In-State versus Out-of-State Students: The Divergence of Interest between Public Universities and State Governments

Jeff Groen
University of Michigan
and
Michelle J. White
University of California, San Diego and RAND Corporation

April 2001

Abstract

This paper examines the divergence of interest between universities and state governments concerning standards for admitting in-state versus out-of-state students. States have an interest in using universities to attract and retain high ability individuals because they pay higher taxes and contribute more to economic development. Universities have an interest in their graduates being successful, but little interest in where students come from or where they go after graduation. We show that universities have an incentive to set equal admissions cutoffs for marginal in-state versus out-of-state students, but states have an interest in universities favoring in-state students.

We test the model for public and private universities and find that public universities favor in-state students in admissions much more strongly than private universities do. We also find that attending a public university increases a marginal in-state student's probability of locating in the state after graduation by more than it increases marginal out-of-state students' probability of locating in the state. However, marginal in-state students earn less than marginal out-of-state students as adults and therefore pay less in state taxes. Because the former effect more than offsets the latter, states gain financially when public universities admit a marginal in-state rather than out-of-state student. But an offsetting factor is that out-of-state students pay higher tuition than in-state students. This loss in tuition revenue more than offsets the gain in future state tax payments when a marginal in-state student substitutes for a marginal out-of-state student. We repeat the analysis for middle and high ability students in order to check whether state governments would gain by imposing a maximum as well as a minimum cutoff for admission. The results show that when a high ability in-state student substitutes for a high ability out-of-state student, the state gains more in expected future state tax revenues than it loses in foregone tuition revenue.

In-State versus Out-of-State Students:
The Divergence of Interest between Public Universities and State Governments[1]

Jeff Groen and Michelle J. White

States have an interest in using their public universities as tools to encourage economic development. Universities are useful tools of state economic development because university graduates have higher productivity and higher future earnings, so that they pay more in state taxes. Also, attending college in a particular state raises graduates' probability of locating in that state as adults, but the increase is greater for students from in-state than those from out-of-state. States therefore have an interest in universities favoring in-state over out-of-state students as applicants for admission.[2]

However, universities' interests are different from those of their states. Both public and private universities have an interest in attracting high ability students, in maximizing revenue from tuition and donations, and/or in having graduates who are rich or famous, but they have little or no interest in where their students come from or where they go after graduation. Public universities in particular often have a financial incentive to favor out-of-state over in-state students, because out-of-state students pay higher tuition and public universities may be able to keep the additional revenue for their own purposes. Private universities have no particular interest in encouraging economic development in their home regions, since economic development raises wages and land prices. These factors suggest that there is a divergence of interest between public and private universities and their state governments. Universities do not necessarily have an incentive to act in the best interests of their states.

In this paper, we explore the divergence of interest between public and private universities and their states. We focus in particular on states' interest versus public and private universities' behavior in admitting in-state versus out-of-state students. We develop several behavioral rules representing states' interest and universities' interest and test them on data for both public and private universities.

---

[1] We are grateful to John Bound, Caroline Hoxby, and Rohini Somanathan for very helpful comments. A previous version of this paper was presented at the University of Michigan and at the NBER Higher Education Workshop. We also benefited from comments by participants at these presentations.

[2] A number of states have or are considering programs to encourage graduates to remain in-state. See Appendix 1 for a partial list.

After a brief literature review, section 2 presents several simple theoretical models that illustrate the divergence of interest between universities and their state governments. The theoretical models yield conditions that determine the optimal split between in-state and out-of-state students from both universities' and state governments' viewpoints. Section 3 tests the models, using the Mellon Foundation's *College and Beyond* dataset. Our main result is that public universities favor in-state over out-of-state students much more strongly than private universities do. We also find that states gain in expected future state tax revenues when marginal in-state rather than out-of-state students are admitted, but the difference is more than offset by the higher tuition charge levied on out-of-state students. Thus when public universities admit many out-of-state students, they are not necessarily acting against their states' interest. Finally we examine whether states would benefit if public universities impose maximum as well as minimum cutoffs for admission to the public university.[3]

1. **Literature Review**

In a historical study of the development of higher education in the U.S., Goldin and Katz (1998) provide support for the idea that state governments have historically viewed public universities as a tool for encouraging economic development. They show that most public universities were founded around the turn of the 20th century, a time when manufacturing, mining and agriculture were all becoming more specialized and science-based. Public universities were founded both to train educated workers in these fields and to conduct research to advance the fields. Goldin and Katz document that individual states established specialized faculties at public universities to conduct research and provide training in specific areas that each state's economy specialized in. Examples include tobacco production in North Carolina, dairy farming in Wisconsin, mining in Colorado, and oil exploration/refining in Texas. When students studied these areas, their productivity would increase by more if they remained in the state than if they left for an alternate state.[4]

Quigley and Rubinfeld (1993) examined how the supply of public universities varies across states. They show that states with higher private university enrollment have lower public university enrollment and vice versa. They also show that there is wide variation across states in the level of

[3] For ease of exposition, we often use the term "university" to refer to both colleges and universities.

tuition and the level of state support for public universities. They estimate a reduced form model that explains the size of public universities, using aggregate data for U.S. states over time. An interesting result of their analysis is that, in states with more mobile populations, less money is spent on public higher education. Presumably these states expect to attract educated migrants from other states and/or expect local students to move elsewhere, so that they have less need to provide public universities to educate the local population. See also Hoenack and Pierro (1990).

There has been quite a bit of research on the economics of higher education more generally. Rothschild and White (1994) provide a model of production of higher education in which students are both purchasers of the output of higher education and inputs into the production process for higher education, because of peer effects on learning. Epple, Romano, and Sieg (1999) test the importance of peer effects by examining how universities set financial aid (tuition discounts) for individual students. They find that universities that have average student quality in the middle of the overall student quality distribution charge lower tuition to more able students, presumably because these students have positive peer effects. Hoxby (1997) argues that, over the period since World War II, U.S. universities have been transformed from local autarkies into competitors, since students who previously attended universities close to home are now more likely attend universities that are more distant. This means that universities are increasingly forced to compete for students on regional or national markets. Hoxby argues that the increase in competition gave universities an incentive to raise quality, since investments in increasing quality have higher returns when markets are larger. The result is that tuition has risen and universities' student bodies have become more homogeneous, i.e., the top students are more likely to attend the best universities, and students with lower ability levels are more likely to attend lower quality universities. Hoxby documents these trends by showing that students have become less likely to attend college in their home states, that the standard deviation of students' SAT scores has declined over time at all types of universities, and that tuition levels have increased rapidly. See also Cook and Frank (1993).

There are at least two other explanations for the rise in higher education tuition levels. Clotfelter et al. (1991) argue that the return to a college education has been rising over time and that this has increased demand for higher education and allowed universities to raise tuition without cutting class size. Brewer, Eide, and Ehrenberg (1999) also found that the return to a college

[4] Goldin and Katz also argue that increasing specialization of knowledge around the turn of the 20th century meant that the efficient scale of universities increased substantially. This made it difficult for new entry of private universities to occur.

education varies with university quality and is higher for students who attend higher quality universities. This would suggest that higher quality universities are able to raise tuition by more than lower quality universities – a testable hypothesis. Mixon and Hsing (1994) find that demand by out-of-state students to enroll at public universities rises as quality increases. Another approach to explaining the rise in tuition uses Baumol's (1967) argument that the cost of producing services rises more quickly than the cost of producing goods, since productivity improvements occur more quickly in manufacturing than in services. Clotfelter (1996) examines four universities in detail to explore how and why costs have risen. See also McPherson, Schapiro, and Winston (1993).[5]

2. **Theory**

We first examine public and private universities' interest in admitting in-state versus out-of-state students and then examine the state's interest. Our model is specifically oriented to selective universities, regardless of whether they are public or private. Because the model is intended for empirical implementation, we intentionally keep it simple.

2.1 *The university s interest*

The *equal cutoff rule.* Consider first the interest of public and private universities in admitting in-state versus out-of-state students. We start with considerations that apply to both types of universities. Suppose the ability level of in-state students is denoted s_i and the ability level of out-of-state students is denoted s_o. The numbers of in-state and out-of-state students of ability level s_i who apply to the university and would attend if accepted are denoted $n_i(s_i)$ and $n_o(s_o)$, respectively. Universities are assumed to select students by adopting minimum cutoff scores of $\bar{s}_i$ for in-state applicants and $\bar{s}_o$ for out-of-state applicants. They reject all in-state applicants with $s_i < \bar{s}_i$ and all out-of-state applicants with $s_O < \bar{s}_O$ and they accept all in-state applicants with $s_i \geq \bar{s}_i$ and all out-of-state applicants with $s_O \geq \bar{s}_O$.[6] Universities also have binding

[5] Bowen and Bok (1998) examine the experiences of African-American versus white students at 30 colleges and universities.

[6] Because we assume that universities accept all in-state applicants who have $s_i \geq \bar{s}_i$, $n_i(s_i)$ equals the number of in-state applicants of ability level s_i times the "yield rate" for in-state applicants of ability level s_i. (The yield rate is the probability of an accepted student attending the university.) The same applies to $n_o(s_o)$. The functions $n_i(s_i)$ and

capacity constraints (total class size) of $\overline{N}$. Assume that the universities' goal is to maximize the average ability level of their students, subject to the capacity constraint. They therefore set the cutoff levels $\bar{s}_i$ and $\bar{s}_o$ so as to maximize:

$$(\frac{1}{\overline{N}})[\int_{\bar{s}_i}^{\infty} s_i n_i(s_i) ds_i + \int_{\bar{s}_o}^{\infty} s_o n_o(s_o) ds_o], \tag{1}$$

subject to the capacity constraint:[7]

$$\overline{N} = \int_{\bar{s}_i}^{\infty} n_i(s_i) ds_i + \int_{\bar{s}_o}^{\infty} n_o(s_o) ds_o. \tag{2}$$

The first order condition is:

$$\bar{s}_i = \bar{s}_o. \tag{3}$$

This condition says that the cutoff levels for admission of in-state and out-of-state students should be the same. We refer to this result as the "equal cutoff rule." It follows from the fact that universities are assumed to care only about the average ability of their students, not about where they come from. We test below whether public and private universities follow the equal cutoff rule. If private universities are found to set equal cutoffs for both types of students while public universities are found to set lower cutoffs for in-state students, then the result will provide support for the hypothesis that states require or pressure public universities to admit lower ability in-state students.

The *equal marginal revenue rule.* Another formulation of universities' interest assumes that they wish to maximize a hybrid of average student ability and total revenues. Suppose universities still admit students in declining order of ability until they reach the relevant cutoff, but they set the cutoff levels so as to maximize total revenues collected from in-state and out-of-state students, rather than to maximize average student ability. Suppose T_i and T_o denote tuition levels charged in-state and out-of-state students, respectively. Tuition levels for in-state versus out-of-state students always differ at public universities, but they may also differ at private universities if universities systematically give larger tuition discounts (financial aid) to one group of students or

---

$n_o(s_o)$ are likely to differ because some students wish to attend university near their homes. As a result, the yield rate will tend to be higher for in-state than out-of-state students at the same ability level. We treat these functions as fixed because our dataset does not contain information on the full set of applicants at particular institutions.

[7] The capacity constraint must be binding or else universities could maximize average ability by accepting only the single student with the highest ability who is willing to attend.

the other. Universities also collect revenue from graduates in the form of donations.[8] Suppose $D_i(s_i)$ and $D_o(s_o)$ denote the expected present value of future donations made by in-state and out-of-state students of ability levels s_i and s_o, respectively. Future donations are assumed to depend on student ability, because higher ability students have higher average earnings. Universities are now assumed to set the cutoff levels $\bar{s}_i$ and $\bar{s}_o$ so as to maximize the sum of tuition plus donations from in-state and out-of-state students, or:

$$\frac{1}{\overline{N}}[\int_{\bar{s}_i}^{\infty}(D_i(s_i)+T_i)n_i(s_i)ds_i+\int_{\bar{s}_o}^{\infty}(D_o(s_o)+T_o)n_o(s_o)ds_o], \tag{4}$$

subject to the capacity constraint, eq. (2).

The first order condition is:

$$D_i(\bar{s}_i)+T_i=D_o(\bar{s}_o)+T_o. \tag{5}$$

This expression says that universities have an interest in setting the cutoff levels for in-state and out-of-state students such that the same amount of revenue in the form of tuition plus future donations is collected from the marginal student of each type admitted.[9]

Eq. (5) suggests several reasons why both public and private universities may have an incentive to set lower cutoff levels for in-state students (or for students who live nearby), rather than equal cutoffs. One reason is that in-state students are more likely to locate near the university as adults and this may cause them to donate more on average than out-of-state students having the same ability levels. This would give both public and private universities an incentive to favor in-state students by setting a lower cutoff level for them. Another reason, which applies more to private than public universities, emerges from the fact that universities have spatial monopoly power over in-state (nearby) students, because some of these students wish to attend college near their homes. Private universities may take advantage of this power by charging higher tuition or giving less financial aid to nearby students. (See Epple et al., 1999, for discussion.)

These considerations suggest that both public and private universities have an interest in setting lower cutoffs level for in-state students. For public universities, this is because marginal in-state students will make higher expected donations than marginal out-of-state students will. For private universities, it is because marginal in-state students both pay higher tuition and make higher

[8] Donations have historically been an important source of revenues for private universities, but not for public universities, although that appears to be changing.
[9] We don't currently have data to test this prediction, but we hope to test it in the future.

donations in the future than marginal out-of-state students do. An additional motive may be that public universities favor in-state students because the state wishes them to do so, while private universities favor in-state students because they wish to maintain support/good will from their local communities.[10]

2.2 *The state s interest*

The *equal additional tax payments rule.* Now consider the interests of an arbitrary state, which we refer to as state *X*. In line with our discussion above of states using universities as tools of state economic development, we assume that state *X* s goal is to maximize the present value of future state tax revenues. Most states collect the bulk of their tax revenue from income and sales taxes. Because these taxes are roughly proportional to income, high ability individuals pay higher taxes because they earn more. (Individuals that have high incomes tend to pay higher amounts of other state taxes, such as property taxes and business taxes, as well.) Therefore state *X* has an interest in both retaining high ability in-state students and attracting high ability out-of-state students. Both in-state and out-of-state students are assumed to have a choice between attending college in state *X* or in some other state. If students attend college in state *X* rather than another state, we assume that their probability of locating in state *X* as adults rises, regardless of whether they are from state *X* or from another state.[11]

Suppose p_{ij} denotes students' probabilities of locating in state *X* as adults. The subscript *i* equals *y* if state *X* is the student's home state and *n* otherwise. The subscript *j* equals *y* if the student attend college in state *X* and *n* otherwise. Thus p_{yy} is the probability of students locating in their home states as adults if they attend college there, p_{yn} is the probability of students locating in their home states as adults if they attend college out-of-state, and $\Delta p_i = p_{yy} - p_{yn}$ denotes the increase in the probability of in-state students locating in their home states if they attend college

[10] An alternate interpretation of private universities' behavior would be that "in-state" students are those whose parents attended the university. Private universities have an incentive to set lower cutoffs for these students, because they and their parents are expected to donate more and are willing to pay higher tuition, holding everything else constant.

[11] Some in-state students' alternative to attending the public university in state *X* is to attend a less selective public university in state *X*, rather than to attend a university in some other state. In this case students' probability of locating in state *X* as adults is unaffected by whether they are admitted to the selective public university in *X* or not, so that – according to our model – state *X* does not benefit when they are admitted to the selective public university. However another benefit of admitting these students is that attending the selective public university raises students' productivity

there rather than elsewhere. Similarly, p_{ny} is the probability of out-of-state students locating in the state where they attend college as adults, p_{nn} is the probability of students locating in a particular state as adults if they are neither from the state nor attend college there, and $\Delta p_o = p_{ny} - p_{nn}$ denotes the increase in the probability of out-of-state students locating in a particular state if they attend college there rather than elsewhere. We assume that all of these terms vary with students' ability levels. Thus we have $\Delta p_i(s_i)$ and $\Delta p_o(s_o)$. We assume that both $\Delta p_i(s_i)$ and $\Delta p_o(s_o)$ are positive and that $\Delta p_i(s_i) > \Delta p_o(s_o)$ at any $s_i = s_o$. (We present evidence concerning these assumptions below.)

Suppose $t_i(s_i)$ denotes the average present value of future state tax payments by in-state graduates having ability level s_i, conditional on locating in state *X* as adults. Similarly, $t_o(s_o)$ denotes the average present value of future state tax payments by out-of-state graduates having ability level s_o, conditional on locating in state *X*. We assume that the present value of future state tax revenues is positively related to ability for both types of students.

The state's goal is for the public university to set cutoff levels $\bar{s}_i$ and $\bar{s}_o$ so as to maximize the additional expected future tax payments by both in-state and out-of-state students that result from attending public university in state *X* rather than elsewhere, or:

$$[\int_{\bar{s}_i}^{\infty} \Delta p_i(s_i) t_i(s_i) n_i(s_i) ds_i + \int_{\bar{s}_o}^{\infty} \Delta p_o(s_o) t_o(s_o) n_o(s_o) ds_o], \tag{6}$$

subject to the same capacity constraint, eq. (2). The first order condition is:

$$\Delta p_o(\bar{s}_o) t_o(\bar{s}_o) = \Delta p_i(\bar{s}_i) t_i(\bar{s}_i). \tag{7}$$

Eq. (7) says that the state wants the public university to set cutoff levels such that the additional expected future state tax revenue collected from the marginal student admitted is the same for in-state versus out-of-state students. We call this the "equal additional tax payments rule." If the functions $\Delta p_o(s_o)$ and $\Delta p_i(s_i)$ are identical in the region of the cutoff levels and the functions $t_i(s_i)$ and $t_o(s_o)$ are also identical in the region of the cutoff levels, then the cutoffs $\bar{s}_i$ and $\bar{s}_o$ for in-state and out-of-state students should be the same. But since we assumed that $\Delta p_i(s) > \Delta p_o(s)$,

relative to attending a less selective public university. We ignore this benefit here because our dataset includes only selective universities and does not include any second tier public universities.

the state will favor a lower cutoff level for in-state students. Note that if $\Delta p_o(\bar{s}_o)$ were equal to zero, then the state would favor admitting no out-of-state students at that ability level. The same applies to in-state students if $\Delta p_i(\bar{s}_i) = 0$.

The *tuition offset rule.* States in fact receive revenue from students in two forms: tuition payments from current students and future state tax payments from graduates who locate in the state as adults. Therefore another formulation of the state's objective is for public universities to determine the cutoff levels for in-state versus out-of-state students by maximizing the sum of tuition revenues plus the increase in expected future tax revenues from both types of students, or:

$$[\int_{\bar{s}_i}^{\infty}(T_i + \Delta p_i(s_i)\tau(s_i))n_i(s_i)ds_i + \int_{\bar{s}_o}^{\infty}(T_o + \Delta p_o(s_o)\tau(s_o))n_o(s_o)ds_o], \qquad (8)$$

subject to the capacity constraint, eq. (2).

The first order condition implies that:

$$T_o - T_i = \Delta p_i(\bar{s}_i)\tau_i(\bar{s}_i) - \Delta p_o(\bar{s}_o)\tau_o(\bar{s}_o). \qquad (9)$$

Eq. (9) says that the extra tuition paid by out-of-state relative to in-state students should just offset the difference between the expected increase in future state tax payments by the marginal in-state relative to out-of-state student admitted to the public university. If this condition holds, then public universities are acting according to the state's interest. But if the left hand side of condition (9) is less than the right hand side, then it would be in the state's interest for public universities to set a lower cutoff for in-state relative to out-of-state students, and vice versa. We refer to this result as the "tuition offset rule" and we test it below.[12]

Maximum cutoffs. So far we have assumed that it is in the state's interest for universities to admit students in declining order of ability and to set only minimum cutoff levels of $\bar{s}_i$ and $\bar{s}_o$ for in-state and out-of-state students, respectively. However states may not have lexicographical preferences for higher over lower ability students and may in fact prefer that universities set multiple cutoffs for one or both groups of students. In particular, we wish to investigate the possibility that states might have an interest in universities rejecting the highest ability applicants from in-state or out-of-state, because these students are unlikely to settle in the state even if they

---

[12] The formulation in the text assumes that tuition revenue goes directly to the state. An equivalent interpretation is that tuition revenue goes to the university but the state has to pay the university $T_o - T_i$ for each in-state student.

attend college there. This possibility is of interest because state legislators often seem reluctant to support public universities at the expenditure levels required to attract high ability students.

Suppose $\tau_o(s_o)$ and $\tau_i(s_i)$ increase monotonically with ability (since earnings are positively related to ability), while $\Delta p_i(s_i)$ and $\Delta p_o(s_o)$ may be either increasing or decreasing with ability. (We present data below.) Then one possibility is that $\Delta p_i(s_i)\tau_i(s_i)$ and $\Delta p_o(s_o)\tau_o(s_o)$ have the shapes shown in figure 1. Here $\Delta p_i(s_i)\tau_i(s_i)$ increases monotonically as s_i rises, but $\Delta p_o(s_o)\tau_o(s_o)$ rises and then falls as s_o rises. As a result, states want universities to set minimum cutoffs of $\bar{s}_i$ and $\bar{s}_o$ for in-state and out-of-state students respectively, but in addition states want their universities to set a maximum cutoff of $\tilde{s}_o$ for out-of-state students. This is because the increase in expected future state tax payments by out-of-state students as a result of attending college there declines rapidly at very high levels of student ability. If the curve for in-state students also turned downward at high ability levels, then states might also want universities to set maximum cutoff levels for in-state students.[13] This consideration suggests a rationale for Federal intervention to subsidize provision of public universities in states that have high emigration rates.[14]

These arguments suggest that states may have an interest in their public universities having an intermediate quality level: not too high because the highest quality students are unlikely to be influenced in their location decisions by whether they attend college in the state, but not too low because then high quality in-state students would attend college elsewhere and this would make them less likely to settle in the state as adults.[15]

2.4 *Summary*

The theoretical discussion resulted in several testable hypotheses. First, if universities wish to maximize average student ability and are free to follow their own interests, then they are predicted to follow the "equal cutoff rule." Second, states prefer that universities set minimum cutoff levels

[13] Giving incentives to high ability students to stay in the state would be an alternate response. A note in the *Chronicle of Higher Education*, Dec. 11, 1998, indicates that the state of Alaska is considering giving $10,800 to high ability in-state students who attend the University of Alaska for four years. Other states give high ability students scholarships to attend public and sometimes also private universities in the state.

[14] Quigley and Rubinfeld (1993) noted the negative effect of higher migration on states' incentive to spend money on public universities, but did not investigate the quality versus quantity tradeoff.

[15] An additional argument for states to favor admitting high quality students from either in-state or out-of-state is the fact that students are both purchasers of universities' services and an input into the production process – since peer

for the two groups of students such that the expected increase in future state tax payments when a marginal in-state student rather than a marginal out-of-state student is admitted just offsets the extra tuition paid by the out-of-state student. Third, states may have an interest in universities' setting maximum as well as minimum cutoffs for in-state and/or out-of-state students, depending on how the highest ability students are influenced in their adult location decisions by attending the state university.

We test these hypotheses for both public and private universities. We use both types of universities on the grounds that private universities are unlikely to be influenced by their states' preferences, so that their behavior is more likely to follow the model of university behavior discussed above. In contrast, public universities are likely to follow a path that is intermediate between their states' preferences and private universities' preferences.

3. **Empirical Work**

Our data are taken from the Mellon Foundation's *College and Beyond (C&B)* dataset. This dataset includes college records and background information from students at 30 selective to highly selective colleges and universities, including four public universities.[16] There are three separate cohorts of students, of which we analyze two.[17] The earlier cohort consists of 32,000 students who entered college in 1976. We have information from college records for these students, as well as from a survey conducted by the Mellon Foundation in 1996, for which there were 23,500 responses. The survey includes information concerning state of residence, income, etc. The later cohort consists of 36,000 students who entered in 1989, of whom 11,500 responded to the 1996 survey. We add information concerning tuition levels at the time each cohort attended college.[18]

---

effects are a factor in the learning environment and higher ability students improve the learning environment for all students (Rothschild and White, 1995).

[16] Some of the data are taken from the Cooperative Institutional Research Program (CIRP), through the Higher Education Research Institute at UCLA. The CIRP freshman survey was administered to some of the students in the *C&B* sample. See Astin et al. (1997) for a full description. For purposes of this study, the Mellon Foundation added to the dataset the current state of residence for survey respondents.

[17] The third cohort matriculated in 1951. We do not analyze it because few of the observations include standardized test scores, which we use as our measure of student ability. (Standardized tests were not widely used at that time.)

[18] A detailed description of the *C&B* dataset is given in Bowen and Bok (1998). A drawback of the dataset is that the institutions were not randomly chosen (in part because they were chosen on the basis of willingness to participate in the study). However they are generally representative of selective institutions and have similar admissions criteria. We omit three institutions in the dataset from our study because their student records did not include sufficient information on students' home states and/or test scores. A list of universities is given in Appendix 2. For the private institutions, all students in the entering class were included in the dataset. For the public universities, a sample of 2,000 students

Table 1 shows that the average proportion of in-state students in the 1976 cohort was .84 at the public universities, compared to .29 at the private universities. Both figures fell between 1976 and 1989, reflecting Hoxby's (1997) finding that, over time, students have become more likely to attend universities further away from their homes. In 1989, the in-state proportions were .76 and .23, respectively.

3.1 *Do universities follow the equal cutoff rule?*

Turn first to the question of whether universities follow the "equal cutoff rule." We treat SAT scores as our measure of student ability. Because it is impossible to identify a single student as *the* marginal in-state or out-of-state student, we treat all in-state students in the lowest decile of the distribution of in-state students at each university as marginal in-state students and we follow the same procedure for out-of-state students. For each institution in the dataset, we construct the average SAT score for marginal in-state and marginal out-of-state students, denoted $\bar{s}_i$ and $\bar{s}_o$, respectively. We then compute the difference between the two cutoffs for each institution, $(\bar{s}_o - \bar{s}_i)$.[19] Because the rules of the *C&B* dataset do not allow us to identify individual institutions, we report the value of $(\bar{s}_o - \bar{s}_i)$ averaged over the groups of public and private universities.

The results are given in table 1. For the 1976 cohort at public universities, the average value of $(\bar{s}_o - \bar{s}_i)$ is 32 points and the minimum and maximum values are 5 and 45, respectively. Thus all four of the public universities set higher cutoff levels for out-of-state students. The results support the hypothesis that public universities act according to their states' preferences by favoring admission of marginal in-state students over marginal out-of-state students. Now turn to the private universities. The average value of $(\bar{s}_o - \bar{s}_i)$ among the 23 private universities is 26 points, with a minimum of -68 and a maximum of 139. Thus, on average, private universities also give in-state students an advantage in admissions, but the advantage is smaller than at public universities and it varies more widely among institutions.

How important is the admissions advantage given to in-state students? To examine this issue, we construct the combined distribution of SAT scores for in-state and out-of-state students at each

---

from each entering class was selected. We use institutional sample weights to account for the probability of being sampled.

[19] Only ACT scores are available for some students. We converted these to equivalent SAT scores, using the equipercentile method.

institution and then determine the proportion of the combined distribution that is between the minimum cutoff values for the two groups of students. For the average public or private university in the 1976 cohort, the share of the combined distribution of SAT scores that falls between the in-state and out-of-state cutoffs is only 1 percent – which suggests that the in-state advantage is relatively small.

However, our calculations of in-state students' advantage in admissions may be affected by other factors in the admissions process, such as recruitment of athletes and minorities. These groups are likely to be heavily represented in the lower tail of the SAT distributions and may also have different in-state versus out-of-state distributions than students in general. Table 1, upper panel, shows that in 1976, only 6 percent of marginal in-state students at public universities were athletes, compared to 34 percent of marginal out-of-state students. Also, 36 percent of marginal in-state students at public universities were minorities, compared to 28 percent of marginal out-of-state students. Together, 52 percent of marginal out-of-state students at public universities were either athletes or minorities, compared to 40 percent of marginal in-state students. For private universities, athletes in the marginal group were equally likely to be from in-state versus out-of-state (17 percent versus 18 percent, respectively), while minorities in the marginal group were more likely to be from in-state (43 percent for in-state versus 34 percent for out-of-state). Because these figures are high, we re-run the calculations omitting both groups.[20]

The results are shown in the lower panels of table 1. When only athletes are omitted, the average preference given to in-state non-athletes increased from 32 to 78 at public universities and the share of the overall distribution that is between the two cutoffs increases from .01 to .05. For private universities, there is no change in the mean preference. Because many of the marginal out-of-state students at public universities are athletes, eliminating them raises $\bar{s}_O$ and therefore increases the preference given to in-state students.[21] In contrast at private universities, athletes are

[20] In re-running these calculations, we start with the full sample, drop the relevant group (athletes or minorities or both), and then select the lowest 10% of the distribution of in-state or out-of-state students. We define an athlete as anyone who played an intercollegiate sport during college. We would have like to use a more restrictive definition of athletes, such as those who were recruited as athletes, but this information was not available. Minorities include African-Americans, Hispanics, and Native Americans.

[21] Apparently state legislators know this. In 1987, the Michigan Senate appropriations bill for higher education contained an amendment designed to limit the number of out-of-state students at the University of Michigan. According to the amendment, "qualified Michigan applicants to Michigan public college and universities shall have priority for admission." After the amendment was passed, Senator Lana Pollack, whose district includes Ann Arbor and who opposed the amendment, sponsored another amendment that would make certain the original measure applied to college athletes as well as to non-athletes. The second amendment was defeated (Jaschik, 1987).

not disproportionately from in-state versus out-of-state, so that eliminating them has little effect. When minorities are omitted, the average in-state preference drops from 32 to 17 at public universities and from 26 to 14 at private universities. This is because minorities in the marginal SAT group are disproportionately from in-state, so that eliminating them raises $\bar{s}_i$ and/or lowers $\bar{s}_o$ and therefore reduces the difference between them. When both groups are omitted, the overall preference given to in-state students increases from 32 to 52 at public universities and decreases from 26 to 10 at private universities.[22] The share of the distribution that is between the cutoffs is .05 at public universities and less than .01 at private universities.

Thus when athletes and minorities are omitted, public universities give a much larger advantage in admissions to in-state students, while private universities on average give these students only a very small advantage. These results are as expected, since they suggest that public universities reflect their states' preferences by giving in-state students who are not in special categories a stronger advantage in admissions than private universities do.

We repeat the analysis using the 1989 cohort and the results are shown on the right hand side of table 1. The pattern of results is similar, but both public and private universities give in-state students a larger advantage in 1989 than in 1976. The difference in minimum cutoffs when athletes and minorities are omitted is 93 points for public universities and 36 for private universites. Again all four of the public universities set lower minimum cutoffs for in-state students, but the behavior of private universities is more variable and some of them give an advantage to out-of-state students. The share of the distribution that is between the cutoffs is .10 at public universities and .01 at private universities.

The discussion thus far has not considered why private universities would find it worthwhile to give any advantage in admissions to in-state students. One possibility is that in-state students are more likely to locate nearby as adults and to become involved in alumni activities and/or donate money or time.[23] Another possibility is that private universities might also wish to gain favor with their state governments by giving in-state students a small advantage in admissions.

3.2 *How does attending college in a state affect marginal students probabilities of locating in that state as adults?*

---

[22] All four of the public universities still give in-state students an advantage when these corrections are made.

Testing the "equal additional tax payments rule" requires that we estimate the increase in the probability of marginal in-state versus out-of-state students choosing to locate as adults in the state where they attended college. These effects are denoted $\Delta p_i(\bar{s}_i)$ and $\Delta p_o(\bar{s}_o)$ for in-state and out-of-state students, respectively, in the lowest region of the relevant SAT distributions. We use a conditional logit model. Our sample consists of students in the 1976 cohort who responded to the post-college survey. We drop students who are from outside the U.S. or lived outside the U.S. at the time of the survey. Also for reasons discussed below, we drop students who did not answer questions in the survey that asked which universities they applied to. Each student enters the sample 51 times, once for each state in the U.S. (including D.C.). The dependent variable equals one for the state in which the student lived at the time of the survey and zero for all other states. Define a dummy variable *home/college* that equals one if the student is from the state and also attended college in the state, a dummy variable *home/~college* that equals one if the student is from the state but attended college in a different state, and a dummy variable *~home/college* that equals one if the student is not from the state but attended college in the state.[24] The omitted category is students who are neither from the state nor attended college in the state. In order to estimate Δp_i and Δp_o for the marginal group of students, we interact the location variables with dummy variables for whether students are in each of three groups within the distribution of SAT scores: the lowest quintile ("low SAT"), the highest quintile ("high SAT"), and the three middle quintiles ("middle SAT"). Our estimate of $\Delta p_i(\bar{s}_i)$ is based on the difference between the coefficients of *home/college* and *home/~college* for the lowest quintile of students. Since *~home/~college* is the omitted category, our estimate of $\Delta p_o(\bar{s}_o)$ is based on the coefficient of *~home/college* for the lowest quintile of the distribution of out-of-state students. In order to estimate $\Delta p_i(s_i)$ and $\Delta p_o(s_o)$ separately for marginal students at public versus private universities, we also include interactions with whether students attended public versus private universities.[25] (We use the lowest quintile rather than the lowest decile of the relevant distributions as our marginal group, because

[23] We repeated the analysis using the lowest 20% of SAT scores, rather than the lowest 10%, and the results were similar.
[24] Students' home states are assumed to be the states where the high schools from which they graduated are located.
[25] The specification also includes a constant term for each state. These terms capture the relative size of states and other factors (such as climate) that vary across states but not across individuals.

some of the data used in the estimation come from the post-college survey and it has fewer observations than the set of college records used in the previous section.)

Table 2 shows the results. All of the location variables are highly significant and most of the interaction terms are also significant. Not surprisingly, students' probabilities of locating in a state are highest if they are both from the state and attended college there and are successively lower if they are from the state but did not attend college there, if they only attended college there, and if they did neither.

Table 3, columns (1) and (2), show the estimates of p_{yy}, p_{yn}, Δp_i, p_{ny}, p_{nn}, and Δp_o for public versus private universities. The probability of students in the lowest quintile locating in their home states as adults if they attended college there (p_{yy}) is .55 for public university students and .50 for private university students. These figures suggest that home state is an important factor in determining graduates' post-college location choice. Alternately if students attended college outside their home states, their probabilities (p_{yn}) of locating in their home states after college fall to .24 for public university graduates and .34 for private university graduates. Thus the increase in the probability of in-state students locating in their home states if they attended college there (Δp_i) is .313 for public university students, compared to .161 for private university students. For out-of-state students, the probabilities of locating in the state where they attended college (p_{ny}) are .15 and .07 if they attended public or private universities, respectively. Finally students' probability of locating in particular states if they are neither from the state nor attended college there (p_{nn}) is .01, regardless of whether the university they attended is public or private. Thus the increase in the probability of out-of-state students locating in their home states if they attended college there (Δp_o) is .140 for public universities and .064 for private universities. These results are averages over all states. The standard errors, given in parentheses, suggest that the increase in the probability of graduates locating in their home states if they attend college there is significantly higher if they attend public than private universities. This difference presumably reflects the fact that students at public universities meet many other students who are from the state. Also, the increase in the probability of graduates locating in their home states if they attend college there is significantly higher for in-state than out-of-state students – regardless of whether students attend public or private universities.

A problem with this method is the possibility of selection bias. Suppose there are three types of students: adventurous, neutral, and non-adventurous. Adventurous students attend out-of-state colleges and are more likely than neutral students to locate in states other than their home states as adults. Non-adventurous students attend in-state colleges and are likely to locate in their home states as adults. Neutral students are in-between: they consider attending college both in their home states and elsewhere and they also consider locating as adults both in their home states and elsewhere. Because the proportions of adventurous, neutral, and non-adventurous students vary in the groups used to estimate Δp_i and Δp_o, the predicted values of Δp_i and Δp_o are subject to bias. The group of students used to estimate p_{yy} contains a mixture of non-adventurous and neutral students, but cannot include any adventurous students since they do not apply to universities in their home states. Because non-adventurous students are likely to remain close to home, the predicted value of p_{yy} is biased upward. In contrast, the group of students used to estimate p_{yn} contains a mixture of adventurous and neutral students, but cannot include any non-adventurous students since they do not apply to universities outside their home states. The fact that these two groups tend to be footloose biases the predicted value of p_{yn} downward. Since $\Delta p_i = p_{yy} - p_{yn}$, both effects bias the predicted value of Δp_i upward.

Now consider the groups of students used to estimate p_{ny} and p_{nn}. Students who attend college outside their home states are used to estimate p_{ny}. They are a mixture of adventurous and neutral types. Some of them choose a state for college because they like that particular state. Since they are likely to remain in that state after college, they bias the predicted value of p_{ny} upward. However the group of students used to estimate p_{nn} can include any of the three types of students – adventurous, non-adventurous and neutral. (Students who locate as adults in a state that is neither their home state nor their college state may have attended college in either their home state or another state.) The predicted bias in p_{nn} is ambiguous as a result. Overall, the bias in Δp_o is also upward, but it is likely to be smaller than the bias in Δp_i.

To address this problem, we use information concerning the set of universities that students applied to. We have information on up to four such universities, including the universities that students attended and other universities they applied to but did not attend. We classify students as non-adventurous if they applied to universities in their home states only, adventurous if they applied to universities outside of their home states only, and neutral if they applied at least one of each. We re-run the model with interactions among the *home/college* variables, the SAT categories, a public versus private dummy, and dummy variables for whether students applied in-state only, out-of-state only, or both (where relevant).[26] The results are shown in table 4. Adding interaction terms for location preferences has an important effect on the estimated coefficients.

Using these results, we re-estimate the figures in table 3 for marginal students who are neutral in their location preferences. The results are shown in columns (3) and (4) of table 3. As predicted, the adjustment causes p_{yy} to fall and p_{yn} to rise. Therefore $\Delta p_i(\bar{s}_i)$ falls from .313 to .158 for public universities and from .161 to .049 for private universities. Also as predicted, p_{ny} falls and causes $\Delta p_o(\bar{s}_o)$ to fall from .140 to .094 for public university students and from .064 to .046 for private university students. Thus adjusting for bias in the estimation of Δp_i and Δp_o sharply reduces the predicted effect of attending college in a state on the probability of graduates' locating in that state and also reduces the difference between the values for in-state versus out-of-state students.

3.3 *Do universities follow the equal additional tax payments rule?*

Now consider the "equal additional tax payments rule," eq. (7). This says that states would like public and private universities within their boundaries to set cutoff levels such that the expected increase in future state tax payments when a marginal student is admitted is the same for marginal in-state versus out-of-state students. For the "equal additional tax payments rule" to be satisfied for an institution, the difference between expected additional state tax payments from in-state versus out-of-state students at an institution, $\Delta p_i(\bar{s}_i) t_i(\bar{s}_i) - \Delta p_o(\bar{s}_o) t_o(\bar{s}_o)$, must equal zero. We refer to this term as *Difference*.

We have already discussed the estimation of $\Delta p_i(\bar{s}_i)$ and $\Delta p_o(\bar{s}_o)$ for marginal students at public versus private universities. Now turn to expected future state tax payments by marginal students, $t_i(\bar{s}_i)$ and $t_o(\bar{s}_o)$. We use the income of survey respondents in 1995 as our proxy for

[26] The regression reported in table 4 includes interactions with the public/private dummy and the SAT categories only for the group of students with neutral location preferences, because our estimates of Δp_i and Δp_o are for this group. Adding interaction terms for other groups would not change the results.

state tax payments.[27] Because most states' income taxes are a fixed or rising proportion of income, income is a good proxy for state tax payments. Using income at a single point in time as a proxy for state tax payments ignores the fact that residents pay state taxes every year, rather than in a single year. But this simplification does not affect the comparison of expected future state taxes paid by in-state versus out-of-state graduates.[28]

For each institution we compute the average income for in-state and out-of-state students in the lowest quintile of the relevant distribution, denoted $t_i(\bar{s}_i)$ and $t_o(\bar{s}_o)$, respectively. Because the estimates of average income can also be affected by selection bias, we compute $t_i(\bar{s}_i)$ and $t_o(\bar{s}_o)$ both with and without adjustments for location preference. The unadjusted values of $t_i(\bar{s}_i)$ and $t_o(\bar{s}_o)$ are based on all students in the relevant marginal group, while the adjusted values of $t_i(\bar{s}_i)$ and $t_o(\bar{s}_o)$ are based only on students who have neutral location preferences (i.e., they applied both to in-state and out-of-state universities).[29]

The middle rows of table 5 report the results for $t_i(\bar{s}_i)$ and $t_o(\bar{s}_o)$, averaged over the groups of public versus private universities. The unadjusted estimates are shown in the left panel. At public universities, the incomes of marginal out-of-state students are higher by 25% than the incomes of marginal in-state students ($59,100 versus $47,100, respectively). These differences could be due to selection bias, because in-state students at public universities are likely to be non-adventurous and may therefore pass up more lucrative occupations in order to remain near home. Or they could reflect the fact that the minimum cutoffs at public universities are lower for in-state than out-of-state students, so that marginal in-state students have lower average ability than marginal out-of-state students do. Marginal private university students have higher average incomes than marginal public university students, regardless of whether they are from in-state or out-of-state. This finding could also reflect either selection bias or higher minimum cutoffs at private universities, or both. The adjusted income results, shown on the right side of table 5, have lower differentials between the incomes of in-state versus out-of-state students, but private university graduates still have substantially higher incomes than public university graduates. Since we have adjusted for selection

[27] The *C&B* survey asked respondents to report their 1995 pre-tax earned income from "jobs, net income from business, farm or rent, pensions or social security payments." This measure does *not* include income from interest, dividends, or other family members.
[28] See below for further discussion.
[29] About half of the marginal students applied to both types of institutions. Using the adjusted values reduces our sample of marginal students at each institution from about 10% to 4% of class size.

bias, the remaining differentials are likely to reflect differences in average ability levels across groups of students.

The results for *Difference* show that it is positive for all of the public universities in the sample. The average unadjusted value is \$6,500 and the range is from \$4,500 to \$8,600. This reflects the balance of two opposite effects: in-state students earn less and therefore pay lower state taxes than out-of-state students, but the "pull" of attending university in the state is higher for in-state students. Since *Difference* is positive, the latter effect more than offsets the former. With the adjustments, the average value of *Difference* falls to \$2,800, but remains positive for all of the public universities in the sample. For private universities, the unadjusted average figure for *Difference* is also positive – \$6,300. But the adjusted value falls to approximately zero (the average value is \$300 and the range is from -\$2,900 to \$3,300).

These results imply that state governments would increase their tax revenues if public universities set the minimum cutoff levels for in-state students lower than the levels that prevailed in 1976. But private universities cannot benefit their states by changing their minimum cutoff levels, i.e., they are already acting in their states' interest.

3.4 *Tests of the tuition offset rule*

The results of the previous section suggest that future tax revenues would increase if public universities accepted more in-state and fewer out-of-state students. But if they did so, tuition revenues would fall because out-of-state students pay higher tuition. How would the increased taxes compare to the foregone tuition revenues? The tuition offset rule, eq. (9), says that the present value of additional tax payments collected from an extra in-state student rather than an out-of-state students should just offset the reduction in tuition revenues because in-state students pay lower tuition. To evaluate this rule, we start with the difference between 1976 tuition charged to out-of-state versus in-state students ($T_o - T_i$) at the four public universities in the *C&B*. We multiply this by four years of college and convert the result to 1995 dollars using the CPI.[30] We assume a real discount rate of .02 per year and adjust to take account of the fact that the tuition differential is collected 16 to 19 years before we observe incomes.[31] The resulting tuition differential figure is \$25,600 on average.

[30] See U.S. Department of Commerce (1998), table 772, p. 489.

[31] The discount rate adjustment is $e^{(0.02)(17.5)}$ = 1.42.

Next, we convert income in 1995 (15 years after graduation) into an estimate of lifetime state tax payments. We use the adjusted income figures from table 5. To convert adjusted income in 1995 into an estimate of lifetime income, we use age-earnings data for college graduates from Murphy and Welch (1990) and standard mortality tables.[32] We estimate that lifetime income is 38 times the value of income in 1995. We convert lifetime income into lifetime state taxes using the sum of the income and sales tax rates. The average combined rate in 1995 for the four states in which our public universities are located is 10%.[33] Therefore, the present value of lifetime state tax payments is about (38)(.10) = 3.8 times income in 1995. Suppose *Difference* is equal to *Difference*, except that *Difference* is based on lifetime state tax payments rather than current income. For each of the four public universities in our sample, we convert *Difference* to *Difference* by multiplying *Difference* times 3.8.[34]

Table 6 summarizes the comparison for the four public universities in our sample. On average, a marginal in-state student generates $10,600 more in lifetime state tax payments than does a marginal out-of-state student. But the tuition differential of $25,600 is much larger. Thus public universities' extra tuition charge for out-of-state students is far more than sufficient to offset states' loss of expected future tax revenue when a marginal out-of-state student rather than a marginal in-state student is admitted. These results suggest that states in fact gain substantially when public universities admit additional out-of-state students.

3.5 *Do states have an interest in setting maximum as well as minimum cutoffs?*

Finally, turn to the question of whether states have an interest in setting maximum as well as minimum cutoffs for in-state or out-of-state students. To investigate this issue, we re-calculate *Difference* for the middle and highest regions of the distribution of SAT scores, as well as for the lowest region. Instead of calculating *Difference* for each institution and then summarizing across groups of institutions (our procedure in the previous sections), we instead pool the individual-level data across institutions. We classify students based on their rank in the overall distribution of SAT

---

[32] Murphy and Welch (1990) report that earnings of college graduates increase by 74.3% during the first 10 years of labor market experience, increase by 29.3% during the next 15 years of experience, and decline by 9.8% during the next 15 years of experience. (See their table 9, p. 227.) Our figure for earned income is assumed to be for the 16th year of labor market experience. We discount income over 10-year age ranges by the probability of death in that range, using mortality data for 1998 from Murphy (2000), table 23, p. 80. We do not apply a discount rate, since the figures for earnings growth are in real terms. The result is that lifetime income is 38 times the value of income in 1995.

[33] See Council of State Governments (1996), tables 6.21 and 6.23. Tax rates are as of Jan. 1, 1996.

scores and calculate the average income for students at public versus private universities in each of three regions: the lowest quintile, the three middle quintiles, and the highest quintile.[35] This procedure abstracts from the characteristics of existing institutions because we want to address the general question of whether states gain when high ability students attend public or private universities within their borders.

Table 7 gives the results. (Figures in parentheses are standard errors.) A surprising result is that the increase in the probability of students locating in a state if they attend university in that state is highest for high ability students. For public universities, $\Delta p_i(s_i)$ is .28 for the highest ability quintile, compared to .14 for the middle group and .16 for the lowest ability quintile. Similarly, $\Delta p_o(s_o)$ for public universities is about .09 for the middle and lowest quintiles, compared to .12 for the highest ability quintile. The pattern is similar (although less pronounced) for private university students. Thus of the three groups, high ability students are the most influenced in their future location decisions by where they attend college. The increase in the probability of locating in a state if students attend college there is greater for in-state than out-of-state students at public universities, but approximately the same for both types of students at private universities.

Now turn to the income figures. As expected, incomes within each group increase monotonically with ability. For example, in-state public university students in the lowest SAT category have average incomes of $55,400, compared to $64,200 in the middle SAT category, and $76,400 in the highest SAT category. The increases are similar for other groups of students. Within ability levels, out-of-state students have higher incomes than in-state students at public universities, while the pattern is reversed at private universities. (However, the differences are usually not significantly different from zero.) Because the "pull" of attending college in a particular state increases with ability and income also increases with ability, *Difference* rises with ability. For public university students, it is $3,400 for the lowest ability group, $2,800 for the middle group, and $12,100 for the highest ability group. Because all of these figures are positive, states always gain (in terms of tax revenues) when public universities admit an additional in-state

[34] As in our previous calculations, we do the calculations separately for each of the public universities in our sample and then report the average value.

[35] In this section, we use adjusted income figures; that is, we use only students who applied to both in-state and out-of-state schools. The SAT ranges for the three groups are: 400-1040, 1040-1330, and 1330-1600.

student rather than an additional out-of-state student of equal ability – regardless of ability level. For private university students, *Difference* is $300 for the lowest group, -$600 for the middle group, and $3,300 for the highest ability group.

An important implication of these figures is that states always gain when higher rather than lower ability students attend college in the state, regardless of whether students are from in-state or out-of-state and regardless of whether they attend public or private universities. These figures also suggest that states gain when their public universities are of high quality, since high quality universities attract students whose expected future state tax payments are higher. Rather than providing support for a maximum cutoff in university admissions, our results suggest a rationale for public support of at least one flagship public university that has high academic quality and is therefore likely to attract high ability students. These students in turn are much more likely to locate in the state if they attend college there rather than elsewhere. It also suggests a rationale – although weaker – for programs that encourage private universities to improve quality.

The last line of table 7 shows the value of *Difference* for each group, which is *Difference* converted to additional lifetime state tax payments. Only the *Difference* figure of $46,000 for high ability students at public universities is larger than the tuition differential of $25,600. Thus although substituting an additional in-state student for an out-of-state student of equivalent ability raises future state tax payments, it only compensates for the loss of tuition revenues if the in-state student is of high quality. For students of lower ability levels, replacing an out-of-state student with an equal ability in-state student has a negative impact overall on state finances. Overall, these results suggest that states have little interest in whether public or private universities admit more or fewer out-of-state students, except for the highest quintile of students at public universities.

4. **Conclusions**

In this paper, we examine the divergence of interest between universities and state governments concerning standards for admitting in-state versus out-of-state students. States have an interest in using universities to attract and retain high ability individuals because they pay higher taxes and contribute more to economic development. Universities have an interest in their graduates being successful, but little interest in where their students come from or where they go after graduation. We show that universities have an incentive to set equal admissions cutoffs for marginal in-state versus out-of-state students. In contrast, states benefit when universities set lower minimum admissions cutoffs for in-state than out-of-state students, because attending college in a particular state raises in-state students' probability of locating in that state after graduation by more than it raises out-of-state students' probability.

We test the predictions of the model for both public and private universities, using the Mellon Foundation's *College & Beyond* dataset. We find that, when athletes and minorities are eliminated from the calculations, public universities consistently set lower minimum admissions cutoffs for in-state than out-of-state students. The proportion of students who are between the in-state and out-of-state minimum cutoffs is 5 to 10 percent. Private universities, in contrast, have little difference between their minimum admissions cutoffs, i.e., they treat in-state and out-of-state applicants equally. We also find that states gain more in expected future tax revenues when marginal in-state students are admitted to public universities than when marginal out-of-state students are admitted. But because out-of-state students pay higher tuition at public universities, the gain in expected future state tax revenues when a marginal in-state rather than out-of-state student is admitted is more than offset by the loss of the out-of-state tuition differential. Thus our calculations suggest that if out-of-state tuition actually covers the marginal cost of educating an additional student at the public university, then states are in fact made better off if more out-of-state students attend their public universities. This is because the additional tuition collected immediately more than offsets the expected loss of additional state tax revenues – since the latter would accrue only many years in the future.

We also investigate whether states would gain from public universities setting maximum as well as minimum admissions cutoffs for in-state or out-of-state students, i.e., discouraging high ability students from attending. We find – surprisingly – that the increase in the probability of high ability students locating in their home states if they attend public university there is greater than that of low or medium ability students. Combined with high ability students' larger earnings, this means that states gain the most when high ability in-state students attend the public university rather than going out of state. The gain when a high ability in-state student replaces a high ability out-of-state student more than offsets the loss of the out-of-state tuition differential.

References

Astin, A.W., S.A. Parrott, W.S. Korn, and L.J. Sax (1997), *The American Freshman: Thirty Year Trends*. Los Angeles: Higher Education Research Institute, UCLA.

Baumol, W.J. (1967), “Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis,” *American Economic Review,* vol. 57, pp. 415-426.

Bowen, W.G. and D. Bok (1998), *The Shape of the River: Long-Term Consequences of Considering Race in College and University Admissions*. Princeton, N.J.: Princeton Univ. Press.

Brewer, D.J., E. Eide, and R.G. Ehrenberg (1999), “Does It Pay to Attend an Elite Private College? Cross Cohort Evidence on the Effects of College Type on Earnings,” *Journal of Human Resources*, vol. 34, pp. 104-123.

Clotfelter, C.T. (1996), *Buying the Best: Cost Escalation in Elite Higher Education*. Princeton, N.J.: Princeton Univ. Press (for NBER).

Clotfelter, C.T., and M. Rothschild, eds. (1993), *Studies of Supply and Demand in Higher Education*. Chicago: Univ. of Chicago Press (for NBER).

Clotfelter, C.T., R.G. Ehrenberg, M. Getz and J.J. Siegfried (1991), *Economic Challenges in Higher Education*. Chicago: Univ. of Chicago Press (for NBER).

Cook, P.J. and R.H. Frank (1993), “The Growing Concentration of Top Students at Elite Schools,” in Clotfelter and Rothschild, eds (1993).

Cornwell, C.M., D.B. Mustard, and D.J. Sridhar (2000), “Enrollment Effects of Merit Aid: Evidence from Georgia’s HOPE Scholarship Program,” working paper, Univ. of Georgia, October.

Council of State Governments (1996), *The Book of the States*, 1996-97 edition (vol. 31). Lexington, Ky.

Durbin, D. (2000), “State Struggles with Loss of Grads,” *Ann Arbor News,* April 16, p. D5.

Ehrenberg, R.G., and D.R. Sherman (1984), “Optimal Financial Aid Policies for a Selective University,” *Journal of Human Resources*, vol. 19, pp. 202-230.

Epple, D., R. Romano, and H. Sieg (1999), “Peer Effects, Financial Aid, and Selection of Students into Colleges and Universities: An Empirical Analysis,” working paper, Carnegie Mellon Univ., December.

Goldin, C., and L. Katz (1998), “The Origins of State-Level Differences in the Public Provision of Higher Education: 1890-1940,” *American Economic Review*, vol. 88, pp. 303-308.

Hartman, R.W. (1972), “Equity Implications of State Tuition Policy and Student Loans,” *Journal of Political Economy*, vol. 80, pp. S142-S171.

Hoenack, S.A., and D.J. Pierro (1990), “An Econometric Model of a Public University’s Income and Enrollments,” *Journal of Economic Behavior and Organization*, vol. 14, pp. 403-23.

Hoxby, C.M. (1997), “How the Changing Market Structure of U.S. Higher Education Explains College Tuition,” NBER Working Paper No. 6323, December.

Jaschik, S. (1987), “Legislators’ Plan to Limit Out-of-State Students at U. of Michigan Stirs Angry Campus Reaction,” *Chronicle of Higher Education*, July 1, p. 16.

McPherson, M.S., and M.O. Schapiro (1991), *Keeping College Affordable*. Washington, D.C.: Brookings Institution.

McPherson, M.S., M.O. Schapiro, and G.C. Winston (1993), *Paying the Piper: Productivity, Incentives, and Financing in U.S. Higher Education*. Ann Arbor, Mich.: Univ. of Michigan Press.

Mixon, F.G., Jr., and Y. Hsing (1994), “The Determinants of Out-of-State Enrollments in Higher Education: A Tobit Analysis,” *Economics of Education Review*, vol. 13, pp. 329-35.

Murphy, S.M. (2000), “Deaths: Final Data for 1998,” National Vital Statistics Reports, Vol. 48, No. 11. Hyattsville, Md: National Center for Health Statistics.

Murphy, K.M., and F. Welch (1990), “Empirical Age-Earnings Profiles,” *Journal of Labor Economics*, vol. 8, pp. 202-229.

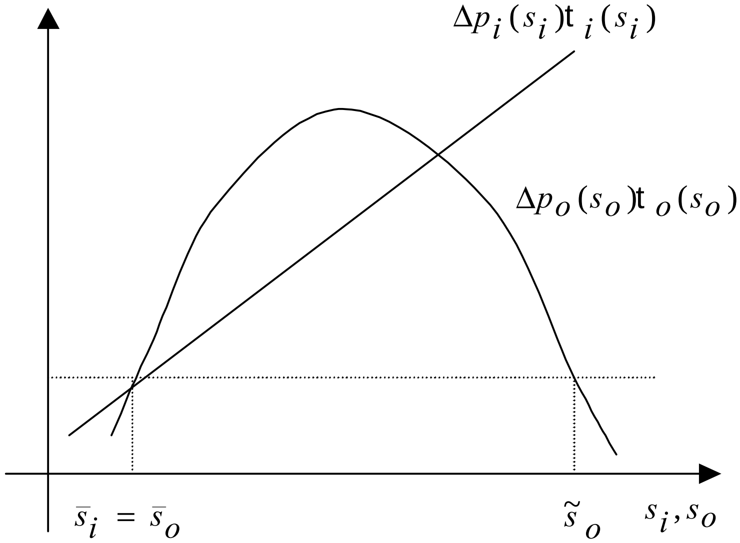
Quigley, J.M., and D.L. Rubinfeld (1993), “Public Choices in Public Higher Education,” in Clotfelter and Rothschild, eds. (1993).

Rothschild, M., and L.J. White, “The University in the Marketplace: Some Insights and Some Puzzles,” in Clotfelter and Rothschild, eds. (1993).

Rothschild, M., and L.J. White (1995), “The Analytics of the Pricing of Higher Education and Other Services in Which the Customers are Inputs,” *Journal of Political Economy*, vol. 103, pp. 573-586.

U.S. Department of Commerce (1998), *Statistical Abstract of the United States: 1998* (118th edition). Washington, D.C.: G.P.O.

Figure 1



$\Delta p_i(s_i)\tau_i(s_i)$
$\Delta p_o(s_o)\tau_o(s_o)$
$\bar{s}_i = \bar{s}_o$
$\tilde{s}_o$
s_i, s_o

Table 1:
Tests of the Equal Cutoff Rule
Using the Lowest Decile of Students

All students

	1976 cohort		*1989 cohort*	
	Public	Private	Public	Private
$(\bar{s}_O - \bar{s}_i)$ (mean)	32	26	40	60
$(\bar{s}_O - \bar{s}_i)$ (min, max)	5, 45	-68, 139	3, 108	-117, 195
No. of institutions	4	23	4	23
Proportion in-state	.84	.29	.76	.23
Share (mean)	.01	.01	.02	.02
Proportion athletes (in-state, out-of-state)	.06, .34	.17, .18	.08, .32	.23, .25
Proportion minorities (in-state, out-of-state)	.36, .28	.43, .34	.38, .42	.57, .38
Proportion athletes or minorities (in-state, out-of-state)	.40, .52	.55, .47	.44, .59	.69, .57

Non-athletes

$(\bar{s}_O - \bar{s}_i)$ (mean)	78	26	78	59
$(\bar{s}_O - \bar{s}_i)$ (min, max)	51, 111	-84, 126	22, 143	-110, 177
Share (mean)	.05	.01	.06	.02

Non-minorities

$(\bar{s}_O - \bar{s}_i)$ (mean)	17	14	55	36
$(\bar{s}_O - \bar{s}_i)$ (min, max)	-8, 30	-62, 87	23, 84	-68, 163
Share (mean)	.01	.01	.04	.01

Non-athletes and non-minorities

$(\bar{s}_O - \bar{s}_i)$ (mean)	52	10	93	36
$(\bar{s}_O - \bar{s}_i)$ (min, max)	8, 79	-122, 81	44, 144	-66, 137
Share (mean)	.05	.00	.10	.01

Table 2:
Conditional Logit Model Estimates
Without Controls for Initial Location Preferences

Variable	Coefficient	Std. Error
Xyy	3.248	0.044
Xyy × public × {SAT low}	0.636	0.070
Xyy × public × {SAT middle}	0.420	0.064
Xyy × public × {SAT high}	0.166	0.132
Xyy × private × {SAT low}	0.485	0.101
Xyy × private × {SAT high}	-0.314	0.088
Xyn	2.803	0.029
Xyn × public × {SAT low}	-0.077	0.154
Xyn × public × {SAT middle}	-0.124	0.111
Xyn × public × {SAT high}	-0.707	0.259
Xyn × private × {SAT low}	0.338	0.068
Xyn × private × {SAT high}	-0.399	0.055
Xny	1.630	0.044
Xny × public × {SAT low}	0.688	0.195
Xny × public × {SAT middle}	0.456	0.157
Xny × public × {SAT high}	0.462	0.301
Xny × private × {SAT low}	0.023	0.116
Xny × private × {SAT high}	-0.159	0.078
Log-Likelihood	-48877	
Pseudo R^2	0.3477	

Notes:
Xyy = *home/college*, Xyn = *home/~college*, Xny = *~home/college*
Number of Observations: 19,058 persons × 51 states

Table 3:
Results for $\Delta p_i(\bar{s}_i)$ and $\Delta p_o(\bar{s}_o)$ with and without Adjustment for Selection Bias
Students in the Lowest SAT Quintile

	(1)	(2)		(3)	(4)
	Public	Private		Public	Private
Unadjusted:			***Adjusted:***		
$\Delta p_i(\bar{s}_i)$	0.313 (0.012)	0.161 (0.009)	$\Delta p_i(\bar{s}_i)$	0.158 (0.029)	0.049 (0.017)
p_{yy}	0.55	0.50	p_{yy}	0.45	0.44
p_{yn}	0.24	0.34	p_{yn}	0.29	0.39
$\Delta p_o(\bar{s}_o)$	0.140 (0.012)	0.064 (0.003)	$\Delta p_o(\bar{s}_o)$	0.094 (0.021)	0.046 (0.007)
p_{ny}	0.15	0.07	p_{ny}	0.11	0.06
p_{nn}	0.01	0.01	p_{nn}	0.01	0.01

Table 4:
Conditional Logit Model Estimates
With Controls for Initial Location Preferences

Variable	Coefficient	Std. Error
Xyy	3.075	0.059
Xyy × {Apply in-state only}	0.653	0.067
Xyy × {Apply both} × public × {SAT low}	0.351	0.118
Xyy × {Apply both} × public × {SAT middle}	0.235	0.101
Xyy × {Apply both} × public × {SAT high}	0.055	0.193
Xyy × {Apply both} × private × {SAT low}	0.291	0.139
Xyy × {Apply both} × private × {SAT high}	-0.275	0.113
Xyn	2.918	0.044
Xyn × {Apply out-state only}	-0.244	0.052
Xyn × {Apply both} × public × {SAT low}	-0.035	0.240
Xyn × {Apply both} × public × {SAT middle}	-0.087	0.164
Xyn × {Apply both} × public × {SAT high}	-1.233	0.428
Xyn × {Apply both} × private × {SAT low}	0.327	0.105
Xyn × {Apply both} × private × {SAT high}	-0.491	0.086
Xny	1.619	0.072
Xny × {Apply out-state only}	0.041	0.082
Xny × {Apply both} × public × {SAT low}	0.310	0.354
Xny × {Apply both} × public × {SAT middle}	0.315	0.256
Xny × {Apply both} × public × {SAT high}	0.260	0.454
Xny × {Apply both} × private × {SAT low}	-0.108	0.206
Xny × {Apply both} × private × {SAT high}	-0.259	0.133
Log-Likelihood	-48890	
Pseudo R^2	0.3476	

Notes:
Xyy = *home/college*, Xyn = *home/~college*, Xny = *~home/college*
{Apply both} = Apply to both in-state and out-of-state colleges
Number of Observations: 19,058 persons × 51 states

Table 5:
Tests of the Equal Additional Tax Payments Rule

	Unadjusted		*Adjusted*	
	Public	**Private**	**Public**	**Private**
$\Delta p_i(\bar{s}_i)$	0.313	0.161	0.158	0.049
$\Delta p_o(\bar{s}_o)$	0.140	0.064	0.094	0.046
$t_i(\bar{s}_i)$ (mean)	$47,100	$67,500	$48,900	$72,349
$t_o(\bar{s}_o)$ (mean)	$59,100	$72,200	$52,600	$70,000
Difference (mean)	$6,500	$6,300	$2,800	$300
Difference (min, max)	$4,500, $8,600	$1,400, $11,400	$2,100, $3,700	-$2,900, $3,300

Table 6:
Test of the Tuition Offset Rule
At Public Universities

	Present Value of Lifetime Amount (1995 dollars)
Difference in Expected Increase in Taxes:	
Difference (mean)	$10,600
Tuition Differential:	
$T_o - T_i$ (mean)	$25,600
Net Amount:	
$Difference - (T_o - T_i)$	
(mean)	-$15,000
(min, max)	-$27,000, -$10,300

Table 7:
Do States Gain When High and Middle Ability Students
Attend College in the State?

	Public			**Private**		
SAT category	*Low*	*Middle*	*High*	*Low*	*Middle*	*High*
$\Delta p_i(s_i)$	.158 (.029)	.141 (.015)	.276 (.041)	.049 (.017)	.065 (.004)	.104 (.010)
$\Delta p_o(s_o)$	.094 (.021)	.087 (.013)	.118 (.037)	.046 (.007)	.074 (.002)	.072 (.004)
$t_i(s_i)$	$55,400 (2,385)	$64,200 (2,219)	$76,400 (5,830)	$71,700 (4,654)	$81,800 (2,202)	$91,200 (3,500)
$t_o(s_o)$	$57,700 (6,765)	$71,400 (4,497)	$78,300 (11,200)	$69,718 (3,264)	$80,400 (1,491)	$85,600 (2,400)
$\Delta p_i(s_i)t_i(s_i)$	$8,800	$9,000	$21,400	$3,500	$5,300	$9,500
$\Delta p_o(s_o)t_o(s_o)$	$5,400	$6,200	$9,200	$3,200	$6,000	$6,200
Difference	$3,400	$2,800	$12,100	$300	-$600	$3,300
Difference	$12,900	$10,600	$46,000	$1,100	-$2,300	$12,500

Appendix 1: State Programs or Proposals to Keep Graduates at Home

Michigan: The state has sent mailings to graduates of Michigan universities who have moved out-of-state to encourage them to return. The Michigan Economic Development Corp. plans to shift its recruitment focus from attracting businesses to retaining skilled workers.

Iowa: Governor Tom Vilsack is proposing a plan to give tax breaks to engineers, teachers, and others who stay in the state.

Pennsylvania: The state gives $3,000 a year to any high school graduate who attends a state university. After graduation, students must stay in Pennsylvania one year for every $3,000 they received, or else repay the money.

Louisiana: The state pays full tuition at any Louisiana public university as long as students stay in the state after graduation.

Wisconsin: The legislature is considering a proposal to provide a tax credit for employers who pay for their workers' education.

Source: Durbin (2000)

Appendix 2: Institutions in the College and Beyond Database

Public Institutions [4]

Miami University (Ohio)
University of Michigan (Ann Arbor)
University of North Carolina (Chapel Hill)
Pennsylvania State University

Private Institutions [26]

Universities [15]	Liberal-Arts Colleges [11]
Columbia University	Barnard College
Duke University	Bryn Mawr College
Emory University	Denison University
Georgetown University	Hamilton College
Northwestern University	Kenyon College
University of Notre Dame	Oberlin College
University of Pennsylvania	Smith College
Princeton University	Swarthmore College
Rice University	Wellesley College
Stanford University	Wesleyan College
Tufts University	Williams College
Tulane University	
Vanderbilt University	
Washington University	
Yale University	