Educational Evaluation and Policy Analysis
September 2011, Vol. 33, No. 3, pp. 318–339
DOI: 10.3102/0162373711406718

Running in Place: Low-Income Students and the Dynamics of Higher Education Stratification

Michael N. Bastedo
University of Michigan
Ozan Jaquette
University of Arizona

The increasing concentration of wealthy students at highly selective colleges is widely perceived, but few analyses examine the underlying dynamics of higher education stratification over time. To examine these dynamics, the authors build an analysis data set of four cohorts from 1972 to 2004. They find that low-income students have made substantial gains in their academic course achievements since the 1970s. Nonetheless, wealthier students have made even stronger gains in achievement over the same period, in both courses and test scores, ensuring a competitive advantage in the market for selective college admissions. Thus, even if low-income students were "perfectly matched" to institutions consistent with their academic achievements, the stratification order would remain largely unchanged. The authors consider organizational and policy interventions that may reverse these trends.

Keywords: *stratification, inequality, class, admissions, higher education*

Although widely accepted by policymakers (Bastedo, 2009; Bastedo & Gumport, 2003), institutional stratification in higher education has demonstrably negative effects for both students and states. First, poor students are increasingly concentrated in community colleges, which has negative effects on baccalaureate attainment. As a nation over the past three decades, we have grown our public higher education system almost exclusively in the community college sector (Gerald & Haycock, 2006). Yet students are 13% less likely to graduate with a bachelor's degree if they first attend a community college instead of a 4-year college or university (B. T. Long & Kurlaender, 2009). Even if students gain access to less selective 4-year colleges, they are far less likely to graduate with a bachelor's degree than are students who attend selective colleges, even when controlling for academic ability (Bowen, Chingos, & McPherson, 2009; Melguizo, 2008).

The increasing concentration of wealthy students in selective colleges, both public and private, has become a major concern in policy circles (Bowen, Kurzweil, & Tobin, 2005; Carnevale & Rose, 2004; Gerald & Haycock, 2006; Hoxby & Avery, 2009; Kahlenberg, 2004). This article tests recent hypotheses about the relationship between college students and institutional selectivity. First, we address whether shifts in institutional stratification are driven by declining academic preparation among low-income students (Haycock, Lynch, & Engle, 2010). Second, we address whether the "undermatching" hypothesis is a major cause of institutional stratification (Bowen, Chingos, & McPherson, 2009). The undermatching hypothesis suggests that there is a significant pool of low-socioeconomic-status (SES) students who are attending colleges that are less selective than the ones they could have attended based on their academic preparation.

Looking at the longitudinal data, we find a more nuanced pattern than either of these hypotheses indicated. We find that although low-income students have shown strong gains in the indicators that lead to admission to highly selective schools—and therefore might be seen as undermatching—higher income students have simultaneously made even stronger gains on these same indicators. Thus, enrollment in selective colleges has become a horse race in which wealthier students always remain at the head of the pack. As a result, low-income students have failed to make substantial gains in college placement despite substantial increases in academic course achievement.

Conceptual Framework and Hypotheses

The relationship between SES and selective college attendance is firmly established (Hearn, 1991; Karen, 2002; Kingston & Lewis, 1990). Affluent households with high levels of parental education have more human, social, and cultural capital to devote to education from the earliest ages, which situates them favorably in the competition for places at selective colleges (Lareau, 2003; McDonough, 1997). Students from high-SES households are likely to live in neighborhoods composed primarily of other high-SES households, attending well-funded schools that have strong cultures of academic achievement (Frank & Cook, 1995).

Nonetheless, there are low-SES students with strong precollegiate academic preparation, and these students are more likely to benefit from attending selective colleges, particularly minority students (Bowen & Bok, 1998). Recent scholarship suggests that undermatching may be a serious problem for these students. Using state-level data from North Carolina, Bowen, Chingos, and McPherson (2009) argue that a substantial proportion of low-income students are attending institutions that are less selective than schools consistent with their academic achievements. The result, they argue, is reduced academic attainment among low-income students because graduation rates are weaker at less selective institutions.

Unfortunately, scholarship on matching—the difference between a student's precollegiate academic preparation and the average of the institution as a whole—has focused predominantly on affirmative action. In the 1980s and 1990s, critics of affirmative action argued that racial minorities were damaged by affirmative action through lower graduation rates and that minority students would perform better—earn higher GPAs and be more likely to graduate—if they attended colleges that "fit" their academic profile (e.g., Cole & Barber, 2003; Light & Strayer, 2000; Thernstrom & Thernstrom, 1999; Trow, 1999). These claims were largely refuted by empirical data (Alon & Tienda, 2005; Bowen & Bok, 1998; Melguizo, 2008). The debate played out again over affirmative action at law schools, after a legal scholar conducted an analysis showing far lower bar pass rates for minority students graduating from elite law schools (Sander, 2004, 2005). These claims were also largely refuted through more sophisticated empirical analysis (Ho, 2005). Yet these debates have largely framed our understanding of matching effects in a limited way, in that the focus is on only the most elite colleges and the focus on affirmative action policy obscures larger trends across race and class.

Attending selective institutions does have substantial benefits for students (Bowen & Bok, 1998; Espenshade & Radford, 2009). Economists find that the economic returns of graduating from selective institutions are higher than for nonselective institutions, and these returns have increased over time (Brewer, Eide, & Ehrenberg, 1999; Hoxby & Long, 1998; Monks, 2000). The most prestigious firms and the most prestigious graduate schools reproduce themselves by recruiting almost exclusively from selective institutions (Rivera, 2009), and thus a disproportionate number of *Fortune* 500 CEOs graduate from the most selective institutions (Useem & Karabel, 1986). Thus, the matching process between students and selective institutions has a significant impact on class differences in American society.

Although some doubt the influence of selective colleges on student incomes (Dale & Krueger, 2002), few doubt that the *perception* of increasing returns to selective colleges has shaped the competitive market for access to higher education (Manski, 1993). The academic profiles of students attending selective colleges have improved over time, and certain forms of academic achievement (such as SAT scores) have become particularly crucial indicators for admission to selective colleges (Alon, 2009). Lower transportation costs have created a

national market for higher education, resulting in significant decreases in within-institution variance in academic preparation over time at both public and private colleges (Hoxby, 1997). Academic competition has thus increased across the ability spectrum, resulting in more highly competitive dynamics and concentrating the best students in a small number of highly selective colleges.

The concepts of "absolute competition" versus "relative competition" are fundamental to increasing competition for access to selective institutions. These concepts are important in both economics (Frank & Cook, 1995) and sociology (Blau, 1994; Boudon, 1974). In an absolute competition rewards are given to any individual who achieves a minimum baseline of competency, meaning that there is no limit to the number of candidates that may receive an award. In a relative competition a fixed number of places, X, exist. When the number of candidates exceeds the number of places, candidates are rank ordered according to some criteria and the first X candidates receive the award. Relative competitions often provide aspirants with strong incentives to increase effort because no absolute measure of competency is sufficient for success. Rather, the performance of one candidate is compared to the performance of all other candidates. These competitive dynamics lead to what Frank and Cook (1995) describe as the "arms race" in educational attainment.

Relative competition aptly describes the competition to selective institutions. The employment benefits of selective institutions have increased relative to those of nonselective institutions (Hershbein, 2010), and the number of students seeking access to selective institutions has increased more than the number of opportunities in these selective institutions (Bound, Hershbein, & Long, 2009). Just as the competition between students to get into the best schools has increased, so has the competition between schools to attract the best students because the benefits of enrolling a high-achieving student body have increased over time (McPherson & Shapiro, 1998; Winston, 1999). Affluence is itself often determined by the prestige of the student body, in that high-quality students graduating from prestigious institutions earn higher incomes and are more likely to donate. The result is a Matthew effect where high-prestige institutions attract more and more revenues.

These dynamics have intensified because colleges are ranked primarily by the precollegiate academic characteristics of their students, and the importance of ranking systems, especially that of *U.S. News & World Report* (USNWR), has increased over time. Moving onto the "front page" of USNWR rankings in any category provides a substantial boost in the following year's admissions indicators (Bowman & Bastedo, 2009). College rankings have a significant impact on financial resources that are controlled by insiders to the higher education system, such as through alumni donations or when faculty decide which research to fund (Bastedo & Bowman, 2011). Published college rankings also have a significant impact on future peer assessments, independent of any real changes in organizational quality and performance and controlling for prior peer assessments of reputation (Bastedo & Bowman, 2010; Bowman & Bastedo, 2011). Ranking systems thus increase competition both through their cognitive effects on college leaders and by their real impacts on the characteristics of the incoming class and the distribution of financial resources.

Thus, competition for access to selective institutions and matching between students and institutions seems to be increasing over time, incentivized by the perception of increasing returns. To examine how these dynamics affect institutional stratification, we build a data set that tracks change over time in access to higher education over 30 years, testing hypotheses about academic preparation, SES diversity, and matching. We examine the institutional stratification system and class structure as a whole rather than simply limiting our analysis to low-income students. As a result, we are able to document how shifts across the class spectrum have effects for low-income students that otherwise are difficult to see and how these dynamics have been shaped over time. We test the following hypotheses:

Hypothesis 1 (H1): Over time, precollegiate academic preparation has risen regardless of SES.

Hypothesis 2 (H2): Over time, low-SES students are less likely to attend selective colleges and more likely to attend community colleges and nonselective 4-year institutions.

Hypothesis 3 (H3): "Matching" between precollegiate academic preparation and

postsecondary destination has increased over time, and this is true for low-SES students as well.

Hypothesis 4 (H4): "Perfect matching" between academic preparation and institutional destination would not lessen institutional stratification.

Data, Measures, and Method

We draw on a nationally representative sample of high school completers (diploma or GED) from the 1972, 1982, 1992, and 2004 high school senior classes. We utilize data from the National Longitudinal Study of 1972 (NLS), the sophomore cohort of the High School and Beyond Study of 1980 (HS&B), the National Education Longitudinal Study of 1988 (NELS), and the Education Longitudinal Study of 2002 (ELS). We construct the sample to be consistent across cohorts. To be consistent with NLS, which begins with a nationally representative sample of 12th graders in 1972, we exclude students who are not in 12th grade when the rest of their cohort begins 12th grade. For each cohort, our sample includes only students who complete high school within 1.5 years of their high school graduating class to be consistent with the most recent wave of the ongoing ELS study. Allowing only 1.5 years for students to attend postsecondary education may understate the percentage of students who ultimately attend a 4-year institution, but estimates of the first institution attended must be consistent over time. Finally, because only ELS2002 utilizes hot-deck imputation for key covariates, we drop ELS observations with imputed variables.

Weighted Sample Size

To make claims over time, we must use the same weight variable across all surveys. Consistent with Bound et al. (2009), we create a single data set from several national longitudinal surveys, with results weighted to be nationally representative. Appendix Table 1 shows the availability of weights by survey for the restricted data used in our study.[1] We select a weight variable, which we have named *LONGWGT*, that is nonzero for students who were survey respondents in 12th grade and who were survey respondents 2 years later, when students identify initial postsecondary attendance.

National Center for Education Statistics (NCES) longitudinal surveys employ a multistage sampling design. First, a stratified sample of schools (the primary sampling unit) is selected. Second, a stratified sample of students is selected within each secondary school. To calculate the correct standard errors, our regression models define the strata, the primary sampling unit, and employ analysis weights.

Variables

Dependent variable. The dependent variable is selectivity of first institution attended. We create three different measures of first institution attended: (a) using only Postsecondary Education Transcript (PETS) data (available only for NLS72, HS&B, and NELS), (b) using only survey response data, and (c) using a combination of PETS and survey data. This article employs the second measure (survey data only) for two reasons: First, weighted postsecondary attendance rates for NLS72 and HS&B80 using PETS data (52.0% and 57.3%, respectively) are lower than attendance rates using survey data (57.0% and 65.6%, respectively), primarily because of missing transcripts; and second, we want to avoid using PETS data for some cohorts (NLS, HS&B, NELS) and survey data for ELS2002.

Our selectivity measure employs data from Barron's *Profiles of American Colleges*. Our dependent variable has seven categories, using Barron's data for the final four categories: (a) no postsecondary education, (b) 2-year or less than 2-year college, (c) noncompetitive 4-year college, and (d) competitive, (e) very competitive, (f) highly competitive, and (g) most competitive colleges. Appendix Table 2 shows that Barron's selectivity criteria have remained remarkably constant over time. Appendix Table 3 shows that the proportion of colleges categorized as competitive, very competitive, or highly competitive decreased from 1972 to 1982; the college-age population declined relative to institutional capacity (NCES, 2010, Table 15). From 1982 to 2004, the proportion of institutions categorized as very, highly, or most competitive increases.

Although we collected Barron's selectivity data for 1972, 1982, 1992, and 2004, the analyses presented in this article apply 2004 Barron's selectivity data to all cohorts. We chose to constrain competiveness to 2004 levels because allowing competitiveness to vary would increase the percentage of

TABLE 1
Means and Standard Deviations of HS Math, HS Science, and HS GPA by SES Quartile, Cohort

	Highest HS math passed[a]			Highest HS science passed[b]			HS GPA		
	1982	1992	2004	1982	1992	2004	1982	1992	2004
SES Q1									
M	1.99	2.53***	3.10***	2.76	3.26***	3.67***	2.41	2.37*	2.59***
SD	1.14	1.30	1.37	1.41	1.16	1.22	0.63	0.65	0.66
SES Q2									
M	2.44	3.04***	3.41***	3.07	3.65***	3.92***	2.57	2.58	2.74***
SD	1.33	1.41	1.40	1.44	1.15	1.17	0.66	0.64	0.68
SES Q3									
M	2.77	3.44***	3.88***	3.39	3.92***	4.15***	2.68	2.67	2.92***
SD	1.38	1.42	1.40	1.51	1.20	1.14	0.65	0.66	0.64
SES Q4									
M	3.33	4.18***	4.46***	3.82	4.46***	4.57***	2.81	2.98***	3.12***
SD	1.49	1.42	1.33	1.50	1.18	1.08	0.65	0.62	0.58
Total									
M	2.66	3.32***	3.74***	3.28	3.84***	4.10***	2.62	2.66***	2.86***
SD	1.43	1.51	1.47	1.52	1.25	1.20	0.66	0.68	0.67

a. Math pipeline measures as defined by Burkam and Lee (2003): 1 = *no math or "low" math*; 2 = *algebra 1 or plane geometry*; 3 = *algebra 2*; 4 = *trigonometry, analytic geometry, or algebra 3*; 5 = *precalculus*; and 6 = *calculus*.
b. Science pipeline measures as defined by Burkam and Lee (2003): 1 = *no science or "low" science*; 2 = *basic biology or secondary physical science*; 3 = *general biology*; 4 = *chemistry 1 or physics 1*; 5 = *chemistry 1 and physics 1*; and 6 = *chemistry 2, physics 2, or advanced biology*.
Difference in means for current and previous year is significant at the 1% (***), 5%(**), or 10% (*) level, two-tailed test.

low-SES students attending selective colleges over time but that this would be purely the result of change over time in the number of institutions defined as selective. However, this approach has potential drawbacks that we discuss in the limitations section.

Covariates. Demographic, socioeconomic, and precollegiate academic preparation variables are included in the models. We used identical variable definitions across cohorts. Demographic variables include gender and ethnicity. Although we created measures of parental education and family income, the analyses presented here focus on SES quartile. SES includes slightly different components from survey to survey.[2] We created weighted SES quartile variables by sorting the weighted sample by SES ascending and dividing students into groups of equal size to determine the cut points for each quartile. Dummy variables were created for each SES quartile to reflect potential nonlinearity of the relationship between SES and the outcome variable.

Precollegiate academic preparation variables include SAT or ACT score, senior year test score, high school GPA, and highest high school math and science courses passed (D– or better). We created high school course-taking variables using raw course-level high school transcript data, except for NLS, which did not collect high school transcripts. Math and science preparation were defined using "pipeline" measures shown in Table 1 as defined by Burkam and Lee (2003).

We created the SAT or ACT score variable in four steps: First, we determined composite SAT scores and ACT scores; second, we recentered ACT test scores for HS&B and SAT scores for HS&B and NELS to reflect modifications to the ACT in 1989 and the SAT in 1995; third, we converted all ACT scores to SAT scores using standard concordance tables; and, fourth, we chose the higher composite score if students took both the SAT and the ACT.

The proportion of missing SAT or ACT scores differs across surveys. Of the students who indicated taking the SAT and/or ACT, test scores were missing for 3.3% in NLS, 38.65% in HS&B, 23.9% in NELS, and 10.0% in ELS. NLS survey respondents reported their own scores. In HS&B,

NELS, and ELS, test scores were retrieved from high school transcripts by NCES. Some high schools, especially in the HS&B and NELS cohorts, did not collect test scores.

We imputed missing SAT or ACT test scores for survey respondents who indicate taking the SAT or ACT, using the average of the math and reading components from the standardized senior year test taken by all NCES survey respondents.[3] Appendix Table 4 shows how the weighted and unweighted sample sizes change depending on what variables are included in the model. We run regressions on the "weighted academic, SAT" sample.

Method

Hypotheses 1 and 2 use simple descriptive statistics, whereas Hypotheses 3 and 4 use multinomial logistic regression. In a model with M outcome variable categories, a multinomial logistic regression model creates one equation for each outcome variable category, except for the base outcome (here, noncompetitive 4-year institutions). Therefore, M − 1 coefficients exist for each covariate. Each coefficient represents the logged effect of a one-unit increase in x on the log of the odds of attending a particular institution type as opposed to attending a noncompetitive 4-year institution. Equation 1 presents the general equation used in our multinomial logistic regression model,

$$p_{ij} = \frac{e^{x_i' \beta_j}}{\sum_{l=1}^{m} e^{x_i' \beta_l}}, \quad (1)$$

where p_{ij} is the probability of individual i attending institution type j out of a total number of m possible events; x_i is a vector of demographic, socioeconomic, and academic covariates; and β_j is a vector of coefficients for these covariates.

We note four analytic decisions. First, we exclude the 1972 cohort from regression analyses because of the absence of high school transcript variables. Second, we organize our results by SES rather than its primary components (parental education, parental occupation, household income, and household items). The components of SES do have separate effects but do not substantially alter model fit as compared to a model with SES quartile.

Third, we run models for students from the first and second SES quartiles separately from students in the third and fourth SES quartiles. From a theoretical perspective, this article is concerned with change over time in how students from different socioeconomic backgrounds match their academic preparation with postsecondary destination. We want to allow those relationships to vary across SES group. When the model is run on the full sample, indicators for SES quartile merely change the intercept of the probability of attending a particular destination, but the coefficients for academic preparation variables are the same for all students regardless of SES. By running the models separately for each SES quartiles we allow the relationship between academic preparation and institutional destination to vary across SES quartiles.

Fourth, regression results presented in this article primarily use a three-category dependent variable: (a) no postsecondary education, 2-year institution; (b) noncompetitive and competitive institution; and (c) very, highly, or most competitive institution. The rationale for using the three-category dependent variable is purely for parsimonious presentation of results. Appendix Table 9 shows regressions results for a six-category dependent variable, run separately for each SES half, where highly and most competitive institutions are combined.

Finally, because multinomial logistic regressions produce so many coefficients, especially when models are run separately for each cohort, we seek more parsimonious results by calculating regression-adjusted probabilities of institutional destination. In particular, we calculate regression-adjusted predicted probabilities of institutional destination for individuals with particular covariate values, utilizing the "prvalue" function introduced by J. S. Long and Freese (2006). For each set of covariate values, the predicted probabilities of all destinations sum to a probability of one. We calculate the standard errors associated with each predicted probability point estimate, allowing us to create 95% confidence intervals. In the results section, we graph the point estimates and 95% confidence intervals to compare how predicted probabilities differ across cohorts, across SES groups, or across groups with different levels of academic preparation.

We employ regression-adjusted predicted probabilities to test H3, that matching has increased over time. The calculation of regression-adjusted probabilities requires covariate values. Choice of covariate values is based on evidence that the relative

competition for admission into selective institutions has changed from 1982, to 1992, to 2004. We set the covariate values equal to the mean value of students enrolled in competitive, very competitive, highly competitive, and most competitive institutions in 1982, 1992, and 2004, respectively.[4] These covariate values (shown in Appendix Table 7 and Appendix Table 8) are thus different for each cohort. For simplicity, race and gender are set to the reference group categories of White and male (note that manuscripts in preparation analyze institutional destination with a focus on race and gender, respectively). We then calculate point estimates and confidence intervals of predicted probabilities of institutional destination. An example of positive evidence of increased matching over time would be if students with academic preparation consonant with very competitive institutions were more significantly more likely to attend very competitive institutions in 2004 than in 1982.[5]

Limitations

First Postsecondary Institution Attended

Although the measure of first institution attended uses identical construction across cohorts, comparisons across cohorts may still be problematic. Students in more recent cohorts may be more likely to transfer from their initial postsecondary destination than students in previous cohorts (Adelman, 1999, 2006). In particular, to the extent that rates of transfer from community colleges to 4-year institutions have increased over time, our measure of first institution attended understates the proportion of students who ultimately attend 4-year institutions more so for recent cohorts than for older cohorts. We would prefer the dependent variable to be selectivity of most selective institution ever attended or selectivity of primary postsecondary institution (e.g., based on credit hours), but these measures are unavailable for the ongoing ELS study.

Time-Constant Selectivity Categories

The decision to use time-constant rather than time-varying measures of selectivity has drawbacks. Although we apply 2004 selectivity criteria to all cohorts, institutions were often less competitive in previous cohorts. For example, Barron's categorized Syracuse University as very competitive in 1972 and 1982 and as highly competitive in 1992 and 2004. Although students had a more difficult time gaining admission to Syracuse in 2004 than 1982, our analyses define Syracuse as highly competitive for all cohorts. We find that about 18% of students attend institutions that have movement in their Barron's selectivity category in 2004 relative to 1982 or 1992.

However, we find that the relative selectivity of institutions changes minimally over time. In other words, selectivity increases over time for a small proportion of institutions—in part as the result of growth in the college-age population, increases in the rate of college going, and increasing returns to selective education (Hoxby, 2009)—but the pecking order within this group of institutions rarely changes. For example, both Georgetown and the George Washington University become more selective over time, but Georgetown retains its selectivity advantage over the George Washington University. Therefore, applying 2004 selectivity categories to prior cohorts generally does not lead to incorrect relative rankings in prior cohorts.

Observable Academic Preparation Variables

Our academic preparation variables include high school GPA, SAT or ACT score, highest math course passed, and highest science course passed. Admission to selective institutions is also influenced by additional academic preparation variables such as success in honors courses, Advanced Placement (AP) courses, and class rank. Unfortunately, these variables are not available consistently over time in the high school transcript data. We also created measures of participation in and leadership in extracurricular activities (student government, honors society, athletics, vocational club, academic club). We find that participation in extracurricular activities generally has an insignificant relationship with initial institutional destination and its inclusion does not affect the coefficients on other regressors. Leadership in extracurricular activities does have a significant relationship with institutional destination, but leadership variables are available only for NELS and ELS. The analyses presented in this article exclude participation and leadership in extracurriculars. To the extent that both institutional destination and the observed academic preparation variables are both correlated to unobserved

TABLE 2

Proportion of Students Taking the SAT and/or ACT, Mean SAT Scores (ACT Converted to SAT) by SES Quartile, Cohort

	Proportion taking SAT and/or ACT[a]				Mean SAT score			
	1972	1982	1992	2004	1972	1982	1992	2004
SES Q1								
M	0.30	0.38***	0.39	0.48***	965	851***	893	878
SD	0.46	0.49	0.49	0.50	184	188	182	181
SES Q2								
M	0.41	0.52***	0.57***	0.61***	1,017	936***	957	944***
SD	0.49	0.50	0.50	0.49	172	184	169	183
SES Q3								
M	0.52	0.66***	0.71***	0.77***	1,041	973***	991	1,007***
SD	0.50	0.47	0.45	0.42	162	182	178	182
SES Q4								
M	0.73	0.81***	0.86***	0.90***	1,105	1,042***	1,089***	1,102*
SD	0.44	0.39	0.34	0.30	177	185	187	191
Total								
M	0.49	0.60***	0.64***	0.70***	1,051	971***	1,003***	1,004
SD	0.50	0.49	0.48	0.46	181	195	193	202

a. Proportion taking the SAT and/or SAT is based on student self-reports.

For proportion taking the SAT and/or ACT, difference in proportions for current and previous year is significant at the 1% (***), 5%(**), or 10% (*) level, two-tailed test. For mean SAT score, difference in means for current and previous year is significant at the 1% (***), 5%(**), or 10% (*) level, two-tailed test.

academic preparation variables, such as AP courses, high school class rank, and extracurricular leadership, the coefficients on academic preparation variables may be biased (Dale & Krueger, 2002).

Selection Into the SAT

Change over time in the composition of students who take standardized tests has important implications for research on college access (Clark, Rothstein, & Schanzenbach, 2009). Statistical models that include SAT score as an independent variable drop non–test takers from the model. The proportion of high school completers who take the SAT and/or ACT has increased dramatically over time, from 0.49 in 1972 to 0.79 in 2004 (Table 2). Does change over time in the socioeconomic and academic characteristics of test takers bias the coefficient on SAT score? Grodsky (2007) accounts for selection into college entrance using a two-stage modeling strategy. He first models the probability of taking a college entrance exam on the entire sample and, second, includes the predicted probability of taking a college entrance exam in the model of institutional attendance. In other words, Grodsky eliminates nonrandom selection into the sample of test takers by explicitly including information about test taking in the outcome model.

Although we do not use a two-stage strategy to account for selection into the SAT, we highlight three reasons to believe that change over time in the composition of test takers does not undermine our regression results. First, SAT test taking differs primarily by SES, ethnicity, region, and precollegiate academic preparation (Dynarski, 1987). We have measures of these variables so that many important determinants of selection into the SAT are observable rather than unobservable. Second, change over time in the composition of test takers is unlikely to affect the probability of attending selective institutions. This is because even by 1972 most of the students enrolled in selective institutions took the SAT and/or ACT (Appendix Table 8). Therefore, change over time in the composition of test takers is relevant for students on the margin of attending no postsecondary education, a 2-year institution, or a noncompetitive 4-year institution but not for students competing for admission to selective institutions. Third,

sensitivity analyses comparing coefficients on the senior test score—a proxy for SAT—on models run on the whole sample versus models run only for SAT test takers also indicate selection into the SAT is not a problem.[6]

Results

H1: Rising Precollegiate Academic Preparation

We begin by testing whether precollegiate academic preparation has risen over time regardless of SES. Table 1 shows trends for high school math, science, and GPA and *t* tests for the difference in means between the current and previous cohort.

Table 1 indicates highly significant gains over time in math preparation for all SES quartiles. For example, mean math preparation for students in the lowest SES quartile rose from 1.99 (2 = *algebra 1 or geometry*) in 1982 to 3.12 (3 = *algebra 2*) in 2004. From 1982 to 2004, mean math preparation rose by roughly a full point for each SES quartile, such that the difference between SES quartiles remained roughly constant over time. A similar pattern emerges for highest science course passed. Mean high school GPA also increased over time for all cohorts. Only students from the fourth SES quartile realized significant GPA gains from 1982 to 1992, but students from all SES quartiles did so from 1992 to 2004. One limitation, however, is that grade inflation may be a causal factor for rising GPA over time (Sadler, 2009).

Table 2 shows the proportion of students taking the SAT and/or ACT and average SAT scores by SES quartile. Generally, the proportion of students taking the test increases over time for all SES quartiles, but the change is most pronounced in the second and third SES quartiles. The rising proportion of test takers may help explain why mean test scores remained static or decreased; academically weaker students, who would not have taken the test had they belonged to earlier cohorts, took the test in later cohorts. In summary, H1 is strongly supported. Trends in precollegiate math preparation, science preparation, GPA, and SAT or ACT test taking strongly support the hypothesis that precollegiate academic preparation has increased over time for all SES strata.

H2: Increasing Social Stratification in Institutional Destination

H2 states that over time low-SES students are less likely to attend selective colleges and more likely to attend community colleges and nonselective 4-year institutions. Our analyses for H2 focus on the "academic preparation sample." We first provide simple statistics of institutional destination for the entire sample. Appendix Table 5 shows the percentage of high school completers attending some kind of postsecondary education increased from 57% in 1972 to 80% in 2004. The proportion of students attending noncompetitive and competitive 4-year institutions increased substantially, with more modest increases at very, highly, and most competitive institutions, reflecting the relatively fixed supply of spaces at selective institutions. With 3.5% of students attending a most competitive institution, 1992 is an outlier, in part because of a temporary decrease in the size of the college-going cohort that allowed a larger proportion to attend selective institutions (Bound, Hershbein, & Long, 2009; NCES, 2009).

Table 3 shows institutional destination by SES quartile for the academic preparation sample. The percentage of students from the first SES quartile who attend some kind of postsecondary education increased from 36.8% in 1972 to 62.2% in 2004. Table 3 separates public and private 2-year institutions because declining enrollment in private 2-year institutions obscures the growth in the community college sector. For students from the first SES quartile, the increase over time in postsecondary attendance is concentrated within the 2-year public sector, which increased from 14.2% in 1972 to 31.5% in 2004.

The proportion of low-SES students attending noncompetitive and competitive 4-year institutions also increased over time, albeit more modestly than in the community college sector. In contrast, the proportion attending very, highly, and most selective colleges did not increase over time. Results for the second SES quartile are similar to those for the first SES quartile. Thus, H2 was not entirely supported. As predicted, the increase over time in postsecondary attendance for low-SES students is concentrated in community colleges and noncompetitive 4-year institutions. Contrary to H2, however, the proportion of low-SES students in selective institutions has not

TABLE 3
Institutional Destination by Cohort (Column Percentages), by SES Quartile, "Weighted SES" Sample

	SES Quartile 1				SES Quartile 2			
	1972 (%)	1982 (%)	1992 (%)	2004 (%)	1972 (%)	1982 (%)	1992 (%)	2004 (%)
No PSE	63.2	57.6***	48.2***	37.6***	52.3	41.9***	31.8***	25.8***
2yr/LT 2yr (pub)	14.2	19.9***	25.8***	31.5***	18.1	26.2***	31.5***	33.1
2yr/LT 2yr (priv)	4.7	6.2**	3.8***	3.9	5.2	6.7**	3.7***	3.8
Noncompetitive	6.9	6.8	6.9	11.2***	8.1	7.7	10.1***	13.5***
Competitive	6.5	5.5	9.0***	11.1**	9.8	11.3*	15.0***	15.2
Very competitive	3.1	3.1	4.3**	3.3*	4.6	4.1	5.6**	6.3
Highly competitive	0.9	0.5	1.1**	1.0	1.3	1.2	1.9*	1.7
Most competitive	0.4	0.3	0.8**	0.5	0.6	0.9	0.4*	0.8
	SES Quartile 3				SES Quartile 4			
	1972 (%)	1982 (%)	1992 (%)	2004 (%)	1972 (%)	1982 (%)	1992 (%)	2004 (%)
No PSE	40.3	27.6***	21.8***	14.7***	18.6	12.9***	9.5***	5.7***
2yr/LT 2yr (pub)	20.3	28.9***	26.9	30.3**	18.8	23.7***	15.3***	18.5***
2yr/LT 2yr (priv)	7.2	6.2	2.6***	3.0	4.3	3.0**	2.2*	0.9***
Noncompetitive	9.2	10.2	13.8***	14.4	11.7	10.4	11.1	12.3
Competitive	14.0	15.9*	18.1*	22.3***	20.4	21.5	23.7*	26.8**
Very competitive	6.0	6.6	10.3***	10.4	15.1	15.9	18.8***	18.9
Highly competitive	2.4	3.2	3.3	3.3	5.9	7.4**	10.0***	10.6
Most competitive	0.8	1.4**	3.3***	1.7***	5.2	5.2	9.5***	6.2***

Note. SES = socioeconomic status.
Difference in proportions for current and previous year is significant at the 1% (***), 5%(**), or 10% (*) level, two-tailed test.

decreased over time but has remained constant. However, the differences in institutional destination across SES quartile are dramatic. Appendix Table 6, SES representation of each institutional destination, shows that enrollments in highly and most competitive institutions are dominated by students in the fourth SES quartile.

H3: Tighter Matching Between Preparation and Destination

H3 states that matching—defined as tightness in the relationship between the precollegiate academic preparation of individual students and the average academic preparation in the institution they attend—has increased over time and that this is also true for low-SES students. Results in support for the matching hypothesis would find that high-achieving students are significantly more likely to attend institutions consonant with their academic preparation than similarly high-achieving students in earlier cohorts. In addition, students with academic preparation below the mean preparation for a particular destination should be significantly less likely to attend that institution in later cohorts than in earlier cohorts.

We graph the regression-adjusted probabilities of institutional destination as shown in Figures 1 through 4. To simplify the presentation, these graphs are based on a three-category dependent variable (results for the six-category dependent variable yield similar conclusions; see Appendix Tables 10–13). The models were run separately for each half of the SES distribution, allowing for comparisons over time and across SES halves. Academic preparation covariates were set equal to mean values for students enrolled in competitive, very competitive, highly competitive, and most competitive institutions, respectively.[7] These mean values are shown in Appendix Tables 7 and 8. The associated 95% confidence intervals indicate whether a predicted probability for one group is significantly different than that for another group. If the confidence interval for Group A does not contain the point estimate for Group A, then Group A exhibits a significantly different probability than Group B.[8]

Figure 1 shows regression-adjusted probabilities of institutional destination for students with

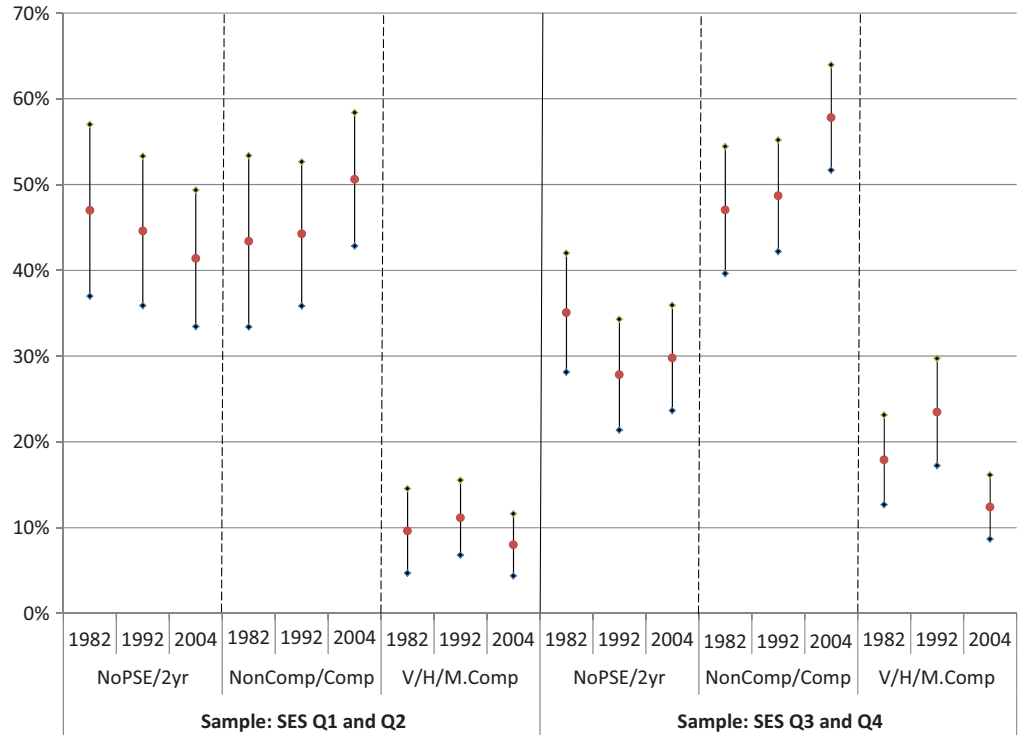

FIGURE 1. *Regression-adjusted probabilities of institutional destination, academic preparation covariates equal to the mean values for students enrolled in competitive institutions.*
Note. SES = socioeconomic status.

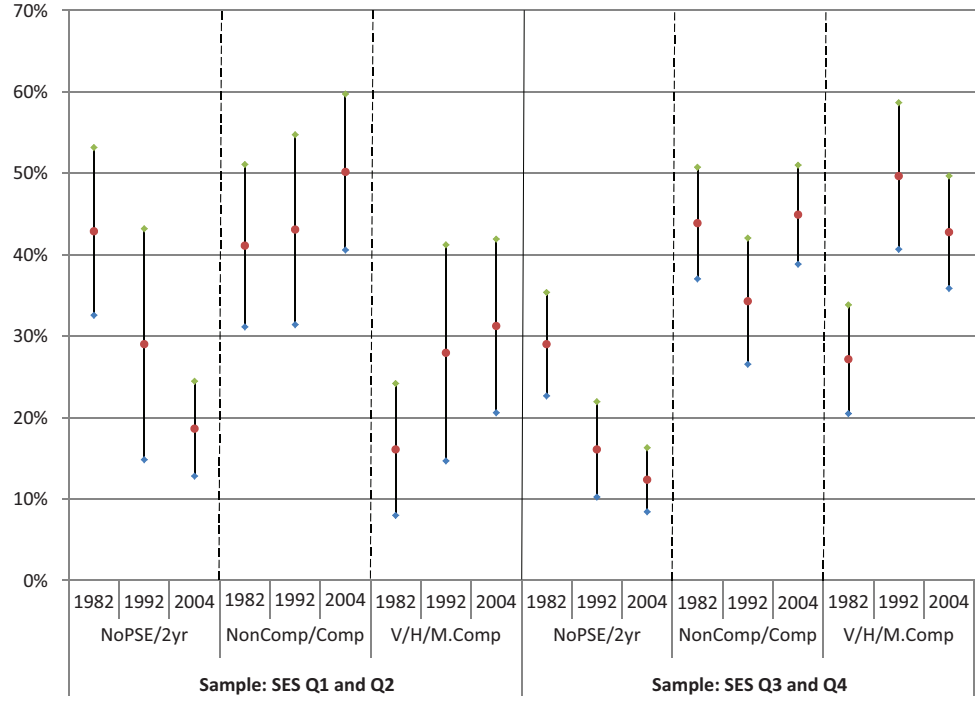

FIGURE 2. *Regression-adjusted probabilities of institutional destination, academic preparation covariates equal to the mean values for students enrolled in very competitive institutions.*
Note. SES = socioeconomic status.

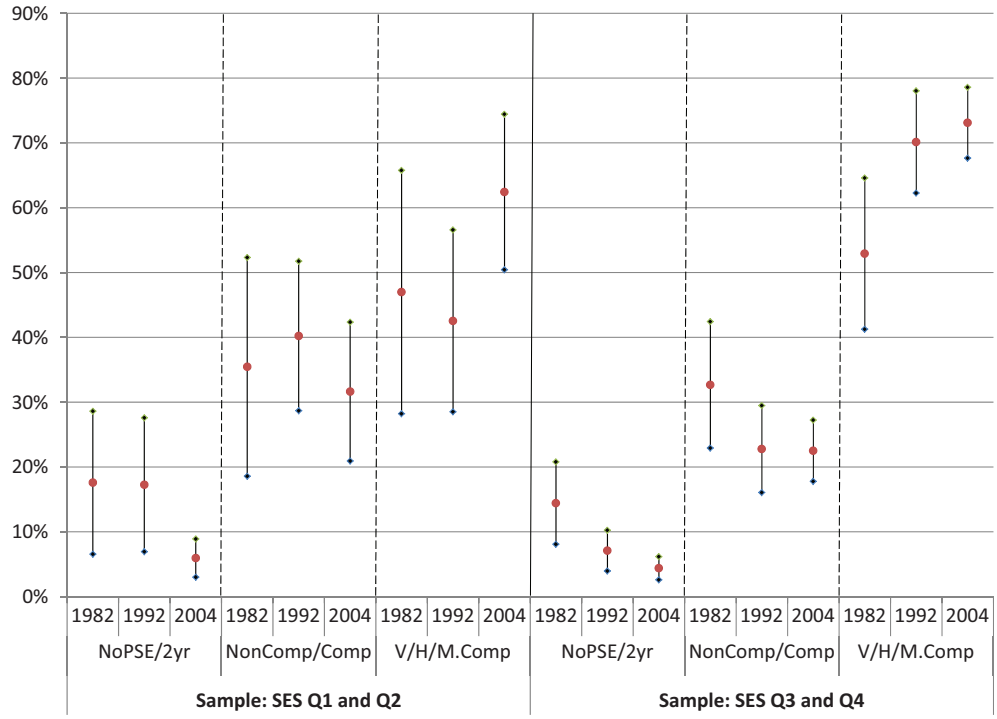

FIGURE 3. *Regression-adjusted probabilities of institutional destination, academic preparation covariates equal to the mean values for students enrolled in most competitive institutions.*
Note. SES = socioeconomic status.

academic preparation consonant with competitive institutions. For students from the lower half of the SES distribution, the probability of no postsecondary education or attending a 2-year institution declines across successive cohorts but not significantly. The probability of attending a noncompetitive or competitive institution increases across cohorts but not significantly. The probability of attending a very, highly, or most competitive institution remains flat. Results from the six-category regression shown in Appendix Table 9 show that the probability of attending a highly or most competitive institution declines significantly over time for these students, consistent with the matching hypothesis.

The upper half of the SES distribution shows evidence of increased matching in that the 1992 cohort has a significantly lower probability (28%) of no postsecondary education or attending a 2-year institution than the 1982 cohort (35%). The 2004 cohort has a significantly higher probability of attending a noncompetitive or competitive institution (58%) than the 1982 (47%) and 1992 (49%) cohorts. The 2004 cohort also has a significantly lower probability of attending a very, highly, or most competitive institution (12%) than the 1982 and 1992 cohorts, suggesting that students with modest academic achievement can no longer gain access to selective institutions by 2004. Within-cohort comparisons across SES groups are revealing. For all cohorts, low-SES students have a significantly higher probability of attending 2-year institutions and a significantly lower probability of attending very, highly, or most competitive institutions. Low-SES students do undermatch relative to high-SES students.

Results for Figure 2, institutional destination for students with academic preparation consonant with very competitive institutions, are much more intriguing. Students in the lower half of the SES distribution are significantly less likely to have no postsecondary education or attend a 2-year institution in 2004 (43%) than in 1982 (19%) and significantly more likely to attend a very, highly, or most competitive institution in 2004 (31%) than in 1982 (16%). For high-SES students, the probability of not attending college or attending a 2-year institution declines significantly from 29%

in 1982 to 12% in 2004 and the probability of attending a very, highly, or most competitive institution increases significantly from 27% in 1982 to 43% in 2004. However, the probability of attending a very, highly, or most competitive institution in 2004 was significantly less than in 1992. This may reflect increased difficulty in gaining admission to selective institutions. Comparisons within cohort across SES groups again show that in all three cohorts low-SES students were significantly less likely to attend very, highly, or most competitive institutions than high-SES students.

Figure 3, academic preparation consonant with most competitive institutions, shows that, for low-SES students, the probability of attending a very, highly, or most selective institution increased significantly from 43% in 1992 to 62% in 2004. High-SES students exhibited a lower probability of attending a middle-range institution in 1992 and 2004 as compared to 1982 and a higher probability of attending a very, highly, or most competitive institution in 1992 and 2004 as compared to 1992. Finally, the comparison across SES groups shows that in 2004 low-SES students do not exhibit a significantly lower probability of attending a very, highly, or most competitive institution than high-SES students. However, this result is partly the result of the wide confidence intervals associated with the low-SES group (note that the point estimate for low-SES students is outside the narrower confidence interval for the high-SES students).

A reasonable criticism to our approach for H3 is that hypothesis testing depends not only on changes in coefficient values across cohorts but also on changes in academic preparation covariate values, which we have chosen. We feel our choice of academic preparation covariates values—the mean value of students enrolled in a particular institution in a particular cohort—is defensible in that it is motivated by social theory about relative competition (Frank & Cook, 1995). Nevertheless, it is important to show that results for H3 do not depend only on covariate values of our choosing. Therefore, we also calculated predicted probabilities of attendance by applying 2004 academic achievement covariate values to 1982 and 1992 regression coefficients (results available on request).

Recall that the 2004 academic preparation values are higher than values in 1982 and 1992, reflecting the fact that higher levels of academic preparation were required to enroll in selective institutions in 2004 than in 1982 and 1992. Therefore, if student preferences remain constant over time, then applying 2004 academic preparation values to all cohorts should lead to higher probabilities of attending more selective institutions in 1982 and 1992 than in 2004. What we find, however, is that similarly high-achieving students have lower probabilities of no postsecondary education or of attending a 2-year institution in later cohorts than in earlier cohorts, and higher probabilities of attending noncompetitive or competitive institutions in later cohorts than in earlier cohorts. For low-SES students with academic preparation consonant with most competitive institutions low-SES students have a higher probability of attending selective institutions in later cohorts than they do in earlier cohorts, although these differences are not statistically significant. These results imply that evidence about increasing matching results from changes in student preferences or constraints (coefficients) rather than being merely the result of assigning higher academic achievement values in later cohorts.

To summarize, consistent with Bowen, Chingos, and McPherson (2009), Figures 1 through 3 show that similarly qualified low-SES students undermatch relative to high-SES students. However, we also find evidence that matching behavior has increased over time for low-SES students as well as high-SES students. Students that are high achieving relative to their cohort are more likely to attend very, highly, or most competitive institutions in later cohorts and less likely to attend noncompetitive institutions, whereas modestly achieving students are generally less likely to attend selective institutions than they were in prior cohorts. Thus, a paradox exists. Over time, the academic achievement of low-SES students has increased and low-SES students are more likely to attend the best institution they can. However, Table 3 shows that by 2004 low-SES students were no more likely to attend very, highly, or most competitive institutions than they were in 1982. The next section shows that this paradox can be explained by vast differences in precollegiate academic preparation between low-SES and high-SES students.

"Perfect Matching"

Recently, two arguments have emerged about the causes of social stratification in higher

education. Using data from the College Board, Hoxby and Avery (2009) find that a typical high school cohort has about 30,000 low-income students who have high academic achievement, defined as SAT scores of at least 1300 and high school GPAs of at least 3.7. Of these students, only 18% send their SAT scores to at least one institution consonant with their own academic achievement, defined as a college whose median SAT composite score is not more than 5 percentiles below the student's score. According to this argument, social stratification is not merely a problem of academic preparation but also a problem of financing higher education and information asymmetries about the opportunities available.

By contrast, Alon and Tienda (2007) find that as the number of positions in selective institutions decreased relative to the number of aspirants for these positions, selective institutions increasingly relied on SAT scores to cull applicants. Alon (2009) finds that the increased salience of SAT scores in admissions decisions decreased socioeconomic diversity at selective institutions because low-SES students generally score lower than high-SES students. Although Hoxby and Avery (2009) state that a large pool of qualified low-SES students exists, Alon (2009) implies that increasing reliance on college entrance exams has decreased the size of this pool.

Class rank provides an alternative metric to rank students for selective admissions. Texas, for example, grants admission to any University of Texas campus to students who graduate with a GPA in the top 10% of their graduating class. Critics of the 10% plan argue that students who graduate in the top 10% of low-achieving high schools are academically inferior to lower ranked students from high-achieving high schools. However, using administrative data on Texas high school students, Niu and Tienda (2010) find that "top 10% students" perform as well or better than White students not admitted under the top 10% plan in the following outcomes: grades, 1st-year persistence, and 4-year graduation likelihood. Although SAT score has become more influential in selective admissions decisions nationally, the results from Niu and Tienda (2010) imply that class rank provides a reasonable alternative for matching students to institutions.

The debate on matching and the best criteria to match students to institutions raises an interesting counterfactual: How would institutional stratification change if students were "perfectly matched" to institutions? We operationalize "perfect matching" by assigning students with the strongest academic achievement to the most selective institutions. For example, in 2004, 2.2% of our weighted cohort attended a most competitive institution and 4.1% attended a highly competitive institution. Therefore, our perfect matching variable assigns the top 2.2% of achievers in the 2004 cohort to most competitive institutions, the remaining top 4.1% to highly competitive institutions, and so on. Sorting students by academic achievement depends on what characteristics define academic achievement. We used three different methods to rank high school achievement. The first method ranks students according to high school GPA. The second method ranks students according to SAT score.[9]

The third method of sorting uses high school GPA, SAT score, highest math course passed, and highest science course passed, weighting each academic preparation variable according to its importance in institutional destination. Specifically, we begin by standardizing the academic preparation variables. Each standardized variable has a mean of 0 and a standard deviation of 1. Next we regress the six-category dependent variable (6 = *highly or most selective*) onto the standardized academic preparation variables. The regressions are run separately for each cohort. For each student, we multiply his or her standardized academic preparation covariates by the associated standardized coefficients for the probability of enrolling in highly or most competitive institutions as opposed to noncompetitive institutions.[10] Finally, we sum these products to obtain an academic achievement score. Table 4 shows that SAT score has the most influence in determining enrollments to highly or most competitive institutions and that this influence grows over time. The influence of GPA also grows over time but is more modest than that of SAT score. The resulting metric ranks each component of academic achievement according to its relative influence in enrolling at selective institutions.

Figures 4 and 5 compare real institutional destination to three different methods of perfect matching: GPA, SAT scores, and the regression-based method. Figure 4 shows the probability of attending a very competitive institution for students in the first and fourth SES quartile, with the vertical lines representing 95% confidence

intervals. In 1982 and 1992, students from the first SES quartile would have even lower probabilities of attending very competitive institutions had they been perfectly matched to institutions based on SAT scores. For students in the first SES quartile from the 2004 cohort, the probability of attending a very competitive institution is significantly higher under perfect matching by GPA as opposed to actual destination. For students from the fourth SES quartile, the probability of attending very selective institutions declines significantly relative to actual destination, when students are matched to institutions by GPA. Note that for students from both the first and fourth SES quartiles, actual destination becomes closer to SAT perfect matching and regression-based perfect matching as SAT scores become increasingly important in determining who goes where. The most striking result, however, is the stark difference between students in the first and fourth SES quartiles. These results imply that even if students were perfectly matched to institutions based on academic preparation criteria, profound social stratification in institutional destination would remain.

Figure 5 shows the probability of attending a highly or most competitive institution for students in the first and fourth SES quartiles. The results are similar to those for very competitive institutions. In all cohorts, the probability of attending highly or most competitive institutions would increase significantly for students from the first SES quartile if students were perfectly matched to institutions by GPA. For students from the fourth SES quartile, perfect matching by GPA would result in a significant reduction in the proportion of students attending most or highly competitive institutions, and this is true across cohorts. Comparing the probability of attendance across SES quartiles, vast differences would remain regardless of how students are matched to institutional destination, but perfect matching by GPA would close this gap somewhat.

We have imagined a world where students were perfectly matched to institutions, based on alternative matching criteria. Although Hoxby and Avery (2009) find that approximately 25,000 high-SAT and high-GPA students do not apply to institutions consonant with their academic achievement, our results indicate that perfect matching via SAT score or via a combination of academic achievement factors would not increase the percentage of low-SES students attending very, highly, or most selective institutions. One striking finding of Figures 4 and 5 is that actual destination is much closer to perfect matching under SAT scores than perfect matching under high school GPA, reinforcing the idea that SAT scores are much more important to selective admissions than SAT scores. Our results are consistent with those of Alon (2009), in that weight given to SAT scores undermines socioeconomic diversity at selective institutions. Niu and Tienda (2010) find class rank to be at least as good a predictor of college performance as SAT score. Unfortunately, class rank is unavailable in the ELS data set, forcing us to use high school GPA. Nevertheless, ranking students according to high school GPA would significantly increase the probability of low-SES students attending a very, highly, or most competitive institution.

As an additional test of the change over time in matching across SES quartiles, Table 5 examines the actual destination over time for students with different levels of regression-based perfect matching. For example, if a student had academic preparation consonant with a very competitive institution and actually attended a very competitive institution, that student would be entered into the "match" row. If the student actually enrolled in a less selective institution, the student would be entered into the "under" row. Table 5 separates results by SES quartile. Although the trends are not entirely consistent, two patterns emerge. First,

TABLE 4

Standardized Regression Coefficients for the Probability of Attending a Highly or Most Competitive Institution as Opposed to a Noncompetitive Institution

	1982	1992	2004
HS GPA	0.090	0.159	0.589
SAT score	1.189	1.237	1.684
High math = 1	–0.109	–0.166	–3.882
High math = 2	–0.054	0.076	0.379
High math = 4	0.118	0.128	0.292
High math = 5	0.043	0.139	0.397
High math = 6	0.213	0.119	0.501
High sci = 1	0.017	–3.203	–0.104
High sci = 2	–0.040	–0.125	–0.211
High sci = 4	0.141	–0.115	0.135
High sci = 5	0.150	0.198	0.184
High sci = 6	0.212	0.227	0.142

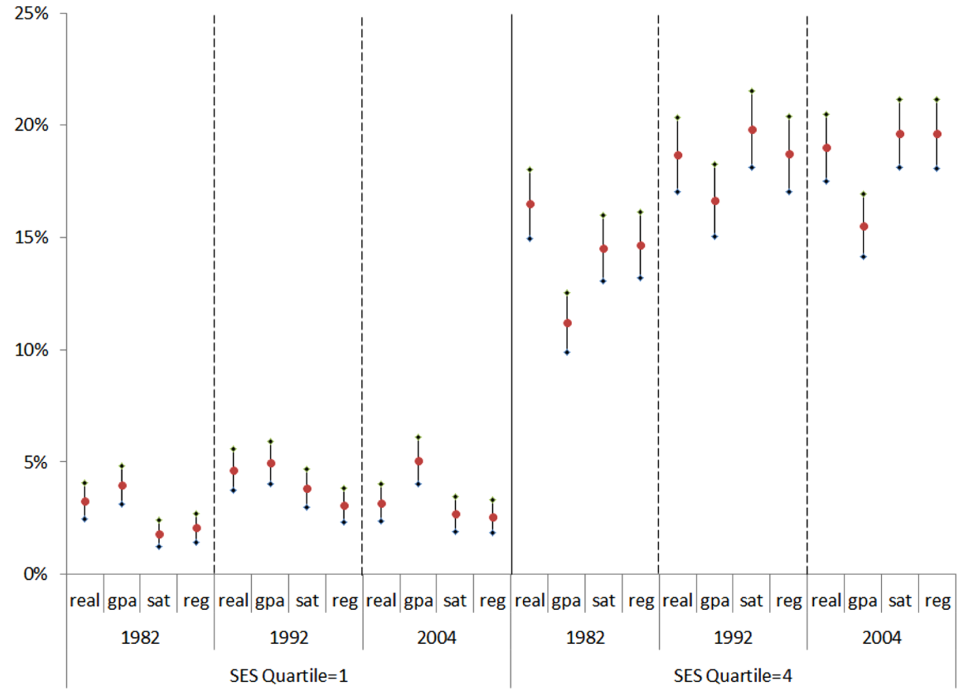

FIGURE 4. *Probability of attending a very competitive institution SES quartile 1 and quartile 4: real destination, GPA perfect matching, SAT perfect matching, and regression-informed perfect matching.*
Note. SES = socioeconomic status.

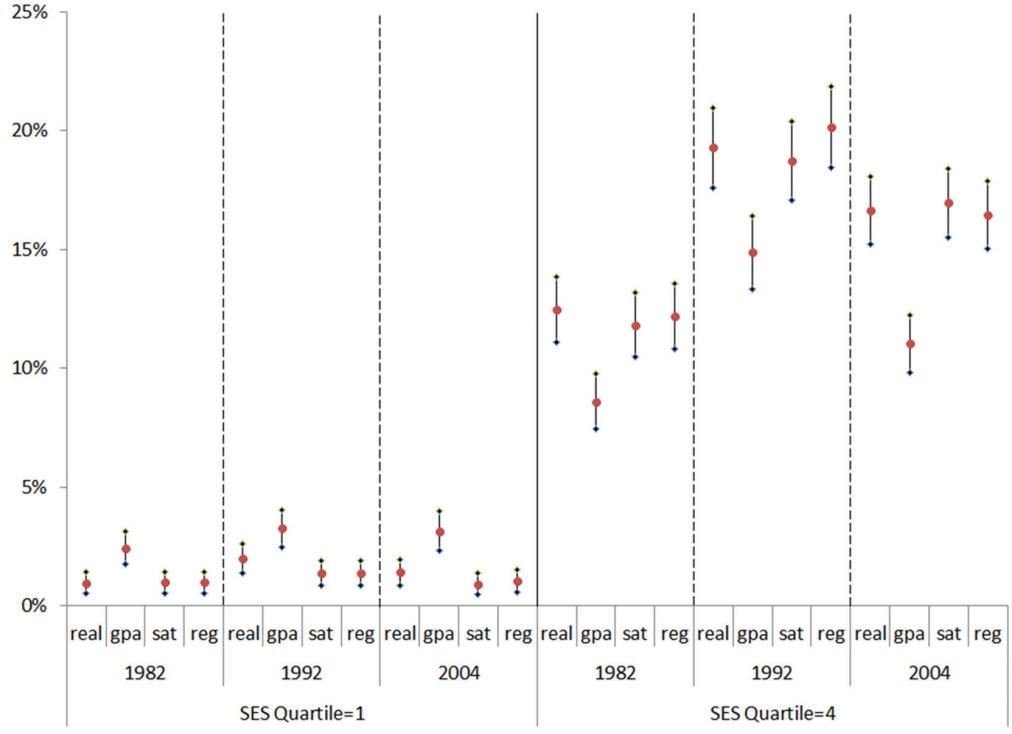

FIGURE 5. *Probability of attending a highly or most competitive institution SES quartile 1 and quartile 4: real destination, GPA perfect matching, SAT perfect matching, and regression-informed perfect matching.*
Note. SES = socioeconomic status.

TABLE 5
Actual Institutional Destination as Compared to Regression-Adjusted "Perfect" Matching

	SES Q1			SES Q2			SES Q3			SES Q4		
	1982 (%)	1992 (%)	2004 (%)	1982 (%)	1992 (%)	2004 (%)	1982 (%)	1992 (%)	2004 (%)	1982 (%)	1992 (%)	2004 (%)
Perfect match = competitive												
Under	65.0	46.1	53.3	59.5	54.9	44.6	49.0	47.2	38.6	33.0	31.1	29.1
Match	17.4	29.1	31.6	24.0	28.6	33.9	30.9	29.0	38.3	35.2	33.0	40.7
Over	17.6	24.7	15.0	16.6	16.5	21.5	20.1	23.8	23.1	31.7	35.9	30.2
Perfect match = very competitive												
Under	65.8	61.8	53.9	75.6	66.4	61.7	68.7	57.7	56.6	44.8	43.1	39.8
Match	21.0	21.5	33.1	11.9	21.3	22.8	14.8	25.1	29.2	32.1	34.3	33.9
Over	13.3	16.6	13.0	12.5	12.3	15.5	16.5	17.2	14.2	23.1	22.6	26.3
Perfect match = highly or most competitive												
Under	70.9	71.7	71.6	81.7	80.7	67.1	72.2	68.3	69.8	51.1	47.9	48.5
Match	29.1	28.3	28.4	18.3	19.3	32.9	27.8	31.7	30.2	48.9	52.1	51.5
Over	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note. SES = socioeconomic status; Q = quartile.

high-SES students have higher rates of matching than low-SES students. The probability of matching is especially high for students from the fourth SES quartile. Second, matching generally increased over time for all SES quartiles. For example, the percentage of students with "perfect match = very competitive" who actually attended a very competitive institution from 21.0% in 1982 to 33.1% in 2004 for students in the first SES quartile, from 11.9% in 1982 to 22.8% in 2004 for students in the second SES quartile, and from 14.8% in 1982 to 29.2% in 2004 for students in the third SES quartile.

Finally, although Table 5 indicates that low-SES students are more often "undermatched" relative to high-SES students, Figures 4 and 5 indicate that regression-based perfect matching would not increase the probability of low-SES students enrolling in selective institutions. If high-achieving low-SES students are often undermatched, then why does perfect matching not increase the probability of attending selective institutions for low-SES students? To explain this apparent contradiction, it is important to note that very few low-SES students have academic preparation consonant with selective institutions. The percentage of students in the first SES quartile with academic preparation consonant with very competitive institutions or above was 3.1% in 1982 and 3.6% in 2004. By contrast, the percentage of students in the fourth SES quartile with academic preparation consonant with very competitive institutions or above was 26.9% in 1982 and 36.1% in 2004. Second, although the small number of high-achieving low-SES students were more likely to be undermatched than high-achieving high-SES students, the majority of low-SES students who attend selective institutions are overmatched. For example, of the first SES students who actually attended a very selective institution, 80.2% were overmatched in 1982 and 60.3% were overmatched in 2004. To summarize, perfect matching would not increase the proportion of low-SES students attending selective institutions because the total number of low-achieving students who are overmatched exceeds the total number of high-achieving students who are undermatched.

Discussion

The results show a consistent pattern over time. Academic preparation has increased for all students, including low-SES students. Competition for enrollment—defined as the precollegiate academic

preparation of enrolled students—in selective institutions has increased quite dramatically over the same period. Matching between academic preparation and institutional destination has also increased, as shown by decreasing variation in academic preparation associated with each institutional destination and in shifts in regression-adjusted probabilities. Matching has even increased for low-SES students.

Despite the increasing academic achievements of low-income students, and their increasing tendency to match to the best institution they can, low-SES students have not increased their representation in selective institutions. We show that an important reason for the maintenance of a socially stratified higher education system—aside from the increase over time in prices—is that the increases in academic preparation for low-SES students have not been sufficient to catch up to the academic prerequisites for admission to selective institutions.

The number of places in selective institutions remains relatively fixed over time because institutions purposely restrict the supply of places to maintain selectivity (Winston, 1999). In any competition with a fixed number of opportunities, relative competitiveness matters far more than absolute competitiveness (Frank & Cook, 1995). Despite rising academic preparation over time for all students (absolute competitiveness), the distance in academic preparation between SES quartiles has remained nearly constant over time (relative competiveness). Our results indicate that unless policymakers are successful in helping low-SES students catch up to the academic preparation of high-SES students, the higher education system will remain highly stratified.

This research suggests a number of avenues for future research. First, we need a better understanding of the impacts of race and gender on the institutional stratification of higher education and of the intersections among race, gender, and class (Bielby, Posselt, Jaquette, & Bastedo, 2011; Grodsky & Felts, 2009; Posselt, Jaquette, Bielby, & Bastedo, in press). Examinations of cross-sectional data have often yielded contradictory and paradoxical results. For example, some researchers report that once you control for academic preparation, minority students are more likely to attend selective colleges than are nonminority students (Bowen & Bok, 1998; Grodsky & Jones, 2007). However, the prior cross-sectional work on institutional stratification finds exactly the opposite result (Hearn, 1991; Karen, 2002).

Data on stratification and gender are equally paradoxical and difficult to interpret as they are cross-sectional. The increasing college enrollment and academic achievements of women have been widely reported in recent years (e.g., Buchmann, 2009; Goldin, Katz, & Kuziemko, 2006). Yet a simple look at descriptive statistics shows that women and men have nearly equal enrollments at the most selective institutions, with men even slightly ahead at the most highly selective colleges. We have also seen in previous work the importance of differences that cut across race and class, especially differences in the attainment of Black and Latino men and women.

We also need a better understanding of the organizational dynamics within colleges that yield differences in college enrollment, particularly how admissions offices make decisions on low-SES students. In the media, selective college admissions officers have repeatedly suggested that students who "max out" their curriculum at their schools will have increased chances of admission, but we have no evidence if this is implemented in reality. We also do not know how admissions officers handle differences in SAT scores (Zwick & Sklar, 2005) and extracurricular achievements (Kaufman & Gabler, 2004) that are persistently class linked. In addition, despite the important research on undermatching conducted to date, we still have limited data on the application behaviors of all students, especially low-income students.

The systematic processes in selective college admissions that systematically exclude low-income students—particularly the predominant influence of SAT scores (Alon, 2009)—are not well supported by evidence linking these differences to future achievement. Despite the well-known correlations between SAT scores and student SES, the predictive validity of SAT scores lies primarily in its ability to serve as a proxy for high school quality rather than predicting a student's individual achievement (Rothstein, 2004). Colleges that have made SAT scores optional for admission report that these students achieve at the same levels as their SAT-reporting counterparts. In addition, SAT-optional policies generate more applications from low-income and minority students, resulting in more diverse entering classes at selective colleges (Espenshade & Chung, 2009). As a result, there are a number of

psychometric efforts to develop noncognitive measures that better predict future student achievement (Sedlacek, 2004; Sternberg, 2006).

In terms of value added, low-income students are likely to benefit disproportionately by enrolling in selective colleges (Bowen & Bok, 1998; Bowen et al., 2009). In addition, increased SES diversity in selective colleges is likely to increase the overall baccalaureate attainment rate in states, leading to increases in human capital and state revenues. A number of policy interventions could be considered, from using noncognitive measures to designing SES-based affirmative action programs. Regardless of the policy interventions that are considered, a better understanding of the fundamental dynamics of stratification and academic competition is vital for achieving public and institutional goals.

Notes

1. The appendix tables are available online from the authors at http://www.umich.edu/~bastedo/papers/EEPA-Appendix.pdf.

2. In the Education Longitudinal Study of 2002, socioeconomic status (SES) is based on five equally weighted, standardized components: father's or guardian's education, mother's or guardian's education, family income, father's or guardian's occupation, and mother's or guardian's occupation. In the National Education Longitudinal Study of 1988, SES was constructed using the following parent questionnaire data: father's education level, mother's education level, father's occupation, mother's occupation, and family income. For cases where all parent data components were missing (8.1% of the participants), student data were used to compute the SES. The first four components from the student data are the same as the components used from parent data, and the fifth component for SES from the student data consisted of summing the nonmissing household items. In the High School and Beyond Study of 1980 the SES composite is based on five equally weighted, standardized components: father's occupation and education, mother's education, family income, and material possessions. No information is available about the construction of SES in the National Longitudinal Study of 1972.

3. The correlation between SAT score and senior year test score is strong, .81 in 1972, .83 in 1982, .84 in 1992, and .84 in 2004. First, we rescaled the senior year test score into SAT or ACT test scores. Using the sample of all students with nonmissing SAT or ACT scores, we sorted both the SAT or ACT scores and the senior year test scores into 1,000 quantiles. This procedure was performed separately for each cohort. For example, in 2004 the 970th quantile—equivalent to the 97th percentile—SAT score was 1390 and the 970th quantile senior test score was 68.86. Using this method, we found the SAT score associated with each senior test score and then converted all senior test scores to SAT scores. We compared regression results from models with SAT scores to a model with imputed SAT scores. The coefficients were not statistically different, but the model with imputed SAT scores had better model fit because of the larger sample size. Therefore, our final models employ imputed SAT scores when SAT is missing.

4. Covariate values for highest math course passed and highest science course passed are rounded to the nearest integer.

5. Clearly, results are sensitive to the covariate values used. As a sensitivity analyses we also tested academic preparation covariates values at the 50th, 75th, 90th, 95th, and 99th percentiles in each cohort, as opposed to academic preparation consonant with enrollment in competitive, very competitive, highly competitive, and most competitive institutions. The results were the same under both strategies: High-achieving students in later cohorts generally had higher probabilities of attending selective institutions than similarly high-achieving students in earlier cohorts. Given space limitations we present results where academic preparation covariates are set to mean values of students enrolled in competitive, very competitive, highly competitive, and most competitive institutions because this choice of covariate values is more consistent with the concept of matching that we attempt to test.

6. We have senior-year test scores (hereafter, senior test) for all respondents. We know that change over time in the composition of senior-year test takers is not problematic because all survey respondents are required to take the test. We compared a model with SAT scores (M1) to a model with senior test score converted to an SAT score scale (M2). If the test score coefficients on these two models are not statistically different, then we can use senior test instead of SAT score in all models. Although the test score coefficients are generally the same for enrollment in no postsecondary, 2-year, and competitive institutions, they differ for very, highly, and most selective institutions. For selective institutions the coefficient on SAT score is larger than the coefficient on senior test, and the difference between the two coefficients is greater for later (1992 and 2004) cohorts. This finding, however, makes intuitive sense because institutions use SAT scores to make actual admissions decisions. Furthermore, SAT scores matter more in the higher echelons of institutional selectivity, and over time SAT scores have become more important for admission into selective institutions (Alon, 2009). Next, we reran the senior test model (M2) but used the sample of students who have SAT scores (M3). The coefficients for M2 are the same as M3. This result implies that the differences between the SAT score model (M1) and the model without a

potential selection problem (M2) are not the result from nonrandom selection in M1 but purely from the fact that SAT scores matter more for access to selective institutions than senior test scores, which admissions officers do not see. Collectively, these analyses imply that our inferences about change over time in the effect of SAT score on institutional destination are not biased by change over time in the characteristics of test takers.

7. As a sensitivity check, we also set the academic preparation covariates equal to the 50th, 75th, 90th, and 95th percentiles of each respective cohort, and the results (not shown) were nearly identical. In other words, these results are robust to different choices of covariate values.

8. If the point estimate for Group A is significantly different than the point estimate for Group B, this does not necessarily mean that the point estimate for Group B is significantly different than the point estimate for Group A (e.g., if Group B has a much wider confidence interval than Group A).

9. We added random noise—a random variable with mean 0 and standard deviation 1—to SAT score to break ties.

10. A multinomial logistic regression equation with M outcomes creates M – 1 sets of coefficients. We must choose which set of coefficients to use. This section is interested in enrollment at selective institutions, so we should use coefficients associated with enrolling in selective institutions. We decided to run a six-category regression model and use the coefficients associated with enrolling in a highly or most competitive institution rather than running a seven-category regression and using the coefficients associated with enrolling in a most competitive institution. However, this is a matter of taste.

Acknowledgments

Thanks to Stephen Desjardins, Brad Hershbein, Aurora D'Amico, Clifford Adelman, and Julie Posselt for their advice and consultation, and to Robert Bielby, Nathan Harris, Alfredo Sosa, and Joseph Waddington for research assistance. We would like to thank the University of Michigan program in labor economics for their feedback during a presentation in December 2009. Finally, we would like to thank the three anonymous reviewers for their excellent comments.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by an AERA Research Grant with funding from the National Science Foundation, as well as earlier grants provided by the USC Center for Enrollment Management and the Rackham Graduate School of the University of Michigan.

References

Adelman, C. (1999). *Answers in the toolbox: Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, DC: U.S. Department of Education.

Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education, Office of Vocational and Adult Education.

Alon, S. (2009). The evolution of class inequality in higher education: Competition, exclusion, and adaptation. *American Sociological Review*, *74*, 731–755.

Alon, S., & Tienda, M. (2005). Assessing the "mismatch" hypothesis: Differences in college graduation rates by institutional selectivity. *Sociology of Education*, *78*, 294–315.

Alon, S., & Tienda, M. (2007). Diversity, opportunity, and the shifting meritocracy in higher education. *American Sociological Review*, *72*, 487–511.

Bastedo, M. N. (2009). Convergent institutional logics in public higher education: State policymaking and governing board activism. *Review of Higher Education*, *32*, 209–234.

Bastedo, M. N., & Bowman, N. A. (2010). The *U.S. News and World Report* college rankings: Modeling institutional effects on organizational reputation. *American Journal of Education*, *116*, 163–184.

Bastedo, M. N., & Bowman, N. A. (2011). College rankings as an interorganizational dependency: Establishing the foundation for strategic and institutional accounts. *Research in Higher Education*, *52*, 3–23.

Bastedo, M. N., & Gumport, P. J. (2003). Access to what? Mission differentiation and academic stratification in U.S. public higher education. *Higher Education*, *46*, 341–359.

Bielby, R., Posselt, J. R., Jaquette, O., & Bastedo, M. N. (2011). Gender dynamics and higher education stratification: Examining the longitudinal evidence. Unpublished paper, University of Michigan.

Blau, P. M. (1994). *Structural contexts of opportunities*. Chicago, IL: University of Chicago Press.

Boudon, R. (1974). *Education, opportunity, and social inequality: Changing prospects in Western society*. New York, NY: Wiley.

Bound, J., Hershbein, B., & Long, B. T. (2009). Playing the admissions game: Student reactions to increasing college competition. *Journal of Economic Perspectives*, *23*(4), 119–146.

Bowen, W. G., & Bok, D. C. (1998). *The shape of the river: Long-term consequences of considering race in college and university admissions*. Princeton, NJ: Princeton University Press.

Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton, NJ: Princeton University Press.

Bowen, W. G., Kurzweil, M. A., & Tobin, E. M. (2005). *Equity and excellence in American higher education*. Charlottesville: University of Virginia Press.

Bowman, N. A., & Bastedo, M. N. (2009). Getting on the front page: Organizational reputation, status signals, and the impact of *U.S. News and World Report* on student decisions. *Research in Higher Education*, *50*, 415–436.

Bowman, N. A., & Bastedo, M. N. (2011). Anchoring effects on world university rankings: Exploring biases in reputation scores. *Higher Education, 61,* 431–444.

Brewer, D. J., Eide, E. R., & Ehrenberg, R. G. (1999). Does it pay to attend an elite private college? Cross-cohort evidence on the effects of college type on earnings. *Journal of Human Resources*, *34*, 104–123.

Buchmann, C. (2009). Gender inequalities in the transition to college. *Teachers College Record*, *111*, 2320–2346.

Burkam, D. T., & Lee, V. E. (2003). *Mathematics, foreign language, and science coursetaking and the NELS:88 transcript data* (NCES 2003–01). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

Carnevale, A. P., & Rose, S. J. (2004). Socioeconomic status, race/ethnicity, and selective college admissions. In R. D. Kahlenberg (Ed.), *America's untapped resource: Low-income students in higher education* (pp. 101–156). New York, NY: Century Foundation Press.

Clark, M., Rothstein, J., & Schanzenbach, D. W. (2009). Selection bias in college admissions test scores. *Economics of Education Review*, *28*, 295–307.

Cole, S., & Barber, E. G. (2003). *Increasing faculty diversity: The occupational choices of high-achieving minority students*. Cambridge, MA: Harvard University Press.

Dale, S. B., & Krueger, A. B. (2002). Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables. *Quarterly Journal of Economics*, *117*, 1491–1527.

Dynarski, M. (1987). The scholastic aptitude test: Participation and performance. *Economics of Education Review*, *6*, 263–273.

Espenshade, T. J., & Chung, C. Y. (2009). *Diversity implications of SAT-optional admission policies at selective colleges*. Unpublished manuscript, Princeton University, Office of Population Research, Princeton, NJ.

Espenshade, T. J., & Radford, A. W. (2009). *No longer separate, not yet equal: Race and class in elite college admission and campus life.* Princeton, NJ: Princeton University Press.

Frank, R. H., & Cook, P. J. (1995). *The winner-take-all society*. New York, NY: Free Press.

Gerald, D., & Haycock, K. (2006). *Engines of inequality: Diminishing equity in the nation's premier public universities*. Washington, DC: Education Trust.

Goldin, C., Katz, L. F., & Kuziemko, I. (2006). The homecoming of American college women: The reversal of the college gender gap. *Journal of Economic Perspectives*, *20*(4), 133–156.

Grodsky, E. (2007). Sponsored mobility in higher education. *American Journal of Sociology*, *112*, 1662–1712.

Grodsky, E., & Felts, E. (2009). Social stratification in higher education. *Teachers College Record*, *111*, 2347–2384.

Grodsky, E., & Jones, M. T. (2007). Real and imagined barriers to college entry: Perceptions of cost. *Social Science Research*, *36*, 745–766.

Haycock, K., Lynch, M., & Engle, J. (2010). *Opportunity adrift: Our flagship universities are straying from their public mission*. Washington, DC: Education Trust.

Hearn, J. C. (1991). Academic and nonacademic influences on the college destinations of 1980 high-school graduates. *Sociology of Education*, *64*, 158–171.

Hershbein, B. (2010). *Worker signals among new college graduates: The role of selectivity and GPA*. Ann Arbor: University of Michigan.

Ho, D. E. (2005). Why affirmative action does not cause Black students to fail the bar. *Yale Law Journal*, *114*, 1197–2004.

Hoxby, C. M. (1997). *How the changing market structure of U.S. higher education explains college tuition* (NBER Working Paper 6323). Cambridge, MA: National Bureau of Economic Research.

Hoxby, C. M. (2009). The changing selectivity of American colleges. *Journal of Economic Perspectives*, *23*(4), 95–118.

Hoxby, C. M., & Avery, C. (2009, January). *The missing "one-offs": The hidden supply of high merit students for highly selective colleges.* Paper presented at the American Economic Association annual meeting, San Francisco, CA.

Hoxby, C. M., & Long, B. T. (1998). *Explaining the rising income and wage inequality among the college-educated* (NBER Working Paper 6873). Cambridge, MA: National Bureau of Economic Research.

Kahlenberg, R. D. (2004). *America's untapped resource: Low-income students in higher education*. New York, NY: Century Foundation Press.

Karen, D. (2002). Changes in access to higher education in the United States: 1980–1992. *Sociology of Education*, *75*, 191–210.

Kaufman, J., & Gabler, J. (2004). Cultural capital and the extracurricular activities of girls and boys in the college attainment process. *Poetics*, *32*, 145–168.

Kingston, P. W., & Lewis, L. S. (1990). *The high-status track: Studies of elite schools and stratification*. Albany: State University of New York Press.

Lareau, A. (2003). *Unequal childhoods: Race*, *class*, *and family life.* Berkeley: University of California Press.

Light, A., & Strayer, W. (2000). Determinants of college completion: School quality or student ability? *Journal of Human Resources*, *35*, 299–332.

Long, B. T., & Kurlaender, M. (2009). Do community colleges provide a viable pathway to a baccalaureate degree? *Educational Evaluation and Policy Analysis*, *31*, 30–53.

Long, J. S., & Freese, J. (2006). *Regression models for categorical dependent variables using Stata* (2nd ed.). College Station, TX: Stata Press.

Manski, C. F. (1993). Adolescent econometricians: How do youth infer the returns to schooling? In C. T. Clotfelter & M. Rothschild (Eds.), *Studies of supply and demand in higher education* (pp. 43–57). Chicago, IL: University of Chicago Press.

McDonough, P. M. (1997). *Choosing colleges: How social class and schools structure opportunity*. Albany: State University of New York Press.

McPherson, M. S., & Shapiro, M. O. (1998). *The student aid game.* Princeton, NJ: Princeton University Press.

Melguizo, T. (2008). Quality matters: Assessing the impact of attending more selective institutions on college completion rates of minorities. *Research in Higher Education*, *49*, 214–236.

Monks, J. (2000). The returns to individual and college characteristics: Evidence from the National Longitudinal Survey of Youth. *Economics of Education Review*, *19*, 279–289.

National Center for Education Statistics. (2009). *Digest of education statistics*, *2008*. Washington, DC: Author.

National Center for Education Statistics. (2010). *Digest of education statistics*, *2009*. Washington, DC: Author.

Niu, S. X., & Tienda, M. (2010). Minority student academic performance under the uniform admission law: Evidence from the University of Texas at Austin. *Educational Evaluation and Policy Analysis, 32,* 44–69.

Posselt, J. R., Bielby, R., Jaquette, O., & Bastedo, M. N. (2010). Access without equity: Longitudinal analyses of institutional stratification by race and ethnicity, 1972–2004. Paper presented at the annual meeting of the Association for the Study of Higher Education, Indianapolis, IN, November 17–20, 2010.

Rivera, L. (2009). *Cultural reproduction in the labor market: Homophily in job interviews*. Unpublished manuscript, Northwestern University, Evanston, IL.

Rothstein, J. (2004). College performance predictions and the SAT. *Journal of Econometrics*, *121*, 297–317.

Sadler, D. R. (2009). Grade integrity and the representation of academic achievement. *Studies in Higher Education*, *34*, 807–826.

Sander, R. H. (2004). A systemic analysis of affirmative action in American law schools. *Stanford Law Review*, *57*, 367–483.

Sander, R. H. (2005). A systematic response to systemic disadvantage: A response to Sander—A reply to critics. *Stanford Law Review*, *57*, 1963–2016.

Sedlacek, W. (2004). *Beyond the big test: Noncognitive assessment in higher education*. San Francisco, CA: Jossey-Bass.

Sternberg, R. J. (2006). The Rainbow Project: Enhancing the SAT through assessments of analytical, practical and creative skills. *Intelligence*, *34*, 321–350.

Thernstrom, S., & Thernstrom, A. (1999). Reflections on *The shape of the river*. *UCLA Law Review*, *46*, 1583–1631.

Trow, M. A. (1999). California after racial preferences. *Public Interest*, *135*, 64–85.

Useem, M., & Karabel, J. (1986). Pathways to top corporate management. *American Sociological Review*, *51*, 184–200.

Winston, G. C. (1999). Subsidies, hierarchy and peers: The awkward economics of higher education. *Journal of Economic Perspectives*, *13*(1), 13–36.

Zwick, R., & Sklar, J. C. (2005). Predicting college grades and degree completion using high school grades and SAT scores: The role of student ethnicity and first language. *American Educational Research Journal*, *42*, 439–446.

Authors

MICHAEL N. BASTEDO is associate professor at the University of Michigan, School of Education, 610 E. University, 2108C SEB, Ann Arbor, MI 48109; bastedo@umich.edu. His research interests are in the governance, politics, and stratification of higher education.

OZAN JAQUETTE is assistant professor at the University of Arizona, College of Education, 1430 E. Second Street, .O. Box 210069, Tucson, Arizona 85721; ozanj@email.arizona.edu. His research interests include quantitative research methods, organizational theory, and university finance.

Manuscript received February 15, 2010
Revision received September 20, 2010
March 17, 2011