Assessing the “Mismatch” Hypothesis: Differences in College Graduation Rates by Institutional Selectivity

Sigal Alon
Tel Aviv University

Marta Tienda
Princeton University

This article evaluates the “mismatch” hypothesis, advocated by opponents of affirmative action, which predicts lower graduation rates for minority students who attend selective post-secondary institutions than for those who attend colleges and universities where their academic credentials are better matched to the institutional average. Using two nationally representative longitudinal surveys and a unique survey of students who were enrolled at selective and highly selective institutions, the authors tested the mismatch hypothesis by implementing a robust methodology that jointly considered enrollment in and graduation from selective institutions as interrelated outcomes. The findings do not support the “mismatch” hypothesis for black and Hispanic (as well as white and Asian) students who attended college during the 1980s and early 1990s.

Waning support for affirmative action during the 1990s challenged the research community to justify the consideration of race as a legitimate factor in college admissions decisions. Proponents of affirmative action practices have argued that there is a compelling societal interest in maintaining affirmative action policies because such initiatives are addressing long-term societal needs by promoting diversity and equality of educational opportunity. From this vantage point, race-sensitive admissions are necessary not only to correct past discrimination, but to broaden disadvantaged students’ access to education. Moreover, these initiatives enrich the education of all students by assembling a student body with diverse talents and perspectives. In addition, in response to a societal need for more members of minority groups in business, government, and the professions, elite institutions that admit minorities give them opportunities to become leaders in all walks of life (Bowen and Bok 1998).

Critics of affirmative action have charged that racial preferences are contrary to the core American values of fairness, equality, and respect for individual achievement in a meritocracy. They have argued that affirmative action constitutes reverse discrimination that lowers the odds of admission for “better”-qualified white students. Another claim is that affirmative action stigmatizes all members of the target group as unqualified, which results in demoralization and substandard performance, regardless of individual qualifications.

One of the main allegations against affirmative action is that treating race and ethnicity as a plus factor for the purposes of admission to selective and highly selective institu-
Assessing the “Mismatch” Hypothesis

Assessing the “Mismatch” Hypothesis

...ions sets up minority students for failure because these students are putatively unprepared to succeed academically (Graglia 1993; Sowell 2003; Thernstrom and Thernstrom 1997). Bowen and Bok (1998) and others dubbed this the “fit” hypothesis, but the mismatch hypothesis better captures the essence of the debate, namely, that minority students with lower credentials than the institutional average are “mismatched” at selective institutions and thus have worse outcomes.

The debate about affirmative action practices raises a specter of educational and social policy questions that deserve careful consideration. As Bowen and Bok (1998:275) eloquently argued: “In the face of what seems like a veritable torrent of claims and counter-claims, there is much to be said for stepping back and thinking carefully about the implications of the record to date before coming to settled conclusions.” In our analysis, we heeded their advice and empirically evaluated the mismatch hypothesis. Using two nationally representative longitudinal surveys—High School and Beyond (HS&B) and the National Longitudinal Study of 1988 (NELS:88)—and a unique survey of students who were enrolled at selective and highly selective postsecondary institutions—College and Beyond (C&B)—we tested claims that considering Hispanic origin and race in admissions decisions predestined “affirmative admits” for inevitable failure.

THE MISMATCH HYPOTHESIS

The controversy over affirmative action in college admissions and the derivative mismatch hypothesis is about access to the most selective postsecondary institutions in the nation. Although many factors determine the selectivity of admissions, two key indicators are singled out for ranking postsecondary institutions: the average SAT score of freshman classes and the percentage of applicants who are admitted (Barron’s 2003; “Best Colleges” 2003; Bowen and Bok 1998; Greenberg 2002). Of the 1,650 institutions that were listed in Barron’s 2003 Profile of American Colleges, only 64 institutions, or 3.9 percent, were classified as “most competitive.” According to Greenberg (2002:526), the nation’s 25 most highly selective universities offer about 50,000 slots annually. The rising demand for a relatively fixed number of slots at the most competitive institutions has certainly fueled growing disapproval of affirmative action in college admissions, but so, too, has the growing belief that standardized scores on college entrance examinations are reliable criteria for establishing admission cutoffs. That black and Hispanic students typically average lower scores on standardized college entrance examinations is used to justify claims that they are unsuitable to attend selective institutions, where the average SAT score is much higher than the minority-group average (Arkes 1999; Graglia 1993; Lerner and Nagai 2001; Pell 2003).

The basic claim is that the lower average graduation rates of “affirmative admits” result from a mismatch between their academic preparation—indicated by their lower scores on standardized college entrance examinations and high school grades—and the scholastic requirements of the schools that admitted them by taking race into account (Pell 2003). As Thernstrom and Thernstrom (1997:406) argued, “When students are given a preference in admission because of their race or some other extraneous characteristics, it means that they are jumping into a competition for which their academic achievements do not qualify them and many find it hard to keep up.” Presumably, mismatched minority students become demoralized, underperform, and ultimately fail to graduate (Crawford 2000; Lerner and Nagai 2001; Pell 2003; Thernstrom and Thernstrom 1999). This logic implies that a better match between the academic credentials of minority students with the average of the institutions they attend will lead to stronger performance, including higher graduation rates and postgraduate activities (Arkes 1999). In this article, we assess whether minority students are hurt, in terms of the likelihood of graduating, from attending selective postsecondary institutions compared to their same-race counterparts who attend less-selective colleges and universities, where their academic credentials are presumably better matched to the institutional average.
The claims embedded in the mismatch hypothesis contrast with both common knowledge and empirical research with elementary and secondary school students, which has demonstrated that regardless of their prior achievements, students who attend higher tracks and/or better schools make greater scholastic gains (Entwisle, Alexander, and Olson 1997; Gamoran 1987; Gamoran and Berends 1987; Gamoran and Mare 1989; Hallinan 1996, 2001; Hoffer 1992). Empirical studies have repeatedly demonstrated the advantages of placing students in higher ability groups with better instruction, less distraction, more time spent on task, more academic role models, and more serious learning climates (Hallinan 2001). These findings indicate that the development of cognitive skills depends crucially on the opportunities for learning that schools afford (Gamoran 1987). Participation in higher academic tracks and more-demanding schools may have offsetting advantages for disadvantaged students (Hallinan 2001).

Black students’ postsecondary experiences further support this idea. By demonstrating that for all intervals of the SAT distribution, the graduation rates of black students increase as institutional selectivity rises, Bowen and Bok (1998) challenged the core of the mismatch hypothesis. Not only did their findings dispute allegations that black students cannot succeed at selective colleges and universities, but they demonstrated a consistent positive association between institutional selectivity and several postgraduation outcomes, including the completion of advanced degrees, earnings, and overall satisfaction with college experiences (Dworkin 1998). Attending to the same question, Kane (1998) argued that affirmative action narrows, rather than widens, the gaps in college retention rates by race because the net relationship between college selectivity and college graduation rates is positive for all students.

Although informative, findings that are based on comparisons of students attending institutions that differ in the selectivity of their admissions fall short of demonstrating a causal link between institutional selectivity and subsequent college outcomes by ignoring students’ allocation to selective and nonselective college destinations. Because the determinants of attending a selective institution and graduating from college overlap to a large extent, ignoring students’ institutional assignment can lead to biased inferences about the effect of college selectivity on graduation resulting from unmeasured influences that are correlated both with institutional assignment and college graduation. This point is particularly important if the conditional probability of attending selective postsecondary institutions differs for minority and nonminority populations with various academic qualifications—that is, if institutions practice affirmative action. Therefore, testing the mismatch hypothesis requires joint estimation of the selection regime that allocates students to colleges and students’ probability of graduating. Jointly modeling the graduation outcomes and the institutional assignment process not only resolves a methodological weakness of prior studies, but bears important substantive implications for the ongoing debate about affirmative action.

Our evaluation of the mismatch hypothesis extends prior research in three important ways. First, unlike prior studies, in this article, we account for the selection bias stemming from the fact that the allocation of individuals to colleges and universities that differ in the selectivity of their admissions is endogenous to subsequent academic success. Our analytical framework—devised to assess the causal link between institutional selectivity and college graduation—stands up to this challenge by combining several statistical methods that model the allocation regime governing assignment to a selective institution (Heckman and Hotz 1989). We use two different estimation techniques—propensity score (Rosenbaum and Rubin 1983) and matching estimator (Heckman, Ichimura, and Todd 1997, 1998)—that differ in their assumptions about functional form. We also present evidence that takes into account the possibility of selection on unobservables. Using a dummy endogenous variable model (Heckman 1978), we simultaneously model enrollment in selective and nonselective institutions on the likelihood of graduation.
Second, we compare the experiences of students attending selective and highly selective institutions using the C&B database to national college-bound populations. Analyzing the C&B data allows us to analyze the experiences of students who attend the most competitive institutions in the country, which are the main focus of the controversy about race-sensitive admissions practices. Comparing the experiences of these students to national college-bound populations yields a broader perspective on the selection processes that allocate students to institutions that vary in the competitiveness of their admissions and provides a reliability check on Bowen and Bok’s (1998) claims for blacks on the basis of the C&B data. It is especially important to do so because the C&B institutional selectivity spectrum is truncated, which may limit the generalizability of inferences.

Finally, we compare the educational experiences of the four major ethno-racial groups. By emphasizing black-white differences, prior analysts neglected the most rapidly growing segments of the college population, namely, Hispanics and Asians (see Bowen and Bok 1998; Kane 1998).2 We pay special attention to Hispanics, whose position in higher education has been relatively understudied compared with that of blacks. Although Hispanics are notorious for their educational underachievement, particularly their persistent and elevated rate of noncompletion of high school (Fry 2003), understanding their success in higher education—both who gains admission to and who graduates from selective institutions—holds promise for the design of policy that is geared to improve their standing in postsecondary institutions and beyond. Multi-group comparisons that are based on nationally representative data not only situate Hispanics in the broader terrain of higher education, but validate findings for blacks on the basis of a subset of highly selective institutions.

In what follows, we elaborate on the testable implications of the mismatch hypothesis and formulate a strategy for evaluating them. After describing the three data sources that we used for empirical estimation, we report the statistical results. We found that conditional on admission, all groups of students who attended selective institutions were more likely to graduate within six years of enrollment than were their counterparts who attended less-selective colleges. We reject the mismatch hypothesis for students who enrolled at the most selective institutions during the late 1980s and early 1990s.

ASSESSING THE MISMATCH HYPOTHESIS

The broad implication of the mismatch hypothesis is that Hispanics and blacks who are enrolled in institutions with selective and highly selective admissions have a lower probability of graduating than do their counterparts with similar characteristics who attend postsecondary institutions with less-selective admission criteria.3 Before we present our analytical strategy, it is important to distinguish between racial and ethnic probabilities of graduating within institutions and the predictions of the mismatch hypothesis, which focus on same-group comparisons between selective and nonselective institutions. Both sources of inequality are of policy interest, but we are concerned with the latter.

Assessing the mismatch hypothesis requires comparing the likelihood of graduation by students who attend selective institutions with their same-race counterparts who attend nonselective schools. However, graduation from a selective institution is conditional on being admitted, a highly selective process that is influenced by many observed and unobserved factors that also influence the likelihood of timely college graduation.4 Analytically, the mismatch hypothesis has two related but separable components: (1) group differences in the probability of graduating from institutions that differ in the selectivity of their admissions and (2) group differences in the probability of attending a selective institution. The following two equations formally summarize the model:

\[ Pr(Y_i = 1|X = \chi_i) = \alpha D_i + \beta' X_i + \varepsilon_i \]  
\[ Pr(D_i* = 1|Z = z_i) = \phi' Z_i + \nu_i \]
Let $Y$ be a measure of college graduation of the $i$th individual; $D_i^*$ is a latent continuous variable denoting institutional selectivity of the $i$th individual’s destination college, where $D_i = 1$ if $D_i^* \geq 0$ (selective college destination) and $D_i = 0$ if $D_i^* < 0$ (nonselective college destination); $\alpha$ is its coefficient; $X$ is a vector of observed attributes that influence college graduation; $\beta$ is the vector of their coefficients; and $\varepsilon$ is an error term that captures unobserved factors that affect graduation.

The parameter $\alpha$ in Equation 1 is the coefficient of interest for testing the mismatch hypothesis; the hypothesis cannot be rejected when $\alpha < 0$; that is, if students who attend less-selective schools ($D = 0$) are more likely to graduate than are students who attend more-demanding schools ($D = 1$). However, comparisons between students who attend colleges that differ in selectivity are prone to bias because of observable and unobservable differences that govern the selection regime. Equation 2 represents the selection regime that determines assignment to college destinations, where $Z$ is a vector of observed exogenous covariates that allocate students among postsecondary institutions; $\phi$ is a vector of associated coefficients, and $\nu$ is an error term that captures unobserved influences in the allocation regime.

We use the counterfactual account-of-causeality conceptual and notational framework to describe the problem (for a review, see Heckman et al. 1997; Winship and Morgan 1999; Winship and Sobel 2004). Each individual is exposed to one of two destination states—nonselective ($D = 0$) versus selective colleges ($D = 1$), although each individual may be exposed to either state a priori. Each college destination is characterized by a set of conditions that, upon exposure, affects students’ likelihood of graduating from college. In this framework, college destination states may be considered as treatment ($D = 1$) and control ($D = 0$) in a quasi-experiment. A key assumption of the counterfactual framework is that all students have a probability of graduating in both states: the one in which they are observed and the one in which they are not observed. A student who is attending a nonselective college has an observable outcome at a nonselective college, $Y^0_i$, and an unobservable counterfactual outcome at a selective institution, $Y^1_i$.

The gain from attending a selective institution is given by $\delta_i = Y^1_i - Y^0_i$. If $Y_1$ and $Y_0$ could be observed simultaneously for all students, there would be no evaluation problem because $\delta$ would be measured for everyone. The evaluation problem arises because ordinary observational data do not provide sample counterparts for the missing counterfactual, namely, $Y_0$ values for students who attend a selective institution ($D = 1$). Because only one outcome is observed for each individual, it is not possible to calculate individual-level gains from attending a selective institution. The evaluation problem is therefore a missing data problem (Heckman et al. 1997).

However, we can calculate the mean outcome for all students who attend selective and nonselective institutions, $\bar{Y}^1$ and $\bar{Y}^0$, respectively. The standard estimator for the average treatment effect is the difference between these two estimated means, $\delta = \bar{Y}^1 - \bar{Y}^0$. This strategy is adequate for randomized studies in which the random assignment ensures that the treatment assignment is independent of all the individual characteristics. In other words, a balanced design—a design in which the treatment and control groups do not differ with respect to $Z$ in any way that is also related to the treatment assignment $D$—is required to estimate $\delta$. However, because students who are allocated to selective and nonselective institutions are dissimilar in their observed characteristics, such a straightforward comparison is not possible (Slavin 1990). In this case, some observed set of factors in $Z$ is related to the likelihood of graduation. Therefore, in observational studies, we must adjust for possible differences in observed $Z$ attributes across treatment and control groups to ensure that the assignment is random with respect to the graduation outcome. The ignorability condition (i.e., that the potential outcome $Y^1_i$ is independent of the treatment assignment) is sufficient for the standard estimator to be unbiased and consistent (Rosenbaum and Rubin 1983). In other words, the treatment assignment can be ignored within the strata defined by $Z$.

We used two methods that adjust for
Assessing the “Mismatch” Hypothesis

observed group differences in $Z$. Because there is no perfect model to assess causality in nonexperimental designs and alternative methods may yield different results, our multipronged analytical strategy that builds on different assumptions about underlying relationships afforded a highly rigorous standard for testing the mismatch hypothesis (Heckman and Hotz 1989; Winship and Mare 1992). The continuing level of controversy requires nothing less.

The first approach is the widely used matching estimator (Heckman et al. 1997, 1998). To match, one identifies individuals in the treatment and control groups with equivalent or, at least, similar values of the $Z$ covariates and matches them, creating a new sample of matched cases. The standard estimator is then applied to the matched sample. By construction, the treatment and control cases in the matched sample have identical values of $Z$. Thus, matching eliminates the effect of any potential differences in the distribution of $Z$ between the treatment and control groups by equating the distribution of $Z$ across students who enroll in selective and nonselective institutions (Winship and Sobel 2004). Calculating $\delta$ for students who are matched on $Z$ simulates a balanced design in which the assignment is random with respect to the graduation outcome.

Matching has several advantages. First, it is a nonparametric estimator that makes no assumptions about the functional form of the dependence between the outcome of interest and $Z$. Second, matching ensures that the $Z$s in the treatment group are similar (matched) to those in the control group. Third, because fewer parameters are estimated than in a regression model, matching is more efficient. One problem with the traditional matching approach is that if the sample is small, there are more than a few covariates in $Z$, and it may be difficult to find both treatment and control cases that match.

A solution was suggested by Rosenbaum and Rubin (1983), who advocated the propensity-score method. Propensity scores represent the probabilities that individuals with observed characteristics $Z_i$ are assigned to selective, rather than nonselective, institutions. Rosenbaum and Rubin argued that little is gained by refined matching on the $Z$ variables, as in matching estimations compared with the propensity scores alone. Propensity scores contain all the information that is needed to create a balanced design, while matching can be estimated on a single dimension (the propensity score), which makes the matching more feasible. If the likelihood of attending a selective college is purely a function of the observables, then conditional on the $Z$ vector, assignment is random with respect to the graduation outcome. Including the propensity score as a control variable in the graduation equation (Equation 1) removes from both $Y$ and $D$ the component of their correlation that is due to the assignment process (Winship and Morgan 1999). By so doing, the parameter $\alpha$ in Equation 1 gives us $\delta$.

Testing the mismatch hypothesis once selection is accounted for requires evidence of lower odds of graduation for students who attend selective schools relative to statistically similar group members who attend less-demanding schools. That is,

$$H_0: \delta < 0 \mid Z = z_i \quad (3)$$

$$H_1: \delta \geq 0 \mid Z = z_i \quad (4)$$

The mismatch hypothesis ($H_0$) predicts that Hispanic and black students (as well as white and Asian students) are less likely to graduate from selective than from nonselective institutions, conditional on their likelihood of attending a selective institution. Because the predictions of the mismatch hypothesis focus on comparisons of the same groups who are attending selective and nonselective institutions, estimation of $\delta$ is group specific. The mismatch hypothesis cannot be rejected if group counterpart students are more likely to graduate from less-selective schools ($\delta < 0$). Alternatively, the mismatch hypothesis ($H_1$) can be rejected if statistically similar Hispanic and black students are equally or more likely to graduate from selective than from nonselective institutions (when $\delta \geq 0$).

Both propensity scores and the matching estimator are designed to address selection on observable characteristics $Z$. However, selection could also be related to unobserv-
able attributes. That is, when unobserved (by
the analyst) variables influence both the insti-
tutional assignment and the graduation out-
come, the errors of the prediction equations
for both outcomes (ε and ν) are likely to be
correlated and hence must be jointly estimat-
ed to obtain unbiased estimates (Pindyck and
Rubinfeld 1998). We examined this issue of
selection on unobservables to get a sense of
how much such a selection is a problem in
our context and how much and to what
direction estimates of δ, based on the
propensity score and the matching estimator,
would change after such a correction. Above
all, we wanted to know whether these esti-
mates are upwardly or downwardly biased.

Ensuring the ignorability condition for
unobservable attributes is more complicated
than for observed characteristics. None of the
existing alternatives is perfect. To assess the
bias stemming from the “selection on the
unobservables” (ε and ν are correlated), we
jointly estimate the likelihood of enrollment
at selective institutions (Equation 2) and the
likelihood of graduation (Equation 1).
Following Heckman (1978), we fit a dummy
endogenous variable model to obtain unbi-
ased and consistent estimates. Using appro-
priate distributional assumptions, this tech-
nique estimates error covariances (the corre-
lation between ε and ν) across equations
(Greene 2000; Pindyck and Rubinfeld 1998).
There are some exclusion restrictions, but
since the determinants of college enrollment
and graduation overlap to a large extent,
identification is achieved primarily via distrib-
utional assumptions (Greene 2000).

DATA AND EMPIRICAL
ESTIMATION

To estimate the probabilities of graduation for
students who attended selective and highly
selective institutions, we analyzed the 1989
cohort of the C&B database. However, because
these data represent the experience of a rela-
tively small share of students who attended
selective and highly selective four-year institu-
tions, we also analyzed two nationally repre-
sentative data sets—HS&B and NELS:88.

C&B is a restricted-access database that
was constructed by the Andrew W. Mellon
Foundation between 1995 and 1997 (Bowen
and Bok 1998:Appendix A). Two strengths of
these data for analyzing graduation rates at
selective colleges and universities are the
accurate persistence data that were derived
from college transcripts (rather than students’
self-reports) and the relatively large samples
of minority students who attended highly
selective institutions. The core of the C&B
data base is an “institutional data file” consist-
ing of undergraduate students who enrolled
at one of 28 academically selective colleges
and universities in fall 1989.

The institutional file contains information
that was drawn from students’ applications
and transcripts, including race, sex, SAT
scores, college grade point average, major
field of study, and graduation status (out-
come and date). Institutional records were
collected for all students who enrolled in fall
1989 at all but three of the C&B institutions.
Records of individual students were linked to
several other sources, including a survey that
collected retrospective data, files provided by
the College Entrance Examination Board, and
data collected by the Higher Education
Research Institute at UCLA. Limiting the
analysis to U.S. residents or citizens with valid
racial and ethnic identities and graduation
status, we had a final sample of 29,018 stu-
dents, including 23,086 white, 2,260 black,
1,235 Hispanic, and 2,437 Asian-origin stu-
dents.

The HS&B and NELS:88 surveys are nation-
ally representative samples of the 1982 and
1992 high school graduation cohorts, respec-
tively, collected by the National Center for
Education Statistics (NCES). The detailed edu-
cational histories provided by these longitudi-
nal surveys make them ideal for studying
both the transition to college and the institu-
tional selectivity of matriculants. In addition
to oversamples of blacks and Hispanics, these
surveys include rich information about test
scores and academic performance in high
school, as well as standard indicators of family
background. Transcript data are available
for students who attended college.

Our substantive interest dictated restrict-
ing both samples to students who attended
Assessing the “Mismatch” Hypothesis

four-year postsecondary institutions with valid institutional selectivity rankings. For NELS:88, the analysis sample included the respondents from the 1992 high school graduation cohort who were interviewed in the 2000 follow-up. Of the 4,530 eligible students, 3,326 were white, 386 were black, 361 were Hispanic, and 457 were of Asian origin. The comparable HS&B analysis sample consisted of 4,704 students who graduated from high school in 1982 and were reinterviewed 10 years later. The eligible respondents included 3,260 whites, 644 blacks, 559 Hispanics, and 241 Asians.

The descriptive analyses were weighted to adjust for oversampling, nonresponse, and attrition. Moreover, the multivariate analyses were adjusted to account for the clustered survey design of the data sets. Flags for missing values were included in all the models, but are not reported in the results presented here. Appendix Table A provides detailed definitions and descriptive statistics of the variables that were analyzed from each data set.

Variables

The measure of institutional selectivity for the HS&B and NELS:88 is identified as the mean combined SAT score of entering freshmen in 1982 and 1992, based on data from the Cooperative Institutional Research Project (CIRP). “Selective” institutions include those whose mean class SAT scores were higher than 1050; the remainder of the four-year institutions are classified as “nonselective.” The mean combined SAT score of the 1989 entering freshmen exceeded 1050 for all C&B institutions, which qualify as selective under the CIRP classification. The C&B data defined “most-selective” institutions as those where the average combined SAT score of the entering class was 1300 or higher (Bowen and Bok 1989:Appendix B).

The graduation equation (Equation 1) includes a dummy variable for attending a selective school and a vector of covariates that are known to influence persistence and success in college (Tinto 1993), including social class (parental education and income); academic preparation (high school class rank and individual SAT scores), to isolate students’ qualifications from institutional selectivity; and sex. The propensity score model (Equation 2) includes Z covariates that are known to influence access to selective institutions and were also used to match students in the matching estimator procedure. These covariates are background characteristics (parental education and income, dummy variables for attending a public high school, home geographic region, a dummy variable for residing in a rural area, and athlete status) and academic preparation (based on high school class rank and SAT scores) (Carnevale and Rose 2003; Davies and Guppy 1997; Hearn 1984, 1990, 1991; Karen 2002; Kingston and Lewis 1990; Persell, Catsambis, and Cookson 1992). Dummy variables for race and ethnicity are included only in pooled models to capture minority students’ possible preferential admission advantage.

RESULTS

Table 1 reveals the diversification of college campuses during the expansion of affirmative action between 1982 and 1992, after the decision in Regents of the University of California v. Bakke (1978). The relative share of white students who attended selective institutions declined from the early 1980s to the early 1990s, when the HS&B students began their postsecondary education. Asians witnessed the most substantial gains at selective institutions, nearly doubling their shares between 1982 and 1992. Despite the rapid growth of the Hispanic college-age population after 1980 and the aggressive recruitment of black and Hispanic students by admissions officers from selective colleges and universities, their shares of the entering cohort rose only slightly during the 1980s.

At the most competitive institutions in the C&B sample, the combined representation of blacks and Hispanics reached 13 percent. Paralleling national trends, the diversification of the most-elite institutions largely reflects the rising Asian presence. Cross-data comparisons revealed relatively similar shares of black students attending selective institutions, approximately 6 percent and 7 percent for
NELS and C&B, respectively, but lower shares of Asian and Hispanic students in selective institutions in C&B than in NELS. Most likely, this finding reflects the exclusion of public flagship institutions in Texas and California from the C&B database.

Although minority enrollment and graduation from selective postsecondary institutions have increased since 1980, racial and ethnic disparities in graduation rates have persisted. Six-year graduation rates are higher, on average, at selective than at nonselective institutions, which undermines allegations that lowering admission thresholds to include more minority students lowers overall graduation rates. Table 2 refutes this claim by showing that the graduation rates of black and Hispanic students increased between 1982 and 1992 at both selective and nonselective institutions, even as these students’ relative shares of the student body rose. Specifically, the graduation rate of black students who attended nonselective schools rose from 26 percent in 1982 to 48 percent in 1992, while the graduation rate of black students at selective institutions rose 20 percentage points—from 52 percent to 72 percent over the decade. The rise in the graduation rates of Hispanic students during this period rose from 26 percentage points to 40 percentage points at nonselective institutions, compared with a modest increase of only 7 percentage points at the selective institutions.¹¹

Graduation rates are uniformly higher for selective than for nonselective institutions (see the odds ratio columns in Table 2), although the graduation gap between selective and nonselective colleges and universities narrowed over time for all groups. White students’ 1982 graduation odds ratio of 3.9 indicates that students who attended selective schools were about four times more likely to graduate than were their racial counterparts who attended nonselective institutions. This odds ratio declined modestly 10 years later. For Hispanic and black students, the 1982 graduation odds ratios between selective and nonselective institutions were somewhat smaller than for whites (2.7 and 2.9, respectively) and remained stable over time—increasing slightly for blacks and decreasing slightly for Hispanics. That the graduation
rates were higher for the C&B institutions than for the selective schools that were included in the NELS and HS&B samples is unsurprising, given the positive association between institutional selectivity and graduation rates overall (Kane 1998). However, these differences also highlight a limitation of the C&B data for an exclusive test of the mismatch hypothesis, namely, that the truncated distribution of institutional selectivity greatly restricts variation in both students' attributes and graduation rates.

In sum, Hispanic and black students' probabilities of graduation are higher at selective than at nonselective institutions, contrary to the predictions of the mismatch hypothesis. In fact, it appears that the racial and ethnic gap in graduation narrows as institutional selectivity increases. However, this conclusion is tentative because students who attend selective institutions are generally better prepared academically than are their counterparts who attend nonselective institutions. Thus, the higher minority graduation rates at selective institutions may simply reflect the students' higher average qualifications relative to their group average.

**The Mismatch Regime**

To show the degree of mismatch between students and their postsecondary institutions, Table 3 reports the deviation of each group SAT and mean class rank from the institutional tier average. The top panel reports the corresponding tier averages to which group-specific means are compared. In both 1982 and 1992, the average SAT scores for white and Asian students were slightly higher than the institutional tier average at both selective and nonselective institutions. By contrast, and in line with the claims of proponents of the mismatch hypothesis, both black and Hispanic students in selective institutions averaged test scores that were well below the respective institutional tier averages—162 and 112 points lower, respectively, for black and Hispanic HS&B students, and 176 and 95 points lower, respectively, for black and Hispanic NELS students. However, the deviation of the black and Hispanic mean SAT scores for the nonselective institutional aver-
age was greater still, about 180 and 115 points for black and Hispanic HS&B students, respectively, and 155 and 100 points for black and Hispanic NELS students, respectively. Racial and ethnic disparities in class rank mirror those that are based on average SAT scores.

That black and Hispanic mean SAT scores lag behind institutional averages at both selective and nonselective institutions would appear to challenge the mismatch hypothesis. Presumably, group-specific disparities in test scores lower the odds that black and Hispanic students will graduate in six years, yet the tabular differences reveal more pronounced disparities among students who attend nonselective than selective institutions. The C&B results show similar patterns, indicating that Hispanic students are better matched to their institutions’ average academic level than are black students, but less well matched than either white or Asian students.

Table 3. The Mismatch Regime: Deviations from Mean Institutional Scholastic Achievement and Class Rank, by Selectivity Tier, Entry Cohort, and Race

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-</td>
<td>Selective</td>
<td>Non-</td>
</tr>
<tr>
<td>Tier SAT mean</td>
<td>930.7</td>
<td>1112.6</td>
<td>912.7</td>
</tr>
<tr>
<td>(SD)</td>
<td>(182.2)</td>
<td>(179.3)</td>
<td>(176.7)</td>
</tr>
<tr>
<td>Tier class rank mean</td>
<td>64.6</td>
<td>78.5</td>
<td>67.4</td>
</tr>
<tr>
<td>(SD)</td>
<td>(25.5)</td>
<td>(19.8)</td>
<td>(23.1)</td>
</tr>
</tbody>
</table>

Deviations from Tier Means

White
- SAT mean
  - 21.8 10.0
  - 21.8 13.5
  - 13.2 13.3
- Class rank mean
  - 1.5 0.1
  - 1.0 -0.4
  - 2.3b 1.0b
- N
  - 2,680 580
  - 2,387 939
  - 17,983 5,103

Black
- SAT mean
  - -180.0 -162.3
  - -155.1 -176.0
  - -170.7 -154.7
- Class rank mean
  - -9.5 -7.0
  - -6.9 -3.2
  - -25.3b -18.9b
- N
  - 549 95
  - 298 88
  - 1,770 490

Hispanic
- SAT mean
  - -115.2 -112.0
  - -100.1 -95.1
  - -83.3 -89.0
- Class rank mean
  - -10.6 -3.1
  - -0.1 1.5
  - -11.9b -3.1b
- N
  - 467 92
  - 278 83
  - 861 374

Asian
- SAT mean
  - 7.4 37.0
  - -19.3 32.6
  - 49.7 51.1
- Class rank mean
  - 9.1 9.3
  - -5.7 4.5
  - 2.8b 7.1b
- N
  - 151 90
  - 209 248
  - 1,639 798

a For C&B data, class rank represents the percentage ranked in the top decile.
b The number reported is the deviation from the corresponding tier average percentage in high school top 10 percent.
Hispanic students' mean SAT scores lag about 83 and 89 points, respectively, behind the tier averages at selective and most selective schools, but Hispanic students are better matched to the most-selective institutions than to selective institutions on the basis of class rank. That Hispanic and black students who attend both selective and nonselective institutions appear to be less well prepared scholastically has direct implications for their persistence in and ultimate graduation from the postsecondary educational system. Their unequal preparation may be more consequential at the most-selective schools than at the less-selective schools, according to the mismatch hypothesis, because the academic curriculum is more demanding (Bowen and Bok 1998; Massey et al. 2003).

Comparisons of the academic preparedness of students who attend selective and nonselective institutions underscore the nature of the misunderstanding of the mismatch hypothesis. Although minority students average lower test scores and class rank than do white and Asian students, those who are enrolled in selective colleges are better prepared than are their same-race counterparts who attend nonselective institutions. The mismatch hypothesis is not about racial and ethnic differences in graduation within institutions but, rather, about same-group comparisons across institutions that differ in the selectivity of their admissions. The ultimate question that can be derived from the mismatch hypothesis is whether Hispanics and blacks who are enrolled in institutions with selective and highly selective admissions have a lower probability of graduating than do their counterparts with similar characteristics who attend institutions with less-selective admission criteria. The multivariate results provide more robust evidence of whether race-sensitive admissions harm their beneficiaries than do the tabular results.

**Multivariate Analysis**

The multivariate analysis was designed to assess the effect of institutional selectivity on the six-year graduation status (1 = yes, 0 = no) of white, black, Hispanic, and Asian students for all three surveys. Because the predictions of the mismatch hypothesis focus on same-group comparisons of students who attend selective and nonselective institutions, estimation of \( \delta \) is group specific (except for one general pooled model). The strategy was designed to account for selection bias stemming from the fact that the institutional selectivity allocation regime is endogenous to subsequent academic success. Toward that end, we present the results from a propensity-score analysis and from a matching estimator.

For the propensity-score analysis, we calculated a propensity score as a function of several \( Z \) covariates that are known to influence access to college: parental education, family income, SAT scores, high school class rank, type of high school, geographic region, and a dummy variable for residing in a rural area. We added the calculated propensity score as a control variable in the graduation equation (Equation 1), effectively "subtracting out" of \( Y_i \) the component of their correlation that is due to the assignment process (Rosenbaum and Rubin 1983; Winship and Morgan 1999). To estimate the matching estimator, we matched individuals on the same set of \( Z \) covariates to obtain the average treatment effect. For ease of interpretation, Table 4 reports the marginal effects that are associated with the covariate of theoretical interest, namely \( \delta \), estimated by both propensity-score methods and matching estimator. Also reported in the table are the baseline predicted probabilities of graduating from a nonselective institution, controlling for family background and academic achievements.

The results for the entire HS&B cohort indicate that regardless of the statistical method that is used, there is a positive and substantial effect of institutional selectivity on six-year college graduation status. That both methods yield similar results indicates that our results are robust to functional-form or other method-specific assumptions. For the entire cohort, the predicted probability of graduating from a nonselective institution is 0.51. The gain from attending a selective institution is substantial, since the probability of graduating is about 0.18 higher at selective institutions than at nonselective institutions for students who are matched on the \( Z \) covariates.
Nonetheless, the group-specific models reveal racial and ethnic variation in the benefits that are associated with attending a selective institution in 1982. The estimates of the matching estimator ranges from 0.12 for Hispanics to 0.36 for Asians, but whites and blacks share similar gains in graduation probability, on the order of 0.18–0.19. However, these gains need to be judged against the group-specific baseline probability. Because black and Hispanic students’ baseline graduation probabilities are much lower than are white students’, these students’ gains from attending a selective institution are much more substantial than are those of whites’.

Point estimates for the 1992 entering class (NELS:88 data) reveal the same positive relationship between institutional selectivity and college graduation, regardless of the estimation method that is used. For some groups, the marginal effects are smaller than they are for the 1982 cohort. This finding could reflect a ceiling effect on the likelihood function that is associated with the rise in the baseline probabilities of graduating. Consistent with this interpretation, the marginal effects are smaller for groups with the highest average probabilities of graduating, namely, whites and Asians. For the entire cohort, the gain in the probability of graduating from attending a selective institution is about 0.12. For white students, both methods yield the same point estimate (0.10). However, for minority groups, it appears that the functional form of the propensity-score method underestimates their gains from attending a selective institution. The matching-estimator results suggest that all minority groups benefited more than did whites from attending a selective institution in 1992. Hispanics’ gains were especially large, considering their lower baseline probabilities of graduating. Combined, these results in Table 4 allow us safely to reject the mismatch hypothesis for all HS&B and NELS:88 students.

To test the mismatch hypothesis further, we direct attention to highly selective colleges. Not only are these institutions the focus of controversy about race-sensitive admission policies, but elite institutions are wealthier and have other resources to support all the students they admit, thereby increasing the students’ odds of graduation. For this reason, the difference in the probabilities of graduating between C&B students who attend elite schools and those who attend very and highly selective colleges and universities is particularly instructive. Again, we found a positive causal impact of institutional selectivity on the likelihood of graduation, regardless of the estimation strategy we used. The smaller gains compared with the national HS&B and NELS:88 cohorts are to be expected because of a ceiling in the graduation likelihood function and because of the smaller variation in graduation rates among the C&B institutions. Nevertheless, the findings reported in Table 4 reject the mismatch hypothesis for the C&B students. The results that are based on the nonparametric matching estimator are particularly revealing. Evidence that is based on comparisons of “matched” samples that attend selective and most-selective colleges implies that blacks and Hispanics gain more from attending a most-selective institution relative to a less-selective college than do whites. For example, the matching estimator point estimate for whites and Asians is 0.07 and 0.04, respectively, whereas it is 0.09 for blacks and 0.11 for Hispanics. This finding suggests that underrepresented minority students benefit more than do whites from attending the most-selective schools in the country. Thus, the C&B findings not only refute the mismatch hypothesis for all students, but indicate special gains for minority students from attending elite colleges.

Selection on Unobservables

Admissions offices consider many factors, such as legacy status, special talents (e.g.,
### Table 4. Group-Specific Marginal Effects (Discrete Change)\(^a\) of Attending a Selective Institution on Six-Year Graduation Status

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Baseline</td>
<td>Baseline</td>
</tr>
<tr>
<td></td>
<td>Graduation</td>
<td>Graduation</td>
<td>Graduation</td>
</tr>
<tr>
<td></td>
<td>Probability(^b)</td>
<td>Probability(^b)</td>
<td>Probability(^b)</td>
</tr>
<tr>
<td></td>
<td>P(^c)</td>
<td>ME(^d)</td>
<td>Bivariate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Probit(^e)</td>
</tr>
<tr>
<td>All Students</td>
<td>0.51</td>
<td>0.18**</td>
<td>0.18**</td>
</tr>
<tr>
<td></td>
<td>(\rho = -0.33^{**})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group-Specific Models</td>
<td>0.56</td>
<td>0.17**</td>
<td>0.19**</td>
</tr>
<tr>
<td>White</td>
<td>0.56</td>
<td>0.17**</td>
<td>0.19**</td>
</tr>
<tr>
<td></td>
<td>(\rho = -0.46^{**})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.36</td>
<td>0.14*</td>
<td>0.18**</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.38</td>
<td>0.17**</td>
<td>0.12*</td>
</tr>
<tr>
<td>Asian</td>
<td>0.50</td>
<td>0.31**</td>
<td>0.36**</td>
</tr>
</tbody>
</table>

\(^{a}\) The marginal effect represents the change in the probability associated with a discrete change in the variable from 0 to 1, holding other variables at their mean (Long, 1997).

\(^{b}\) Predicted probability of graduating from a nonselective institution controlling for family background and academic achievements.

\(^{c}\) Propensity score results.

\(^{d}\) Matching estimator results.

\(^{e}\) Marginal effects are reported only when the rho coefficient was found to be statistically significant.

\(*) p \leq .05, \quad ** p \leq .01, \quad † p \leq .10.\)
musical ability), and unique circumstances (e.g., hardships or special awards), that are not measured by surveys. Therefore, we also considered whether selection on unobservables determines access to different college destinations and, if so, whether the estimates obtained from propensity scores and matching estimator techniques are upwardly or downwardly biased. To evaluate possible bias from the selection on unobservables, we jointly estimated the likelihood of enrollment at (Equation 2) and the likelihood of graduation from (Equation 1) selective institutions. Specifically, we used a bivariate probit technique that fits a dummy endogenous variable model, as suggested by Heckman (1978), to correct for correlated errors across equations (Greene 2000; Pindyck and Rubinfeld 1998).

The estimated ρ (rho coefficient) is of special importance for our purpose because it reveals the correlation between the error terms ε and v of Equations 1 and 2 and indicates whether selection on unobservables is a problem, and, consequently, whether the joint estimation is required. Whenever ρ is not statistically significant, selection on unobservables is assumed to be ignorable. In such a case, estimates that are based on propensity scores and matching estimator are not biased because of different distributions of unobservables.

Table 4 also reports the results from fitting a bivariate probit model to the three data sets. We report the marginal effects that are associated with attending a selective institution only when the ρ coefficient was found to be statistically significant. Overall, for both the 1982 and 1992 cohorts, the ρ coefficient is not significantly different from zero. That the ρ coefficient is not statistically significant for minority groups (as well as for whites in 1992) suggests that selection on unobservables is not a major underlying factor in the assignment process. The ρ coefficient is significant only for whites in the HS&B data, indicating the selection on unobservables and supporting the need for a simultaneous assessment for this group. Specifically, after the selection on unobservables is controlled for, the effect of attending a selective institution increases white students' probability of graduating by approximately 40 percent. This finding suggests that previous estimates that were based on propensity scores and the matching estimator underestimated white students' benefits of attending a selective institution in 1982.

The results for the C&B data are somewhat different. The ρ coefficient is significant for all minority groups, indicating that selection on unobservables may be involved. The marginal effects produced by the dummy endogenous variable model are larger than those produced by both propensity score and the matching estimator techniques. In other words, taking the selection on unobservables into account, the minority students' gains from attending the most selective institutions in the country are even larger than are those produced by the other methods.

These results raise questions about why unobserved (by the analyst) characteristics are more influential determinants of admission and graduation in the C&B than in the national data. One possible explanation is the "full file review" in admission that is performed by elite institutions, compared with a more formula-based admission in less-selective institutions—particularly before race-sensitive admissions practices came under assault in the mid-1990s. Clarke and Shore (2001) argued that selective private institutions, which base their decision on full file review, tend to interpret a student's test score and diversity characteristics subjectively and in combination with other information. In this process, each student's application is read in its entirety by one or more of the admission staff, who assign a score based on their subjective evaluations of all the information in the file. Selective public institutions, which have much larger applicant pools but proportionately smaller admission staff than do elite institutions, tend to rely on objective formulas that draw heavily on a student's high school achievements and test scores.

The results reported in Table 4 indicate that the most-selective institutions pay more attention to a diverse array of (unobserved by us) characteristics when deciding who to admit. The propensity score and matching estimator methods that adjust for observed characteristics are successful in simulating the admission decision in most postsecondary institutions, selective and nonselective.
However, these methods fall short of replicating the subjective admission decisions that take place at the most selective institutions in the country. Moreover, Clarke and Shore (2001) noted that the full file review is viewed by admissions directors at private selective colleges as the best way to predict whether a student will be successful in college. By showing that after unobservables are controlled for, the benefits from attending an elite institution are larger than simply after observed characteristics are controlled for, our results lend support for this view.

CONCLUSION

By rejecting the mismatch hypothesis, our results are consistent with claims that minority students thrive at selective postsecondary institutions, despite their disadvantaged starting lines (Bowen and Bok 1998; Massey et al. 2003). Minority students’ likelihood of graduation increases as the selectivity of the institution attended rises. Our findings, based on three data sets and several analytical methods, suggest that the mismatch hypothesis is empirically groundless for black and Hispanic (as well as for white and Asian) students who attended college during the 1980s and early 1990s. On the basis of the robust evidence we presented, we conclude that affirmative action practices both broaden educational opportunities for minority students and enable minority students to realize their full potential.

These findings clearly demonstrate the advantages that are associated with attending a more-selective institution and call for future research to identify the mechanisms that produce such an advantage. Institutional selectivity may reflect better learning opportunities via better-prepared classmates or better teachers (Kane 1998). It also could capture the retention of students that is possible because of the large institutional endowments that permit smaller classes and facilitate strong mentoring at the most-competitive schools. In other words, if the higher graduation rates reflect better opportunities for learning, then it is incumbent on future researchers to specify what “best practices” enable minority students to succeed at less-selective institutions.

Support mechanisms are especially important for students from socioeconomically and academically disadvantaged backgrounds, particularly first-generation college goers, among whom black, but especially Hispanic, students are disproportionately represented (Tinto 1993). Evidence about interaction with faculty members suggests that more contact with professors and others on campus is conducive to higher graduation rates (Davis 1991; NCES 1996; Nettles 1991; Nettles, Thoeny, and Gosman 1986; Pascarella and Terenzini 1980; Pascarella, Terenzini, and Hibel 1978; Von Destinon 1988). Alon (2004) directly linked financial aid to college graduation by showing that grants, more than loans, help equalize black and Hispanic minority students’ success in college with that of whites and Asians.

Nevertheless, our results do not speak to the persistent racial and ethnic graduation gap within selectivity tiers. Given the immense efforts and ample resources that are devoted to attracting and recruiting underrepresented minorities to the most-selective colleges and universities, evidence that any black and Hispanic students leave these institutions without a college diploma is disconcerting. Even more disturbing are racial and ethnic differences in graduation rates among students of comparable academic ability and socioeconomic background (Bowen and Bok 1998; Small and Winship 2002; Vars and Bowen 1998).

Racial and ethnic gaps in college graduation rates are a major concern not only because education serves as a gateway to personal financial success and social standing, but because of the shadow that disparities in graduation rates casts on race-sensitive admission practices. For these reasons, researchers must continue to explore the reasons for minority students’ underperformance in both selective and nonselective institutions. Striving to increase access to college while narrowing graduation gaps is all the more urgent in light of the changing demographic contours of the college-age population.
1. The growing belief in the importance of standardized scores for admission is manifested by the small industry that developed over the past two decades to prepare students, mainly from the middle and upper middle classes, to improve their SAT scores (McDonough 1994).

2. Bowen and Bok (1998) were aware of this limitation and were directly responsible for ensuring that the college-going behavior of Hispanics was studied with the C&B data. Our research was derived from that effort.

3. A narrower interpretation of the mismatch hypothesis is that the larger the gap between students' credentials and institution-specific SAT averages, the greater the likelihood that the students will not graduate from college. Such a narrow interpretation raises several issues (e.g., levels of mismatch, multidimensionality of mismatch, and selection issues). Of the two directions, we believe that the broader implications are more important and better inform the policy debate. Our analytical strategy is therefore designed to deal with the broader implications of the mismatch hypothesis.

4. This is one transition in a multistage selection process that includes high school graduation and the decision to continue education after high school. It is necessary to control for prior selection stages so as not to confound current selection with the determinants of prior selection (Camron and Heckman 1998). Unfortunately, like most analysts who do not implement full structural models, we were unable to control for selection prior to high school graduation.

5. In two empirical articles, Heckman et al. (1997, 1998) argued that the emphasis in the recent econometric literature on the elimination of selective differences in unobservables is misplaced. Showing that selection bias (on unobservables) is a relatively small part of bias as conventionally measured, they concluded that simply balancing observables in the treatment and control-group samples goes a long way toward producing a more effective evaluation strategy. However, it is unclear whether this conclusion can be generalized to other situations.

6. The most used method, but also the most criticized, is instrumental variable (IV) correction. IV techniques have three main weaknesses (Winship and Morgan 1999). First, assumptions that exclusion restrictions are valid are generally untestable. Second, the standard errors of IV estimates can be large if the instrument is weak. Third, IVs consistently estimate the true average treatment effect only when the treatment effect is constant for all individuals. In our case, we believe that all three problems exist. Moreover, Heckman et al. (1997) showed that using IV to assess the benefits of participation in a program produces substantially biased estimators of the impact of the program, especially when persons have private (thus unobserved by the analyst) information that is useful for forecasting the gains from participating in the program. In our case, using IV would require us to assume ignorance or irrationality on the part of students. The evidence presented in Heckman et al. (1998) also does not justify the application of IV. Therefore, we chose not to use this technique.

7. Six institutions were excluded from the analysis on the basis of the C&B data: four historically black colleges and universities (HBCU) and two universities that did not provide the detailed information that we needed to measure the timing of graduation. The HBCUs (all were classified as nonselective schools) were not included in the C&B analysis because their selectivity level was lower than that of the other C&B institutions (classified as very, highly, and most selective). The HBCUs are included in the analyses that used the NELS:88 and HS&B data sets in the nonselective category where they belong.

8. For most institutions, the C&B data files included the entire entering cohorts. However, for some institutions, the data were derived from samples (Bowen and Bok 1998). In these cases, the sample weights are equal to the inverse of the probability of being sampled. All descriptive statistics that are presented used appropriate sample weights so that the results accurately represent the entire entering cohort at each institution. These weights allowed us to make projections to all C&B institutions (but not to the entire postsecondary universe).
9. This correction affected the estimated standard errors and the variance-covariance matrix of the estimators, but not the estimated coefficients.

10. Using this strategy, a modified zero-order method, we filled all missing data with zeros and added a dummy variable that took the value of 1 for missing observations and zero for complete ones. These flags provide a useful method for testing whether the pattern of missing observations is random with respect to Y. The modified zero-order strategy is the simplest solution when the proportion of missing data is small (Anderson, Basilevsky, and Hum 1983). We found that the missingness pattern is random in all three data sets, that is, it is not related to either the likelihood of graduation or to the selection into top institutions. However, as with most remedies for missing data, it does not completely eliminate its potential biasing effects.

11. That Asians’ probability of graduating was lower in 1992 than in 1982 may reflect the greater heterogeneity of the Asian sample in 1992 than in 1982. The earlier sample included a higher share of South and East Asian youths, who are known to have high rates of academic success. In addition, the high graduation rate of Asian students in 1982 may be inflated because of the small sample size, which increased the error of the estimate.

12. For the C&B, we report the percentage in the top decile of their class because of the restricted variation on this item for highly selective institutions.

13. We used the Stata—nnmatch—command that implements the nearest-neighbor matching estimator for the average treatment effect (Abadie et al. 2004). This command corrects for bias that is associated with matching on multidimensional covariates, as in our case.

14. For a dummy variable, the marginal effect represents the change in the probability associated with a discrete change in the variable from 0 to 1, holding other variables at their mean (Long 1997).

15. The null hypothesis is \( \rho (\varepsilon, \nu) \). That the \( \rho \) coefficient is not significant suggests that we cannot reject this null hypothesis that \( \varepsilon \) and \( \nu \) are not correlated. In other words, we cannot reject the hypothesis that there is no selection on unobservables. However, the corresponding standard errors of the \( \rho \) coefficient are quite large, along with wide confidence intervals. Such wide confidence intervals containing the null hypothesis value of the parameter signify the lack of precision in our inference. Overall, this finding suggests that the data are not informative enough regarding the existence of selection on unobservables in the HS&B and NELS:88.
APPENDIX TABLE A

Descriptive Statistics of HS&B, NELS:88 and C&B Samples

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>HS&amp;B 1982 Mean (SD)</th>
<th>NELS 1992 Mean (SD)</th>
<th>C&amp;B 1989 Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grad6</td>
<td>Six-year graduation proportion</td>
<td>0.54</td>
<td>0.65</td>
<td>0.87</td>
</tr>
<tr>
<td>White</td>
<td>White, not of Hispanic origin</td>
<td>0.83</td>
<td>0.79</td>
<td>0.81</td>
</tr>
<tr>
<td>Black</td>
<td>Black, not of Hispanic origin</td>
<td>0.10</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>Hispanic</td>
<td>Hispanic, regardless of race</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Mexican</td>
<td>Hispanic of Mexican origin</td>
<td>0.45</td>
<td>0.47</td>
<td>NA</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>Hispanic of Puerto Rican origin</td>
<td>0.13</td>
<td>0.11</td>
<td>NA</td>
</tr>
<tr>
<td>Cuban</td>
<td>Hispanic of Cuban origin</td>
<td>0.42</td>
<td>0.42</td>
<td>NA</td>
</tr>
<tr>
<td>Asian</td>
<td>Asian or Pacific Islander</td>
<td>0.02</td>
<td>0.06</td>
<td>0.08</td>
</tr>
<tr>
<td>Selective</td>
<td>If attend a selective institution (most selective in C&amp;B)</td>
<td>0.17</td>
<td>0.28</td>
<td>0.21</td>
</tr>
<tr>
<td>Thresholds for selective</td>
<td>HS&amp;B and NELS:88: above 1050</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C&amp;B: Selective: above 1050</td>
<td>C&amp;B: Selective: above 1050, most selective: above 1250</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parents, BA</td>
<td>At least one parent with a BA degree</td>
<td>0.19</td>
<td>0.22</td>
<td>0.09</td>
</tr>
<tr>
<td>Parental income</td>
<td>In categories (HS&amp;B: 6, NELS: 15, C&amp;B: 17 )</td>
<td>0.10</td>
<td>0.10</td>
<td>0.19</td>
</tr>
<tr>
<td>Class rank</td>
<td>High school class rank in percentile (C&amp;B: in top 10 percent)</td>
<td>50.01 (36.20)</td>
<td>55.19 (35.79)</td>
<td>55.55</td>
</tr>
<tr>
<td>SAT</td>
<td>SAT score</td>
<td>960.47 (193.83)</td>
<td>963.25 (192.81)</td>
<td>1217.03 (156.07)</td>
</tr>
<tr>
<td>Athlete</td>
<td>If student was an athlete</td>
<td>0.12</td>
<td>0.09</td>
<td>(proxy) 0.12</td>
</tr>
<tr>
<td>Female</td>
<td>Female = 1, Male = 0</td>
<td>0.53</td>
<td>0.55</td>
<td>0.51</td>
</tr>
<tr>
<td>Public</td>
<td>If attend a public high school</td>
<td>0.83</td>
<td>0.75</td>
<td>0.44</td>
</tr>
<tr>
<td>South</td>
<td>If home region in South</td>
<td>0.29</td>
<td>0.31</td>
<td>0.26</td>
</tr>
<tr>
<td>Midwest</td>
<td>If home region in Midwest</td>
<td>0.30</td>
<td>0.27</td>
<td>0.23</td>
</tr>
<tr>
<td>West</td>
<td>If home region in West</td>
<td>0.14</td>
<td>0.15</td>
<td>0.08</td>
</tr>
<tr>
<td>Rural</td>
<td>Residing in a rural area</td>
<td>0.28</td>
<td>0.27</td>
<td>NA</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>4,704</td>
<td>4,530</td>
<td>29,018</td>
</tr>
</tbody>
</table>
REFERENCES


—. 1990. “Pathways to Attendance at the Elite


Small, Mario Luis, and Christopher Winship. 2002.
Assessing the “Mismatch” Hypothesis


Sigal Alon, Ph.D., is Assistant Professor, Department of Sociology and Anthropology, Tel-Aviv University, Tel-Aviv, Israel. Her main fields of interest are sociology of education, social stratification and mobility, and quantitative methods and statistics. Dr. Alon is currently studying the U.S. post-secondary education system to evaluate the impact of social policies on race and class disparities in the access, experiences, and performance of students at selective and nonselective institutions. She also developed a conceptual framework for examining the role of financial aid in facilitating the success of low-income students and students of color.

Marta Tienda, Ph.D., is Professor, Woodrow Wilson School of Public and International Affairs and Department of Sociology, Princeton University. Her main fields of interest include stratification of higher education, the sociology of employment and labor markets, and social policy. She is currently investigating the consequences of the Texas top 10 percent law on college admissions. Her recent publications include The Color of Opportunity (University of Chicago Press, 2001), Youth in Cities (Cambridge University Press, 2002), and Ethnicity and Causal Mechanisms (Cambridge University Press, 2005).

We gratefully acknowledge research support from the Mellon Foundation and institutional support from the Office of Population Research at Princeton University. Direct all correspondence to Sigal Alon, Department of Sociology, Tel-Aviv University, Tel Aviv, Israel; e-mail: salon1@post.tau.ac.il. From September 2005 to September 2006, she can be reached at the Office of Population Research, Princeton University, 243 Wallace Hall, Princeton, NJ 08544; e-mail: salon@princeton.edu.