *NEWENG*, *SW*, and *WEST* simply suggests that, all other factors held equal, out-of-state students find these regions to be neither favorable nor unfavorable places to attend school relative to the base region.

Other insignificant variables are more difficult to explain. It is surprising that higher per-student institutional expenses (*EXP*) do not, according to my results, have a significant impact on out-of-state tuition. The correlation coefficient between *EXP* and *APPROP* (calculated from all of the data utilized to estimate the original model, including the records for schools that charge no in-state tuition) is equal to .5978, which signifies a moderately strong positive association. This suggests that the level of governmental appropriations to a university is, at least to a certain extent, tied to the university's expenses, which may help to prevent higher expenses from being passed on to students in the form of higher tuition. If this reasoning is stated in reverse, it becomes clear that this correlation could also explain the insignificance of *APPROP*: since per-student appropriations increase with per-student expenses, any tuition-reducing benefits of increased appropriations would be offset by the associated increase in per-student expenses, which would tend to place upward pressure on tuition. Therefore, when considered in isolation, neither changes in *APPROP* nor changes in *EXP* could be said to have a discernable marginal impact on the level of out-of-state tuition. Further qualitative and quantitative research is needed to determine whether this reasoning is consistent with the formulas or methods utilized by governments to determine per-student appropriation levels. An alternative explanation for the insignificance of *EXP* is that universities may pass on certain expenses to students in the form of fees that are not included in the tuition "sticker price." For example, costs associated with the construction of new residential facilities could be reflected in increased on-campus housing charges. An alternative explanation for the insignificance of *APPROP* is that public universities may pass on the benefits of increased appropriations to students in the form of higher financial aid awards, rather than lower tuition. Again, because my model considers only out-of-state

tuition as the dependent variable, further research would be required in order to evaluate the plausibility of these alternative explanations.

Previous research suggests that *STUDENTFAC* and *UNEMP* should both have negative demand-side impacts on out-of-state tuition. The fact that my estimate shows both variables to be insignificant may be a product of differences between my sample set and those used by the previous researchers. As noted above, earlier institution-level studies estimate their models utilizing much smaller samples, which primarily of large "flagship" public research institutions. Conceivably, if prospective students at larger, more well-known public universities are more interested in the student-faculty ratio and the quality of the state labor market than prospective students at smaller, more "average" or "generic" public universities, the heavy sampling preference given to the former could have biased these researchers' results. Because my sample includes a much larger number of institutions, and presumably more variability in institutional characteristics, my estimates are less likely to be affected by such a bias. This may explain why previous researchers detected a significant impact for these two variables while I did not.

Although I anticipated the possibility of multicollinearity between *ADMITRATE* and *SAT*, a correlation coefficient of -.0606 makes it clear that other explanations are needed for the insignificance of these variables. As noted above, the insignificance of *SAT* may simply indicate that the objective academic quality of the student body has much less of an impact on institutional appeal than, for instance, the reputation of the university itself. The insignificance of *ADMITRATE* suggests that universities faced with a more constrained supply of enrollment "slots" for out-of-state students do not respond by raising tuition levels as a means of equalizing demand with supply. Rather, they simply choose to admit a smaller percentage of applicants. Although this would seem to contradict basic economic theory, it makes intuitive sense when the unique characteristics of the market for higher education are taken into account. After all, universities have incentives both to avoid raising tuition when possible and to decrease admission rates: lower tuition allows a university to compete with its peer institutions on the basis of price, while lower admission rates give the university a higher place on prominent national ranking lists such as that published by *US News and World Report*. Of course, if true, this explanation may call into question the interpretations given above for the impacts of institutional appeal factors such as *RESEARCH*, *RETENT*, *PUBLICIVY*, the regional variables, etc. If the standard supply-and-demand model does not fully apply to the higher education market, we may not be able to assume that changes in these variables affect out-of-state tuition simply by the adjustment of a competitive market equilibrium price to increased student demand. Rather, we must consider the possibility that public universities with these desirable characteristics find other reasons to charge high out-of-state tuition levels relative to universities with less desirable characteristics. Thus, as with *APPROP*, the seemingly disappointing results for *ADMITRATE* suggest intriguing paths for future research.

IV. CONCLUSIONS

Based on the results of previous research, I began by hypothesizing a total of 21 determinants of out-of-state tuition levels. My initial estimate of the multiple linear regression model indicated that a large number of these variables were more or less irrelevant. I responded by estimating an adjusted model with 11 independent variables, and by dropping data for

universities that charge no in-state tuition. The estimation of the adjusted model indicates that, at public 4-year universities in the United States that charge positive in-state tuition, out-of-state tuition is positively associated with classification as a high research activity institution; retention rate; classification as a Public Ivy; location in the Pacific region; and the level of in-state tuition. Out-of-state tuition at these institutions is negatively associated with location in the Mid-Atlantic or Midwest region and location in a state where the legislature holds tuition-setting authority. I find statistically significant results consistent with the hypothesis that the marginal impact of in-state tuition diminishes as the level of in-state tuition increases. Implications of the results for each variable are discussed in detail above, but four key conclusions are particularly salient.

First, the results for *PUBLICIVY* suggest that a university's *perceived* academic quality is much more important than its actual quality—measured by the incoming class's SAT scores and the student-faculty ratio—in predicting out-of-state tuition. This may be good news for bargain-hunting prospective students: in theory, if a school is not listed as a Public Ivy but still boasts a low student-faculty ratio and/or high incoming SAT scores, a student could expect to pay a lower price for an education that, objectively speaking, would be of similar quality to the more elite and well-known public universities.

Second, public universities located in states where the legislature holds tuition-setting authority tend to charge lower out-of-state tuition, indicating that state-level elected officials perceive economic or educational benefits to attracting out-of-state students by offering more competitive prices. Again, students seeking a quality education at a relatively low price would do well to take note of this fact and seek out schools located in such states.

Third, the insignificance of *ADMITRATE* suggests that the standard supply-and-demand model may not fully apply to universities, since they have both the ability and the incentive to respond to a constrained supply of enrollment slots not by raising tuition to equalize demand with supply, but rather by simply reducing the percentage of applicants admitted. With this in mind, it is clear that an effort must be made to develop better *theoretical* models of the market for higher education. Without such an effort, the validity of any future empirical research into the determinants of tuition is called into question; specifically, the assumption that institutional appeal factors increase tuition through their effect on student demand (implicit in the conclusions both of this paper and of the previous literature) becomes highly debatable.

Fourth, and finally, the insignificance of both *EXP* and *APPROP* calls for further exploration of the formulas utilized by local, state, and federal governments in determining the amount of money appropriated to public institutions. If it is found that officials do so primarily based upon an institution's reported expenses, we may be able to conclude that appropriations do not decrease tuition levels because they are not intended for this purpose, and that expenses do not increase tuition levels because they are purposefully offset by appropriations. Alternatively, by modeling the determinants of other dependent variables—average per-student institutional aid awards, average non-tuition student charges, etc.—we could investigate whether these per-student expenses and appropriations have other, less obvious impacts on a university's total price of attendance.

V. REFERENCES

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VI. ENDNOTES

[1] In the context of Greene's study, "tax price" refers to "the cost of an extra dollar's worth of [state tax] revenues to the residents of a state." Because "most state and local taxes [are] deductible against the federal income tax," the cost of an extra dollar of state taxes to a state resident who itemizes is actually less than one dollar. Thus, Greene utilizes the tax price to represent "the actual cost of the [higher education] subsidy to state residents" (p.232-233). His model defines the tax price is one less the product of "the proportion of a state's taxpayers who itemize and the proportion of state and local taxes that are deductible under the federal income tax" (p.235).

[2] There are, of course, a plethora of publications—Barron's guides, *US News and World Report*, *Princeton Review* guides, etc.—that rank the top US universities. The reader may wonder why I do not follow the lead of previous researchers in using one of these rankings, thereby allowing the reputation variable to be quantitative. First, I could find no way to objectively choose the "best" ranking system to use. Second, and more importantly, most of these publications rank only "top tier" public institutions, a category that excludes most of my data set. Therefore, rather than including "rank" as a variable, I choose to simply indicate which state universities have national reputations as "academic powerhouses," and the Public Ivies listing seemed to be a reasonably accurate and comprehensive representation.

[3] I originally retrieved data from *all* institutions listed in IPEDS as public, 4-year, degree-granting postsecondary institutions in the 50 states, which numbered 573. However, a significant number of institutions did not report data for one or more of the included variables, reducing the effective sample size to 383. My sample excludes the US military academies.