Choosing Colleges:
Identifying and Modeling Choice Sets

Sunny Xinchun Niu
Marta Tienda

Office of Population Research
Princeton University

Abstract
Although largely ignored in the growing literature about college choice that adopts a random utility modeling framework, there is reason to believe that the estimates are sensitive to the criteria used to define the choice sets. Accordingly, this paper examines the methodological and substantive implications of using merit (class rank) and socioeconomic (high school strata) to define college choice sets. Using Texas as a case study, results show that criteria used to constrain choice sets—and type of high school attend in particular—not only produce quite different post-secondary institutional profiles, but also different estimates of institutional attributes on students' top choice. These findings have methodological implications for future research about college choice and substantive importance for the prospects that the Texas top 10% law, which guarantees automatic admission to students who graduate in the top decile of their high school class, will equalize access to the state's competitive public institutions.

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Introduction

The expansion of the U.S. post-secondary education system since 1970 coupled with successful institutional marketing activities (McDonough, 1994) and the proliferation of institutional rating schemes by popular print media, like *U.S. News & World Report*, has heightened public awareness of the diverse options facing college-bound youth while fomenting interest in the determinants of college choice (Lipman Hearne Inc., 2006; Renner, 2003; Soss, 1974). Claims that post-graduation returns depend on the quality of institution attended further fueled interest in institutional quality (Hoxby, 2001; Hossler, et al., 1989), heightening competition for access to the most selective colleges and universities (Alon and Tienda, 2006). Concomitantly, scholarly attention to college choice was spurred by the release of nationally representative longitudinal data spanning the transition from high school to college (Manski and Wise, 1983), and controversies about unequal access to selective institutions (Bowen and Bok, 1998; Bowen, Kurzweil and Tobin, 2005; Massey, Charles, Lundy & Fischer, 2003; Alon and Tienda, 2005).

Two general approaches to understanding the complex college decision have emerged. One line of research focuses on how students aspiring to post-secondary education develop a college choice set, decide where to apply, and conditional on admission, make their enrollment decisions (Zemsky and Oedel, 1983; Hearn, 1984; Hossler, Braxton and Coopersmith, 1989; Paulsen, 1990; McDonough, 1997; Hossler, Schmit and Vesper, 1999; Lipman Hearne Inc., 2006). An important insight from these

studies is that high-achieving students and those from high SES families apply to more schools, to more selective schools, and to more costly schools. In Zemsky and Oedel's words (1983): "… the patterns of college choice are stitched deeply into the social and economic fabric of the nation."

Geography also imposes constraints on college choices. That most students attend public, in-state institutions implies that college options are circumscribed by state of residence. Although many quantitative studies of college choice use national data, most analysts note large differences in post-secondary education systems across states in terms of the number and selectivity of institutions as well as the balance between public and private institutions (Zemsky and Oedel, 1983; NCES, 2002). For example, Zemsky and Oedel (1983) show that Massachusetts is most successful among New England states in retaining its college-bound high school seniors partly because of the large range of public and private options. McDonough's (1997) study of students from four California high schools also documents how students make their choices within the constraints of the state's highly stratified, public post-secondary educational system. Hossler, Schmit and Vesper's (1999) longitudinal study of Indiana students underscores how the dominance of public institutions in the state influences college choices. Analyzing college choice within a single state reduces some complications arising from state differences in post-secondary options.

A second line of research about college decision-making emphasizes how institutional characteristics, such as cost, size, distance, the quality of academic programs, and the availability of financial aid influences college decision-making (Manski and Wise, 1983; Montgomery, 2002; Long, 2003, 2004; Avery and Hoxby, 2004; Niu, Tienda

& Cortes, 2006; Lipman Hearne Inc., 2006). Early analysts acknowledged the enormity of the college choice matching problem, but until empirical tools to analyze multi-state decision outcomes were readily available, resorted to descriptive stage models (Soss, 1974; Chapman, 1981; McDonough, 1994; Hossler, et al., 1989; Hossler and Gallagher, 1987). Manski and Wise (1983) were among the first to illustrate the power of the random utility framework for understanding college preferences.

Most empirical researchers concerned with institutional attributes employ a random utility framework, which assumes that students enroll in the institution that yields the highest utility. Studies differ in how college choice sets are specified, however. Some analysts presume that students consider every possible postsecondary institution (Long, 2003, 2004; Niu, et al., 2006), while others define subsets of institutions that granted respondents admission (Avery and Hoxby, 2004; Niu, et al., 2006) or simulated subset of institutions that would likely grant admission under simulation (Montgomery, 2002).[1]

Theoretically, students' choice set can potentially include any postsecondary institution in the country, but in reality students can not and do not consider all of the possible alternatives (Simon, 1957). Rather, due to time, information, and resource constraints, most students consider only a handful of institutions. None of the extant approaches grapples directly with the difficult question of how to delimit students' college choice set. Available evidence indicates that student academic achievement and type of high school attended are most influential in the formulation of college choice sets (Lipman Hearne Inc., 2006; Niu, et al., 2006).

[1] McDonough (1996) reports about 3600 possible college choices, but both Barron's and *U.S. News and World Report* list about half as many. In large part this disparity arises because two-year institutions, the fastest growing segment of the post-secondary system, are excluded from ranking schemes; another fast-growing segment, the private on-line systems, also are not considered by the organizations that evaluate post-secondary institutions.

How researchers define a choice set will likely influence parameter estimates of institutional attributes on the college selected, yet the college choice literature has largely ignored the analytical implications of defined choice sets for drawing inferences about college decision-making. In fact, research on recreation choice well illustrates that alternative definitions of choice sets produce quite different coefficient estimates in random utility modeling (Peters, Adamowicz and Boxall, 1995; Haab and Hicks, 1997; Parsons, Plantinga & Boyle, 2000; Hicks & Strand, 2000). As both the diversification of the college-age population (Tienda, 2005) and the higher education system continues to grow, the college choice process will become even more complex (Hosler, et al, 1989), requiring closer attention to the specification of plausible choice sets.

Accordingly, we address two questions that have both substantive and methodological implications: First, in what ways do college choice sets differ if left unconstrained to include all postsecondary institutions relative to choice sets that are constrained by students' academic achievement and the high school attended? This methodological consideration is germane for inclusion of selective and non-selective institutions on students' choice sets, which rests at the core of ongoing national debates about equity and access to higher education (Bowen, et al., 2005). Second, how sensitive are the estimates when applying RUM framework and using alternative criteria to define choice sets? And what are the substantive implications?

Empirical results show that constraining the criteria used to define choice sets produces quite different institutional profiles both in terms of the number of post-secondary alternatives students consider and, importantly, the representation of public and private, in-state and out-of-state, and selective as well as non-selective institutions.

Using conditional logit modeling to estimate the influence of college characteristics on students' top choice reveals that the choice set constrained by type of high school attended produces very different estimates from an unconstrained choice set, yet the choice set delimited only by class rank produces essentially similar results. We discuss the implications of this finding in light of recent policy strategies attempting to broaden access to college for low income students.

The following section discusses why Texas is a particularly appealing case study for this investigation. After describing the Texas Higher Education Opportunity (THEOP) data and specify the criteria used to delimit college choice sets, we compare the institutional composition of choice sets based on different operational constraints. Subsequently, we estimate conditional logit models using unconstrained choice sets, and those constrained by class rank, by high school attended, and by both criteria. The concluding section discusses the methodological significance of these findings for future research on college choice, and evaluates their substantive implications for equalizing access to higher education by guaranteeing admission to top achieving students.

Higher Education Opportunity in Texas

Texas is an interesting case study for understanding college decision-making for three important reasons: (1) the state's rapidly growing college-eligible population; (2) the character of its post-secondary system; and (3) a recent policy change governing college admission criteria.

An echo of the baby boom, the number of high school graduates rose throughout the 1990s into the current decade. Between 1994 and 2004, the number of high school

graduates surged 40 percent in Texas, compared with the national average of 19 percent, and well below the 27 percent growth in the State's college enrollment (WICHE, 2003).[2] Although the growth of the college-eligible population is projected to slow over the next decade, rising a meager two percent nationally, in Texas the number of high school graduates is projected grow 16 percent by 2015.

As the second most populous state, Texas has the third largest post-secondary education system, consisting of 198 degree-granting institutions and branches that differ in the selectivity of their admissions and the field of study options they offer. Over half of the State's degree-granting institutions are public, but only 21 percent (N = 42) are 4-year degree granting institutions (NCES, 2002: Table 244).[3] The expansion of higher education in Texas is distinctive for another reason, namely that enrollment at 2-year institutions has exceeded that at 4-year institutions since the mid-1990s, but nationally, growth of 2 and 4-year enrollment was more even. In addition, Texas has a tradition of relatively low tuition for residents, which raises the attractiveness of its public institutions relative to expensive private and out-of-state institutions (Leicht and Sullivan, 2000). These features of Texas higher education—the predominance of public institutions, the proliferation of 2-year institutions, and the relatively low cost of public education—have direct implications for the degree of competition for access to the public flagships, and college decision-making more generally.

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[2] During this period, the number of high school graduates in California and Florida increased 32 percent, but only 8 percent in New York State.

[3] For example, according to the National Center for Education Statistics (2002), California had a total 413 degree-granting institutions and branches, of which 65 percent were private; New York State had 309 institutions, with nearly three-fourths private. Among 4-year degree-granting institutions the differences are greater still: less than 8 percent of California's 4-year colleges and universities are public versus 13 percent for New York.

A third unique feature of Texas's post-secondary profile is its uniform admission regime, popularly known as the top 10% law, which grants automatic admission to any Texas public postsecondary institution to high school seniors who graduate in the top decile of their class (THECB, 1998). The guarantee of automatic admission for top 10% graduates coupled with uneven expansion of 2- and 4-year institutions heightened competition for admission to the most competitive public institutions, especially the affordable public flagships, Texas A&M and the University of Texas at Austin (Tienda and Niu, 2006). Therefore, top decile students should be more likely than lower ranked students to include the public flagships in their choice set. We investigate how these features of the Texas higher education system—its cost, public/private make-up and selectivity distribution—shape students' choice sets and their matriculation decisions.

Analytical Strategy

Empirical analyses are based on the senior cohort survey date from the Texas Higher Education Opportunity Project (THEOP), a longitudinal study of Texas public high school students who were first surveyed during spring of 2002 using a paper and pencil in-class survey instrument (N=13,803 from 96 high schools).[4] In addition to basic demographic, socioeconomic and standard tracking information, the baseline survey obtained information about students' future plans, including up to five ranked college preferences, applications and admission decisions. The first follow-up survey (wave 2),

[4] The 2002 graduation class was the first for which the uniform admission law was in effect throughout their high school career. Therefore, these students had maximum opportunity to learn about the provisions of the legislation, which was passed in 1997.

conducted one year following high school graduation, recorded up to three institutions to which students were admitted, in addition to the institution where they enrolled.[5]

Because prior studies indicate that *academic achievement* and *type of high school* attended are the most influential factors in students' post-secondary preferences, we use these two criteria to define college choice sets. The former largely determines the selectivity of institutions that students are likely to consider in their choice set, including those located out-of-state (Lipman Hearne Inc., 2006), while the latter influences both knowledge about college options and expectations about enrollment prospects within a family budget constraint (Bowen, Kurzweil and Tobin, 2005).

Class Rank

The uniform admission law increased the salience of class rank in gaining access to public colleges and universities in Texas. Therefore, we use this measure of student achievement to impose constraints on college choice sets. Seniors self-reported their class rank, measured in deciles, in the baseline survey. Class rank is either known to students or estimated by students when unknown, and is based either on spring semester of the junior year or fall of the senior year, depending on the semester in which students applied and were admitted to college.[6]

High School Strata

Texas public high schools vary appreciably in their size, urbanicity, socioeconomic status, ethno-racial composition and college-going traditions –

[5] For cost reasons, the longitudinal sample is based on a random subsample of the baseline respondents (N=5,836) who were re-interviewed by phone one year following high school graduation.

[6] Students who achieve top 10% rank during the spring of their senior year can also qualify for the admission guarantee, but because application deadlines have passed, at the selective institutions, they can only apply for the year following. The admission guarantee remains in force for two years following graduation, provided that students do not enroll in any post-secondary institution.

characteristics that portend heterogeneity in college preferences. To represent this diversity, we appended high school attributes provided by the Texas Education Agency (TEA) to individual records in order to stratify secondary schools according to the average socioeconomic status of their student body. Specifically, we devised a 5-category typology that differentiates resource-poor and affluent high schools from those of average resources.

Among affluent and resource-poor high schools, we further distinguish between those with low and high college-going traditions. Feeder high schools are a subset of the affluent schools with very strong college-going traditions, including a large number of students who historically attended the two Texas public flagships (Tienda and Niu, 2006). The University of Texas at Austin and Texas A&M University targeted a subset of resource-poor high schools for Longhorn Opportunity (UT) or Century (A&M) scholarships, which are made available to students who graduate in the top decile of their class. Although the schools targeted for the Longhorn or Century scholarships are identified on the basis of economic criteria and low college-going traditions, most have large shares of minority students.

RUM in College Choice Decision Making

Applying the random utility model framework in college choice decision making, it is assumed that student i chooses among J alternative colleges. Formally, the utility of student i stating a preference for college j is given by:

$$U_i\,(\text{college j}) = \beta \mathbf{Z}_{ij} + \varepsilon_{ij}\,,\ j = 1, \ldots, J \qquad (1)$$

where **Z** is a vector of institutional attributes X_{ij} and individual characteristics W_i. Choosing college j over other alternatives implies that U_i(college j)> U_i(college k), for all k ≠ j. Under the assumption that error terms ($\varepsilon_{i1}, \ldots, \varepsilon_{ik}$) are random, independently-distributed with an extreme value distribution (the Gumbel distribution), the probability that student i chooses college j is:

$$\text{prob(i chooses college j)} = \frac{e^{\beta Z_{ij}}}{\Sigma_J e^{\beta Z_{ij}}} \qquad (2)$$

Maximum likelihood estimation of β provides the estimated effect of institutional attributes X_{ij} and student characteristics W_i on the probability that student *i* chooses college j.

College Choice Sets

Criteria used to define college choice sets are not inconsequential for the application of random utility models. From equation (2) we can see that the probability of choosing college j depends on the choice set J, thus the likelihood function also depends on J. Consequently, the definition of choice set can affect parameter estimates. Current college choice literature assumes that rational decisions are made with perfect information, researchers commonly define college choice sets using all post –secondary institutions or, for computational efficiency, a random subset (Montgomery, 2002; Long, 2003; Niu et al., 2006). Therefore, the benchmark against which we compare choice sets constrained by academic achievement and high school attended is an "unconstrained college choice set," which includes all Texas post-secondary institutions registered by the

Texas Higher Education Coordinating Board (THECB) and all non-Texas post-secondary institutions identified by seniors in their top five college preferences, up to three institutions to which they were admitted (if not redundant), and the institution in which they ultimately enrolled.[7] So defined, the unconstrained college choice set includes 870 institutions and assumes that the non-Texas institutions named by respondents in any choice set are a representative sample of all non-Texas institutions (Niu, et al., 2006). Essentially this operationalization assumes that all students consider the same choices when deciding where to enroll.

We acknowledge that we do not know the true choice set, however, the literature provides evidence that resource and information constraints limit the range of institutions students' list as preferences. Therefore, we construct three alternative college choice sets by constraining expressed preferences using class rank and the type of high school attended. The *rank-constrained* set presumes that the highest achieving students will gain admission to the most selective institutions. Because the top 10% law rendered class rank the primary merit criterion for access to Texas's public flagships (as well as all other public institutions), the *rank-constrained* choice set restricts institutions to students of equal rank (specified by deciles) across all high schools. To avoid loss of student records missing class rank, we designate an additional category for a total of 11 *rank-constrained* choice sets.

Whether and where students aspire to attend college will partly depend on their exposure to ideas about post-secondary possibilities. Guidance counselors are an important source of information about college options and provide vital information

[7] Although most analysts of college choice presume that the institution in which students matriculate is included in both the preference and the admission choice set, this is not necessarily so because non-selective institutions with open admission policies become default options that add to the institutional set.

about application requirements and the availability of financial aid, but not all guidance departments emphasize college attendance to an equal extent (Bellessa Frost 2005; 2006). To acknowledge that high schools differ appreciably in their orientation to post-secondary education, the *school-constrained* choice set includes the colleges named by students who attend the *same* high school in their preference, admission and enrollment lists. With a different choice set for each high school represented in the THEOP data, we analyze 96 different *school-constrained* college choice sets.

Finally, the *school & rank-constrained* choice set, which is the most restrictive definition, includes the institutions identified by students of comparable rank who attended the same high school. Using these criteria, over 1,000 different choice sets are possible (11 * 96), but due to some empty cells in the rank distribution, these constraints produce only 783 distinct choice sets.[8] This operational definition of college choice sets acknowledges that *both* students' scholastic achievement and the college orientation of their high school restrict their college preferences and enrollment behavior. That is, even if high schools share similar academic climates, this specification of choice sets acknowledges that students' post-secondary alternatives are often narrowed by myriad factors, including geographic factors, peer networks, and family socioeconomic status (Boyle, 1966; Hotchkiss and Vetter, 1987; McDonough, 1997; Alwin and Otto, 1977). The multivariate analyses include covariates that take into account these influences.

Institutional Attributes

IPEDS codes permit us to append institutional characteristics designating size, location (in or out of state), public/private status, annual cost, distance from high schools,

[8] It bears repeating that the number of institutions comprising each choice set differs, but that the 783 is the number of unique combinations within rank and high school. This differs from the unconstrained set, which is a single choice set consisting of 870 institutions.

and a measure of individual-institutional fit, which expresses a student's College Board score as a deviation from the institutional spread and indicates the likelihood of admission (Long, 2004).[9] We also classify colleges and universities according to the competitiveness of their admissions and overall academic quality, using a modified Barron's selectivity classification scheme: most competitive; highly competitive; very competitive; competitive; and non- or less competitive. Although the Barron's typology is restricted to four-year post-secondary institutions, we also include two-year colleges as a separate category because of their importance as a post-secondary option in Texas (Tienda, 2006a).

The data analysis begins with a descriptive comparison of the four choice sets in terms of the number, the selectivity, the location and the public-private status of their constituent institutions. Subsequently, we estimate conditional logit models to evaluate whether and how inferences about the relative importance of institutional attributes, such as size, cost, admission selectivity, public/private status, location and scholastic "fit," vary depending on the criteria used to define choice sets. Finally, to further illustrate the substantive implications of the conditional logit estimation, we examine the resemblance of students' actual preferences according to the type of high school attended. The policy implications of these results are discussed in the context of the Texas top 10% law.

Descriptive Comparisons of College Choice Sets

[9] Two-year colleges do not report SAT scores, and these data are also missing for some four-year institutions. For institutions lacking information about SAT 25th and 75th percentiles, we substitute the mean for institutions of their selectivity category. Because 2-year colleges have virtually open admissions, we assign 200 and 700 as their 25th and 75th percentile values scores – that virtually qualify all students for admissions (Niu and Tienda, 2006).

College choice sets reflect students' perceptions, their admissibility based on their aspirations, their academic achievement, and the post-secondary orientation of their high school. As the college squeeze intensifies throughout the country, but particularly in high growth states like Texas (Tienda, 2006a), many college-bound students cast their choice set wide, combining "safety" schools with their top preferences.

Table 1 summarizes how the alternatively defined choice sets differ. Most important, the number and size of the choice sets differs. These range from the least constrained, consisting of a single choice set with of 870 different institutions to the most constrained definition, which consists of 783 distinct choice sets that vary in size from a single college to a maximum of 73 institutions. There is also considerable variation in the size of the school-specific choice sets, which range in size from two to 197 colleges and universities, with an average of 52. The school-constrained college count is partly a function of class size, but other factors, such as distance from specific institutions, cost and reputation also influence both the number and types of institutions included in the rank-specific choice sets (Niu, et al., 2006; Lipman Hearne In., 2006).

(Table 1 about Here)

The rank-constrained set, which includes all colleges and universities mentioned by students of equivalent class rank across the state (irrespective of high school attended) shows a monotonically decreasing number of institutions in the choice set, with exceptions at the second and fifth deciles. Seniors graduating in the top two deciles of the rank distribution named over 400 unique institutions as college preferences, while those in the lowest decile named only 95 institutions. That students ranked in the second decile identified slightly more colleges than top 10% graduates likely reflects their lower

confidence about gaining admission to their top preferences, hence their inclination to add more "safety" schools. With both class rank and high school attended constrained, the rank-specific range is narrowed considerably, but the maximum values reveal great disparities across high schools in the number of institutions considered by students of comparable achievement. The average number of institutions per choice set exhibits the same monotonic pattern observed when only rank constraints are imposed, with a slight up tick for the second and fifth decile.

Table 2 illustrates how the composition of the colleges and universities included in the four types of choice sets varies along three dimensions: institutional selectivity; private-public status; and location. Of the 870 institutions included in the unconstrained choice set, 60 percent are private and one-in-four are two-year colleges. This is consistent with Texas's overall profile of higher education described above. About 6 percent of the institutions included in the unconstrained set qualify as "most competitive," according to Barron's selectivity index. The attributes of the unconstrained choice set are the same for all seniors and those who qualify for the admission guarantee under the top 10% law, but this is not so for the full rank-constrained choice set and that of the highest achieving students.

(Table 2 About Here)

Neither the unconstrained nor the school-constrained choice sets show how the institutional selectivity of the colleges differs for students who are guaranteed admission to the public flagships. The rank-constrained choice set reveals that college-bound seniors who graduated in the top 10% of their high school class were more likely to include private, out-of-state, and highly competitive institutions in their choice sets compared

with all seniors (see second column of Table 2). Compared to all seniors high-achieving students are more likely to include the most competitive institutions when their choice sets are constrained by both rank and high school and far less inclined to list two-year institutions among their college preferences. Only 8 percent of the institutions included in the school & rank-constrained choice sets by top decile graduates were two-year colleges, but over half were very, highly or most competitive.

Compared to the rank-constrained choice sets, the rank & school-constrained choice sets reveal considerable variation (indicated by the standard deviations) in the representation of private, non-Texas and competitive institutions, especially among the highest ranked students. Variation in the selectivity of choice sets according to type of high school attended is equally striking. The typology of high schools, which partly reflects campus differences in orientation toward post-secondary preparation, further illustrates how the institutional preferences differ among students of comparable rank. Because institutional selectivity distribution of the school-constrained and the school & rank-constrained choice sets are similar for all seniors, Figure 1 illustrates this point by imposing the most restrictive criteria.

(Figure 1 About Here)

For students attending typical, resource-poor, or Longhorn/Century high schools, the selectivity composition of the school & rank-constrained choice set approximates that of the unconstrained and the rank-constrained choice sets. However, the school & rank-constrained choice set for graduates from affluent schools, and especially feeder high schools, includes a disproportionate share of highly and most selective colleges. Over half of the institutions in the college choice set of all seniors attending feeder high

schools were classified as very, highly, or most competitive according to the Barron's scheme (upper panel), with 30 percent in the two highest selectivity categories alone. Among top decile graduates who attended feeder high schools (lower panel), nearly 80 percent of the institutions included in the most constrained choice set qualified for Barron's the top three selectivity categories, with about one-in-three in the most competitive stratum. By contrast, less than 10 percent of the colleges included in the choice sets of top decile seniors attending Longhorn or Century high schools are classified as most competitive and another 10 percent are designated highly competitive.

The choice set for graduates from affluent high schools not only includes an above average share of the most competitive institutions, but also higher than average representation of private and out-of-state colleges and universities. About 60 percent of the college options listed by top 10% graduates from feeder and affluent Texas high schools are private and over 70 percent are located out-of-state. Yet, among comparably ranked seniors attending schools targeted for Longhorn or Century scholarships, about half of the choice set consists of private institutions and less than half of the institutions are located outside of Texas. As a point of reference, in 2001-02, out of 198 Texas post-secondary degree-granting institutions and branches, 45 percent were private, but they account for approximately 5 percent of the state's college enrollment.

To summarize, these comparisons illustrate that college choice sets differ in the number, selectivity, location, and public/private status of their constituent institutions depending on whether student preferences are constrained by class rank, by high school attended, or both. The composition of the unconstrained choice set does not differ according to high school attended or class rank, and while that of the rank-constrained

choice does vary according to class rank, variation is limited. However, the institutional make-up of school-constrained choice sets shows much greater variation across high schools. The greatest variation in the institutional composition of choice sets corresponds to the school&rank-constrained choice sets. In particular, the college choice set for students who attend affluent high schools, and especially the feeder schools distinguished by their strong traditions of sending students to the Texas public flagships, includes disproportionate numbers selective, private and out-of-state college and universities. That the size and composition of college choice sets differ appreciably when constrained by school type has direct implications for how institutional attributes influence student preferences and enrollment decisions, as the multivariate analysis demonstrates.

Conditional Logit Model Estimation

To appreciate how institutional attributes, such as selectivity, type, location, cost, and individual-institutional fit, influence students' top college preference, we estimate a conditional logit model using four alternative constructions of the choice set: the full set (870 institutions); the rank-constrained set ($142 \leq$ set ≤ 866); the school-constrained set ($2 \leq$ set ≤ 197); and the school-and-rank-constrained set ($2 \leq$ set ≤ 197).

For theoretical and practical reasons, we use students' first preference as the dependent variable. Theoretically, the top preference reveals students' college aspirations, unconditioned by whether they actually applied or were admitted. Several studies show that enrollment at students' top preference is related to various measures of success in college (Hossler, et al., 1989; Kim, 2002). From a practical standpoint, about half of respondents who specified a 1st preference enrolled at that institution, and another

10 percent enrolled at a post-secondary institution different from their top choice, but of comparable selectivity.

Two additional issues about the conditional logit modeling warrant mention. First, in estimating conditional logit models, we expand rank-constrained and school & rank-constrained choice sets to include preferences of students who are ranked below designated thresholds. Specifically, the *rank-constrained* set for conditional logit modeling includes post-secondary preferences and enrollment decisions of students of *equal or lower* decile rank *across all high schools*, and the *school & rank-constrained* choice set includes college preferences and enrollment options of *equal or lower* rank students who attended the *same high school*. Imposing these academic merit and information constraints produces no adverse effect on conditional logit estimation (Kohn, Manksi and Mundel, 1976).

Second, conditional logit modeling of the 1st preference requires limiting the working sample to college-bound seniors because at least one post-secondary institution is necessary to enter the sample. Thus, the analysis sample represents a selective sub-sample of 7,417 Texas college-bound seniors, of which nearly 40 percent graduated in the top two deciles of their high school class and about 80 percent ranked in the upper half of the class rank distribution.

Table 3 presents the conditional logit estimates for college-bound students' top institutional preference using four definitions of the choice set. With few exceptions, odds ratios estimated from the unconstrained choice set are almost identical to those derived from the rank-constrained set, while the estimates based on the school-constrained choice set are virtually identical to those based on the school-and-rank-

constrained choice set. Although both sets of estimates are consistently signed, they differ in magnitude, particularly for the odds ratios associated with college selectivity, private status, and non-Texas location. Put differently, because college bound students largely hail from the upper half of the rank distribution, constraining choice sets only by class rank does not significantly alter the empirical estimates. This is because, as shown earlier, the choice sets exhibit less variation according to class rank than among high school attended, which largely determines the range of options students consider in selecting their top choice.

(Table 3 About Here)

As indicated by the odds ratios are close to unity, students are generally less responsive to college attributes when choice sets are constrained by high school attended (school-constrained and school & rank-constrained sets) than if choice sets are totally unconstrained, as most analysts assume, or constrained only by some measure of academic achievement, such as class rank. This inference finds additional support in the pseudo R-square values, which drop from 0.33 and 0.31 for the full and rank-constrained choice sets to 0.16 and 0.12 for the choice sets where school constraints are imposed.

The uniform admission law raises interest in the responsiveness of the highest achieving students—those who graduate in the top decile of their class—to alternatively defined choice sets. Table 4 presents the results of the conditional logit model based on the subset of students who graduated in the top decile of their class. Changes in the estimates across definitions parallel the changes in results based on the full sample, with some interesting deviations. That is, the estimates are similar based on the unconstrained and the rank constrained choice sets, but rather different from estimates obtained from

school constrained choice sets, whether or not constrained by rank. Again, students are less responsive to institutional characteristics when choice sets are constrained by high school attended. In one instance, coefficients attain statistical significance— Top 10% graduates are more likely to choose a private institution as their first preference compared with all seniors intending to pursue higher education, but this inference obtains only for the school-constrained rank sets. Unlike the estimates based on the all graduating seniors, the unconstrained choice set reveals that top 10% graduates are indifferent to the public-private status of their top choice.

(Table 4 About Here)

Taken together, results in Tables 3 and 4 support claims based on the descriptive tabulations that the type of high school attended most decisively influences college aspirations, and consequently, the construction of choice sets. Lower average responsiveness to institutional attributes based on school-constrained choice sets reflects the relatively homogeneous preferences of students who graduate from competitive high schools, and particularly those with strong college-going traditions.[10] Within schools, students are exposed to similar college attendance rate—high, moderate or low—and the college-bound likely receive similar counseling advice (Bellessa Frost, 2006).

For example, seniors who designate a most competitive college as their top preference are more likely to graduate from a feeder or affluent high school. Conversely, seniors who designate a two-year college as their top choice are more likely to graduate from a poor or Longhorn/Century high school. That their choice sets include clusters of institutions with similar admissions criteria produces odds ratios close to unity because of the narrower variation in college selectivity within high school strata. Also, students

[10] Separate estimates by high school type are available upon request.

probably also consider other college attributes not considered in our models, such as reputation of a desired discipline or program (Lipman Hearne Inc., 2006), distance from home (Niu, et al., 2006), and advice from friends and relatives (Bellessa Frost, 2006).

Our claim about the relatively homogeneous choice sets associated with type of high school attended is further bolstered by another statistical property of the conditional logit model, namely its strong assumption about the independence of irrelevant alternatives (IIA). The IIA assumption is rejected rarely using the full choice set, but never when using the school&rank-constrained choice set. Statistically, it implies that school-constrained choice sets fit the model's restriction better than the full choice set. In substantive terms, our results imply that for students who make their college choice from a list of Ivy League schools, adding or dropping one such institution from the list will not affect their preference for universities classified as the "most competitive."

The final section further illustrates how the stratification of secondary education in Texas delimits post-secondary educational opportunity, even for students whose academic achievements qualify them for the admission guarantee. Because odds ratios lack texture about the institutional composition of choice sets, we illustrate how college preferences are related to type of high school attended by examining the "selectivity spread" among students' ranked preferences. Subsequently we ask whether students eligible for the admission guarantee actually include the two public flagships among their preferences.

Mirage of Uniform Admissions: Expanded Opportunity or Binding Constraints?

Heretofore our examination of how college attributes influence students' choices has taken the 1st preference as given, without considering how much and in what ways choice sets themselves may reflect limited range in students' top preference. In interpretating of changes in the conditional logit estimates between the unconstrained and school-constrained choice sets, we claim that students' low responsiveness to college selectivity reflected relatively homogeneous choice sets corresponding to type of high school attended. To further demonstrate the homogeneity of students' preferences, we shift our analytic focus from constructed choice sets to students' five listed preferences in the baseline survey.

Figure 2 compares Texas seniors' 1st preference arrayed against lower ranked alternatives in their choice sets. Specifically, the bar charts graph the distribution of first preferences against 2nd , 3rd and higher order preferences for students who included more than one institution in their choice set. The bar charts, which portray preferences using Barron's selectivity categories plus two-year colleges, show a strong resemblance among students' ranked preferences. Simply put, the more preferences identified, the stronger the resemblance. For example, over 40 percent of students who reported only two preferences and specified a 2-year college as their top choice listed another 2-year or a non/less competitive institution as their 2nd preference. Furthermore, nearly 60 percent of students who reported five options and identified a 2-year institution as their top choice listed another 2-year or a non/less competitive institution among as their 2nd and higher order preferences.

(Figure 2 About Here)

At the other end of the selectivity spectrum, nearly half of all seniors with only two preferences who named a "most competitive" institution as their top choice identified another equally competitive (20 percent) or highly competitive (30 percent) college as their 2nd choice. Students aspiring to a most competitive institution as their top choice, but with five identified preferences that include "safety schools" also exhibit considerable homogeneity among their college options. About 40 to 60 percent of them named another most competitive institution as their 2nd and higher order preferences, while another 20 to 40 percent of them specified highly competitive institutions as their lower order preferences. The striking resemblance of students' college preferences acquires even greater significance in light of the fact that the selectivity of students' first preference is strongly related to the type of high school attended. More than 60 percent of seniors graduating from feeder schools and nearly half of graduates from affluent high schools name a very competitive (A&M is so classified), a highly competitive (e.g., UT-Austin is so classified), or a most competitive (i.e., Rice and SMU) institution as their top college preference, but only about 20 percent of seniors graduating from resource-poor and Longhorn century school students do so.

Other researchers have found that students' applications resemble each other and their characteristics are strongly related to students' socioeconomic and academic background (Jackson 1978; Zemsky and Oedel, 1983; Paulsen, 1990). From an institutional perspective, this means that collegiate competition occurs principally between like institutions, and for similar groups of students (Zemsky and Oedel, 1983). Although our data were collected several decades later in the context of legislation designed to equalize college access for high performing students in Texas, our findings

re-affirm results of prior studies that demonstrate powerful relationships between high school attended and students' college choices. Whether bold policy initiatives like the uniform admission law can weaken the link between high school quality and post-secondary attendance is not yet clear. For some insight into this question, we consider whether rank-eligible graduates included one or both of the public flagships among their college preferences, defined to also include institutions where they were admitted and enrolled, and how this institutional preference differed according to type of high school attended.

College Preferences and the Public Flagships

The Texas top 10% law was motivated by a desire to broaden access to Texas public flagships – The University of Texas at Austin and Texas A&M at College Station – by fostering greater geographic, socioeconomic and race/ethnic representation among seniors ranked in the top decile of their class. The abrupt changes in college admission regimes during the mid-1990s resulting from the 1996 judicial ban on racial preferences and the enactment of the uniform admission law in 1997 led to initial confusion about the new guidelines. For example, the year following the *Hopwood* decision, applications dropped appreciably, particularly among members of underrepresented groups (Leicht and Sullivan, 2000).

In an effort to notify students of the changed admission criteria, at the initiative of administrators at the public flagships, graduating seniors received letters signed by then Governor George W. Bush encouraging qualified students to exercise their option. Moreover, in an effort to recruit high achieving students from high schools with low college-going traditions, UT-Austin and Texas A&M stepped up outreach to resource

poor high schools that sent relatively few students to their campuses. As the first cohort for whom the uniform admission law was in effect since the beginning of their secondary schooling, the intensified outreach could induce nontrivial shares of 2002 graduates from the Longhorn/Century high schools to include one or both of the public flagships among their college preferences.[11]

Using the typology of Texas public high schools described above, Table 5 reports the share of students who included one or both of the two Texas public flagships among their college preferences (including admission and enrollment institutions). For parsimony, tabulations are based on the upper half of class rank distribution, which represents the bulk of college-bound students. Not surprisingly, 44 percent of all seniors from feeder high schools included one or both of the public flagships in their preference list, but only 18 percent of graduates from Longhorn/Century schools did so.

(Table 5 About Here)

These school-wide averages conceal important variation by class rank, which is the key mechanism for leveling the playing field under the top 10% law. In general, there is an inverse monotonic relationship between class rank and the shares of students who aspire to attend one of the public flagships. The notable exception are the feeder schools, where students ranked in the second decile of their class are more likely to include UT or A&M in their choice set compared with their higher ranked peers.

Over half of top decile seniors who attend the feeder schools included the public flagships in their choice set but only 42 percent of top 10% graduates Longhorn/Century high schools. Tienda and Niu (2006) claim that for many top decile students from feeder

[11] The Texas percent plan differs from the Florida and California plans in this respect, as neither allows students to select their campus (Tienda, 2006a).

and affluent high schools, the public flagships serve as a back-up for the most selective private institutions in the nation where, because of rising demand, admission is highly uncertain even for the most accomplished students. Also noteworthy is the strong association between feeder school status and aspirations to attend the public flagships. About one-in-three feeder high school students ranked in the middle of their class aspire to attend one of the public flagships, compared with only 12 to 14 percent of typical or affluent high schools, respectively, and less than 10 percent of equally ranked graduates from resource poor high schools.

A comparison of the resource poor and Longhorn/Century high schools suggests that the aggressive outreach to entice high achieving students to apply by offering tuition scholarships to qualifying students has paid off. Among second decile students at these schools, there is no difference in the shares who aspired to attend either UT-Austin or Texas A&M after graduation. However, 42 percent of top decile students who attended Longhorn/Century high schools include one of the public flagships in their listed preferences compared with only 31 percent of top decile graduates from resource poor high schools. This comparison suggests that, beyond the admission guarantee, the prospects of receiving financial aid may raise hopes low income students to attend one of the public flagships.

Conclusions and Implications

In this paper, we examine college choice sets without and with constraints of students' academic achievement and high school attended, and we further examine how use of different criteria to construct choice sets affects inferences about the influence of

college attributes on college preferences. Our results have both substantive and methodological lessons.

Substantively, we find that the criteria used to define choice sets produces very different institutional profiles based on the number of institutions, the distribution by type (public vs. private), location (in state vs. out-of-state) and selectivity. Most important our results demonstrate that type of high school attended determines how broadly and how high students set their college sights, and ultimately, how they weigh various college attributes in ranking their personal preferences. That class rank does not significantly delimit students' college choice sets and how they weigh various factors in ranking options runs counter to the image of the Texas top 10% plan as a strategy to broaden access to college across the state by leveling level the playing field.

We also confirm a high degree of resemblance in the selectivity of institutions included among students preferences according to the type of high school attended. Specifically, graduates from feeder schools aspire to attend selective institutions including the Texas public flagships; among students from resource poor high schools, the availability of Longhorn or Century scholarships also raises hopes to attend either UT-Austin or Texas A&M university. That the selectivity of students' 1st preference is strongly related to quality of high school attended has direct implications for the success of the uniform admission law in equalizing college opportunity in Texas. Combined with the statistical estimates establishing that choice sets differ significantly according to the type high schools attended, this finding suggests a direct link between types of high schools attended and ranked college preferences—something the uniform admission law by itself can not change.

On a methodological front, our results warrant further thought about the use of random utility models to understand college choice. On the one hand, the consistently signed estimates reaffirm the usefulness of the random utility framework for understanding the general contours of a rather complex decision process. On the other hand, the differing coefficient magnitudes suggests a need for caution when using random utility models model for prediction, especially where the precision of the estimates are critical. As such, researchers should carefully consider the choice sets that students face and possibly produce different prediction values using estimates obtained from different choice set construction.

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Table 1: Number of Institutional Alternatives Using 4 Definitions of Choice Sets (Counts)

Class Rank	Un-constrained	Rank-Constrained	School-Constrained			School & Rank-Constrained		
			min	max	average[a]	min	max	average[a]
10	870	412	2	197	52	1	65	17.9
20	870	429	2	197	52	1	73	18.7
30	870	366	2	197	52	1	71	16.3
40	870	321	2	197	52	1	52	13.3
50	870	381	2	197	52	1	60	15.5
60	870	296	2	197	52	1	48	11.2
70	870	247	2	197	52	1	32	9.8
80	870	201	2	197	52	1	26	7.5
90	870	144	2	197	52	1	17	5.1
100	870	95	2	197	52	1	12	4.2
missing	870	142	2	197	52	1	23	5.7
# of Choice S	1	11	96			783[b]		

Source: THEOP Wave 1 & 2 Senior Surveys

Note:

Unconstrained set: All Texas post-secondary institutions and Non-TX institutions mentioned by students.

Rank-Constrained set: institutions mentioned by students of equal rank across schools; uniform within class rank.

School-Constrained set: institutions mentioned by students in the same high schools; uniform within high schools.

School & Rank-Constrained set: institutions mentioned by students of equal rank in the same high school; uniform within schools and class ranks.

a: Average over positive number of alternatives.

b: Maximum possible is 1056 different choice sets (96 * 11). The lower number results because in some schools, there are no students for specific class ranks.

Table 2: Selective Characteristics of College Choice Sets (In Percents; Standard Deviations in Parentheses)[a]

Barron's Selectivity Index	Unconstrained	Rank-Constrained		School-Constrained		School & Rank-Constrained	
	Percent	Percent	(s.d.)	Percent	(s.d.)	Percent	(s.d.)
All Seniors							
Two-Year	25	30	(10.17)	19	(13.91)	21	(25.21)
Non/Less Competitive	18	18	(1.90)	19	(8.12)	20	(17.01)
Competitive	24	23	(2.52)	26	(8.45)	26	(19.04)
Very Competitive	19	17	(4.60)	20	(7.72)	19	(14.17)
Highly Competitive	7	6	(2.85)	7	(4.04)	7	(8.42)
Most Competitive	6	6	(2.52)	9	(5.61)	6	(7.83)
Private	60	47	(9.47)	46	(14.15)	34	(20.10)
Non-TX	77	54	(16.10)	46	(19.89)	29	(19.88)
Top Decile Seniors[b]							
Two-Year	25	17		19	(13.91)	8	(11.98)
Non/Less Competitive	18	15		19	(8.12)	14	(13.58)
Competitive	24	24		26	(8.45)	25	(19.07)
Very Competitive	19	21		20	(7.72)	23	(11.71)
Highly Competitive	7	12		7	(4.04)	12	(8.47)
Most Competitive	6	11		9	(5.61)	17	(13.47)
Private	60	58		46	(14.15)	48	(20.96)
Non-TX	77	71		46	(19.89)	41	(21.66)

Source: THEOP Wave 1 & 2 Senior Surveys

a: Standard deviations do not apply to unconstrained choise set, which is based on the full universe.

b: Rank-Constrained is based on universe of top 10% seniors.

Figure 1: College Selectivity of School&Rank-Constrained Choice Sets
by Type of High School Attended

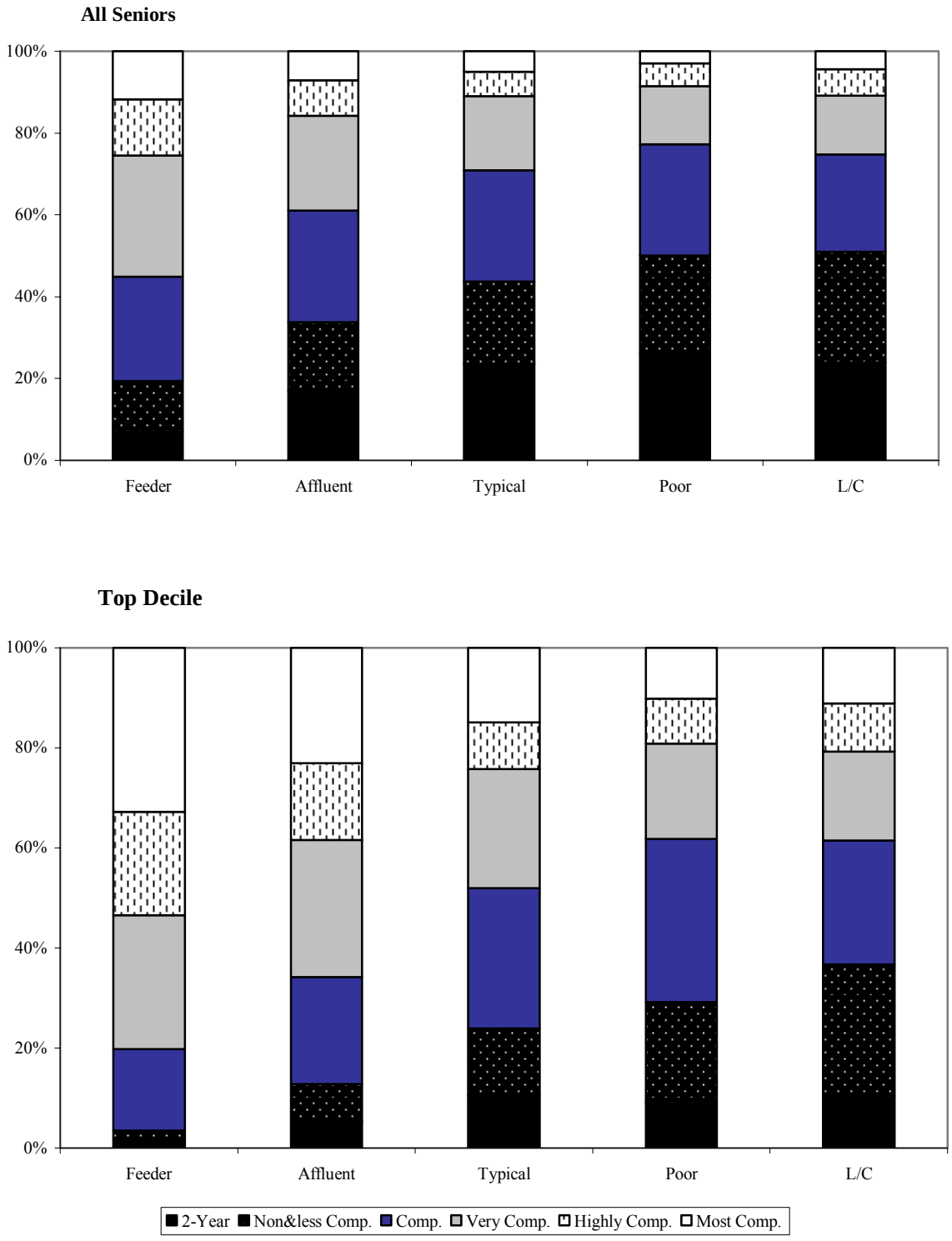


Table 3: Conditional Logit Estimation of the First College Preference
(Odds Ratios; S.E. in parentheses)

	Unconstrained	Rank-Constrained	School-Constrained	School&Rank-Constrained
Institutional Selectivity[a]				
Two-Year	0.2 (.011) ***	0.2 (.011) ***	0.6 (.032) ***	0.6 (.033) ***
Competitive	2.0 (.076) ***	1.9 (.075) ***	1.7 (.067) ***	1.7 (.066) ***
Very Competitive	1.8 (.094) ***	1.9 (.095) ***	1.6 (.080) ***	1.7 (.082) ***
Highly Competitive	2.4 (.169) ***	2.5 (.176) ***	2.2 (.154) ***	2.1 (.148) ***
Most Competitive	9.4 (.930) ***	9.3 (.928) ***	3.7 (.380) ***	3.8 (.397) ***
Institutional Attributes				
Annual Cost	0.846 (.006) ***	0.843 (.006) ***	0.867 (.007) ***	0.866 (.007) ***
Annual Cost^2	1.005 (.000) ***	1.005 (.000) ***	1.004 (.000) ***	1.004 (.000) ***
% Need Fully Met	0.995 (.001) ***	0.995 (.001) ***	0.998 (.001) **	0.999 (.001)
Distance	0.935 (.001) ***	0.936 (.001) ***	0.962 (.001) ***	0.969 (.001) ***
Distance^2	1.000 (.000) ***	1.000 (.000) ***	1.000 (.000) ***	1.000 (.000) ***
Enrollment Size	1.082 (.001) ***	1.080 (.001) ***	1.049 (.001) ***	1.044 (.001) ***
Private Institution	0.528 (.023) ***	0.560 (.025) ***	0.760 (.033) ***	0.845 (.037) ***
Non-Texas Institution	0.330 (.015) ***	0.382 (.017) ***	0.669 (.031) ***	0.710 (.034) ***
Individual-Institutional Fit				
SAT>75th Percentile	0.6 (.028) ***	0.6 (.028) ***	0.6 (.029) ***	0.6 (.029) ***
SAT<25th Percentile	0.4 (.015) ***	0.4 (.015) ***	0.4 (.016) ***	0.5 (.018) ***
Strata (n)	7,417	7,417	7,417	7,402
College Choice Set	870	142≤set≤866	2≤set≤197	2≤set≤197
Observations (N)	6,452,790	4,894,506	716,611	483,656
Pseudo R-Squared	0.3366	0.3092	0.1557	0.1226

Source: THEOP Wave 1&2 Senior Surveys

[a]Reference group: Non/Less Competitive

***: p<0.001, **: p<0.01, *: p<0.05

Table 4: Conditional Logit Estimation of College Preferences for Top 10% Seniors
(Odds Ratios; S.E. in parentheses)

	Unconstrained	Rank-Constrained	School-Constrained	School&Rank-Constrained
Institutional Selectivity[a]				
Two-Year	0.1 (.010) ***	0.1 (.010) ***	0.2 (.031) ***	0.2 (.031) ***
Competitive	1.7 (.168) ***	1.7 (.166) ***	1.5 (.146) ***	1.5 (.146) ***
Very Competitive	2.3 (.266) ***	2.3 (.263) ***	1.9 (.220) ***	1.9 (.220) ***
Highly Competitive	3.2 (.481) ***	3.2 (.477) ***	2.8 (.406) ***	2.8 (.406) ***
Most Competitive	17.9 (3.401) ***	17.8 (3.381) ***	7.2 (1.407) ***	7.2 (1.407) ***
Institutional Attributes				
Annual Cost	0.816 (.013) ***	0.817 (.013) ***	0.846 (.014) ***	0.846 (.014) ***
Annual Cost^2	1.006 (.000) ***	1.006 (.000) ***	1.004 (.000) ***	1.004 (.000) ***
% Need Fully Met	1.000 (.001)	1.000 (.001)	1.004 (.001) ***	1.004 (.001) ***
Distance	0.943 (.002) ***	0.943 (.002) ***	0.963 (.002) ***	0.963 (.002) ***
Distance^2	1.000 (.000) ***	1.000 (.000) ***	1.000 (.000) ***	1.000 (.000) ***
Enrollment Size	1.099 (.004) ***	1.099 (.004) ***	1.067 (.004) ***	1.067 (.004) ***
Private Institution	0.954 (.099)	0.960 (.100)	1.267 (.129) *	1.267 (.129) *
Non-Texas Institution	0.298 (.032) ***	0.297 (.032) ***	0.693 (.074) ***	0.693 (.074) ***
Individual-Institutional Fit				
SAT>75th Percentile	0.7 (.065) ***	0.7 (.065) ***	0.7 (.065) ***	0.7 (.065) ***
SAT<25th Percentile	0.4 (.038) ***	0.4 (.038) ***	0.4 (.042) ***	0.4 (.042) ***
Strata (n)	1,509	1,509	1,509	1,509
College Choice Set	870	866	4≤set≤197	4≤set≤197
Observations (N)	1,312,830	1,306,794	141,715	141,715
Pseudo R-Squared	0.4002	0.4000	0.2172	0.2172

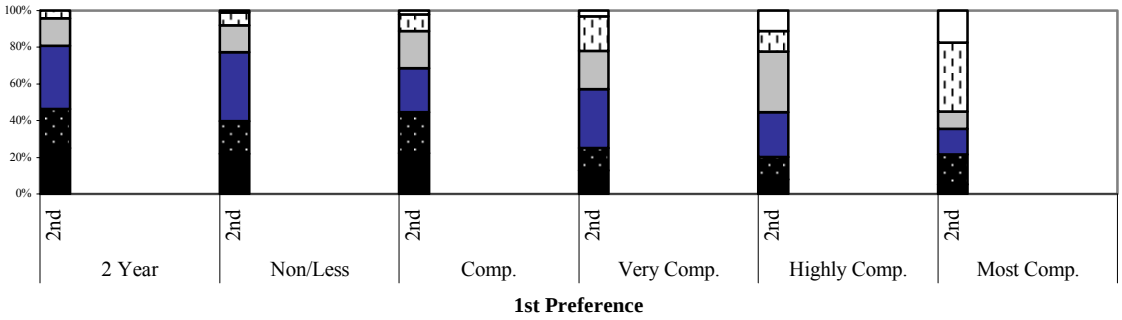
Source: THEOP Wave 1&2 Senior Surveys

[a]Reference group: Non/Less Competitive

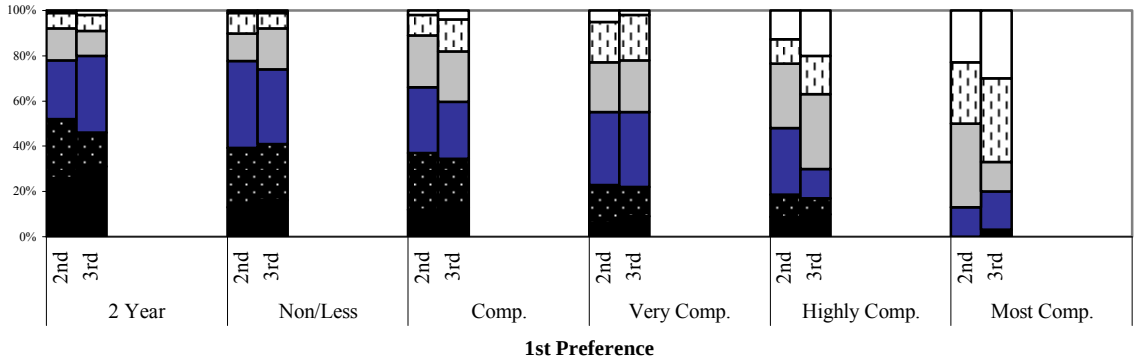
***: p<0.001, **: p<0.01, *: p<0.05

Figure 2: Selectivity of College Choice Sets by Preference

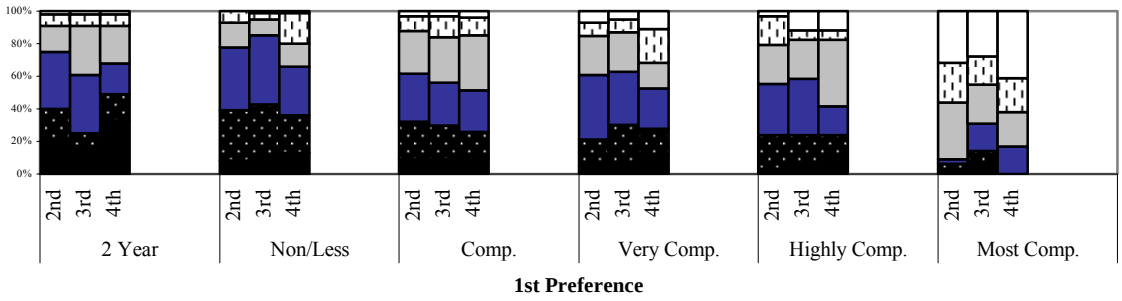
1st vs. 2nd Preferences (N=2280)



1st vs. 2nd and 3rd preferences (N=1075)



1st vs. 2nd, 3rd and 4th Preferences (N=425)



1st vs. 2nd, 3rd, 4th and 5th Preferences (N=294)

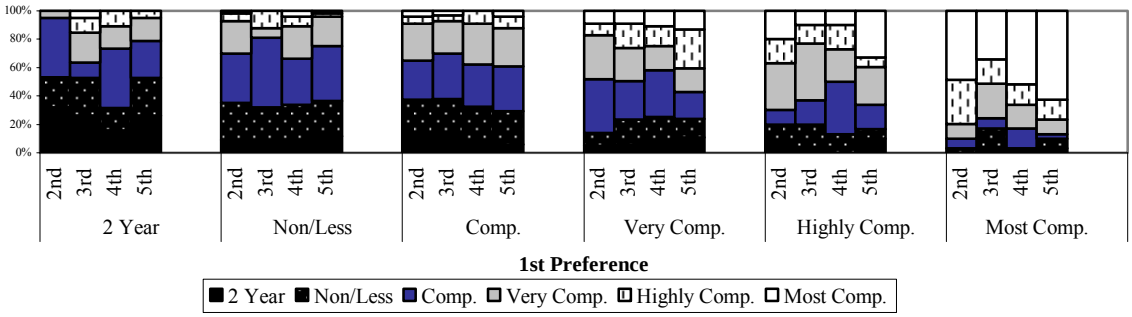


Table 5: Texas Public Flagships Included in Students' Preferences[a] (Percent)

Class Rank	School Type					
	Feeder	**Affluent**	**Typical**	**Poor**	**L/C**	***N***
All Seniors	44	29	24	17	18	7483
10	55	60	47	31	42	1512
20	63	37	25	18	19	1605
30	47	26	22	13	13	1166
40	40	15	17	13	7	825
50	32	14	12	7	9	915

Source: THEOP Wave 1 & 2 Senior Surveys

Note:

a: Includes all institutions identified in ranked preference list and where students enrolled