Preliminary Draft
July 22, 2002
Comments Solicited

Resident and Nonresident Tuition and Enrollment at Flagship State Universities

by

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(To be presented at the NBER Conference on "College Decisions: How Students Actually Make Them and How They Could", August 2002)

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I. Introduction

The recent economic downturn in the United States has led to severe current and projected budget deficits in most states. Sharp rises in healthcare costs and increased competition for state funds from other sources has concurrently led to a decrease in the shares of state budgets earmarked for the higher education sector.[1] Because universities are able to attract revenue from other sources (e.g. tuition, annual giving and federal student aid) and they are a discretionary component of most state budgets, they are often the first to go under the knife during tough times. The resulting revenue shortages from these budget cuts will most certainly have deleterious effects on college accessibility and on the behavior of these higher educational institutions. Inasmuch as 65% of the 9.2 million students enrolled in four-year institutions in 1999 were enrolled in public institutions and in most states the major public research universities are also the most selective in terms of admissions, it is important to understand institutional responses relating to tuition and enrollment policies, as well as the likely changes in state grant aid policies.

During the 1979 to 1996 period, the average state appropriation at the flagship public research institutions, as a share of total current fund revenues at the institution, fell from 42% to 32%. Among the schools whose shares declined the most were the universities in Virginia and California, as well as the University of Michigan. Only ten institutions saw increases in the share of their revenues coming from state appropriations over this period, and only three of these (Cincinnati, Iowa State and New Mexico State) saw any increase in the share during the 1988 to 1996 period.

[1] From 1988-2000, the share of states' total budget allocated to higher education has fallen 1.8 percentage points from 12.0% to 10.2%. Health care's share has risen from 11.3% to 17.9% during this time. See *National Association of State Budget Officers, State Expenditure Report 2000.*

To make up for this revenue shortfall, public institutions are largely constrained to using two tools.[2] First, they may increase the tuition they charge in-state students, however this is often a politically unpopular move. Second, because all public research institutions charge a higher tuition to out-of-state students than they do to in-state students, they can raise the tuition they charge out-of-state students and adjust the composition of their student body by enrolling more out-of-state students. Adjusting the share of students that come from out-of-state is at best a short-run solution. After some point, it may be difficult to further expand this share. In addition, enrolling more nonresidents might preclude students from one's own state from attending the flagship public university in the state. On the flip side, it would be unwise for a state to exclude nonresidents from its universities' corridors because their states might potentially retaliate against students from the state in question.

The prospects for revenue augmentation from increasing nonresident enrollments are diminished by the presence of tuition reciprocity agreements. These are either bilateral or multi-lateral agreements between schools and / or states allowing nonresident students to attend a public university at less than the normal out-of-state tuition.[3] These agreements are often program specific, have a regional focus and were created to encourage universities to achieve cost efficiencies in their program offerings.

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[2] There are of course other sources of revenue. Total educational and general current fund revenues include tuition and fees, federal, state and local appropriations, government grants and contracts, private gifts, payouts from endowments, sales and services of educational activities and other sources. Local revenues are typically directed to community colleges while federal monies are focused on direct student support. The endowment levels at most publics are small, so increasing the payout rate is unlikely to have a large impact on annual revenues.

[3] In some cases, if the flow of students between states taking advantage of tuition reciprocity agreements is not roughly equal, the state that exported more students than it imported makes a payment to the importing state to compensate it for bearing more than its fair share of the costs. These payments go to the state treasury, however, not to the universities themselves.

Schools' ability to employ different tuition and enrollment strategies are dependent upon their degree of autonomy from state interests. Because elected state officials interests diverge from university administrators' and faculty members', we expect institutions in states where there is more legislative oversight in the form of a statewide coordinating board and/or fewer governing boards to find it more difficult to increase tuition and to adjust their enrollment margins.[4]

Concern has also been expressed by some that direct student aid (both federal grant aid and state aid), which was designed to improve access, has instead given institutions the freedom to increase tuition. States' financing of higher education is increasingly being provided in the form of grant aid to students rather than in the form of appropriations to institutions. From 1979 to 1996, average (median) direct student aid as a share of total higher educational aid has increased from 3.0% to 5.3% (1.8% to 4.0%). While the real value of the federal Basic Educational Opportunity Grant (Pell Grant) fell by 28% over this time period, access to federal subsidized loans was vastly expanded. In fact, by 1999, 45.4% of students receiving financial aid did so in the form of federal loan aid.

How tuition levels, or the availability of grant or loan aid, influence access are empirical questions that we will not address in this chapter. Rather, we will analyze how tuition and enrollment strategies at institutions react to changes in federal and state student need based aid and to state appropriations to public higher education institutions. The former increases student mobility by expanding their choice set while the latter does not travel with the student.

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[4] See Lowry (2000, 2001). Lowry also points out that states (schools) where a high percentage of university trustees are appointed by elected officials or directly elected by the voting public also have lower tuition.

Institutions may also choose nonresident enrollment policies to satisfy different interests. Since many flagship publics are also high quality institutions, they typically experience an excess demand for seats and can enroll nonresidents to improve academic quality or to enhance the diversity of their student bodies.

Given differing state governance structures, political climates, institutional objectives, and the like, it is not surprising to see the dramatic disparity across states in their use of nonresidents as an enrollment strategy. Figure 1 shows that many of the larger, more populous states such as New Jersey, Ohio, Illinois, Texas, California and New York, do not make great use of this strategy, enrolling less than 10% of their first time freshmen from out-of-state in 1996.[5] However, other states that are smaller, older and/or have a history of private provision of higher education enroll nearly half of their entering classes as nonresidents. Vermont, Delaware, Rhode Island and New Hampshire respectively enrolled 67%, 61%, 54% and 46% of their classes in 1996 in this manner.

Table 1 lists the 91 flagship public research institutions whose behavior is analyzed in our study.[6] They are primarily Research I and II institutions and were chosen because they are the most selective and largest public institutions in each state and they enroll the largest shares of nonresidents, or out-of-state students. This chapter is motivated by our desire to understand the causes and consequences of nonresident enrollment. We seek to explain how the share of nonresidents among first-time freshmen varies at a point in time

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[5] The categories were defined using a means clustering analysis described by Everitt (1993). This is an exploratory data technique meant to find natural groups in the data. We chose to employ a partition method that breaks the observations into k-non-overlapping groups. Multiple iterations suggest that k=4 is the most natural group size. States near the average include Maine and Georgia, enrolling about 20% each.

[6] There are 84 schools from 43 states that were classified as Research I and II in 1994 by the Carnegie Foundation for the Advancement of Teaching. To fully exploit state variation in tuition, enrollment and grant aid policies, we added the flagship public institution from each state that did not have a Research I or II institution. These states were Alaska, Maine, Montana, Nevada, New Hampshire, North Dakota and South Dakota.

across these institutions and over time at any given institution. We employ panel data from a variety of sources and estimate a system of equations to explain the levels of state need-based grant aid per student, in-state tuition, out-of-state tuition and the share of out-of-state students among first-time freshmen. The longitudinal nature of the data permits us to control for omitted variable bias.

In the next section, we briefly survey related literature. Section III presents information on trends in tuition, enrollment and grant aid. In addition to summarizing the data we use to explain these trends, it also discusses the results of a survey we undertook to obtain information on the nature and prevalence of tuition reciprocity agreements. Section IV describes our estimation strategy, presents empirical results and conducts some policy simulations based upon these results. Section V briefly concludes.

II. Selective Literature Review

The literature on pricing and access in public higher education is replete with papers that analyze issues related to one or more of state grant aid, in-state tuition, out-of-state tuition and nonresident enrollment shares, but none has studied all of these issues simultaneously. Two papers have addressed the determinants of nonresident enrollments. Mixon and Hsing (1994) found, using cross-section data for a sample of public and private academic institutions, that higher nonresident tuition levels were associated with higher nonresident enrollment shares. Their findings lent credence to the notion that universities enroll nonresidents for revenue purposes. Siow (1997) found, after controlling for student body ability, that universities with more successful researchers were more likely to have larger shares of nonresident and foreign students.

Other studies have addressed the determinants of tuition levels for in-state students at public universities. Using cross-section data, Lowry (2000, 2001) found that net tuition and fee revenues were higher at public universities that receive less state government funding per student and in states in which public universities have more financial autonomy. Quigley and Rubinfeld (1993) found that states with high private enrollments and many private colleges and universities charged higher tuition levels at their public universities.

Several studies have treated tuition levels at public higher education institutions and state appropriations to these institutions as being simultaneously determined. In the context of a model in which state appropriations were treated as endogenous, Koshal and Koshal (2000) found that lower state appropriations per student, higher median family income and a higher share of students that came from out-of-state were all associated with higher in-state tuition levels. However, Lowry's (2000, 2001) work suggests that state appropriations per student can be treated as exogenous in in-state tuition equations.

Greene's (1994) is one of the few studies that addressed out-of-state tuition levels at public universities. Using cross-section data, he found that states with many private colleges, lower tax rates, poor labor markets and with strong in-migration of both population and students, charged higher nonresident tuition. While he observed that higher regional tuition was associated with higher nonresident tuition levels, the association was not statistically significant.

Research relating to federal and state grant aid has addressed how grant aid affects tuition levels and access. Examples include Balderson (1997), Coopers and Lybrand (1997), Haupman and Krop (1998), McPherson and Shapiro (1998), and

National Center for Education Statistics (2001). Of concern to many researchers and policymakers is whether academic institutions respond to increases in the Pell Grant program maximum benefit level by increasing their tuition levels. Estimates of the size of this "Bennett Hypothesis" at public institutions range from negligible to a $50 increase in tuition for every $100 increase in aid.[7] Little attention has been given to the determination of federal grant aid levels themselves, let alone to how states determine how much of their resources to devote to financial aid for students.

Most of the prior studies are cross-section analyses, and are subject to the criticism that unobserved institutional or state specific variables may lead to biased coefficient estimates. To avoid this problem, we employ a rich longitudinal institutional level data set that is derived primarily from the Higher Educational General Information System (HEGIS) and its successor the Integrated Postsecondary Education Data System (IPEDS) in the estimation reported below. The HEGIS and IPEDS data are supplemented with data from numerous other sources.

We report estimates of a system of four simultaneously determined equations for state need-based grant aid, in-state tuition, out-of-state tuition and the share of undergraduate students that are nonresidents. The explanatory variables that are treated as exogenous in our models include federal financial aid parameters, institutional characteristics, state governance characteristics, tuition reciprocity agreement information, measures of higher education competition in the state and the institution's enrollment capacity, and other state and regional specific information. Our analyses should be viewed as reduced form in nature due to the difficulty of finding suitable supply and demand restrictions for each equation.

[7] Named for William Bennett, the Secretary of Education during the Reagan administration.

III. Data

Our study uses data on resident and nonresident enrollment and tuition levels for a sample of 91 American public research institutions representing all 50 states. The data come from a variety of sources including HEGIS, IPEDS, the National Association of State Student Grant and Aid Programs (NASSGAP) and annual Current Population Surveys (CPS), as well as other sources, for seven years during the 1979 to 1996 period.[8]

Table 2 presents data on the share of full-time first-time freshmen that were nonresidents at sample institutions during the 1979 to 1996 period. Overall, the enrollment share of nonresidents rose from .174 to .196 during the period. However, from 1981 through 1992, when states faced particularly difficult financial times, the average share increased from .166 to .205, an increase of almost .04 and then remained relatively constant as budget situations improved during the remainder of the period.

To illustrate the magnitude of a 4 percentage point increase in nonresident enrollment, consider a school with a freshmen enrollment of 3,000 students and a nonresident tuition premium of $6,000. If this school decides to enroll 4% more of its class as nonresidents (120 students), over the course of four years, this would provide the institution with an additional $2.88 million of revenues that could be used to raise faculty salaries, invest in start-up costs for new scientists, hire additional faculty and staff and offer more courses.

Schools that exhibited the largest increases in nonresident enrollments shares during the period included Pittsburgh, Massachusetts, Minnesota and Mississippi State,

[8] Appendix Table 1 details the sources for all of our data. The specific years included in the study were dictated by the years in which information on resident and nonresident enrollments were collected as part of HEGIS or IPEDS. Our analysis ends with 1996 because data on nonresident enrollments is collected every two years and at the time of this paper's writing the 1998 data had yet to be made available in WebCASPAR.

which all more than doubled their shares during the period. In contrast, Illinois-Chicago, Texas Tech, Houston, South Florida and the University of California schools all reduced their nonresident enrollment shares by more than half. While the time series variation in nonresident enrollment shares exhibited in this table may not appear very striking, more dramatic cross-section variation exists and can be seen in figure 1.

The well-documented increases in resident and nonresident tuition that occurred during the period are shown in Table 3. In real terms, resident and nonresident tuition levels both more than doubled between 1979 and 1996, with each growing at about 4.5% per year above the rate of inflation. This table veils the dramatic cross-section variation that exists in public higher education tuition levels. For instance, in 1996 Vermont charged its residents over $7,000 and Pittsburgh, Temple, Michigan, Penn State, Massachusetts and New Hampshire all charged over $5,000, while all of the Florida universities, Idaho, Houston, Texas A&M and Nevada-Reno charged below $2,000. The public higher education institutions in California and Texas are among those that increased tuition at the fastest rates, while the Florida and Mississippi schools exhibited the smallest increases during the period.

Every public research institution charges a higher price to nonresidents, presumably because state taxpayers do not want to subsidize the schooling of non-taxpayers from other states. Moreover, the extent to which nonresidents pay more than residents increased during the period. The roughly equal percentage increases during the period in resident and nonresident tuition caused the real difference in resident and nonresident tuition levels to substantially increase during the period.

Table 3 shows that while in-state tuition increased by an average of less than $2,000 in real terms, nonresident tuition increased by an average of more than $5,000 in real terms. As a result the average premium charged to nonresidents has increased in real terms from $2,700 in 1979 to $6,100 in 1996 (table 4). It appears that during the period institutions adjusted their out-of-state tuition levels to generate revenue.

The lowest out-of-state tuition levels and smallest increases occurred largely in the southeastern region. Both the largest out-of-state tuition levels and tuition increases occurred at Michigan, the Virginia schools, North Carolina schools and the California schools. As with the overall level of nonresident tuition, the smallest premia charged to nonresidents and the smallest increases tended to occur at southeastern public institutions. The strong regional patterns that we observe in tuition and enrollment trends suggests the importance of historical competitive and political economic factors.

Turning to trends in state support for public higher education, tables 5 and 6 outline the changes in state need based grant aid to students attending public institutions and state appropriations to public higher education institutions that occurred during the period. Table 5 shows that average state provided need based grant aid per full-time equivalent undergraduate enrolled in public higher education institutions in the state has more than doubled in real terms, growing from roughly $67 per student per year to $184 per student per year.[9] One recent study found that 68.5% of first-time, full time students enrolled in public higher educational institutions received financial aid from any source and that 26.9% of these students received state grant aid averaging $1,742 per year.[10]

[9] Though the annual percentage increases in real student grant aid (5.7%) outpaced the annual real increases in tuition (4.5%), the real dollar cost to students still rose during the period.

Inasmuch as the average in-state tuition in 1996 was $3,348, state grant aid alone appears to cover over half of the tuition costs for eligible students.

Among the most generous states, in terms of state provided grant aid per full-time equivalent student enrolled in public higher education institutions are New York, Illinois and Pennsylvania, while the least generous states include Wyoming, Utah, Montana and Mississippi. New Mexico, Virginia, Washington, Maine and Massachusetts are among those states that increased state aid per student the fastest during the period, while Utah, Wyoming, Montana, Alabama and Mississippi actually decreased in real terms the amount of need based grant aid they awarded per student enrolled in public institutions during the period.

While direct student aid grew rapidly, real state appropriations per full-time equivalent student to public higher education institutions saw very little growth during the period. Table 6 summarizes data on real average state government appropriations per full-time equivalent undergraduate. Nationwide real state appropriations per student did not increase between 1988 and 1996, and only grew by 19% between 1979 and 1996, a 1% per annum annual growth rate. Again, dramatic cross-section variation existed in state funding per student. In 1996, Minnesota, Alabama-Birmingham, Wayne State and North Carolina each received over $20,000 in state appropriations per full-time equivalent undergraduate while Montana, Oregon, Colorado, Vermont and New Hampshire each received less than $5,000.

A few states were able to generously increase support for selected institutions during the period. Minnesota, Wayne State, Georgia Tech, Maine and LSU all enjoyed a

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[10] National Center for Education Statistics (2001). In addition, 28.3% of aid recipients receive federal grants averaging $2,262, 30.9% of aid recipients received institutional grants averaging $2,576 per student and 45.4% received loan aid averaging $3,490 per student in 1999.

doubling of real state support, amounting to increases between $6,000 and $12,000 per student. However, of the 91 schools in our sample, 25 faced decreases in real state appropriations per student between 1979 and 1996. Among the hardest hit were the California and Virginia schools, each losing anywhere from 10% to 49% of its state support. These losses represented $1,000 to $12,000 per student cuts in real state appropriations

In the face of budget pressures and changing political attitudes, states may have an easier time funding direct student aid increases under the guise of promoting access. Legislators and their constituents may also prefer not to fund institutions directly, because they may worry that the dollars will not go to the intended uses. Raw correlations, however, do not indicate that states that are more generous to students are less generous to institutions (the simple correlation coefficient is 0.14). In fact, it appears that there are states that are generous to higher education on both dimensions and states that are not.

Figure 2 depicts state preferences for direct student aid versus institutional aid in 1996, controlling for per capita tax revenues[11]. The axes represent US averages. We see that New York, Michigan, Maryland and California exert a great deal of effort to fund both student financial aid and state appropriations to public higher education, while Wyoming, Nebraska, Delaware, Idaho, Utah and Montana fund neither very well. Some states do appear to prefer one form of aid to another. New Jersey, Minnesota, Pennsylvania and Illinois are above average funders of public higher education

[11] The figure plots normalized residuals from a regression of grant aid on per capita tax revenues in 1996 against residuals from a regression of state appropriations on per capita tax revenues in 1996. These are institutional level regressions and each point on the graph represents enrollment weighted state averages for those states with multiple institutions.

institutions, while Alaska, Hawaii, North Dakota and Mississippi are above average funders of aid to students.[12] Wealthier and larger states seem to support higher education on both fronts (northeast quadrant of figure) more greatly than the rural and poorer states (southwest quadrant). It is somewhat of a surprise that no clear regional disparities emerge when comparing state preferences for direct student aid versus in-kind institutional aid.

Tuition reciprocity agreements are agreements between a school or state and another state or consortium that allow a nonresident student from a neighboring state to attend that school at some pre-determined, discounted tuition rate. Eligibility and the size of the discount may depend on the type of program in which a student is interested, the county in which a student resides, the availability of opportunities in the home state, whether the student is an undergraduate or graduate, whether the student attends part- or full-time and many other factors. While some schools negotiate agreements bilaterally with other states, many now choose to participate in consortium agreements in which a number of states in a geographical region are treated similarly under the agreement.

In the spring of 2001, the Cornell Higher Education Research Institute conducted a "Survey of Tuition Reciprocity Agreements at Public Research and Doctoral Universities". The sample consisted of all 149 public institutions that were classified as Research or Doctoral institutions by the Carnegie Foundation in their 1994 classification scheme. Sixty-one of the 128 universities that responded to the survey said that the participated in a tuition reciprocity program with schools in another state, or as part of a

[12] This table shows results for need based aid. Many states are now moving to merit-based aid programs (e.g. GA) and inclusion of this would alter this picture.

consortium. Table 7 indicates that 39 of the 91 institutions in our sample, a slightly smaller percentage, participated in such an arrangement.

Four consortia are represented among our survey responses: the Academic Common Market, the Midwest Student Exchange Program, the New England Regional Student Program and the Western Interstate Commission for Higher Education. Some institutions in the survey also participate in student exchange programs (e.g. the National Student Exchange, the Consortium of Universities in the Washington Metropolitan Area and the Tuition Exchange, Inc.). Student exchange programs differ from reciprocity agreements in that students participating in them are either visiting another school for a specified time period, or eligibility is limited to a narrowly defined group of students.[13]

While the number of schools participating in these agreements has not changed over our sample period, columns 4 and 5 suggest that students have been increasingly taking advantage of such programs. In addition, the schools that report reciprocal enrollments also enroll a larger share of nonresidents than the average school in our survey. In 1996 for example, an average of 23.9% of enrolled students were nonresidents in the 28 schools reporting reciprocal enrollments while an average of 19.6% of enrolled students were nonresidents in the entire sample.

Increasing nonresident enrollment shares under these programs does not translate into higher revenues for public higher education institutions given that these students often pay the in-state tuition level.[14] The final column of the table indicates that for these schools, nearly a quarter of their nonresident enrollments are covered under this plan.

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[13] A brief description of each of the consortia and exchange programs and the institutions participating in each is found at http://www.ilr.cornell.edu/cheri, click on surveys and then click on tuition reciprocity.

[14] However, there are sometimes arrangements in which revenues flow from one state to another if the flow of students across the two states does not equalize.

Returning to our example from earlier, a typical school would then forego about $720,000 in additional tuition revenues due to the presence of these agreements.[15]

IV. Estimation Strategy & Results

A) Model Specification

To achieve a fuller understanding of the causes and consequences of changing tuition and enrollments, we move to a multivariate analyses. We estimate a system of four simultaneously determined equations using panel data, with the institution - year as our unit of analysis, in which the logarithm of state need-based grant aid per student, the logarithm of in-state tuition, the logarithm of out-of-state tuition and the logarithm of the odds-ratio of the share of first time freshmen that are nonresidents are each specified to be functions of each other, state and institutional level variables, federal financial aid variables and random uncorrelated (across equations) error terms.[16] Our model should be thought of as being reduced form, rather than structural, in nature because the variables found on the right hand side of each equation likely capture both demand and supply factors and represent an equilibrium condition in the underlying structural model.

To give the reader a sense of the sides of the market from which each variable originates, we have included our prior assumptions next to each variable name in table 8. We write a "D" if the variable is assumed to influence the outcome through the demand side of the market, an "S" if it assumed to influence the outcome through the supply side

[15] Of course, it is unlikely that anyone would leave cash on the table. The long term cost savings from taking advantage of these economies of scope is very likely to make up for the revenue losses. States might also gain politically from engaging in these agreements. States that send students likely save money because they do not have to establish and maintain costly programs. States and colleges that receive students can operate programs more efficiently because they gain quality students and if the supply of students is elastic, they might be able to fill spaces that otherwise would have been vacant. Students benefit by not having to pay out-of-state tuition, which may have prevented many of them from earning degrees in the fields they had chosen.

[16] The first variable, average state need-based aid per student is observed at the state, not institutional level.

of the market, and a "B" if it is assumed to influence the outcome through both sides. Similarly, we have included a "+" if we expect that the net effect of the variable is to increase the outcome, a "-" if we expect that the net effect of the variable is to decrease the outcome and a "?" if the prediction is ambiguous. The state need-based grant aid equation is assumed to result from the interaction of students' demand for financial aid and the state's willingness to supply it. The in-state tuition equation is assumed to result from the interaction of in-state students' demand for seats at the institution and the institution's willingness to supply such seats. The out-of-state tuition and the share of nonresident students enrolled at the institutions are assumed to result from the interaction of out-of-state students' demand for seats at the institution and the institution's willingness to supply such seats.

The grant aid equation includes variables that relate to federal and institutional sources of student financial aid. Federal loan and grant program variables included in the model are the size of the maximum Pell grant (PELL), the share of households with incomes below that necessary to be eligible for a Pell (ELIG), the percent cap on costs (CAP) and categorical variables that indicate the degree the degree of access that students have to subsidized federal loans(1979, 1992).[17] Variables that relate to institutional sources of aid are the logarithm of real state appropriations per student (APP), the logarithm of real endowment per student (END) and the logarithm of in-state tuition (TUITI) – each of these variables generates income that the institution can use, in principle, for scholarship aid. Also included in this equation to help capture a state's

[17] The percent cap is a percentage of college costs that students were eligible to receive in Pell grants. The cap was removed in 1992, so that students at low-tuition institutions that were eligible for the maximum Pell grant could use any funds in excess of tuition costs to pay for living and other expenses. In 1981, student access to subsidized loans was dramatically reduced with the repeal of the Middle Income Student Assistance Act (MISAA) after a run-up in usage from its inception in 1978. Access was expanded again in 1992 with the removal of a portion of housing assets in the expected family contribution formula.

financial capacity to provide need based student aid is the real tax revenues per capita (TAX), its unemployment rate (UNEMP) and the share of its population that is college aged (AGE).

To control for the impact of enrollment pressure on grant aid, we include measures of state seating capacity (SEAT), calculated as the ratio of the maximum public university full-time equivalent enrollment in a state during the sample period to the states' current number of high school graduates in the year and the share of new students enrolled in private colleges (PRIV) and in two-year colleges (TWO). Also included in the equation are the overall quality, as measured by the Barron's rating of public (BPUB) and private (BPRIV) institutions in the state, the logarithm of real average tuition in the region (TUITR - excluding the state in which the institution is located) and the degree of political autonomy of each school, as measured by the number of governing boards in the state (GOV). Finally, we include the ratio of graduate enrollments to undergraduate enrollments at the institution (GRAD).

Our in-state tuition equation is similarly specified. However, state tax revenues are excluded from this equation because the impact of state resources on tuition is captured by the inclusion of real state appropriations per student (APP). In addition, we include institutional measures of school quality, categorical variables that indicate the Barron's rank of each institution.[18] More generous federal financial aid programs make it easier for a school to increase tuition for at least two reasons. First, federal financial aid may reduce barriers to entry for students at the margin of attending college. Second,

[18] For roughly three decades, Barron's Profiles of American Colleges has assigned categorical rankings to 4-year institutions according to a subjective measure of quality. From best to worst, they rank institutions as *most competitive, highly competitive, very competitive, competitive, less competitive and non-competitive.* We created a categorical variable HIGHB for those institutions in the top two categories as well as LOWB for those in the bottom two. The coefficients on these variables are then relative to the omitted middle categories.

institutions can increase tuition and for those students not at the grant or loan limits, each dollar of tuition increase will be covered by an additional dollar of aid, up until some maximum. Increased state appropriations per student may allow schools to keep tuition low, but this increase in in-kind student aid may result in an increase in demand, forcing tuition upward. Larger endowments per student and higher Barron's rankings reflect higher institutional quality and permit higher tuition levels.

The logarithm of real out-of-state tuition (TUITO) is specified to be a function of the logarithm of real in-state tuition (TUITO) and most of the variables included in the in-state tuition equation. A notable difference is that we replace the institution's Barron's rankings with measures of the shares of students in the state enrolled at other public (BSPUB) or private (BSPRIV) institutions in the state that are enrolled at school of equal or better Barron's rankings than the institution. These variables capture the institution's monopoly power within the state for students seeking to attend institutions of its quality or higher. Similarly, we include the share of students in the region enrolled in schools of equal or better quality that are enrolled in private schools (SPRIV), the greater this share is the higher the average tuition will be at institutions perceived as good alternatives to the institution.

The logarithm of the share of first time freshmen that are nonresidents (NON) is included to capture the financial benefits to the institution from increasing out-of-state enrollments. Finally, we include the logarithm of the share of undergraduates that are enrolled under reciprocity agreements (RECIP).

The final equation is the nonresident enrollment share equation. The dependent variable in this equation is specified as the logarithm of the odds-ratio of the share of first time freshmen that are nonresidents to allow the error term to be normally distributed. This equation is specified very similarly to the out-of-state tuition equation, but now the logarithm of real out-of-state tuition (TUITO) is included as an explanatory variable. We also include the logarithm of the mean SAT scores in the state in which the institution is located (SAT) to see if states with a low supply of high "quality" high school graduates seek to recruit out-of-state students to attract top talent.[19]

We present two types of estimates for each equation. First, to understand why tuition, grant aid and nonresident enrollment vary across states and institutions at a point in time, we present pooled cross-section time-series estimates, using institutional level data for 7 years between 1979 and 1996. Year dichotomous variables are included in these models to control for idiosyncratic time effects.

While the wide variation in the cross-section data makes this approach appealing, it is subject to possible omitted variables bias. For example, institutions located in beautiful areas, other factors held constant, may be able to charge higher tuitions. In this example, omission of "beauty" as an explanatory variable might bias the estimates of other explanatory variables' parameters effects on tuition if these variables are correlated with "beauty." We have attempted to minimize this problem by including a carefully constructed, rich set of explanatory variables in our models.

An alternative way of controlling for omitted variables is to take advantage of the panel nature of the data and employ a fixed effects estimation strategy. The panel data results are useful in understanding how *changes* in explanatory variables affect *changes* in the dependent variables. In addition, the panel data results will be employed to

[19] Groen and White (2001) discuss this issue in detail.

simulate how changes in key explanatory variables will affect changes in the outcomes of interest to us.

For each approach, we estimate a jointly determined system of four equations, using a two-stage least squares (2SLS) estimation procedure to control for the endogeneity of all four outcomes.[20] 2SLS estimation is necessary to attempt to correct for the biases that result from the violation of the orthogonality conditions necessary for OLS to be unbiased, though the signs of the potential biases here are ambiguous. The success of this procedure is highly dependent on finding appropriate "instruments" for the endogenous variables in the system.[21]

Though finding suitable exclusion restrictions is a challenging endeavor for this system of equations, the estimates that follow in table 8 have proven to be robust to a variety of specification changes. Estimates in a non-instrumented setting, or using different instrument sets, or from a reduced form system are all strikingly similar to the 2SLS results that follow and as such, we present only the 2SLS results. We suspect that the insensitivity of the 2SLS estimates and their similarity to OLS estimates is due to the instruments being either too weak or too strong. In the former case, there is not enough exogenous variation to produce a change in the outcome in question (with a

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[20] The efficiency of a system such as ours can be improved if one accounts for the correlation among the error terms in each equation. 3SLS estimates were largely similar to the 2SLS estimates, but are not reported here due to concern that one or more of the equations in the system are misspecified, which can effect estimates in other equations (Johnston and DiNardo).

[21] In the grant aid equation, we instrument for in-state tuition using the institution's Barron's ranking because quality likely affects tuition, but not a state's willingness to disperse financial aid. In the in-state tuition equation, we instrument for grant aid with state tax revenues per capita and the weighted ranking of public schools in the state. In the out-of-state tuition equation, we instrument for in-state tuition with state private enrollment share, state two year enrollment share, weighted ranking of private schools in the state, state tax revenues per capita and weighted rank of public schools in the state. Nonresident enrollment shares are instrumented with average SAT scores of high school seniors in the state. In the nonresident enrollment share equation, out-of-state tuition is instrumented with state private enrollment share, state two-year enrollment share, weighted ranking of private schools in the state, state tax revenues per capita and weighted rank of public schools in the state.

corresponding large asymptotic variance matrix of the 2SLS estimator), while the latter suggests that the instruments are also correlated with the underlying model's disturbance term.

B) Econometric Estimates: Cross – Section Findings

The odd numbered columns of table 8 present the estimated coefficients and standard errors from the cross-section equations. Turning first to the average state need-based grant aid per student equation (column (i)), while the level of in-state tuition (TUITI) does not affect grant aid, states in regions in which average (excluding in-state) tuition (TUITR) is higher award more grant aid per student, other variables held constant.[22] Wealthier states, as measured by per capita tax revenues (TAX), award more grant aid per student, but states in which a larger share of the population is of college-aged (AGE) award less aid per student.

As expected, states with higher quality public (BPUB) and private (BPRIV) academic institutions, and thus likely higher costs, offer more grant aid. States in which a larger share of students attend low-cost (and thus likely low state-appropriations) two-year colleges (TWO) award more grant aid per student. However, as expected, the state appropriation per student to the specific 4-year institution (APP) does not affect the average need based state aid per student attending public institutions in the state. Finally, states with greater available seating capacity in their public institutions relative to the number of high school graduates in the state (SEAT) award more grant aid per student and states in which the public institutions are more autonomous (GOV) also award more grant aid.

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[22] All of the results discussed in the paper are *ceteris paribus,* or other variables in the model held constant, findings.

Moving to the in-state tuition equation (column (iii)), we find that every 10% increase in state need based grant aid per student (AID) across states is associated with public universities charging tuitions about 2% higher. Schools that receive higher state appropriations per student (APP) charge lower tuition, though the elasticity is far from unity. As expected, higher quality schools, as measured by better Barron's rankings (HIGHB) and higher endowment per student (END) are able to charge more for their product.

A striking finding is that undergraduates may be partially subsidizing the huge costs of graduate education at these research universities. Across institutions, the higher is the ratio of graduate to undergraduate students (GRAD), the higher is the in-state undergraduate tuition. However, this finding might merely reflect that universities with larger shares of their students enrolled as graduate students may be higher quality institutions, which attract better faculty and thus can charge higher tuition levels.[23]

Turning to other variables, public universities in states in which the unemployment rate (UNEMP) is high and hence the opportunity cost of enrolling in school is low, charge higher in-state tuition, as do institutions in states in which a smaller share of students attend two-year colleges (TWO). Unlike Lowry (2001), we find no evidence that public universities in states with more autonomous governance structures (GOV) charge higher tuition. Finally, when private competition in a state is important, as measured by the share of first time freshmen in the state that are enrolled in private academic institutions (PRIV), public universities are able to charge higher tuition.

[23] We estimated models that included explicit controls for graduate faculty and graduate program quality (as determined by the National Research Council) and inclusion of these variables did not affect the estimated effect of the graduate enrollment share variable. Including an interaction terms of quality and graduate school enrollment share did make the main effect of the share variable disappear, but the sign of the interaction term was positive. This suggests that it is only at high quality public graduate schools that undergraduates subsidize graduate education.

Column (v) in part B of the table displays the results for the nonresident tuition equation. In-state tuition (TUITI) is a strong predictor of out-of-state tuition, although the elasticity is less than one. An institution's out-of-state tuition does not appear to be significantly positively associated with its nonresident enrollment share (NON). Institutions in states in which a larger share of households are eligible for Pell grants (ELIG) appear to charge lower nonresident tuition. As with in-state tuition, institutions with more selective Barron's rankings (HIGHB) are able to charge higher out-of-state tuition, while institutions receiving higher state appropriations per student (APP) charge less. Regional competition clearly also matters, as schools located in regions in which a large share of students attend private schools (SPRIV) are able to charge more to out-of-state residents. Similarly, when the average tuition in the geographical region is higher (TUITR), schools also charge more to nonresidents.

Column (vii) presents the nonresident enrollment share equation. As one might expect, institutions with higher out-of-state tuition levels (TUITO), ceteris parabis, enroll smaller shares of nonresidents. While the variables relating to federal financial aid policies do not contribute to explaining the cross-sectional variation in nonresident enrollment shares, measures relating to institutional quality clearly do. Schools with larger endowments per student attract more nonresidents, while schools with below average Barron's rankings (LOWB) attract fewer.

Another variable relating to institutional quality is the institution's share of enrollments in a state at schools of equal or higher quality. Other variables held constant, institutions whose enrollment is large relative to the total of all public enrollments

(BPUB) or all private enrollments (BPRIV) at institutions of equal or greater quality in the state have larger shares of nonresident enrollments.[24]

Flagship public institutions face political pressure to ensure access to the children of state residents. We find that when seating capacity at all public institutions in a state is high relative to the number of high school graduates in the state (SEAT), that public institutions are able to enroll larger fractions of nonresidents. Conversely, in states such as California, in which the number of high school graduates is large relative to the capacity of the public universities to enroll them, we observe very small shares of out-of-state students.[25] Second, we find that schools located in states where high school student quality is relatively poor (SAT) enroll a larger share of nonresidents – they need to look elsewhere to find high quality students. Contrary to our expectations, we find that once we control for other factors, schools in states with more governing boards (GOV), hence more autonomous institutions, enroll smaller shares of nonresidents. Finally, states that provide higher state appropriations per student (APP) tend to enroll fewer nonresidents. While one might expect nonresidents to prefer to attend institutions that receive more state support per student, sometimes state support per student is endogenous in the sense that institutions may receive greater state appropriations per student for each in-state student they enroll.

C) Econometric Estimates – Panel Data Results

[24] For example, for the public schools, we simply take the ratio of full-time equivalent first time freshmen enrollments in the school under observation and divide it by the total number of full-time equivalent first time freshmen students in public institutions in the state that have at least as high a Barron's ranking as the school under observation.

[25] Due to concerns that the enrollment constraints at the University of California may be heavily influencing our results, we reestimated all of our equations without these schools. These results were very similar (with larger standard errors) to those presented in the text.

The even numbered columns of Table 8 present our fixed effects estimates. Because these parameters are estimated from within institution changes over time, they are useful for understanding the potential impacts of policy changes. As most of the variation in our data occurs across institutions, fewer statistically significant coefficients arise. Our discussion focuses on results that significantly differ from those found in the cross section.

Turning first to the state need based grant aid equation (column (ii)), grant aid per student does not respond to changes in either in-instate tuition (TUITI) or changes in regional tuition (TUITR) levels. Grant aid does increase when per capita state tax revenue (TAX) increases and state grant aid also responds to changes in income distribution of a state's population. An increase in the share of households whose incomes fall below the maximum level that permits them to be eligible for Pell grants (ELIG), leads to higher levels of state needs based grant aid per student.

Turning next to the in-state tuition equation (column (iv)), the panel estimates are very different from the cross-section ones. While changes in state aid levels (AID) now do not appear to influence in-state tuition levels, institutions are seen to respond to increases in Pell grant generosity (both the maximum level (PELL) and in the types of eligible expenses that the program covers(CAP)) by dramatically increasing tuition. A 10% increase in the maximum Pell award, appears to lead institutions to increase their in-state tuition by 22.7%, other factors held constant.[26] While increased state appropriations per student (AID) are associated with lower in-state tuition changes, neither increases in endowment per student (END) nor changes in the share of students

[26] We question below whether responses of this magnitude are "believable"

that are graduate students (GRAD) are statistically significantly associated with changes in in-state tuition in the panel.

Similarly, the nonresident tuition equation results (column (vi)) indicate that increases in the Pell grant maximum (PELL) also lead to higher nonresident tuition. While increases in the share of students that are graduate students (GRAD) did not lead to higher in-state tuition, we find that increases in this share are associated with increases in nonresident tuition levels.

Finally, turning to the nonresident enrollment share equations (column (viii)), while the nonresident enrollment share is not responsive to changes in out-of-state tuition levels (TUITO), it is positively related to increases in regional tuition levels (TUITR). Inasmuch as an increased generosity of federal financial aid makes it less costly for students to attend out-of-state institutions, it is not surprising that increases in the Pell grant maximum (PELL) and in the amount of expenses it can cover (CAP) lead to higher nonresident enrollment shares. Finally, as the number of slots available at public institutions in a state increase relative to the number of high school graduates (SEAT) or as the share of students enrolled under reciprocity agreements increases (RECIP), the nonresident enrollment share at the institution increases.

D. Policy Simulations

Table 9 outlines the effects that selected policy changes have on the four outcomes, using the panel data estimates presented in Table 8.[27] Inspection of the grant aid results indicates that changes in grant aid are primarily a result of political and demographic factors in a state, not the result of economic factors. If a state at the average

[27] The table reports marginal effects from the presented regressions evaluated at the sample means in the data. When we calculated the marginal effects for individual institutions and then took their means, the impacts were nearly identical.

per student grant aid level experienced an increase of $1,000 in per capita tax revenues, that state would only increase per student grant aid by $8 over an average of $206.

Increases in state support for higher education institutions helps to curb in-state tuition increases but the magnitude of this effect is quite small. For the average institution in our sample, it would take an increase of $1,000 in state appropriations per student to generate an in-state tuition reduction of $67. The comparable reduction in out-of-state tuition would be only $37.

Our estimated impacts of changes in the maximum Pell grant on in-state and out-of-state tuition levels are implausibly large. Taken at face value, they suggest that were the federal government to enact a $100 increase in the maximum Pell grant, in-state and out-of-state tuition would increase by $308 and $367 respectively. Such responses would leave students eligible to receive the maximum Pell grant worse off and they are implausibly large because only a fraction of students are eligible for Pell grants. If taken at face value, they would mean that an increase in the Pell grant would be more than fully cannibalized by the institutions.

We believe that these unrealistically high estimates of the effect of Pell grants on tuition arise from the fact that the Pell grant maximum is determined periodically by the President and Congress and that this decision is likely influenced by many of the same factors that cause in-state and out-of-state tuitions to rise. Hence, we have another simultaneity problem; and the direction of causation may run from public and private tuition increases to Pell grant increases rather than visa versa.

With only 7 years of data used in our estimation, it is impossible for us to specify a Pell grant equation as part of the model. Instead, we take a history of the Pell grant maximum from 1973 to 1999, which provides us with 27 observations, and then regress the real value of the maximum Pell grant in a year on the national average 4-year public and private tuitions in the year, the national unemployment rate, the real value of the per capita federal government budget, and dichotomous variables for the presence of a Democratic President and if the President and both houses of Congress were controlled by the same party. This model "explains" less than a quarter of the variation in the real maximum Pell grant level and one variable is statistically significant of the wrong sign.

We then used this equation to construct an instrument for the maximum Pell grant in each year of our sample and reestimated our panel data model using the instrument rather than the actual value of the Pell grant. When we did this, the estimated impacts of the Pell grant on in-state and out-of-state tuition were not statistically significantly different from zero. While this suggests that our evidence in favor of the Bennett hypothesis is a statistical artifact of not treating the maximum Pell grant as simultaneously determined with tuition levels, we caution that our finding may simply reflect that our instrument set is not very good.

While the elasticity of out-of-state tuition with respect to in-state tuition is close to one, the coefficient estimates imply that every $1,000 increase in in-state tuition, leads to a larger increase, at the mean $2,361, in out-of-state tuition. While institutions maintain the ratio of out-of state to in-state tuition, an increase in the latter is associated with a larger real increase in the former.

Finally, our estimates suggest that changes in most of the variables in the model fail to influence the share of nonresidents that public universities enroll. Even the impact of reciprocity agreements is minimal. While deteriorating in-state high school quality and an excess of empty seats in universities can lead to increased shares of nonresident enrollments, states are unlikely to be able to affect these variables in a short period of time.

V. Conclusion

In this chapter, we have analyzed why state need based grant aid per student, in-state and out-of-state tuition levels and nonresident enrollment shares differ across flagship public research universities at a point in time and how each changes over time. There are wide disparities across states in political persuasion, demographic characteristics, income, the availability of private college alternatives, historical factors, university governance and funding priorities that lead to most of the cross-section differences that we observe in these outcomes. Exploiting the panel nature of the data enables us to control for unmeasured institutional heterogeneity, but it also removes much of the variation in our data. Despite this, there are four insights to be drawn from our empirical work.

First, aside from the higher quality institutions, public universities cannot (or do not) use nonresident enrollment as a revenue generating strategy. Rather the institutions use nonresident enrollments to augment academic quality and/or to take advantage of cost efficiencies achieved through participation in tuition reciprocity agreements. The increased usage of tuition reciprocity programs suggests that institutions realize this revenue limitation. These agreements also reflect the growing regionalization of these state schools. In fact, institutions respond to higher regional tuition by charging high in-state and out-of-state tuition and we see that nonresident students tend to migrate more often when average tuition in their region of residence is higher.

Second, while at first blush, it appears that the institutions attempt to capture additional revenues through higher tuition when the maximum real Pell grant level increases, this may be a statistical artifact of our failure to treat the maximum Pell grant level and public tuition levels (on average) as simultaneously determined. When we construct an instrument for the Pell grant variable, all evidence of the "Bennett hypotheses" goes away.

Third, we find that enrollment pressure from high school graduates in a state affects state need based grant aid per student, in-state and out-of-state tuition levels and nonresident enrollment shares. Public universities in states in which there are a large number of available public higher education seats relative to the number of high school graduates provide higher levels of need based grant aid, charge higher levels of out-of-state tuition and enroll a greater share of nonresidents.

Finally, quality plays an important role in public higher education. An institution's quality, as measured by it's Barron's ranking, influences the in-state and out-of-state tuition levels that it can charge and the share of its undergraduates that come from out-of-state.

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Figure 1
1996 Average Share of First Time Freshmen that are Nonresidents at Research Institutions in the 50 United States
(categories computed through means clustering analysis)

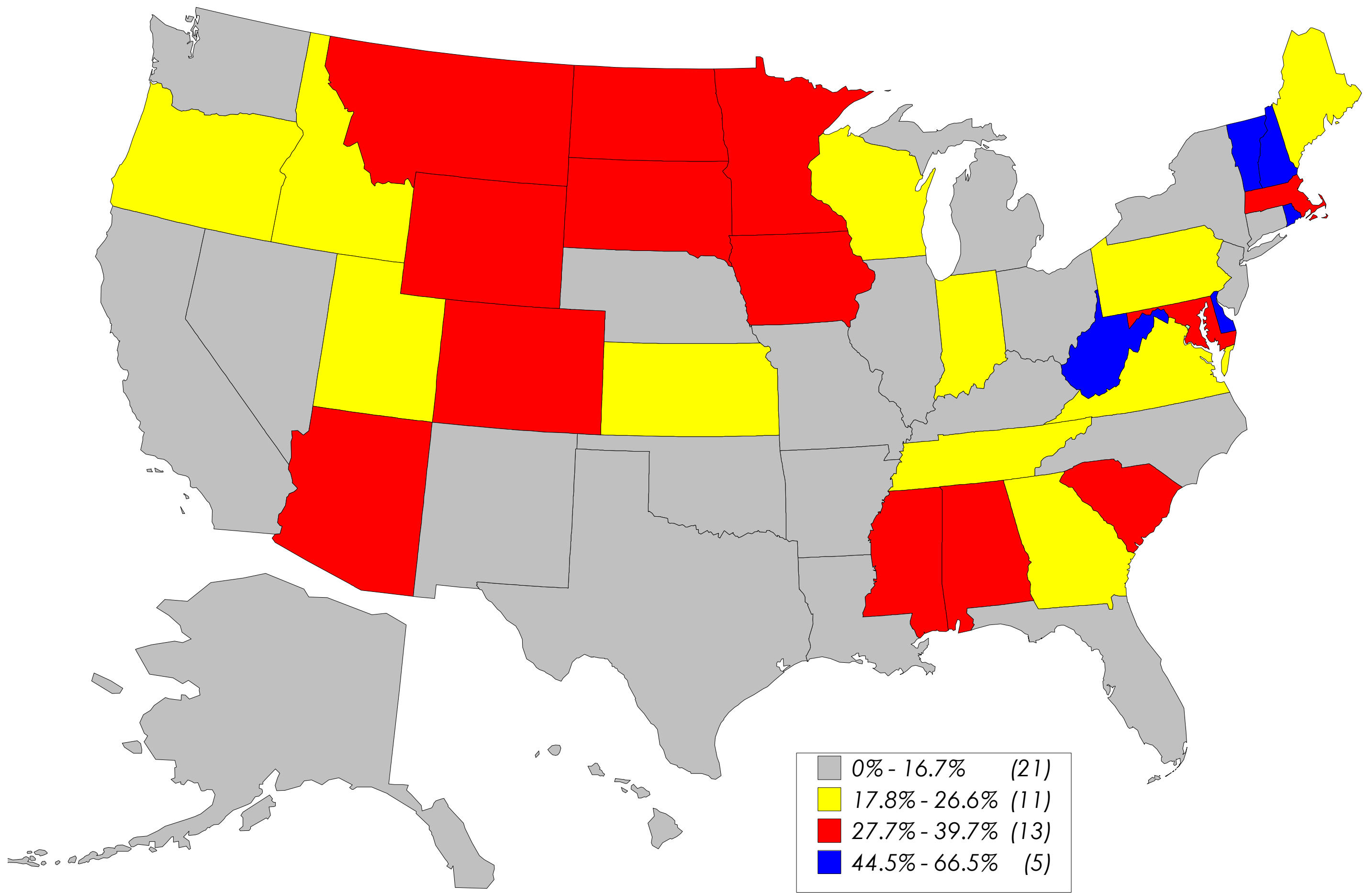


Table 1
Flagship Public Research Institutions in the Sample

School	1994 Carnegie Classification	School	1994 Carnegie Classification
Arizona State University (AZ)	RI	University of Hawaii at Manoa (HI)	RI
Auburn University (AL)	RII	University of Houston (TX)	RII
Clemson University (SC)	RII	University of Idaho (ID)	RII
Colorado State University (CO)	RI	University of Illinois at Chicago (IL)	RI
Florida State University (FL)	RI	University of Illinois at Urb.-Champaign (IL)	RI
Georgia Institute of Technology (GA)	RI	University of Iowa (IA)	RI
Indiana University at Bloomington (IN)	RI	University of Kansas (KS)	RI
Iowa State University (IA)	RI	University of Kentucky (KY)	RI
Kansas State University (KS)	RII	University of Louisville (KY)	RII
Kent State University (OH)	RII	University of Maine (ME)	DII
Louisiana State University (LA)	RI	University of Maryland - College Park (MD)	RI
Michigan State University (MI)	RI	University of Massachusetts - Amherst (MA)	RI
Mississippi State University (MS)	RII	University of Michigan (MI)	RI
New Mexico State University (NM)	RI	University of Minnesota - Twin Cities (MN)	RI
North Carolina State University (NC)	RI	University of Mississippi (MS)	RII
Ohio State University (OH)	RI	University of Missouri, Columbia (MO)	RI
Ohio University (OH)	RII	University of Montana (MT)	DII
Oklahoma State University (OK)	RII	University of Nebraska at Lincoln (NE)	RI
Oregon State University (OR)	RI	University of Nevada-Reno (NV)	DII
Pennsylvania State University (PA)	RI	University of New Hampshire (NH)	DII
Purdue University (IN)	RI	University of New Mexico (NM)	RI
Rutgers University - New Brunswick (NJ)	RI	University of North Carolina - Chapel Hill (NC)	RI
Southern Illinois Univ-Carbondale (IL)	RII	University of North Dakota (ND)	DII
SUNY at Albany (NY)	RII	University of Oklahoma, Norman Campus (OK)	RII
SUNY at Buffalo (NY)	RII	University of Oregon (OR)	RII
Temple University (PA)	RI	University of Pittsburgh (PA)	RI
Texas A&M University (TX)	RI	University of Rhode Island (RI)	RII
Texas Tech University (TX)	RII	University of South Carolina at Columbia (SC)	RII
University of Alaska at Fairbanks (AK)	DII	University of South Dakota (SD)	DII
University of Alabama - Birmingham (AL)	RI	University of South Florida (FL)	RII
University of Arizona (AZ)	RI	University of Tennessee at Knoxville (TN)	RI
University of Arkansas (AR)	RII	University of Texas at Austin (TX)	RI
University of California-Berkeley (CA)	RI	University of Utah (UT)	RI
University of California-Davis (CA)	RI	University of Vermont (VT)	RII
University of California-Irvine (CA)	RI	University of Virginia (VA)	RI
University of California-Los Angeles (CA)	RI	University of Washington - Seattle (WA)	RI
University of California-Riverside (CA)	RII	University of Wisconsin-Madison (WI)	RI
University of California-San Diego (CA)	RI	University of Wisconsin-Milwaukee (WI)	RII
University of California-Santa Barbara (CA	RI	University of Wyoming (WY)	RII
University of California-Santa Cruz (CA)	RII	Utah State University (UT)	RI
University of Cincinnati (OH)	RI	Virginia Commonwealth University (VA)	RI
University of Colorado at Boulder (CO)	RI	Virginia Polytechnic Institute (VA)	RI
University of Connecticut (CT)	RI	Washington State University (WA)	RII
University of Delaware (DE)	RII	Wayne State University (MI)	RI
University of Florida (FL)	RI	West Virginia University (WV)	RI
University of Georgia (GA)	RI		

states in ( )
Carnegie Classification descriptions can be found at http://chronicle.com/stats/carnegie

Table 2
Proportion of First-Time Freshmen from Out-of-State (excluding foreign students)
Flagship Public Research and Doctoral Institutions

Year	Unweighted Average	Standard Deviation	Weighted [b] Average	Median	Minimum	Maximum
1979	0.174	0.120	0.168	0.136	0.011	0.550
1981	0.166	0.120	0.161	0.133	0.007	0.543
1984 [a]	0.171	0.128	0.170	0.127	0.010	0.629
1988	0.203	0.136	0.205	0.158	0.012	0.602
1992	0.205	0.157	0.201	0.169	0.001	0.660
1994	0.202	0.152	0.196	0.172	0.005	0.674
1996	0.196	0.145	0.194	0.167	0.005	0.665
% Δ	12.5	21.0	15.7	22.6	-50.5	20.8

[a] *Numbers of out-of-state freshmen imputed for the 8 California schools in 1984*

[b] *Weights are full-time equivalent first time freshmen enrollments*

Source: NCES Higher Education General Information Surveys (HEGIS), Integrated Postsecondary Education Data System (IPEDS) via direct surveys and WebCASPAR

Table 3
In-State and Out-of-State Tuition Levels (1996 dollars)
Flagship Public Research and Doctoral Institutions

	In-State					*Out-of-State*				
Year	Average	Wtd. Avg.	Median	Minimum	Maximum	Average	Wtd. Avg.	Median	Minimum	Maximum
1979	1,552	1,582	1,509	676	3,435	4,250	4,246	4,097	2,068	8,182
	(520)					(1,273)				
1981	1,633	1,667	1,569	638	3,799	4,431	4,460	4,105	1,844	8,402
	(615)					(1,401)				
1984	1,943	2,006	1,861	557	5,126	5,203	5,334	5,047	1,755	9,799
	(756)					(1,614)				
1988	2,266	2,320	2,100	1,018	4,840	6,282	6,454	6,059	3,238	13,393
	(859)					(1,833)				
1992	2,833	2,887	2,656	1,315	6,724	8,055	8,243	7,604	4,139	16,103
	(1,065)					(2,551)				
1994	3,145	3,174	2,847	1,417	6,919	8,766	8,939	8,169	3,982	17,131
	(1,189)					(2,768)				
1996	3,348	3,397	3,102	1,568	7,726	9,459	9,689	9,030	5,100	17,916
	(1,185)					(2,659)				
% Δ	116	115	106	132	125	123	128	120	147	119
CAGR	4.4%	4.3%	4.1%	4.8%	4.6%	4.5%	4.7%	4.5%	5.1%	4.5%

Standard deviations in ( )

CAGR: "Compound Annual Growth Rate"

Source: NCES Higher Education General Information Surveys (HEGIS), Integrated Postsecondary Education Data System (IPEDS) via WebCASPAR

Table 4
In-State, Out-of-State Tuition Differentials (1996 dollars)
Flagship Public Research and Doctoral Institutions

Year	Mean	Weighted Average	Median	Minimum	Maximum
1979	2,698	2,664	2,537	1,138	5,028
1981	2,798	2,793	2,517	1,077	5,321
1984	3,260	3,328	3,150	1,198	6,526
1988	4,016	4,133	3,878	1,469	8,968
1992	5,222	5,357	4,855	1,878	10,891
1994	5,620	5,765	5,471	1,770	11,439
1996	6,110	6,292	6,060	2,400	12,206
% Δ	126	143	139	111	143
CAGR	4.6%	4.9%	5.0%	4.2%	5.1%

Weights are full-time equivalent first time freshmen enrollment

Source: NCES Higher Education General Information Surveys (HEGIS), Integrated Postsecondary Education Data System (IPEDS) via direct surveys and WebCASPAR

Table 5
Need Based Grant Aid to Instate Undergraduate Public Students per FTE Public Undergraduate in the State (1996 dollars)
Flagship Public Research and Doctoral Institutions

Year	Unweighted Average	Standard Deviation	Median	Minimum	Maximum
1979	67.5	78.4	34.9	5.4	415.9
1981	77.2	89.9	45.2	4.5	410.9
1984	93.2	127.0	51.3	11.0	663.4
1988	117.0	134.2	60.9	10.3	594.8
1992	128.6	140.4	89.2	9.0	644.0
1994	139.1	162.4	92.0	10.8	881.1
1996	183.5	196.6	125.8	10.7	949.1
% Δ	171.7	150.8	260.6	97.8	128.2
CAGR	5.7%	5.2%	7.4%	3.9%	4.7%

Source: NASSGAP Annual Reports, HEGIS and IPEDS

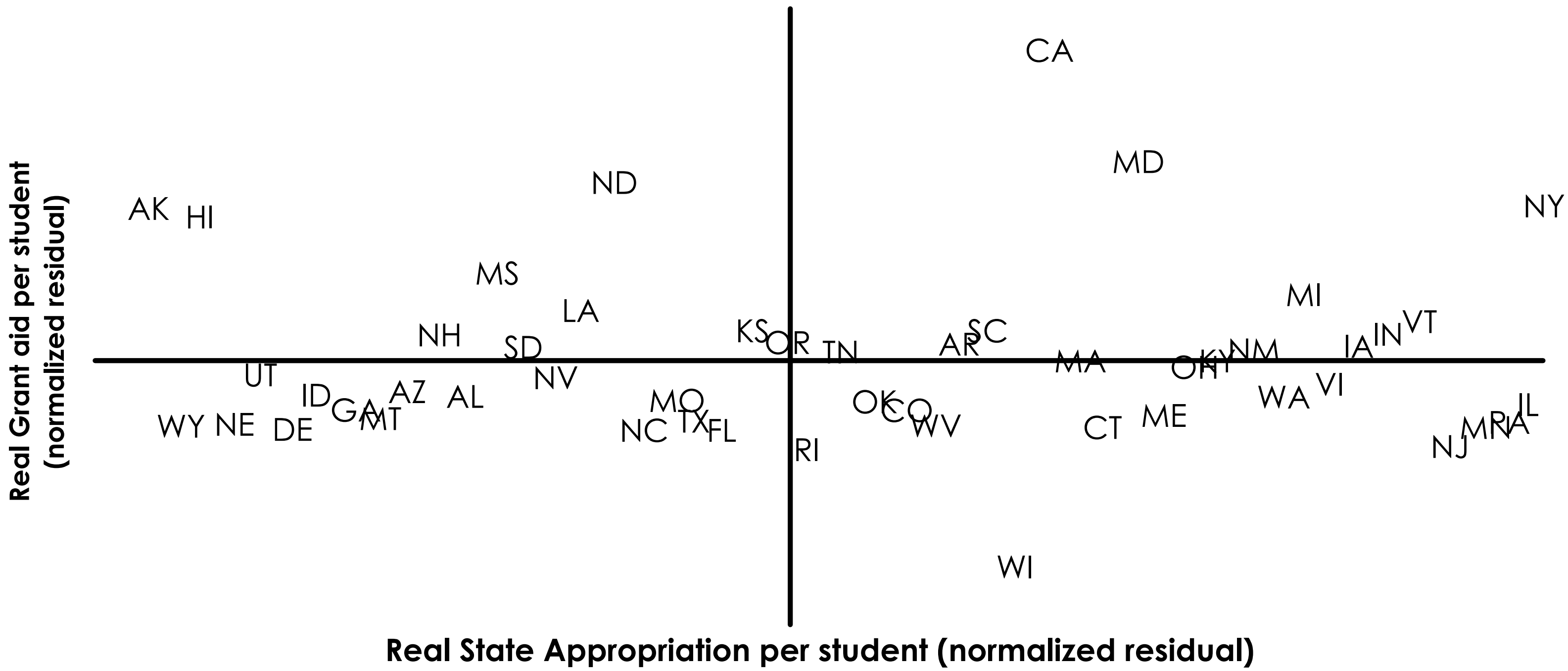
Table 6
State Appropriations per FTE Undergraduate (1996 dollars)
Flagship Public Research and Doctoral Institutions

Year	Unweighted Average	Weighted Average	Standard Deviation	Median	Minimum	Maximum
1979	9,446	8,932	4,355	8,430	3,200	25,297
1981	9,394	8,809	4,757	8,532	3,126	29,429
1984	9,977	9,544	4,495	9,162	3,180	26,045
1988	11,397	10,788	5,203	10,615	3,698	24,741
1992	11,227	10,934	4,769	10,549	3,300	26,736
1994	11,069	10,835	4,522	10,454	3,361	25,372
1996	11,204	10,922	4,429	10,666	3,180	24,421
% Δ	18.6	22.3	1.7	26.5	-0.6	-3.5
CAGR	1.0%	1.1%	0.1%	1.3%	0.0%	-0.2%

Source: HEGIS and IPEDS

Figure 2

1996 State Appropriation per Student vs. Need Based Grant Aid per Student*



* Plot of state averages of residuals from regression of state appropriations per student on per capita tax revenues versus residuals from regression of grant aid per student on per capita tax revenues.

Table 7
Tuition Reciprocity Agreements

I	*II*	*III*	*IV*	*V*	*VI*	*VII*
Year	# schools reporting reciprocal enrollments	agreements, but don't report enrollment	Mean share of undergrads that are reciprocal	Max share of undergrads that are reciprocal	Mean share of enrollment that are nonresidents*	Mean share nonresidents that are reciprocal
1979	3	36				
1981	4	35				
1984	10	29	3.6%	16.6%	21.5%	16.7%
1988	15	24	3.1%	22.4%	23.8%	13.0%
1992	20	19	7.6%	30.1%	24.2%	31.4%
1994	24	15	6.7%	30.1%	25.4%	26.4%
1996	28	11	5.5%	28.6%	23.9%	23.0%

** for those schools that report reciprocal enrollment*

Table 8 - Part A
State Need Based Grant Aid and Instate Tuition Equations
2SLS Results

**** 95% significance level***

		(i)	*(ii)*		*(iii)*	*(iv)*
		GRANT AID			IN-STATE TUITION	
Variable	Prior	Cross-Section	Panel	Prior	Cross-Section	Panel
Log need based grant aid per public student (AID)				D +	**0.202** *	0.011
					(0.047)	(0.155)
Log in-state tuition (TUITI)	B +	0.377	0.449			
		(1.059)	(0.769)			
Log state tax revenues per capita (TAX)	S +	**0.834** *	**0.188** *			
		(0.216)	**(0.078)**			
Share of population aged 18-24 (AGE)	S -	**-30.86** *	0.59	D +	**6.840** *	**-6.724** *
		(4.79)	(6.26)		**(2.310)**	**(1.233)**
Share of population with incomes below Max Pell allowable (ELIG)	D +	0.655	**1.300** *	D -	**-1.035** *	-0.123
		(1.308)	**(0.602)**		**(0.211)**	(0.230)
Log maximum Pell grant award (PELL)	B -	-15.25	0.92	D +	0.568	**2.273** *
		(11.66)	(2.23)		(4.047)	**(0.741)**
Percent cap on costs (CAP)	D -	**-4.470** *	0.533	D +	0.114	**0.674** *
		(2.190)	(0.600)		(0.728)	**(0.220)**
Post-1979 subsidized loan access (1979)	D +	0.709	0.469	D -	-0.153	**0.560** *
		(0.660)	(0.549)		(0.238)	**(0.205)**
Post-1992 subsidized loan access (1992)	D +		0.572	D -		**0.826** *
			(0.753)			**(0.248)**
Log state appropriations per student (APP)	B -	0.067	**0.547** *	B ?	**-0.286** *	**-0.223** *
		(0.322)	**(0.166)**		**(0.034)**	**(0.087)**
Log endowment per student (END)	B -	-0.009	0.004	B +	**0.021** *	0.009
		(0.036)	(0.024)		**(0.009)**	(0.009)
Ratio of fte grad to undergrad enrollments (GRAD)	D -	0.039	-0.106	B ?	**0.038** *	-0.024
		(0.076)	(0.072)		**(0.019)**	(0.032)
Share of ftefff in state in privates (PRIV)	B ?	0.829	**-1.815** *	S +	**0.716** *	**0.956** *
		(1.084)	**(0.928)**		**(0.125)**	**(0.289)**
Share of ftefff in state in 2 years (TWO)	B ?	**0.971** *	**1.141** *	S -	**-0.481** *	-0.157
		(0.430)	**(0.315)**		**(0.086)**	(0.194)
Weak barron's rank (LOWB)				D -	0.001	**0.061** *
					(0.003)	**(0.024)**
Strong barron's rank (HIGHB)				D +	**0.103** *	**0.066** *
					(0.041)	**(0.033)**
Weighted barrons's rank of privates in state (BPRIV)	B +	**0.332** *	0.064	D -	-0.048	0.023
		(0.059)	(0.058)		(0.026)	(0.024)
Weighted barrons's rank of publics in state (BPUB)	B ?	**0.189** *	0.007			
		(0.070)	(0.054)			
Log seating capacity (SEAT)	S +	**0.755** *	**0.885** *	D -	-0.094	-0.234
		(0.166)	**(0.285)**		(0.064)	(0.138)
Log composite regional tuition, ex-in state (TUITR)	B -	**0.298** *	-0.078	S +	0.044	**0.057** *
		(0.147)	(0.064)		(0.036)	**(0.020)**
Log unemployment (UNEMP)	D ?	0.265	0.011	D ?	**0.120** *	**0.085** *
		(0.238)	(0.098)		**(0.046)**	**(0.029)**
Log number of governing boards (GOV)	S ?	**0.236** *		S +	-0.007	
		(0.054)			(0.016)	
Adjusted R^2		0.568	0.501		0.677	0.855

Table 8 - Part B
Out-of-State Tuition and Nonresident Enrollment Share Equations
2SLS Results

**** 95% significance level***		***(v)***		***(vi)***			***(vii)***		***(viii)***	
		OUT-STATE TUITION					NON-RESIDENT SHARE			
Variable	Prior	Cross-Section		Panel		Prior	Cross-Section		Panel	
Log in-state tuition (TUITI)	S +	**0.329** **(0.065)**	*	**0.836** **(0.059)**	*					
Log out-state tuition (TUITO)						B ?	**-1.879** **(0.455)**	*	-0.049 (0.337)	
Log nonresident enrollment share (NON)	B ?	-0.053 (0.030)		-0.005 (0.054)						
Log regional composite tuition (TUITR)	D +	**0.117** **(0.022)**		**0.055** **(0.023)**	*	D +	**0.322** **(0.128)**	*	**0.355** **(0.067)**	*
Share of population aged 18-24 (AGE)	D +	**-0.680** **(1.130)**		**2.125** **(0.980)**	*	D +	4.021 (5.654)		**8.060** **(3.729)**	*
Share of population with incomes below Max Pell allowable (ELIG)	D -	**-1.000** **(0.157)**	*	0.031 (0.149)		D -	-1.677 (0.997)		-0.368 (0.628)	
Log maximum Pell grant award (PELL)	D +	-0.460 (2.820)		**0.957** **(0.401)**	*	D +	-2.667 (14.037)		3.344 (1.754)	
Percent cap on costs (CAP)	D +	-0.348 (0.501)		**0.205** **(0.096)**	*	D +	-0.856 (2.500)		**0.962** **(0.478)**	*
Post-1979 subsidized loan access (1979)	D -	0.047 (0.165)		**0.206** **(0.095)**	*	D -	0.261 (0.822)		0.413 (0.438)	
Post-1992 subsidized loan access (1992)	D -			**0.286** **(0.117)**	*	D -			0.288 (0.517)	
Log state appropriations per student (APP)	B ?	**-0.118** **(0.037)**	*	-0.044 (0.032)		B ?	**-1.248** **(0.133)**	*	-0.027 (0.149)	
Log endowment per student (END)	B +	**0.042** **(0.007)**	*	**0.019** **(0.006)**	*	B ?	**0.231** **(0.035)**	*	0.014 (0.027)	
Ratio of fte grad to undergrad enrollments (GRAD)	B ?	-0.024 (0.013)		**0.041** **(0.018)**	*	B ?	-0.092 (0.066)		-0.085 (0.075)	
Poor Barrons's rank (LOWB)	D -	**-0.115** **(0.023)**	*	0.011 (0.017)		D -	**-0.390** **(0.123)**	*	-0.010 (0.072)	
Strong Barrons's rank (HIGHB)	D +	**0.072** **(0.032)**	*	0.022 (0.024)		D +	0.048 (0.161)		0.066 (0.102)	
Institution's share of quality public seats in the state (BSPUB)	B +	-0.042 (0.037)		0.029 (0.028)		D +	**0.843** **(0.147)**	*	**0.256** **(0.114)**	*
Institution's share of qual. private seats in the state (BSPRIV)	B +	0.0017 (0.0013)		-0.0004 (0.0011)		D +	**0.018** **(0.006)**	*	0.000 (0.005)	
Share of quality seats in region that are private (SPRIV)	D +	**0.242** **(0.059)**	*	-0.103 (0.054)		D +	0.554 (0.308)		**-0.560** **(0.203)**	*
Log seating capacity (SEAT)	B ?	0.048 (0.043)		**0.163** **(0.064)**	*	S +	**0.998** **(0.174)**	*	**0.888** **(0.244)**	*
Log SAT (SAT)						S -	**-1.341** **(0.636)**	*	-1.086 (1.125)	
Log share of fte undergrads in reciprocity agreements (RECIP)	B ?	0.001 (0.005)		0.017 (0.010)		B ?	-0.045 (0.023)		**0.079** **(0.038)**	*
Log number of governing boards (GOV)	S +	**-0.031** **(0.009)**	*			S ?	**-0.039** **(0.009)**	*		
Log unemployment (UNEMP)	B ?	0.051 (0.030)		-0.050 (0.019)	*	B ?	0.004 (0.148)		-0.116 (0.078)	
Adjusted R^2		0.822		0.932			0.348		0.195	

Table 9
Effect of Selected Policy Changes on Outcomes
Fixed Effects Instrumental Variables Results

		Evaluated at 1996 level of appropriate variable		
Selected Policy Change	*Grant Aid*	*Instate Tuition*	*Out-of-State Tuition*	*Nonresident Share**
Increase state grant aid per fte undergrad in the state by $100 per student		$18		
Increase real in-state tuition by $1,000	$28		**$2,361**	
Increase real out-of-state tuition by $1,000				-0.4
Increase nonresident enrollment share by 10 perc. pts			-$24	
Increase state tax revenues per capita by $1,000	**$8**			
Increase maximum real Pell Grant award by $100	$8	**$308**	**$367**	33.7
Increase real state appropriations per student by $1,000	**$10**	**-$67**	-$37	-0.3
Increase real endowment per student by $1,000	$0	$2	**$13**	0.1
Increase ratio of grad students to first time frosh by 10 pts	-$2	-$8	**$39**	-0.8
Having lower than average Barron's ranking**		**$204**	$104	-0.1
Having higher than average Barron's ranking**		**$76**	$213	1.1
Increasing seating capacity .1 units	**$32**	-$136	**$47**	**8.9**
Increasing the number of governing boards by 1				
Having higher SAT scores by 100 points in your state				-10.8
Increasing the share of std. reciprocal by 10 perc. pts			$947	**0.8**
Average 1996 Value of Dependent Variable	#REF!	#REF!	#REF!	#REF!

Items in bold are significant at 95% level

** Elasticities - represents percentage change in share due to a 10% change in selected policy*

*** For enrollment equation, numbers indicate percentage point change in share due to being in this category relative to average*

**** Table reports marginal effects evaluated at mean*

Appendix Table 1
Sources and Definitions of Variables

Variable	Definition/Explanation *	Source
1979	Dummy for years subsequent to repeal of Middle Income Student Assistant Act in 1979 which reinstated "needs" test for eligibility for subsidized federal loans	1, 2
1992	Dummy for years subsequent to 1992 when the 5.64% of home equity that was taxable in the expected family contribution (EFC) calculation was removed from taxable assets	1, 2
AGE	Share of population in a state between age 18 & 24	3
AID	Logarithm of need based state grant aid to instate undergraduate students attending institutions in their own state per full-time equivalent four year undergraduate in the state. Includes federal matching LEAP/SSIG monies.	4
APP	Logarithm of state government appropriations in 000's per full-time equivalent undergraduate at the institution	5
BPRIV	Undergraduate enrollment weighted average Barron's ranking of all rated four-year private institutions in the state.	6, 5
BPUB	Undergraduate enrollment weighted average Barron's ranking of all rated four-year public institutions in the state.	6, 5
BSPRIV	Institution's undergraduate enrollment divided by the total undergraduate enrollment of all equally or more highly rated private (Barron's) institutions in the state	6, 5
BSPUB	Institution's undergraduate enrollment divided by the total undergraduate enrollment of all equally or more highly rated public (Barron's) institutions in the state (including the institution of observation).	6, 5

CAP	Maximum percentage of college costs covered by Pell Grants. Initially 50% of costs, raised to 60% in 1986 and eliminated in 1992.	7
ELIG	Share of state's households with incomes below the maximum allowable to be eligible to received federal grant aid. Maximum income eligibility estimated from EFC calculation.	8, 7
END	Logarithm of institutional endowment in 000's per full-time equivalent undergraduate at the institution.	5
GOV	Number of governing boards in the state.	9
GRAD	Ratio of full-time equivalent graduate students to full-time equivalent undergraduate institutions at the institution.	5
HIGHB	Dummy variable equal to one if Barron's ranking is "Highly Competetive" or "Most Competetive."	6
LOWB	Dummy variable equal to one if Barron's ranking is "Not Competetive" or "Less Competetive."	6
NON	Logarithm of the share of first-time freshmen that are nonresident, non-foreign students. In nonresident share equation, we use the log-odds ratio. That is the share divided by one minus the share.	5, 10
PELL	Logarithm of the maximum available Pell Grant award.	7
PRIV	Share of fteftf in state in privates (PRIV)	
RECIP	Logarithm of the share of full-time equivalent undergraduates enrolled under tuition reciprocity programs.	11

SAT	Average SAT score in the state (includes public and private high school students).	12
SEAT	Maximum number of full-time equivalent first-time freshmen enrollment in the state historically at public schools of equal or greater Barron's rank divided by the current number of high school graduates in the state.	5, 12
SPRIV	In the census region, the share of full-time equivalent first time freshmen in schools that are of equal or greater Barron's rank that are enrolled in private schools.	5, 6
TAX	Logarithm of total state tax revenues received per population in the state, excludes federal receipts, in 000's.	13, 3
TUITI	Logarithm of in-state tuition charged.	5
TUITO	Logarithm of out-of-state tuition charged.	5
TUITR (EQUN 1&2)	Logarithm of the enrollment weighted average of public out-of-state (for schools outside my state), public instate (for schools in my state, excluding my school) and private tuition in the census region.	5
TUITR (EQUN 3&4)	Logarithm of the enrollment weighted average of public in-state, public out-of-state and private tuition in the census region, including schools in the state of observation.	5
TWO	Share of public full-time equivalent first-time freshmen enrollment in the state that are in two-year colleges.	5
UNEMP	Logarithm of the state average unemployment rate.	14

** All data in real values using 1996 calendar year GDP implicit price deflator.*

Data Sources

1. United States Department of Education web-site
2. Michael Mumper, *Removing College Price Barriers,* SUNY Press, 1996.
3. U.S. Bureau of the Census, Population Estimates Program - Age distribution data on web-site.
4. National Association of State Scholarship and Grant Programs, Annual Survey Reports.
5. Integrated Postsecondary Education Data System Surveys via WebCASPAR. See http://caspar.nsf.gov or www.nces.ed.gov/ipeds.
6. *Barron's Profiles of American Colleges* , 1979-1996.
7. American Councilon Education Center for Policy Analyisis, *2000 Status Report on the Pell Grant Program* .
8. Current Population Surveys, *Estimates of Income of Households by State 1979-1996* .
9. Education Commission of the States.
10. Older resident enrollment data from Higher Education General Information Surveys not available on WebCASPAR v retrieved through original "Fall Residence and Migration Surveys."
11. Cornell Higher Education Research Institute (CHERI) *Survey of Tuition Reciprocity Programs at Public Research and Doctoral Institutions,* Summer 2001. Available on CHERI website at www.ilr.cornell.edu/cheri.
12. U.S. Department of Education, National Center for Education Statistics, *Digest of Education Statistics* .
13. U.S. Bureau of the Census, Census of Governments via the *Statistical Abstract of the United States.*
14. U.S. Department of Labor, Bureau of Labor Statistics. Employment and Earnings.