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

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In-State versus Out-of-State Students:
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and State Governments

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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. In contrast, universities have an interest in their graduates being successful, but little interest in where students come from or where they go after graduation. We develop and test a model that illustrates the divergence of interest between universities and their states. We find that public universities set lower minimum admissions standards for in-state than out-of-state applicants, presumably following their states’ preferences, while private universities on average treat both groups equally. However we find that states in fact gain financially when public universities admit additional out-of-state students. This is because attending a public university in a particular state has a similar effect on marginal in-state versus marginal out-of-state students’ probabilities of locating in the state after graduation. And because marginal out-of-state students earn more, their expected future state tax payments are higher. We also examine whether states would gain financially if universities set maximum as well as minimum standards for admission of in-state and out-of-state students.

JEL Categories: I2, I29. Keywords: public universities, private universities, state governments, location choice, state taxes.

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

Jeffrey A. Groen and Michelle J. White

States have an interest in using their public universities as tools to encourage economic development. Universities train students for work in skilled occupations. Skilled graduates contribute to their local economies by starting new businesses themselves, attracting other businesses to the area, and raising wages generally. Attending a university in a particular state increases graduates’ likelihood of locating in the state as adults because they develop local connections. If attending university has a different effect on in-state versus out-of-state students’ probabilities of locating in that state, then states have an interest in favoring the group whose location decisions are most sensitive at the margin.

However universities’ interests differ 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 and famous, but they have little 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 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 on standards for admission of in-state versus out-of-state students and on whether universities act in their states’ interest in setting these standards. After a brief literature review, section 2 develops several behavioral rules that represent states’ interest and universities’

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2 A number of states have or are considering programs to encourage graduates to remain in-state. See Appendix 1 for a partial list.
interest in admitting in-state versus out-of-state students. These rules illustrate the divergence of
interest between universities and their state governments. Section 3 tests the models using data
from College and Beyond for both public and private universities. We find that public universities
set lower minimum admissions standards for in-state than out-of-state applicants, while private
universities treat both groups equally. However, correcting for selection bias, we find that the
location decisions of marginal in-state and out-of-state students are equally affected by attending a
public university. Because marginal out-of-state students have higher future earnings than
marginal in-state students, this means that states lose rather than gain financially when public
universities favor in-state applicants for admission. Finally we examine whether states would
benefit if public universities imposed maximum as well as minimum standards for admission.³

1. Literature Review

Goldin and Katz’s (1998) study of the growth of public higher education from 1890 to 1940
provides support for the idea that state governments historically viewed public universities as tools
for encouraging economic development. During this period, manufacturing, mining, and
agriculture were all becoming more specialized and science-based. States that had substantial
economic activity in particular fields often invested in specialized public universities that trained
workers in these fields and conducted research to advance the fields. Examples include tobacco
farming in North Carolina, dairy farming in Wisconsin, mining in Colorado, and oil exploration in
Texas. Since public universities provided training in fields that their states specialized in, graduates
tended to remain in the state. This allowed states to capture the benefits of their investments.

College graduates create external benefits for other workers in the labor markets where they
locate as adults, regardless of whether they work in the specific fields that the state’s economy
specializes in. Moretti (1999) finds that wages of both high school and college graduates are
positively correlated with the share of college graduates in the local labor market. Also, college
graduates earn more than other workers and therefore pay higher taxes to the state. College
graduates are also more likely than other workers to start new businesses, which generate jobs for
other workers and raise demand for labor (Fan and White, 2000).⁴

³ For ease of exposition, we use the terms “university” and “college” interchangeably.
⁴ See Beeson and Montgomery (1993) for discussion of how the research activities of universities affect local labor
markets. See Bartik (1991) for general discussion of state and local development policies.
Since the period studied by Goldin and Katz, markets for college education and college-educated labor have become more spatially integrated. Hoxby (1997) argues that U.S. universities have been transformed from local autarkies into competitors, since students who previously attended universities close to home are now likely attend universities that are further away. This means that universities are increasingly forced to compete for students on regional or national markets. Top public universities have witnessed an increase in demand for enrollment from out-of-state students (Mixon and Hsing, 1994).

The fact that college graduates from one state may locate in other states after graduation raises questions concerning states’ incentives to invest in higher education and the efficiency of state finance. For a theoretical model on the efficiency of state finance in the presence of integrated labor markets, see Wildasin (2000). See Strathman (1993) and Quigley and Rubinfeld (1993) for discussion of the relationship between migration of college graduates and states’ higher education spending levels. They show 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 incentive to provide public universities to educate the local population.\(^5\)

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 an in-state student \(i\) is denoted \(s_i\) and the ability level of an out-of-state student \(o\) is denoted \(s_o\). The numbers of in-state and out-of-state students

of ability level \( s_i \) and \( s_o \) who apply to the university and would attend if accepted are denoted \( n_i(s_i) \) and \( n_o(s_o) \) for in-state and out-of-state students, 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 \( s_o \geq \bar{s}_o \). Universities also have binding capacity constraints (total class size) of \( \bar{N} \). 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:

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

subject to the capacity constraint:

\[
\bar{N} = \int_{\bar{s}_i}^{\infty} n_i(s_i) ds_i + \int_{\bar{s}_o}^{\infty} n_o(s_o) ds_o.
\]

The first order condition is:

\[
\bar{s}_i = \bar{s}_o.
\]

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

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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 \( n_o(s_o) \) 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.
for the hypothesis that states require or pressure public universities to favor in-state over out-of-state applicants at the margin.

The “equal marginal revenue rule.” Another formulation of universities’ interest assumes that they 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 the other. Universities also collect revenue from graduates in the form of donations.\footnote{Donations have historically been an important source of revenues for private universities, but not for public universities, although that appears to be changing.} 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 $\tilde{s}_i'$ and $\tilde{s}_o'$ so as to maximize the sum of tuition plus donations from in-state and out-of-state students, or:

$$\frac{1}{N} \left[ \int_{\tilde{s}_i'}^{\infty} (D_i(s_i) + T_i) n_i(s_i) ds_i + \int_{\tilde{s}_o'}^{\infty} (D_o(s_o) + T_o) n_o(s_o) ds_o \right], \quad (4)$$

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

The first order condition is:

$$D_i(\tilde{s}_i') + T_i = D_o(\tilde{s}_o') + T_o. \quad (5)$$

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.

We cannot test the equal marginal revenue rule, but it suggests several reasons why both private and public universities may have an incentive to set different cutoff levels for in-state students (i.e., students who live nearby) versus for out-of-state (i.e., distant) students. 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. Another reason is 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, but public universities engage in little price discrimination among in-state students. (See Epplle et al., 1999, for discussion.)

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 assumption that states view 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 choose 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.

Suppose $p_{y}$ denotes students’ probabilities of locating in state $X$ as adults. The subscript $k$ denotes home state and it equals $y$ if the student’s home state is state $X$ and $n$ otherwise. The subscript $j$ denotes college state and it equals $y$ if the student attends 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

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9 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 “legacies,” because they and their parents are expected to donate more and pay higher tuition, holding everything else constant.

10 For some in-state students, the best alternative to attending the most selective public university in state $X$ is to attend a less selective public university in state $X$, rather than a university in some other state. In this case students’ probability of locating in state $X$ as adults is likely to be unaffected by which public university in state $X$ they attend, so that – according to our model – state $X$ does not benefit when they are admitted to the most selective public university.
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 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, $p_{nm}$ is the probability of students locating in a particular state as adults if they are neither from the state nor attend college there, and $\Delta p_o = p_{ny} - p_{nm}$ 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. We further assume that both $\Delta p_i(s_i)$ and $\Delta p_o(s_o)$ are positive, but do not make any assumptions concerning their relative magnitude. (We estimate these terms in the next section.)

Suppose $\tau_i(s_i)$ and $\tau_o(s_o)$ denote the average present value of future state tax payments by in-state graduates having ability level $s_i$ and out-of-state graduates having ability level $s_o$, respectively. The present value of future state tax revenues is assumed to increase with ability for both types of students. But we do not assume that students’ future earnings are affected by which university they attend or where the university is located. Therefore future state tax revenues vary across states for students of the same ability levels only because state tax rates differ.\footnote{An alternate possibility is that students’ future earnings are also affected by the type or location of the university that they attend and, in that case, states would also want universities’ admission decisions to depend on the extent to which attending the university raises students’ future earnings.}

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 increase in expected future tax payments that result from in-state and out-of-state students, respectively, attending public university in state $X$ rather than elsewhere, or:

$$\Delta \tau_i(s_i) = \int_{\bar{s}_i}^{s_i} \Delta p_i(s_i) \tau_i(s_i) ds_i + \int_{\bar{s}_o}^{s_o} \Delta p_o(s_o) \tau_o(s_o) ds_o$$

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

$$\Delta p_o(\bar{s}_o) \tau_o(\bar{s}_o) = \Delta p_i(\bar{s}_i) \tau_i(\bar{s}_i).$$

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 $\Delta p_i(s)$ and $\Delta p_o(s)$ are identical in the region of the cutoff levels and the functions $\tau_i(s)$ and $\tau_o(s)$ are also identical in the region of the cutoff levels, then the minimum cutoff levels $\tilde{s}_i$ and $\tilde{s}_o$ for in-state and out-of-state students should be the same. But if $\Delta p_i(s)$ exceeds $\Delta p_o(s)$ in the region of the cutoff levels, then the state will tend to favor a lower cutoff level for in-state students, and vice versa.

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. Suppose these cutoff levels are denoted $\tilde{s}_i'$ and $\tilde{s}_o'$. The objective function is:

$$\left[ \int_{\tilde{s}_i'}^{\infty} (T_i + \Delta p_i(s_i)\tau_i(s_i))n_i(s_i)ds_i + \int_{\tilde{s}_o'}^{\infty} (T_o + \Delta p_o(s_o)\tau_o(s_o))n_o(s_o)ds_o \right],$$

subject to the same capacity constraint as in eq. (2).

The first order condition implies that:

$$T_o - T_i = \Delta p_1(\tilde{s}_i')\tau_i(\tilde{s}_i') - \Delta p_o(\tilde{s}_o')\tau_o(\tilde{s}_o').$$

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 states’ interest for universities to admit students in declining order of ability and to set only minimum cutoff levels for admission of in-state and out-of-state students. 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 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’ location choices are unlikely to be affected by where they attend college. 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 \( r_o(s_o) \) and \( r_i(s_i) \) increase monotonically with ability (since earnings are positively related to ability), while \( \Delta p_i(s_i) \) and/or \( \Delta p_o(s_o) \) are not monotonically related to ability. One possibility is that \( \Delta p_i(s_i)r_i(s_i) \) and \( \Delta p_o(s_o)r_o(s_o) \) have the shapes shown in figure 1. Here \( \Delta p_i(s_i)r_i(s_i) \) increases monotonically as \( s_i \) rises, but \( \Delta p_o(s_o)r_o(s_o) \) rises and then falls as \( s_o \) rises. As a result, states want universities to set minimum cutoffs of \( s_i^{\text{min}} \) and \( s_o^{\text{min}} \) for in-state and out-of-state students respectively, but in addition states want their universities to set a maximum cutoff of \( s_o^{\text{max}} \) 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 in the state 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. We test the model below.

These arguments suggest that states may have an interest in their public universities having an intermediate quality level: not too high because the highest ability 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 ability in-state students would attend college elsewhere and would be less likely to settle in the state as adults.\(^{13}\) In this case there may be a rationale for Federal intervention to subsidize provision of public universities in states that have high out-migration rates.

2.3 Summary

\(^{12}\) This assumes that tuition revenue goes directly to the state. An equivalent interpretation is that tuition revenue goes to the university but the state pays the university \( T_o - T_i \) for each in-state student.

\(^{13}\) Our model neglects various other reasons why states may favor admitting in-state students or high ability students to public universities. An argument for states to admit 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 effects are a factor in the learning environment and higher ability students improve the learning environment for all students (Rothschild and White, 1995). Our model also neglects the fact that in-state and out-of-state students differ because in-state students have parents who are voters in the state, while out-of-state students do not. Parents often feel that since their taxes support the public university, their children are entitled to admission and, in turn, state legislators often respond by advocating that additional in-state students be admitted to public universities, i.e., lower minimum cutoff levels for in-state students (see Jaschik, 1987).
The theoretical discussion suggests several testable hypotheses. First, if the goal of universities is to maximize average student ability and they 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 for in-state and out-of-state 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 less likely 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. There are three separate cohorts of students, of which we analyze two. The earlier cohort consists of 32,000 students who entered college in 1976 and the later cohort consists of 36,000 students who entered in 1989. We have information from college records for these students. The Mellon Foundation also surveyed the two cohorts in 1996 and asked questions concerning graduates’ incomes and their locations. We use survey information from the earlier cohort, for which there were 23,500 responses.  

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14 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.

15 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.)

16 A detailed description of the C&B dataset is given in Bowen and Bok (1998). 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 from each entering class was selected. We use institutional sample weights to account for the probability of being sampled.
A drawback of the C&B is its selective sample of colleges/universities and the fact that it includes only four public universities. However the C&B institutions are generally representative of selective institutions. The four public universities are all flagship universities in their states and therefore appropriate for our study. Flagship universities are more selective than other public universities and typically have a sizeable number of out-of-state students. (At other public universities, student bodies are composed almost entirely of in-state students.)

Table 1 shows that the average proportion of in-state students in the 1976 cohort was .84 at the public universities and .29 at the private universities, compared to .76 and .23, respectively, in 1989. The fact that both figures fell between 1976 and 1989 accords with Hoxby’s (1997) finding that the trend over time is for students to attend universities further from their homes.

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, $(\bar{s}_o - \bar{s}_i)$. 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.

These estimates 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-

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17 Institutions in C&B sample were chosen in part on the basis of willingness to participate in the study.
18 We repeated the analysis using the lowest 20% of SAT scores, rather than the lowest 10%, and the results were similar.
19 In addition to SAT scores, we would like to have used high school grades in our analysis, since colleges usually base admission on both test scores and high school grades. However, the C&B contains information on high school grades for less than half of the students in the 1976 and 1989 cohorts.

Only ACT scores are available for some students. We converted these to equivalent SAT scores, using the equipercentile method.
state versus out-of-state distributions than students in general.\textsuperscript{20} The upper panel of table 1 shows that in 1976, athletes and minority students comprised about half of the marginal group of students. At the public universities, 40 percent of marginal in-state and 53 percent of marginal out-of-state students were either athletes or minorities. (The proportion of marginal students who are athletes is higher among out-of-state than in-state students, while the reverse is true for minorities.) Because these figures are high, we omit athletes and minorities before constructing the samples of marginal in-state and out-of-state students at each university.\textsuperscript{21}

The results are given in the middle panel of table 1. For the 1976 cohort at public universities, the average value of \((\bar{x}_o - \bar{x}_i)\) is 51 points and the minimum and maximum values are 8 and 78, respectively. Thus all four of the public universities set higher minimum cutoff levels for out-of-state students. Now turn to the private universities. The average value of \((\bar{x}_o - \bar{x}_i)\) among the 23 private universities is 10 points, with a minimum of -122 and a maximum of 81. Thus, on average, private universities treat in-state and out-of-state students equally, but there is a wide range of behavior 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 (omitting athletes and minorities) at each institution and then determine the proportion of the combined distribution that is between \(\bar{x}_i\) and \(\bar{x}_o\). For 1976, the share of the distribution between the two cutoffs is 5 percent at public universities and less than 1 percent at private universities. This suggests that the in-state advantage at public universities is significant but not large, while in-state and out-of-state students are treated equally at private universities.

We repeat the analysis using the 1989 cohort and the results are shown on the right-hand side of table 1. The results show that public universities gave in-state students a larger advantage in 1989 than in 1976; the average difference in minimum cutoff scores rose from 51 to 84 points. As in 1976, all four of the public universities set lower minimum cutoffs for in-state than out-of-state

\textsuperscript{20} 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).

\textsuperscript{21} 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.
students. The private universities also gave a small advantage of 36 points to in-state students, but their behavior was again very variable. The share of the distribution between the cutoffs in 1989 was 8 percent at public universities and 1 percent at private universities.\textsuperscript{22}

As a check on the robustness of our results, we repeat the analysis using college grades as the measure of student ability. At first blush, using college grades in a model of college admissions seems odd since college grades are not observed prior to admission. However, colleges use SAT scores and high school grades in admissions because they are good predictors of college performance. College grades can therefore provide a useful check on our results, given that measures of high school grades are unavailable. Our measure of student ability based on college grades is the percentile GPA rank within each college, with 100 for the highest GPA and 0 for the lowest GPA. The results, given in the bottom panel of table 1, are consistent with the qualitative story of the previous results. Marginal in-state students have lower grades than marginal out-of-state students at both public and private universities, but the difference is significant only at the public universities.

The wide variation in the results concerning whether private institutions give in-state or out-of-state students an advantage in admissions suggests that private universities and colleges perceive their relationships with the local community in varying ways. When we split private institutions into universities versus colleges and do the analysis separately for each group, we continue to see wide variation (results not shown). Overall, private institutions appear to treat in-state and out-of-state students the same, but some institutions favor out-of-state applicants while others favor in-state students--perhaps to increase future donations or to build good relations with the state.

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

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 a particular state if they attend college there. These effects are denoted $\Delta p_i(\tilde{s}_i)$ and $\Delta p_o(\tilde{s}_o)$ for marginal in-state and out-of-state students, respectively, in the lowest region of the relevant SAT

\textsuperscript{22} Our results for public universities are consistent with the evidence on admissions standards in Moll (1985), a guide to top public undergraduate colleges and universities. This book includes interviews with admissions officers at three of the public universities in the \textit{C&B}. At each of the three universities, out-of-state students are subject to higher minimum standards in terms of test scores and high school GPA.
distributions. We use a conditional logit model. Our sample consists of students in the 1976 cohort who responded to the 1996 survey, so that we observe students' locations 16 years after graduation from college. 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 if they did not answer survey questions that asked which universities they applied to. Each student enters the sample 51 times, once for each state in the U.S. plus the District of Columbia.

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 three dummy variables: home/college equals one if the student is from the state and attended college in the state, home/~college equals one if the student is from the state but attended college in a different state, and ~home/college equals one if the student is not from the state but attended college in the state. The omitted category is students who are neither from the state nor attended college in the state. In order to estimate $\Delta p_i$ and $\Delta p_o$ separately for the marginal group of students, we interact the location variables with three dummy variables for whether students are in each of three regions of the distribution of SAT scores: the lowest quintile ("low SAT"), the highest quintile ("high SAT"), and the three middle quintiles ("middle SAT"). Also in order to estimate $\Delta p_i(\tilde{s}_i)$ and $\Delta p_o(\tilde{s}_o)$ separately for students at public versus private universities, we further interact these variables with a dummy variable for whether students attended public versus private universities.

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 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 our estimates of $p_{yy}$, $p_{yn}$, $\Delta p_i$, $p_{yp}$, $p_{pm}$, and $\Delta p_o$ for students in the lowest quintile of the SAT distribution, based on the results in table 2. Because we include state fixed effects, the estimates differ across states and we show the results for a

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23 Students' home states are assumed to be the states where the high schools from which they graduated are located.

24 The specification also includes constant terms for each state, which capture relative sizes of states, climate, and other factors that vary across states but not across individuals. We use the lowest quintile rather than the lowest decile of the relevant distributions as our marginal group, because 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.
representative state. The probability of in-state students locating in their home states as adults if they attended college there \( p_{yn} \) is .55 for public university students and .51 for private university students. These figures suggest that home state is an important factor in determining graduates’ post-college location choices. If these students instead attend college outside their home states, the probability \( p_{yn} \) of locating in their home states after college falls to .32. Thus the increase in the probability of in-state students locating in their home states if they attend college there \( \Delta p_{(S)} \) is .23 for public university students, compared to .19 for private university students. For out-of-state students, the probabilities of locating in the state where they attended college \( p_{yn} \) are .15 and .07 if they attend public or private universities, respectively, and the probability of locating in a particular state if they are neither from the state nor attended college there \( p_{mn} \) is .01 for both types of universities. Thus the increase in the probability of marginal out-of-state students locating in a particular state if they attend college there \( \Delta p_{(S)} \) is .14 for public universities and .06 for private universities.

An implication of these results is that attending a public university has a much larger effect on students’ post-college location choices than attending a private university. This may be because, when students attend a public university, they meet many more students from the state where the university is located than they would if they attended a private university in the same state.

A problem with our procedure is the possibility of selection bias, because going to college in a state may be correlated with a student’s desire to live in the state after college. For example, students from Ohio who want to remain close to their families are likely both to attend college in Ohio and to locate in Ohio after graduation. But students from Ohio who want to live in warm climates are likely both to attend college in Arizona and to locate in Arizona (or another warm state) after graduation. Thus students’ location preferences can produce a correlation between their college states and their states of residence after graduation.

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25 We do not identify the representative state, because the confidentiality rules for the dataset preclude reporting results for particular institutions and most states contain only one institution.
26 This figure is calculated assuming that students from a particular state who attend college out-of-state rather than attending an in-state public university may attend either a public or a private university. We make this assumption because there are few students in our dataset who attended a public university out-of-state and, more generally, because students who attend college out-of-state are likely to consider both public and private universities even if they would consider only public universities if they stayed in-state for college. As a result of this assumption, the value of \( p_{yn} \) is the same for both public and private universities. The same point applies to the calculations of \( p_{mn} \).
Ignoring this factor causes our estimates to overstate the effect of going to college in a state on the probability of locating in that state as an adult. Our estimate of \( p_{yy} \) is based on natives of a representative state who attend college in their home state. This group, on average, is predisposed to their home state as a post-college location. But our estimate of \( p_{yn} \) is based on natives of the same state who go to college outside their home state and therefore tend to be predisposed against their home state as a post-college location. These effects cause our estimates of \( p_{yy} \) and \( p_{yn} \) to be biased upward and biased downward, respectively, so that our estimate of \( \Delta p_i \) is biased upward. Similarly, our estimate of \( p_{ny} \) is based on non-natives of the representative state who go to college in the state and are predisposed to the state as a post-college location; while our estimate of \( p_{nn} \) is based on non-natives of the state who don’t attend college there and are pre-disposed against locating there. These effects cause our estimate of \( \Delta p_o \) to be biased upward. In both cases, the treatment group is composed of students who are predisposed to the state and the control group is composed of students who are predisposed against the state.

To address this problem, we use information concerning the set of universities that students applied to but did not attend. We have information on up to four such universities, in addition to information on which universities students attended. We use the applications information to construct a measure of students’ location preferences for each potential state of residence. Define a dummy variable “predisposed in favor” which equals one if a student applied only to colleges in that state; a separate dummy “applied both” which equals one if a student applied to at least one college in that state and at least one college in another state, and a third dummy variable “predisposed against” if a student did not apply to any colleges in the state. These categories are assumed to represent individual students’ preferences for particular states in order of strongest to weakest. The group of students that applied to universities in at least two states is referred to as having neutral location preferences. We re-estimate the model in table 2 with interactions between these dummy variables and the other variables (where relevant). The results are shown in table 4.\(^{27}\)

\(^{27}\) The regression reported in table 4 includes interactions between the home/college variables and the \{public/private \times SAT\} categories only for the observations with neutral location preferences (“applied both”), because our estimates of \( \Delta p_i \) and \( \Delta p_o \) are for this group. Adding interaction terms for other groups would not change the results. Compared to table 2, the model in table 4 also includes a fourth set of variables. The last six variables in table 4 represent the preference categories for states that were neither the home state nor college state for a given student (the omitted
Using these results, we re-calculate \( \Delta p_i(\bar{s}_i) \) and \( \Delta p_o(\bar{s}_o) \) for students who both have neutral location preferences and are in the lowest SAT region, using the same representative state as in table 2. The results are shown are in columns (3) and (4) of table 3. Comparing the adjusted and unadjusted results, we find that \( p_{ny} \) for public university students falls from .55 to .46 and \( p_{mn} \) for public university students rises from .32 to .36. Both of these changes are as predicted. This causes our estimate of \( \Delta p_i(\bar{s}_i) \) to fall from .23 to .10 for public universities. The change for private universities is from .19 to .083. The value of \( p_{ny} \) is unaffected by the adjustment process, but \( p_{nn} \) rises from .01 to .05, so that \( \Delta p_o(\bar{s}_o) \) falls from .14 to .10 for public universities and from .057 to .018 for private universities. Thus adjusting for bias in the estimation of \( \Delta p_i(\bar{s}_i) \) and \( \Delta p_o(\bar{s}_o) \) sharply reduces the predicted effect of attending college in a state on the probability of graduates’ locating in that state. With the adjustments, we find that attending a public university has only a slightly larger effect on students’ post-college location choices than attending a private university, for in-state students, although the difference remains large for out-of-state students. But the most surprising result of the adjustments is that the effect of attending public university on the probability of graduates in the lowest SAT category locating in that state is now nearly the same for out-of-state students as for in-state students (.104 versus .099). This differs from the unadjusted results, where the in-state student effect was considerably larger.

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 increase in expected future state tax payments when a marginal student is admitted is the same for marginal in-state versus out-of-state students. This requires that the difference between expected additional state tax payments from marginal in-state versus out-of-state students, 
\[
\Delta p_i(\bar{s}_i)\tau_i(\bar{s}_i) - \Delta p_o(\bar{s}_o)\tau_o(\bar{s}_o),
\]
equals zero. We refer to this term as Difference.

We discussed the estimation of \( \Delta p_i(\bar{s}_i) \) and \( \Delta p_o(\bar{s}_o) \) in the previous section. Now turn to expected future state tax payments by marginal students, \( \tau_i(\bar{s}_i) \) and \( \tau_o(\bar{s}_o) \). Our only observation
of graduates’ incomes comes from their answers to the 1996 survey, which asked about income during the previous year. However, graduates earn income and pay taxes to the state every year. We therefore convert reported income in 1995 for each graduate in the sample into an estimate of lifetime income, expressed in 1995 dollars. We use age-earnings data for college graduates from Murphy and Welch (1990) and standard mortality tables.\footnote{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 16\textsuperscript{th} 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 resulting figures underestimate true lifetime state tax payments because they neglect earnings from wealth and pensions, but they overestimate true lifetime state tax payments by assuming that all graduates work for 40 years.} We estimate that lifetime income is 38 times the value of income in 1995. We then convert graduates’ lifetime incomes into lifetime state tax payments by multiplying lifetime incomes by the sum of the income and sales tax rates in 1995 in the state where the graduate attended college. For all of the states represented in our sample, the average combined tax rate is 9.8 percent.\footnote{See Council of State Governments (1996), tables 6.21 and 6.23. Tax rates are as of January 1, 1996. Most states have income taxes that are approximately constant rather than strongly progressive.}

We then compute average lifetime state tax payments for in-state and out-of-state students in the lowest quintile of the relevant distribution for each institution in our sample. These are denoted $\tau_i(\bar{s}_i)$ and $\tau_o(\bar{s}_o)$, respectively. Because our estimates of average income can also be affected by students’ location preferences, we compute $\tau_i(\bar{s}_i)$ and $\tau_o(\bar{s}_o)$ both with and without adjustments for location preferences. The unadjusted values of $\tau_i(\bar{s}_i)$ and $\tau_o(\bar{s}_o)$ are based on all students in the relevant marginal group, while the adjusted values of $\tau_i(\bar{s}_i)$ and $\tau_o(\bar{s}_o)$ are based on students who are both in the marginal group and have neutral location preferences.\footnote{For the unadjusted estimates, we first identify the lowest 20 percent of in-state and out-of-state students (by SAT score) at each institution ("marginal group"). The unadjusted estimates for a given institution are based on the average incomes of these students. For the adjusted estimates, we use only students in the marginal group who applied to at least one college in a different state from the state in which they attended college. Overall, 40 percent of marginal in-state students and 80 percent of marginal out-of-state students applied in another state.}

The middle rows of table 5 report the results for $\tau_i(\bar{s}_i)$ and $\tau_o(\bar{s}_o)$, averaged over the groups of public versus private universities. The unadjusted estimates are shown in the left panel. At public universities, lifetime state tax payments of marginal out-of-state students are higher by 25% than lifetime state tax payments of marginal in-state students ($225,000 versus $177,000, respectively). These differences could be due to bias in location preferences, because students who choose to
attend public universities in their home states are likely to pass up more lucrative occupations in order to remain near home. In addition they could reflect the lower minimum cutoff levels for in-state students at public universities, which imply that marginal in-state students have lower average ability than marginal out-of-state students. Marginal private university students have higher lifetime state tax payments than marginal public university students, regardless of whether they are from in-state or out-of-state. This finding could also reflect either location preferences or higher minimum cutoffs at private universities, or both. The adjusted results, shown on the right side of table 5, have lower differentials between out-of-state versus in-state students at public universities ($227,000 versus $185,000 for out-of-state versus in-state students). But at private universities, the ranking is reversed and in-state students have slightly higher average state tax payments than out-of-state students ($273,000 versus $264,000). Since we have adjusted for location preferences, the remaining differentials are likely to reflect differences in average ability levels across groups of students.

Now turn to the value of Difference for the marginal group of students. The average unadjusted value for public universities is $9,400 and the range for the various institutions in our sample is from $3,600 to $16,800. This reflects the balance of two opposing effects: in-state students earn less and therefore pay lower state taxes than out-of-state students, but the effect of attending university in the state on their adult location choices is about the same. Since Difference is positive, the latter effect more than offsets the former. But with adjusted figures, the picture changes. The average adjusted value of Difference for public universities is -$3,200, because in-state students earn less than out-of-state students and the “pull” of attending university in the state is about the same. The implication is that, as of 1976, public universities would have benefited their states financially if they had reduced the advantage they gave to marginal in-state students and accepted more marginal out-of-state students.

For private universities, the results are different. The unadjusted average value of Difference for private universities is $32,600 and the adjusted figure is $17,900. Therefore state governments would collect more tax revenues if private universities set the minimum cutoff levels for in-state students lower than the levels that prevailed in 1976.

3.4 Tests of the tuition offset rule
Now consider the tuition offset rule, eq. (9). Under this rule, the present value of extra state tax payments collected from a marginal in-state student rather than a marginal out-of-state student (Difference) should just offset the tuition differential between out-of-state and in-state students at public universities. To evaluate this rule, we need the differential between the 1976 tuition levels for out-of-state versus in-state students \((T_o - T_i)\) at the four public universities in the C&I. We calculate this figure for each of the four public universities, multiply it by four years of college, and convert the result to 1995 dollars using the consumer price index. 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 earlier than the date for which we calculate Difference.\(^{31}\) The resulting average tuition differential is $25,600.

Table 6 summarizes the tuition offset rule for the public universities in our sample, using both adjusted and unadjusted figures for state tax payments. Using the unadjusted figures, a marginal in-state student generates $9,400 more in lifetime state tax payments than a marginal out-of-state student, but pays $25,600 less in tuition, for a net loss to the state of $16,200. Using the adjusted figures, a marginal in-state student generates $3,200 less in lifetime state tax payments than a marginal out-of-state student and also pays $25,600 less in tuition, for a net loss to the state of $28,800. These results suggest that states would have had a substantial financial gain if public universities had not favored in-state students as strongly as they did in 1976.

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 calculate Difference separately for all three ability regions of the SAT distribution: the lowest quintile, the three middle quintiles, and the highest quintile. 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, keeping public versus private university students separate. We classify students based on their rank in the overall distribution of SAT scores and calculate the average expected lifetime state tax payment for students in each of the

\(^{31}\) The discount rate adjustment is \(e^{(0.02)(17.5)} = 1.42\). See U.S. Department of Commerce (1998), table 772, p. 489, for the CPI.
three SAT regions by public versus private university students. 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. We use the same procedure to adjust for location preference as we used above.

Table 7 gives the results. The probability of living in the home state for in-state students at public universities \( p_{yy} \) is .46 for the lowest ability group, .43 for the middle ability group, and .39 for the highest ability group; while the probability of living in the home state for those who go out of state to attend university \( p_{yn} \) is .36, .31, and .21 for the three groups, respectively. Thus home state becomes a smaller influence on adult location choice as ability increases, both for in-state and out-of-state students. This is probably because higher ability students have better opportunities generally than lower ability students, so that their best opportunities are more likely to involve leaving their home states. But a surprising result is that, because \( p_{yn} \) falls faster than \( p_{yy} \), \( \Delta p_{i}(s_{i}) \) rises as ability level increases. For in-state public university students, \( \Delta p_{i}(s_{i}) \) is .104 for the lowest ability group, .121 for the middle ability group, and .181 for the highest ability group. For in-state private university students, the pattern is non-monotonic: \( \Delta p_{i}(s_{i}) \) is .083 for the lowest ability group, .064 for the middle ability group, and .099 for the highest ability group. (The differences between the figures for the middle and high ability groups are statistically significant; see the table for standard errors.) This implies that in-state students’ adult location choices are more influenced by attending college in their home states if they are high ability than if they are middle or low ability, regardless of whether they attend public or private universities.

Now consider out-of-state students. For public universities, \( p_{ny} \) and \( p_{mn} \) are not monotonically related to ability and therefore \( \Delta p_{o}(s_{o}) \) does not have a consistent pattern: it is .099, .089, and .105 for the lowest to highest ability groups, respectively. In contrast at private universities, \( \Delta p_{o}(s_{o}) \) generally rises with ability: it is .018, .040 and .038 for the lowest to highest ability groups, respectively. Thus out-of-state private university students are more influenced in their future location choices by where they attend college as their ability level rises, but there is no relationship for out-of-state public university students.

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32 In this section, we use adjusted income figures; that is, we use only students who had neutral location preferences and applied to colleges in more than one state. The SAT ranges for the three groups are: 400-1040, 1040-1330, and 1330-1600.
Now turn to the lifetime state tax payment figures in Table 7. As expected, they increase monotonically with ability for all types of students. For example, in-state public university students in the lowest SAT category have average lifetime state tax payments of $205,000, compared to $237,000 in the middle SAT category, and $292,000 in the highest SAT category. The increases are similar for other groups of students. Within ability levels, out-of-state students have higher lifetime state tax payments than in-state students at public universities, while the pattern is reversed at private universities. (However, the differences are usually not statistically significant.) Because the pull of attending college in a particular state tends to increase with ability and income also increases with ability, Difference also rises with ability. For public university students, it is -$2,100 for the lowest ability group, $4,100 for the middle group, and $20,700 for the highest ability group. For private university students, the figures are $17,300, $8,300 and $22,000 for the three groups, respectively. Because Difference is negative only for low ability public university students, the results suggest that states lose financially when public universities admit additional in-state students from the lowest ability group, but gain financially when public universities admit additional in-state students from any other group (compared to out-of-state students).

Putting these results together, they suggest the following: (1) States would gain financially if public universities reduced the extent to which they favor in-state over out-of-state students at the low ability margin. (2) High ability students are more influenced in their adult location decisions by where they attend college than low ability students, so that states always gain financially when more high ability students attend college in the state. This applies to both public and private universities. This suggests a rationale for public support of at least one flagship public university that has high academic quality and is likely to attract high ability students from both in-state and out-of-state. It also suggests a rationale for states to adopt programs that encourage private universities to improve quality. (3) States gain more financially when in-state rather than out-of-state students of middle or high ability level attend university in the state. But this does not translate into a rationale for a maximum cutoff level for out-of-state students, because the financial gain from public universities admitting an additional out-of-state student is higher than the financial gain from admitting an additional in-state student who is in the lowest ability region, regardless of the ability level of the out-of-state student.
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 state 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 may gain when universities set lower minimum admissions cutoffs for in-state than out-of-state students, if in-state students’ future location choices are more affected by attending public university than are out-of-state students’.

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, 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 5-8 percent. Private universities, in contrast, treat in-state and out-of-state applicants equally. Surprisingly, we find that states gain more in expected future state tax revenues when marginal out-of-state students are admitted to public universities than when marginal in-state students are admitted. Thus when states pressure their public universities to set lower cutoffs for in-state than out-of-state applicants, they are acting against their own financial interest.

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 that students generally are more rather than less influenced in their location decisions by where they attend college as ability levels increase, regardless of whether they are from in-state or out-of-state. As a result, states gain in future tax revenues when higher ability students attend public universities. They also gain when additional out-of-state students rather than in-state students attend, regardless of ability level. Thus states would not benefit from public universities setting a maximum cutoff for admission of out-of-state students. On the contrary, they gain from having a flagship university that attracts high ability students from both in-state and out-of-state.
References


Figure 1

\[ \Delta p_i(s_i) \tau_i(s_i) \]

\[ \Delta p_o(s_o) \tau_o(s_o) \]

\[ s_{i, o}^{\text{min}} = s_{i, o}^{\text{min}} \]

\[ s_{i, o}^{\text{max}} \]
Table 1:
Tests of the Equal Cutoff Rule
Using the Lowest Decile of Students

All students

<table>
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<th>1976 cohort</th>
<th>1989 cohort</th>
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<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>Number of institutions</td>
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</tr>
<tr>
<td>Proportion in-state</td>
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<td>.29</td>
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<td>Proportion in lowest decile overall (in-state, out-of-state):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Athletes or minorities</td>
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<td>.55, .47</td>
</tr>
<tr>
<td>Athletes</td>
<td>.06, .36</td>
<td>.17, .18</td>
</tr>
<tr>
<td>Minorities</td>
<td>.36, .27</td>
<td>.43, .34</td>
</tr>
</tbody>
</table>

Non-athletes and non-minorities

Ability measure: Combined SAT score

<table>
<thead>
<tr>
<th></th>
<th>1976 cohort</th>
<th>1989 cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>((\bar{s}_o - \bar{s}_i)) (mean)</td>
<td>51</td>
<td>10</td>
</tr>
<tr>
<td>((\bar{s}_o - \bar{s}_i)) (min, max)</td>
<td>8, 78</td>
<td>-122, 81</td>
</tr>
<tr>
<td>Share between (\bar{s}_i) and (\bar{s}_o) (mean)</td>
<td>.05</td>
<td>.00</td>
</tr>
</tbody>
</table>

Ability measure: Percentile rank of college GPA

<table>
<thead>
<tr>
<th></th>
<th>1976 cohort</th>
<th>1989 cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>((\bar{s}_o - \bar{s}_i)) (mean)</td>
<td>2.3</td>
<td>0.4</td>
</tr>
<tr>
<td>((\bar{s}_o - \bar{s}_i)) (min, max)</td>
<td>-0.1, 6.9</td>
<td>-14.6, 9.1</td>
</tr>
<tr>
<td>Share between (\bar{s}_i) and (\bar{s}_o) (mean)</td>
<td>.02</td>
<td>.00</td>
</tr>
</tbody>
</table>
### Table 2:
Conditional Logit Model Estimates
Without Controls for Initial Location Preferences

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>H/C</td>
<td>3.249</td>
<td>0.044</td>
</tr>
<tr>
<td>H/C × public × {SAT low}</td>
<td>0.635</td>
<td>0.070</td>
</tr>
<tr>
<td>H/C × public × {SAT middle}</td>
<td>0.423</td>
<td>0.064</td>
</tr>
<tr>
<td>H/C × public × {SAT high}</td>
<td>0.167</td>
<td>0.132</td>
</tr>
<tr>
<td>H/C × private × {SAT low}</td>
<td>0.485</td>
<td>0.101</td>
</tr>
<tr>
<td>H/C × private × {SAT high}</td>
<td>-0.313</td>
<td>0.088</td>
</tr>
<tr>
<td>H/~C</td>
<td>2.804</td>
<td>0.029</td>
</tr>
<tr>
<td>H/~C × public × {SAT low}</td>
<td>-0.067</td>
<td>0.151</td>
</tr>
<tr>
<td>H/~C × public × {SAT middle}</td>
<td>-0.119</td>
<td>0.110</td>
</tr>
<tr>
<td>H/~C × public × {SAT high}</td>
<td>-0.617</td>
<td>0.250</td>
</tr>
<tr>
<td>H/~C × private × {SAT low}</td>
<td>0.337</td>
<td>0.067</td>
</tr>
<tr>
<td>H/~C × private × {SAT high}</td>
<td>-0.399</td>
<td>0.055</td>
</tr>
<tr>
<td>~H/C</td>
<td>1.630</td>
<td>0.044</td>
</tr>
<tr>
<td>~H/C × public × {SAT low}</td>
<td>0.701</td>
<td>0.191</td>
</tr>
<tr>
<td>~H/C × public × {SAT middle}</td>
<td>0.532</td>
<td>0.150</td>
</tr>
<tr>
<td>~H/C × public × {SAT high}</td>
<td>0.455</td>
<td>0.301</td>
</tr>
<tr>
<td>~H/C × private × {SAT low}</td>
<td>0.024</td>
<td>0.116</td>
</tr>
<tr>
<td>~H/C × private × {SAT high}</td>
<td>-0.159</td>
<td>0.078</td>
</tr>
<tr>
<td>Log-Likelihood</td>
<td>-48999</td>
<td></td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.3480</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- H/C = home/college, H/~C = home/~college, ~H/C = ~home/college.
- {SAT low} indicates an SAT score in the lowest quintile.
- {SAT middle} indicates an SAT score in any of the three middle quintiles.
- {SAT high} indicates an SAT score in the highest quintile.
- {public} and {private} indicate that the student attended a public or private university.

Number of Observations: 19,113 persons × 51 states.
Table 3: Estimates of the Increase in the Probability of In-state and Out-of-State Students Locating in their Home States if They Attend College There (Δ$p_i(\bar{S}_i)$ and Δ$p_o(\bar{S}_o)$) Students in the Lowest SAT Quintile

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
<td>Private</td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td><strong>Not adjusted for selection bias:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ$p_i(\bar{S}_i)$</td>
<td>0.226 (0.005)</td>
<td>0.189 (0.007)</td>
<td>Δ$p_i(\bar{S}_i)$</td>
<td>0.104 (0.010)</td>
</tr>
<tr>
<td>$p_{yy}$</td>
<td>0.55</td>
<td>0.51</td>
<td>$p_{yy}$</td>
<td>0.46</td>
</tr>
<tr>
<td>$p_{yn}$</td>
<td>0.32</td>
<td>0.32</td>
<td>$p_{yn}$</td>
<td>0.36</td>
</tr>
<tr>
<td>Δ$p_o(\bar{S}_o)$</td>
<td>0.136 (0.011)</td>
<td>0.057 (0.003)</td>
<td>Δ$p_o(\bar{S}_o)$</td>
<td>0.099 (0.011)</td>
</tr>
<tr>
<td>$p_{ny}$</td>
<td>0.15</td>
<td>0.07</td>
<td>$p_{ny}$</td>
<td>0.15</td>
</tr>
<tr>
<td>$p_{nn}$</td>
<td>0.01</td>
<td>0.01</td>
<td>$p_{nn}$</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Note: The values in the table for $p_{yy}$, $p_{yn}$, $p_{ny}$, and $p_{nn}$ are predicted values for a representative state.
### Table 4:
Conditional Logit Model Estimates
With Controls for Initial Location Preferences

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>H/C</td>
<td>2.237</td>
<td>0.071</td>
</tr>
<tr>
<td>H/C × {Predisposed in favor}</td>
<td>0.542</td>
<td>0.067</td>
</tr>
<tr>
<td>H/C × {Apply both} × public × {SAT low}</td>
<td>-0.159</td>
<td>0.176</td>
</tr>
<tr>
<td>H/C × {Apply both} × public × {SAT middle}</td>
<td>-0.407</td>
<td>0.146</td>
</tr>
<tr>
<td>H/C × {Apply both} × public × {SAT high}</td>
<td>0.066</td>
<td>0.284</td>
</tr>
<tr>
<td>H/C × {Apply both} × private × {SAT low}</td>
<td>0.159</td>
<td>0.170</td>
</tr>
<tr>
<td>H/C × {Apply both} × private × {SAT high}</td>
<td>-0.296</td>
<td>0.133</td>
</tr>
<tr>
<td>H/~C</td>
<td>2.034</td>
<td>0.061</td>
</tr>
<tr>
<td>H/~C × {Predisposed against}</td>
<td>0.751</td>
<td>0.069</td>
</tr>
<tr>
<td>H/~C × {Apply both} × public × {SAT low}</td>
<td>-0.496</td>
<td>0.270</td>
</tr>
<tr>
<td>H/~C × {Apply both} × public × {SAT middle}</td>
<td>-0.306</td>
<td>0.194</td>
</tr>
<tr>
<td>H/~C × {Apply both} × public × {SAT high}</td>
<td>-1.190</td>
<td>0.480</td>
</tr>
<tr>
<td>H/~C × {Apply both} × private × {SAT low}</td>
<td>0.192</td>
<td>0.146</td>
</tr>
<tr>
<td>H/~C × {Apply both} × private × {SAT high}</td>
<td>-0.477</td>
<td>0.112</td>
</tr>
<tr>
<td>~H/C</td>
<td>0.749</td>
<td>0.063</td>
</tr>
<tr>
<td>~H/C × {Predisposed in favor}</td>
<td>0.151</td>
<td>0.088</td>
</tr>
<tr>
<td>~H/C × {Apply both} × public × {SAT low}</td>
<td>0.139</td>
<td>0.252</td>
</tr>
<tr>
<td>~H/C × {Apply both} × public × {SAT middle}</td>
<td>0.245</td>
<td>0.198</td>
</tr>
<tr>
<td>~H/C × {Apply both} × public × {SAT high}</td>
<td>0.361</td>
<td>0.399</td>
</tr>
<tr>
<td>~H/C × {Apply both} × private × {SAT low}</td>
<td>-0.288</td>
<td>0.168</td>
</tr>
<tr>
<td>~H/C × {Apply both} × private × {SAT high}</td>
<td>-0.111</td>
<td>0.111</td>
</tr>
<tr>
<td>{Predisposed against}</td>
<td>-0.981</td>
<td>0.048</td>
</tr>
<tr>
<td>{Apply both} × public × {SAT low}</td>
<td>0.545</td>
<td>0.157</td>
</tr>
<tr>
<td>{Apply both} × public × {SAT middle}</td>
<td>0.277</td>
<td>0.125</td>
</tr>
<tr>
<td>{Apply both} × public × {SAT high}</td>
<td>-0.241</td>
<td>0.246</td>
</tr>
<tr>
<td>{Apply both} × private × {SAT low}</td>
<td>0.121</td>
<td>0.115</td>
</tr>
<tr>
<td>{Apply both} × private × {SAT high}</td>
<td>0.032</td>
<td>0.083</td>
</tr>
</tbody>
</table>

Log-Likelihood  
Pseudo $R^2$

-48630  
0.3529

Notes:  
H/C = home/college, H/~C = home/~college, ~H/C = ~home/college.  
{Apply both} = student applies to colleges both in state j and another state.  
{Predisposed against} = student does not apply to any colleges in state j.  
{Predisposed in favor} = student applies only to colleges in state j.  
Number of Observations: 19,113 persons × 51 states
<table>
<thead>
<tr>
<th></th>
<th>Unadjusted</th>
<th></th>
<th>Adjusted</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
<td>Private</td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>( \Delta p_i(\hat{s}_i) )</td>
<td>0.226</td>
<td>0.189</td>
<td>0.104</td>
<td>0.083</td>
</tr>
<tr>
<td>( \Delta p_o(\hat{s}_o) )</td>
<td>0.136</td>
<td>0.057</td>
<td>0.099</td>
<td>0.018</td>
</tr>
<tr>
<td>( \tau_i(\hat{s}_i) ) (mean)</td>
<td>$177,100</td>
<td>$254,500</td>
<td>$185,300</td>
<td>$273,300</td>
</tr>
<tr>
<td>( \tau_o(\hat{s}_o) ) (mean)</td>
<td>$225,400</td>
<td>$272,300</td>
<td>$227,100</td>
<td>$264,400</td>
</tr>
<tr>
<td>Difference (mean)</td>
<td>$9,400</td>
<td>$32,600</td>
<td>-$3,200</td>
<td>$17,900</td>
</tr>
<tr>
<td>Difference (min, max)</td>
<td>$3,600, $16,800</td>
<td>$11,000, $59,000</td>
<td>-$9,400, $3,200</td>
<td>$6,500, $39,900</td>
</tr>
</tbody>
</table>

Table 5: Tests of the “Equal Additional Tax Payments Rule”
Table 6:  
Test of the "Tuition Offset Rule"  
At Public Universities

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean value of the difference in lifetime expected state tax payments between in-state versus out-of-state students, in 1995 dollars (Difference):</td>
<td>$9,400</td>
<td>-$3,200</td>
</tr>
<tr>
<td>Mean value of the four year tuition differential for in-state versus out-of-state students, in 1995 dollars:</td>
<td>-$25,600</td>
<td>-$25,600</td>
</tr>
<tr>
<td>Net Amount:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(mean)</td>
<td>-$16,200</td>
<td>-$28,800</td>
</tr>
<tr>
<td>(min, max)</td>
<td>-$21,800, -$9,500</td>
<td>-$35,400, -$22,600</td>
</tr>
</tbody>
</table>
Table 7:  
Do States Gain When High and Middle Ability Students Attend College in the State?

<table>
<thead>
<tr>
<th></th>
<th>Public</th>
<th></th>
<th></th>
<th>Private</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SAT category</strong></td>
<td><strong>Low</strong></td>
<td><strong>Middle</strong></td>
<td><strong>High</strong></td>
<td><strong>Low</strong></td>
<td><strong>Middle</strong></td>
<td><strong>High</strong></td>
</tr>
<tr>
<td>$p_{yy}$</td>
<td>0.46</td>
<td>0.43</td>
<td>0.39</td>
<td>0.44</td>
<td>0.37</td>
<td>0.31</td>
</tr>
<tr>
<td>$p_{yn}$</td>
<td>0.36</td>
<td>0.31</td>
<td>0.21</td>
<td>0.36</td>
<td>0.31</td>
<td>0.21</td>
</tr>
<tr>
<td>$\Delta p_{s}(s_i)$</td>
<td>0.104 (.010)</td>
<td>0.121 (.006)</td>
<td>0.181 (.023)</td>
<td>0.083 (.014)</td>
<td>0.064 (.006)</td>
<td>0.099 (.005)</td>
</tr>
<tr>
<td>$p_{ny}$</td>
<td>0.15</td>
<td>0.13</td>
<td>0.15</td>
<td>0.07</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>$p_{mn}$</td>
<td>0.05</td>
<td>0.04</td>
<td>0.04</td>
<td>0.05</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>$\Delta p_{s}(s_o)$</td>
<td>0.099 (.011)</td>
<td>0.089 (.007)</td>
<td>0.105 (.022)</td>
<td>0.018 (.003)</td>
<td>0.040 (.003)</td>
<td>0.038 (.001)</td>
</tr>
<tr>
<td>$\tau_{s}(s_i)$</td>
<td>$205,100$ (9,000)</td>
<td>$236,700$ (8,000)</td>
<td>$291,900$ (22,900)</td>
<td>$262,100$ (17,800)</td>
<td>$309,600$ (8,700)</td>
<td>$347,900$ (14,000)</td>
</tr>
<tr>
<td>$\tau_{s}(s_o)$</td>
<td>$236,600$ (16,900)</td>
<td>$275,600$ (13,000)</td>
<td>$305,900$ (29,100)</td>
<td>$248,800$ (8,500)</td>
<td>$286,500$ (3,800)</td>
<td>$326,400$ (6,300)</td>
</tr>
<tr>
<td>$\Delta p_{s}(s_i)\tau_{s}(s_i)$</td>
<td>$21,300$</td>
<td>$28,600$</td>
<td>$52,800$</td>
<td>$21,800$</td>
<td>$19,800$</td>
<td>$34,400$</td>
</tr>
<tr>
<td>$\Delta p_{s}(s_o)\tau_{s}(s_o)$</td>
<td>$23,400$</td>
<td>$24,500$</td>
<td>$32,100$</td>
<td>$4,500$</td>
<td>$11,500$</td>
<td>$12,400$</td>
</tr>
<tr>
<td><strong>Difference</strong></td>
<td>-$2,100$</td>
<td>$4,100$</td>
<td>$20,700$</td>
<td>$17,300$</td>
<td>$8,300$</td>
<td>$22,000$</td>
</tr>
</tbody>
</table>

Notes: Standard errors are in parentheses.
Appendix 1: State Programs or Proposals to Keep Graduates at Home

Alaska: The state is considering a proposal to give $10,800 to high ability in-state students who attend the University of Alaska for four years.

Iowa: Governor Tom Vilsack has proposed a plan to give tax breaks to engineers, teachers, and others who stay in the state. He has also proposed a plan under which Iowa residents would be reimbursed for all or part of their college tuition costs if they attended an Iowa college and stayed in the state after graduation. The reimbursement rates would be 100% for community college, 50% for public college and 20% for private college.

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

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.

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.

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

Appendix 2: Institutions in the College and Beyond Database

Public Institutions

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

Private Institutions

Universities

Columbia University
Duke University
Emory University
Georgetown University
Northwestern University
University of Notre Dame
University of Pennsylvania
Princeton University
Rice University
Stanford University
Tufts University
Tulane University
Vanderbilt University
Washington University
Yale University

Liberal-Arts Colleges

Barnard College
Bryn Mawr College
Denison University
Hamilton College
Kenyon College
Oberlin College
Smith College
Swarthmore College
Wellesley College
Wesleyan College
Williams College