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The Journal of Higher Education, Volume 86, Number 2, March/April 2015, pp. 233-263 (Article)

Published by The Ohio State University Press
DOI: [10.1353/jhe.2015.0008](https://doi.org/10.1353/jhe.2015.0008)



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Aiming Low: Estimating the Scope and Predictors of Postsecondary Undermatch

Postsecondary undermatch occurs when students fail to enroll at a college or university that possesses a level of selectivity their academic credentials would permit them to attend. Given the demonstrated link between selective college attendance and postsecondary and professional attainment, recent studies have attempted to examine which factors may prevent students from enrolling at appropriately competitive institutions. Using data provided by NCES's Educational Longitudinal Survey (ELS:2002/2006), this study aims to quantitatively assess whether results yielded from these studies generalize to a national level, and whether other contextual variables play a significant role. Descriptive results show that postsecondary undermatch is indeed a pervasive phenomenon, but not as widespread as previous studies have claimed; while multilevel analysis suggests that background, environment, and college-related attitudes have significant influence on the likelihood of undermatch.

Keywords: undermatch, postsecondary, enrollment, postsecondary choice, multilevel modeling

Postsecondary undermatch is a longstanding phenomenon that has received little attention until recently. It occurs when students fail to enroll at a college that possesses a level of selectivity their academic credentials would permit them to attend. Increased interest in undermatch has been spurred primarily by a current deficit of postsecondary graduates. The Lumina Foundation (2012) estimates that an additional 23 million college graduates are needed by 2025 to meet the U.S.'s workforce

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demands; however, graduation rates have remained largely stagnant for several decades (National Center for Education Statistics, 2011). Currently, only 57% of four-year enrollees complete college within six years, and only 27% of students enrolling at two-year institutions complete a certificate or associate's degree within 150% of the normal time required to do so (Aud, KewalRamani, & Frolich, 2011).

Some suggest that one way of remedying the college completion shortfall is by moving students to attend "appropriately selective" institutions (Alon & Tienda, 2005; Bowen, Chingos, & McPherson, 2009). Prior research supports this claim, as students attending more selective colleges are more likely to graduate (Horn, 2006; Ishitani, 2006; Light & Strayer, 2000) and experience greater success in the labor market (Eide, Brewer, & Ehrenberg, 1998; M. Long, 2008), particularly if they come from disadvantaged backgrounds (Dale & Krueger, 2011). However, improving the rate at which students choose colleges that "match" their academic qualifications requires an understanding of which students are more likely to undermatch, and why. Therefore, using data collected through the Educational Longitudinal Study of 2002 (ELS), this study examines how background, achievement, and context influence students' propensity to "aim low" and attend institutions incompatible with their abilities and/or demonstrated record of achievement.

Literature Review

Previous literature has shown that socioeconomic characteristics play an important role in determining the colleges at which students apply and enroll. For example, several studies have revealed that students of low socioeconomic status (SES) disproportionately attend less selective and less endowed institutions, where graduation rates and resources are relatively low (Hearn, 1991; Thomas & Perna, 2004). Additional literature shows that many college-qualified, low-SES students fail to enroll in college altogether (Carnevale & Strohl, 2010). In sum, an extensive body of research has suggested that many low-SES students do not maximize their college prospects; yet few studies have endeavored to examine the extent and determinants of undermatch specifically.

Currently, there exist three prominent studies explicitly focusing on postsecondary undermatch—at a local, state, and national level, respectively. The first study was conducted by the Consortium on Chicago School Research (CCSR). Roderick, Nagaoka, Coca, and Moeller (2009) analyzed the academic records and postsecondary destinations of students attending Chicago Public Schools (CPS) and discovered that 62% of high-achieving CPS graduates failed to enroll in colleges that

matched their academic qualifications—which, given CPS’s predominantly low-SES student population, empirically substantiated previous literature on the strong relationship between SES and selective college attendance. In a subsequent analysis on the same students, Roderick, Coca, and Nagaoka (2011) uncovered a significant relationship between college application, high school context, and the likelihood of undermatch. In particular, Roderick et al. (2011) found that students who completed several applications, submitted a FAFSA, and attended high schools with a strong college-going climate were more likely to attend “match” colleges. Surprisingly, after controlling for measures of achievement, Roderick et al. did not find consistent effects with respect to SES; however, their null finding could be attributed to the uniformly less advantaged subset of students on which their study focused.

In a more inclusive, state-wide study, Bowen et al. (2009) tracked the postsecondary transitions of North Carolina students, and discovered that approximately 40% of graduating seniors were qualified and yet failed to attend a selective college. Additionally, and in contrast to the findings of CCSR, Bowen et al. found that low-SES and African American students were more likely to undermatch, and that students assigned undermatch status were less likely to graduate from college and finish their degree within six years.

Finally, Smith, Pender, and Howell (2013) relied on the same dataset used in this study to find a national undermatch rate of approximately 41% overall, and roughly 55% among low-SES students in particular. Smith et al. contributes important insight into the trends of undermatch, asserting that undermatch rates have declined over the past two decades (by 8%), especially among low-SES students, and primarily because more students are applying to appropriately matched institutions; however, it employs outdated methods¹ and rather lean models to generate findings that, quite frankly, fail to account for the contextual, information, and attitudinal factors associated with college choice and enrollment (Coleman, 1988; McDonough, 1997; Perna, 2006).

In addition to the three studies above, there have been at least two other examinations of the student and school-level determinants of undermatch. Dillon and Smith’s (2009) unpublished report identifies lack of college-related information as the most important predictor of postsecondary undermatch, while a College Board research brief focuses exclusively on undermatch at the school-level and finds that a high school’s undermatch rate is determined, in part, by its location, SAT participation rate, free or reduced lunch rate, and proximity to postsecondary institutions (Hurwitz, Smith, Howell, & Pender, 2012). Both works shape the model specifications used in this analysis.

Although the aforementioned studies have notable limitations, they do corroborate the pervasiveness of undermatch, especially among low-SES students, and highlight why such a phenomenon deserves greater attention from scholars and policymakers alike.

Theory and Evidence

This study draws from theories that strive to explain postsecondary choice as a function of social and cultural circumstances. The research detailed above demonstrates that academic achievement and “college-worthy” credentials, while necessary, are insufficient prerequisites to postsecondary access and match. To matriculate and persist at an appropriately competitive institution, students must also engage in a host of precollege activities that are not strictly related to academics and for which they may or may not receive support (Tierney & Venegas, 2006). These activities include, but are not limited to, taking standardized tests, completing college applications, securing financial aid, and learning the norms and expectations of a postsecondary environment. McDonough (1997), Perna and Titus (2005) and others suggest that the ability to procure the resources and support needed to navigate college entry is largely determined by one’s social capital.

For example, students from affluent circumstances are likely to engage in college-related activities as early as ninth grade—in most cases, relying on their parents or other adult relatives for advice about postsecondary opportunities (Coleman, 1988; Tierney & Venegas, 2009). These adults are able to offer such advice because they have likely graduated from college themselves. Moreover, they are likely to collaborate with other similarly-positioned families to ensure that local educators offer the curriculum and programs that maximize the college planning opportunities and admissions prospects of their respective children (Perna & Titus, 2005). The social capital generated from such relations leads to real and observable outcomes within the local school. Honors and other advanced courses abound; test prep courses proliferate; and the school consistently hosts college admissions officers, who are anxious to recruit the school’s many college-ready students (McDonough, 1997). Ultimately, the network of college-committed adults within the community gives rise to a norm of achievement, and subsequently, students begin to view postsecondary enrollment as an expectation, rather than a special accomplishment (Kim & Schneider, 2005). Eventually, expectations breed attainment, and most students within the community go on to enroll at suitably selective institutions (Bowen et al., 2009).

In contrast, low-SES students are significantly less likely to come from communities with adequate college-related support (L. Hill, 2008; Stanton-Salazar & Dornbusch, 1995). Although students of more advantaged means look to their primary source of social capital, their families, for college planning, disadvantaged students often cannot. For example, low-SES parents are especially uninformed about the academic and financial requirements of postsecondary attendance (Immerwahr, 2003; Tomas Rivera Policy Institute, 2004), and due to their relative inexperience with college and with formal education more generally, are less confident about their ability to engage the college admissions process (Perna, 2004).

Additional research shows that a school's ability to promote college knowledge and enrollment is largely determined by SES (McDonough, 2005; Perna & Titus, 2005). Although low-SES students depend more on their schools for college-related information (Cabrera & La Nasa, 2001; Tomas Rivera Policy Institute, 2004), they are less likely to have access to a school employee who is available and prepared to aid with college planning (Hamrick & Stage, 2004; McDonough & Calderone, 2006). Perna and Thomas (2009), for instance, show that counselors working in low-resource schools devote excessive time to standardized tests and to increasing exam pass rates—"thereby reducing the availability of counseling resources that are more directly related to college going" (p. 475).

The obstacles many disadvantaged students face with respect to securing college-related information and support may be reflected, at least in part, by the fact that only one-third of all low-SES high school attendees meet the minimum course and standardized test requirements needed to complete credit-bearing college coursework (Wyatt & Matern, 2011).

Bourdieu (1996) suggests that social and structural constraints to educational advancement eventually give rise to a set of internalized dispositions and expectations that preclude many low-SES students from considering "match" colleges as suitable or even desirable. For example, students with insufficient social and/or cultural capital may lower their postsecondary aspirations or self-select out of certain institutions, as Maton (2008) explains:

Rather than the educational system blocking access to social agents from nontraditional backgrounds, these social agents relegate themselves out of the system, seeing university as "not for the likes of me." Conversely, middle-class social agents are more likely to consider university education as a "natural" step, as part of their inheritance. When at university they are also more

likely to feel “at home,” for the underlying principles generating practices within the university field—its unwritten “rules of the game”—are homologous to their own habituses. (p. 58)

Maton’s claims are substantiated by previous research suggesting that low-SES students fail to enroll at appropriately selective colleges in large part because they are estranged from the individuals, activities, and norms that facilitate postsecondary access and success (Bastedo & Jaquette, 2011; Grodsky & Jones, 2007; Tierney & Venegas, 2009). Even if they are academically qualified for college, many low-SES students are still likely to determine that college “is not for them” (Luna De La Rosa, 2006, p. 1683).

Research Questions

Given theoretical and empirical research validating the link between background, context, and postsecondary choice, this study incorporates robust methods to assess the magnitude and factors related to postsecondary undermatch—in particular, by endeavoring to answer these research questions:

1. What is the rate of postsecondary undermatch nationally?
2. To what extent do undermatch rates vary across socioeconomic status and student achievement?
3. What student-level characteristics are related to the likelihood of undermatch?
4. What school-level characteristics are related to the likelihood of undermatch?
5. To what extent does the likelihood of undermatch vary by socioeconomic status?

By addressing these questions, this study seeks to promote a more comprehensive understanding of undermatch that, in contrast to previous studies, accounts for the latest college choice literature and reflects the complexity of the college choice process (Perna, 2006).

Data and Methods

Sample

This study used data collected through ELS, a nationally representative survey that tracked high school sophomores over a period of four years and monitored their transitions into postsecondary education or

the workforce. In addition to containing information on the background, achievement, and college-related attitudes and activities of students, ELS also includes information on the colleges at which respondents applied and enrolled. Therefore, we could determine whether ELS students ultimately attended colleges and universities that “matched” the level of institutional selectivity to which they had access, given their academic credentials. The analytic sample for this study included 11,720 students, and after weighting, represented approximately 2.9 million students attending 21,900 high schools.

Variables

Three dichotomous dependent variables were incorporated into this study, the first of which indicated undermatch. That is, our first dependent variable equaled “1” for college-qualified students who did not enroll in postsecondary education, who enrolled at a two-year institution when they were presumed eligible to attend a four-year institution, *or* who enrolled at a four-year college possessing a level of selectivity below that to which they presumably had access. The remaining two dependent variables distinguished between types of undermatch. Our second dependent variable identified four-year college entrants who undermatched by selectivity and failed to attend appropriately competitive colleges, given their credentials. Our third dependent variable identified all college-qualified students who undermatched by institutional level, equaling “1” for “two-year” enrollees who were qualified to attend four-year institutions and also equaling “1” for students qualified to attend two-year or four-year institutions but who did not enroll in postsecondary education.

Independent variables at the student-level were sorted into four groups corresponding to the conceptual and/or empirical foundations of postsecondary choice, and that were likely to influence undermatch, including demographic and socioeconomic characteristics² (Walpole, 2003), access to college selectivity³ (Roderick et al., 2011), college-related attitudes and expectations (Dillon & Smith, 2009; McDonough & Calderone, 2006), and admissions-related activities (McDonough, 1997; Tierney & Venegas, 2006)

In addition to student-level variables, we also accounted for elements of school context that influence college-going, including urbanicity (Hu, 2003), private control (L. Hill, 2008) and college-going climate (Engberg & Wolniak, 2010). To gauge the college climate of sampled high schools, we incorporated summative scores generated from a confirmatory factor model with four indicators of school-level college preparedness, namely the percentage of students enrolled in a college prepara-

tory curriculum, the percentage of students taking AP or IB coursework, the percentage of students completing an SAT or ACT preparatory program, and the percentage of a high school's graduates attending four-year colleges. Model fit indices suggested that the four-factor model adequately fit the ELS data.⁴ Table 1 details the weighted means for student- and school-level variables by "match" classification.

Finally, presuming the influence of SES on undermatch is conditioned by students' academic records, we also included a term interacting our SES and "Access to Selectivity" variable. Ostensibly, students with better credentials have access to a broader range of institutions, and as such, have greater "opportunity" to undermatch. However, "college-qualified" students are also more likely to come from higher socioeconomic backgrounds. Given the correlation between qualifications and undermatch, and qualifications and SES, it was necessary to incorporate a measure that distinguished college qualified low-SES students from low-SES students whose credentials did not provide them with "opportunity" to undermatch. Otherwise, the potential negative relationship between SES and undermatch may have been attenuated or eliminated by the potentially positive effect of college qualifications. In other words, our analysis may have failed to uncover a significant SES effect, simply because low-SES students were less likely to have strong academic credentials, and as such, were less likely to undermatch.

Determining Selectivity

To measure the selectivity of the institutions in our sample, we referred to the Barron's index, which groups institutions according to their admission rate and to the percentage of incoming freshmen who exceed minimum standardized test and class rank thresholds. We then recategorized the original Barron's groupings to account for sparseness of cases (i.e., institutions) at extremes of the selectivity distribution and to devise selectivity groupings that were consistent with past studies on undermatch (Bowen et al., 2009; Smith et al., 2013).⁵ Table 2 presents the original Barron's categories and their subsequent classifications.

Beyond methodological reasons, there appeared to be other, more definitional advantages to grouping institutions at both ends of the index. For example, recategorization may have prevented undermatch status from being assigned to a *Highly Competitive* enrollee who earned admission at one of Barron's *Most Competitive* colleges, but who is nevertheless attending an appropriately selective institution. Although Barron's *Most Competitive* institutions often possess higher admission standards than institutions labeled as *Highly Competitive*, both groups are still extremely selective, admitting less than half of all applicants

TABLE 1

Weighted Means for Student- and School-Level Variables by Match Classification

Variable	Min	Max	Match ^a	Undermatch
<i>Student-Level Variables</i>				
Gender				
Male	0.000	1.000	0.508	0.453
Female	0.000	1.000	0.492	0.547
Race				
Asian	0.000	1.000	0.042	0.038
Black	0.000	1.000	0.163	0.065
Hispanic	0.000	1.000	0.174	0.097
Other	0.000	1.000	0.061	0.039
White	0.000	1.00	0.560	0.761
SES	-2.11	1.82	-0.025	0.131
Access to College Selectivity				
No presumed access	0.000	1.000	0.520	-----
Access to nonselective	0.000	1.000	0.189	0.169
Access to less selective	0.000	1.000	0.138	0.327
Access to selective	0.000	1.000	0.091	0.281
Access to very selective	0.000	1.000	0.062	0.223
College-Related Attitudes				
Importance of low tuition	1.000	3.000	2.170	2.209
Importance of campus social life	1.000	3.000	2.125	1.989
Importance of living at home	1.000	3.000	1.754	1.665
Expected attainment	0.000	2.000	0.945	1.173
Admissions-Related Activities				
Visited counselor for college information	0.000	1.000	0.801	0.785
Applications submitted	0.000	6.000	1.986	2.001
Completed FAFSA	0.000	1.000	0.408	0.490
<i>School-Level Variables</i>				
School Control				
Public	0.000	1.000	0.921	0.920
Private	0.000	1.000	0.079	0.080
School Urbanicity				
Urban	0.000	1.000	0.306	0.237
Suburban	0.000	1.000	0.508	0.542
Rural	0.000	1.000	0.186	0.221
College-Going Climate	5.00	193.00	80.171	78.395
Unweighted Sample Size			8,430	3,290
Weighted Sample Size			2,107,288	813,697

^aStatistics include students who overmatched (i.e., who attended colleges with a level of selectivity above that to which they were presumed to have access).

TABLE 2
 Recategorizing the Barron's Index

Barron's Category	Selectivity Classification
Most competitive, Highly competitive	Very selective
Very competitive	Selective
Competitive	Less selective
Less competitive, Noncompetitive	Nonselective ^a
Special	(Excluded)
	No college

^aIncludes two-year colleges.

and possessing an average SAT (critical reading and math) score of well above 1200. Further, many institutions in Barron's *Highly Competitive* category regularly enroll the most competitive students in several disciplines. A class valedictorian with interests in marine science or film, for instance, may choose UC San Diego or Emerson College, respectively, because they offer top programs in these subjects, not because she is undermatching, and despite the fact that these institutions are ranked by Barron's as only *Highly Competitive*.

On the other end of the index, categorizing as *Nonselective* all two-year institutions and institutions labeled by Barron's as either *Noncompetitive* or *Less Competitive* accounts for the fact that many *Less Competitive* institutions within the Barron's system practice open admissions and admit students with academic records that do not qualify them for admission at a selective four-year school. This regrouping prevents undermatch status from being assigned to *Noncompetitive* enrollees who could have attended a *Less Competitive* institution, but who still did not possess the credentials to matriculate at colleges exhibiting even a minimal level of selectivity. In all, recategorization of the Barron's index is methodologically necessary, from our perspective, and enables a conservative approach to the measure of undermatch, which is similar to that used in previous studies (Bowen et al., 2009; Roderick et al., 2009; Smith et al., 2013).

Determining Undermatch

This study categorized students as undermatched if they did not attend a postsecondary institution or level that corresponded to their college-related qualifications. Students were defined as undermatched by level if they failed to attend a four-year institution despite being academically qualified to do so, or if they failed to enroll in postsecondary

education but possessed credentials that were predictive of postsecondary attendance. Students were defined as undermatched by selectivity if they attended a four-year college, but one that did not match the selectivity of those schools to which they likely had access, given their prior achievement.

To identify the level and institution type to which ELS respondents had access, we employed a two-pronged approach. First, we determined access to *Nonselective* postsecondary education (including two-year and nonselective four year colleges) by assessing whether respondents met certain college readiness benchmarks, as outlined in the work of Adelman (2006) and Conley (2007), and which are highly predictive of college persistence and completion. Specifically, students were classified as eligible to attend a *Nonselective* institution if they completed a minimum of 2.5 course units in science, 3.5 units in English, and a unit in Algebra II or more advanced math subject (such as trigonometry or calculus). Admittedly, all students could be classified as having access to *Nonselective* institutions, because most institutions within this group possess open admissions policies. However, aside from potentially overstating the prevalence of undermatch, this classification approach presumes that all students are able to successfully participate in higher education and that all students should choose college over other viable postsecondary alternatives, like job-specific training, military service, or employment.

After defining access to postsecondary education, we then determined the selectivity of institution that “college-qualified” respondents were presumed eligible to attend. As mentioned previously, the ELS survey contained data on the institutions at which students applied, were admitted, and enrolled. We used this data to construct two new variables: the first indicated the selectivity level of the college to which each respondent presumably had access, given her credentials, and the second variable indicated the selectivity level of the college each respondent ultimately attended. For example, if a student possessed credentials that made admission into Brown University likely, but instead chose to attend the University of Rhode Island, she was assigned to the *Very Selective* category in the first variable and to the *Selective* category in the second variable.

To assess admissions eligibility, we adopted a nonparametric approach similar to that employed by Roderick et al. (2009) and Bowen et al. (2009), which relied on actual admissions outcomes to define an “eligibility frontier” for admission into each level of selectivity within the four-year sector. Specifically, if more than 90% of applicants with a particular combination of SAT (or converted ACT) score and weighted

high school GPA were admitted into a specific level of selectivity, all students with an equal or greater combination of credentials were designated as having access to that level of selectivity.⁶ For example, Table 3 shows that 90.3% of students who applied to at least one *Very Selective* institution, and who possessed a GPA between 3.5 and 3.8 and an SAT score between 1200 and 1290, were admitted into at least one *Very Selective* institution. Therefore, all students with GPA's and test scores in these ranges were determined to have access to a *Very Selective* institution.⁷ Students with access to at least a *Less Selective* institution were also designated as having access to the *Four-Year* level. Finally, it is important to note that we relied on weighted GPAs, rather than unweighted GPAs to account for respondents' strength of curriculum, which along with grades and test scores, plays an extremely important role in the admissions decisions of selective colleges (Clinedinst, Hurley, & Hawkins, 2011).

In general, we employed a conservative definition of access to distinguish students who genuinely undermatch from students who make postsecondary-related decisions that may not maximize selectivity but that still "agree" with their record of achievement. The conservativeness with which we defined undermatch is further substantiated by the nonparametric approach we used to assess admissions eligibility, which minimized the risk of granting students access to a level of selectivity that they were unlikely to have in practice. While model-based

TABLE 3
Determining Access to Selectivity: *Very Selective*

GPA	SAT Score (or ACT equivalent)							
	≤ 800	800–890	900–990	1000–1090	1100–1190	1200–1290	1300–1390	≥ 1400
< 2.0	27.3	15.9	51.4	*	*	*	*	*
2.0	25.9	14.3	37.7	*	*	*	*	*
2.3	31.2	20.3	46.4	31.4	43.7	59.8	*	*
2.6	8.8	61.8	35.4	27.6	74.4	88.5	*	*
2.9	13.0	44.9	29.4	46.0	70.7	61.4	87.3	*
3.2	*	42.9	60.1	64.1	75.2	88.0	77.9	100.0
3.5	*	54.8	61.1	77.8	75.0	90.3	91.5	100.0
3.8	*	*	83.7	86.7	90.8	92.1	95.4	99.1
4.1	*	*	*	70.8	92.8	94.1	93.1	100.0

Note. Each cell shows the percentage of students with the specified combination of high school GPA and SAT scores (or ACT equivalent) who were admitted into the selectivity or level of institution indicated in each table. Cells with fewer than 10 students are marked with an asterisk (*). Cells shaded gray indicate presumed access.

approaches may prove flexible, and may permit the inclusion of more predictors than are possible in a nonparametric setting (due to multidimensionality), they are problematic because they commonly underestimate or overestimate the probability of access to a particular institution type.

For example, employing a probit model, such as that used by Smith et al. (2013), may predict that certain students with outstanding SAT scores and low GPA's have access to selective institutions. However, many selective colleges are unlikely to admit students with such an academic profile, given their holistic admissions process (Clinedinst et al., 2011). Therefore, it is essential that measures of undermatch grant "selectivity" access only to those students who exhibit adequate performance on *all* important admissions indicators. The nonparametric measures described above did just that.

Once defining the institutional level and selectivity to which respondents had access, we categorized students as being matched, undermatched by level, or undermatched by institution—specifically, by comparing their expected and actual enrollment outcomes. If a student enrolled in a four-year institution possessing a selectivity level below that to which he presumably had access, the student was classified as undermatched by selectivity. If a student enrolled in an institutional level below that to which she had access, the student was classified as undermatched by level.

Analytic Design

After determining the "match" status of ELS respondents, we estimated three generalized linear models to identify the individual and contextual predictors of postsecondary undermatch. The first model incorporated a logit link to estimate the likelihood of undermatch in general, while the second and third models also relied on a logit link to assess whether the variables detailed above had differential influence on undermatch by institutional selectivity and institutional level. We estimated models distinguishing between undermatch type because, arguably, undermatch by selectivity and by level are two distinct outcomes with different antecedents and consequences, and which occur at different rates among different student groups. For example, failing to enroll in an "appropriate" institutional level often proves more deleterious to the educational and professional attainment of students (Bowen et al., 2009; B. Long & Kurlaender, 2009), and occurs more frequently among low-SES populations (Baum, Ma, & Payea, 2010).

Each model incorporated into the study employed a random intercept, enabling us to determine whether structural and/or aggregated charac-

teristics influenced a student's propensity to undermatch, and also corrected for the bias and inefficiency (in estimates) that result when failing to account for the nestedness and intracluster correlation inherent to most multilevel surveys (Raudenbush & Bryk, 2002). Each of our two-level logit models is expressed in the following system of equations:

Level 1

$$\eta_{ij} = \beta_{0j} + \beta_{1j} * (\text{Demographics and SES})_{ij} + \beta_{2j} * (\text{Access to Selectivity})_{ij} \\ + \beta_{3j} * (\text{Attitudes})_{ij} + \beta_{4j} * (\text{Activities})_{ij}$$

Level 2

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * (\text{Control})_j + \gamma_{02} * (\text{Urbanicity})_j + \gamma_{03} * (\text{College Climate})_j \\ + \mu_{0j}$$

where η_{ij} denotes the log odds of particular outcome, compared to the log odds of the base outcome in the model, which is no undermatch; i denotes the student; j denotes the school; and β_{0j} denotes the random intercepts that vary over cluster (i.e., school).

Yielding reliable estimates from our models required the implementation of two additional techniques. First, we employed chained-equation imputation (Royston, 2005) to account for missing data that may have otherwise introduced bias to our results (Allison, 2002).⁸ In addition, we also accounted for the complex and multistage design of the ELS survey by incorporating stratification and clustering variables, as well as scaled student-level and school-level sampling weights (Rabe-Hesketh & Skrondal, 2006; Thomas & Heck, 2001). After controlling for missing data and for the complexity of the ELS sample, we estimated our model and analyzed the resulting coefficients to determine which of the aforementioned variables were significantly related to the likelihood of undermatch.

Limitations

This study has at least two limitations of potential consequence. First, like most studies using survey data, there were issues related to nonresponse. Several variables incorporated into this study exhibited missingness, and despite the application of sophisticated imputation techniques, the findings discussed below may still be vulnerable to nonresponse bias, particularly if the data in our sample were not missing at random (NMAR). While regression-based missing value analysis suggested that sample data were missing at random (MAR), there is no statistical test available to confirm this (Enders, 2010).

Second, while we incorporated a conservative and statistically sound approach to defining undermatch, our categorical measures may have designated a small proportion of students as having access to a level of selectivity that they did not have access to, at least in part. Specifically, the descriptive results presented below show that a small percentage of undermatched students applied to, but were not accepted at, institutions possessing a level of selectivity to which they presumably had access. This inconsistency is likely attributed to variation within selectivity categories. For example, our nonparametric approach may have designated a student as having access to a *Very Selective* institution, even when she did not have access to *all Very Selective* institutions. Referring to Table 3, a student with a 3.8 GPA and an 1190 SAT may have had access to some *Very Selective* institutions, but she was not likely to be admitted at Harvard. If she submits applications to Harvard and several other institutions that are not classified as *Very Selective*, she is likely to “undermatch,” despite having applied to an “appropriate” category of institution. Should she be indicated as undermatching? Yes, at least according to the above criteria—ultimately, she did not attend an institution that “matched” her academic credentials—and although certain descriptive data may suggest otherwise. While we could have more precisely distinguished between degrees of selectivity via the creation of more selectivity categories, doing so would have created more problems than it solved. For example, relying on the original Barron’s index results in insufficient sample size at both ends of the selectivity distribution and would have prevented or obscured inferences made with respect to several variables in our model. In addition, distinguishing between *Most Competitive* and *Highly Competitive* institutions, as defined by Barron’s, resulted in undermatch status being assigned to several hundred additional students that attended appropriately selective institutions, where opportunities and challenges were likely to be adequate. Ultimately, there is a degree of measurement error associated with every categorical construct, but the above discussion should highlight why such constructs were nevertheless necessary and why the selectivity indicator used in this study provided the best possible measure of undermatch.

Results

Descriptive results are presented in Table 4 and indicate postsecondary undermatch as less pervasive than previously suggested—an estimated 27.8% of students in our nationally representative sample were ultimately classified as undermatched, which is a rate significantly

TABLE 4
Postsecondary Undermatch by Access to Selectivity and Level

	Enrolled In (%)					Match Type (%)					
	Very Selective	Selective	Less Selective	Nonselective (4-year)	Two-Year	No Enroll	Overmatch	Match	Undermatch	Undermatch (Selectivity)	Undermatch (Level)
Access To:											
Very selective	41.8	28.7	18.5	4.1	4.5	2.4	---	41.8	58.2	51.3	6.9
Selective	19.0	26.5	28.7	6.9	13.4	5.5	19.0	26.5	54.5	35.6	18.9
Less selective	3.5	16.6	32.0	9.7	26.6	11.6	20.1	32.0	47.9	9.7	38.2
Nonselective (including 2-year)	0.4	4.0	18.8	11.3	40.3	25.3	23.2	51.6	25.3	---	25.3
Access To:											
Four-year	17.8	22.7	27.7	7.4	17.1	7.4	14.9	32.7	52.4	28.0	24.4 ^b
Two-year	0.4	4.0	18.8	11.3	40.3	25.3	23.2	51.6	25.3	---	25.3
No college	0.5	1.2	4.9	3.9	33.2	56.3	6.6	---	---	---	---
TOTAL							13.3	58.9 ^a	27.8	12.4	15.4

Note: Weighted percentages presented using the F2FIWT panel weight in the ELS 2002/2006 dataset.

^a This statistic includes students with *no* access to college who did *not* attend college.

^b 7.4 percent of all students with presumed access to four-year colleges did not enroll at any postsecondary institution.

lower than that yielded by Roderick et al. (62%), Bowen et al. (40%) or Smith et al. (40.9%). Such a low figure may be attributed to how we define undermatch; but Bowen et al. and Smith et al., for example, use equally conservative approaches. Nevertheless, differences were expected, especially since this study focused on a broader range of students and enrollment outcomes—in the case of Roderick et al. and Bowen et al.—and employed arguably more sophisticated techniques than Smith et al. specifically.

In contrast, undermatch rates for students with access to selective four-year colleges were greater than those uncovered by Bowen et al. and Smith et al. As indicated in Table 4, students with access to *Very Selective* and *Selective* institutions undermatched at a rate of approximately 58.2 and 54.5%, respectively, while the undermatch rate for students with access to *Less Selective* colleges was 47.9%. Strikingly, Figure 1 reveals that of all students who undermatched by selectivity, more than 60% did not even apply to institutions commensurate with their academic qualifications. In addition, a small yet significant percentage of students were ultimately undermatched because they applied to institutions that were *too* selective. Specifically, 6.5% of undermatched students with access to *Less Selective* colleges applied to and were denied at *Selective* and/or *Very Selective* institutions; yet these same students failed to apply to a *Less Selective* institution, where they were likely to be more competitive. Similarly, 5.8% of undermatched students with access to *Selective* colleges did not apply to a single *Selective* institution, but were denied by at least one *Very Selective* school. Undermatched students who “overreached” are included in Figure 1 among students who did not apply.

In contrast to previous studies, this study also distinguished students who undermatched by institutional level. Specifically, more than half of all students who did undermatch (55.4%) failed to enroll in postsecondary education, or failed to enroll at a four-year institution when their credentials would have likely permitted them to do so, as Table 4 shows. In addition, Figure 2 reveals that approximately half of all students who undermatched by level did not apply to an appropriately selective institution (or postsecondary sector).

Table 5 indicates that undermatch was more common among low-SES students, particularly at the four-year level, and especially among rural students. Astonishingly, low-SES students with access to *Very Selective* institutions, who attended rural high schools, undermatched at a rate of 86.4%, which is nearly double the undermatch rate of low-SES students attending urban schools. This finding supports the widely publicized research of Hoxby and Avery (2013), who discovered that a

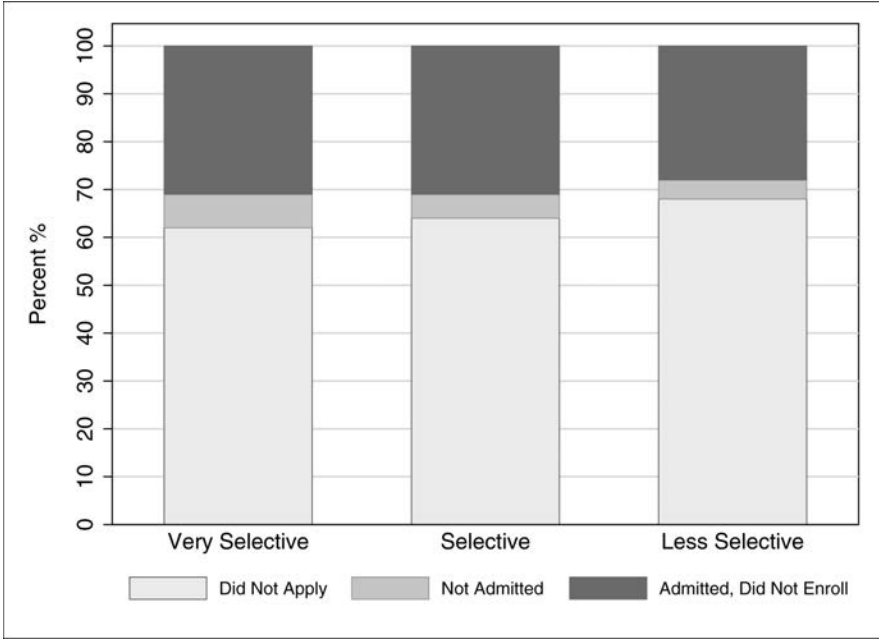


FIGURE 1. Reason for Undermatch (by Access to Selectivity)

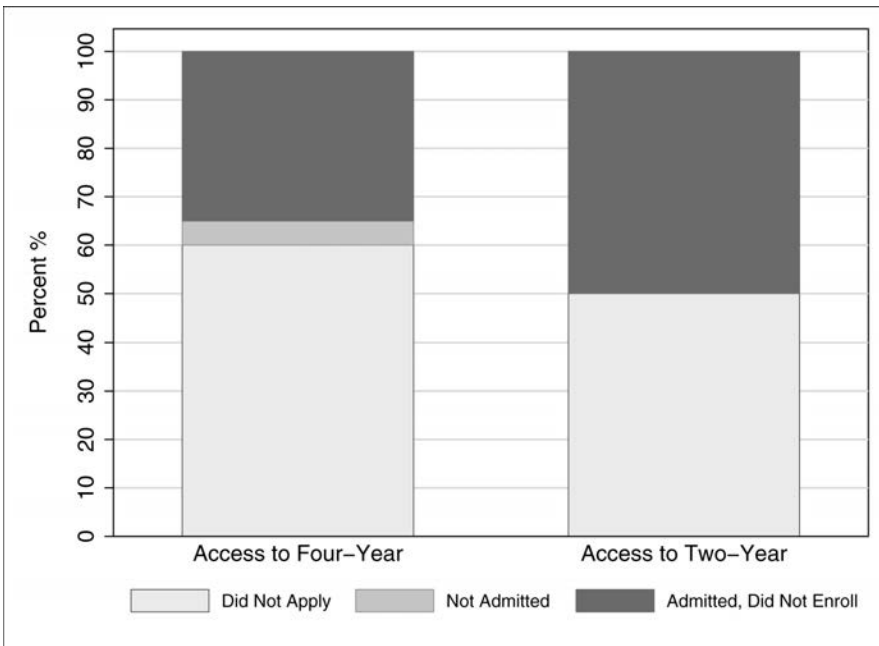


FIGURE 2. Reason for Undermatch (by Access to Level)

vast majority of low-income, high achieving students living away from densely populated areas fail even to apply at selective colleges.

Results generated from our models are detailed in Table 6 and suggest a significant relationship between undermatch and several student- and school-level predictors. Interestingly, after controlling for other important variables, females were more likely to undermatch by selectivity—a finding that contradicts the results of Smith et al.—while African American, Asian and Hispanic students were less likely to undermatch, with African Americans exhibiting a significantly lower likelihood of undermatch by selectivity. These findings are counter to Bowen et al.’s descriptive finding regarding African Americans, and to Roderick et al.’s finding regarding Hispanics, but was consistent with other studies showing underrepresented minorities as equally or more likely to enroll at four-year and selective institutions, particularly when other covariates are controlled for (Engberg & Wolniak, 2010; Roderick et al., 2011).

TABLE 5
Undermatch Rates Among Students With Access to Four-Year Colleges (by SES and Urbanicity)

	Low SES	Middle SES	High SES	TOTAL (Urbanicity)
Access To Very Selective				
Rural	86.4	77.8	56.9	67.9
Suburban	68.9	77.9	49.2	57.4
Urban	45.0	58.1	51.6	52.3
TOTAL (SES)	70.2	74.1	51.1	
Access To Selective (or higher)				
Rural	80.9	72.4	53.3	64.6
Suburban	66.2	71.1	49.3	57.0
Urban	59.1	55.0	42.9	47.6
TOTAL (SES)	68.6	67.8	48.1	
Access To Four-Year (Less selective or higher)				
Rural	71.3	67.5	51.2	61.4
Suburban	66.3	61.4	44.5	53.2
Urban	58.3	48.2	38.5	44.1
TOTAL (SES)	65.8	59.7	43.9	

Note. Weighted percentages presented using the F2F1WT panel weight in the ELS:2002/2006 dataset.

TABLE 6
 Estimating the Likelihood of Postsecondary Undermatch (vs. Match)

Variable	Model 1 Undermatch (All)	Model 2 ^b Undermatch (Selectivity)	Model 3 Undermatch (Level)
Gender ^a			
Female	0.044	0.301**	-0.095
Race ^a			
Black	-0.138	-0.746***	-0.059
Latino	-0.130*	-0.648***	0.120
Asian	-0.713***	-0.967***	-0.333
Other	-0.166	-0.272	-0.026
SES	1.312***	0.147	1.341***
Access to Selectivity ^a			
Less selective	3.724***	-----	3.467***
Selective	4.745***	2.619***	2.976***
Very selective	5.514***	3.520***	2.544***
SES X Access to Selectivity			
SES X nonselective	-3.206***	-----	-3.385***
SES X less selective	-1.674***	-0.113***	-1.809***
SES X selective	-1.829***	-0.470*	-1.982***
SES X very selective	-1.900***	-0.624**	-1.892***
Importance of Low College Expenses ^a			
Somewhat important	0.435***	0.450*	0.388*
Very important	0.686***	0.672***	0.664***
Importance of Campus Social Life ^a			
Somewhat important	-0.205	-0.190	-0.434***
Very important	-0.401***	-0.397**	-0.658***
Importance of Living at Home ^a			
Somewhat important	0.562***	0.509**	0.609***
Very important	0.653***	0.432*	0.694***
Postsecondary Expectations ^a			
Four-year degree	-0.550***	0.016	-0.663***
Graduate degree	-0.730***	0.050	-1.107***
Admissions-Related Activities			
Visited a counselor	-0.253*	-0.355*	-0.022
Completed FAFSA	-0.243*	0.158	-0.566***
No. of applications submitted	-0.279***	-0.208***	-0.340***

TABLE 6 (Continued)
 Estimating the Likelihood of Postsecondary Undermatch (vs. Match)

Variable	Model 1	Model 2 ^b	Model 3
	Undermatch (All)	Undermatch (Selectivity)	Undermatch (Level)
School Control ^a			
Private	0.034	0.035	0.301
School Urbanicity ^a			
Suburban	0.237*	0.004	0.531**
Rural	0.267*	0.183	0.499*
College-Going Climate	-0.007***	-0.010***	-0.003*
Number of Obs. (Unweighted)	11,720	5,820	11,720
Student Population (Weighted)	2,920,985	1,273,529	2,920,985
School Population (Weighted)	21,905	21,571	21,905

Source: From ELS:2002/2006 Restricted Data.

^aReference Categories in Order: Male; White; Noncompetitive; Not important; Not important; Not important; Less than a four-year degree; Public; Urban

^bReference Category for the Access to Selectivity variable includes students with access to nonselective and less selective institutions, since students with access to only nonselective institutions cannot, definitionally, undermatch by selectivity, and therefore do not comprise a meaningful reference group.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

As predicted, both SES and academic qualifications (as defined by access to selectivity) exhibited a strong and consistent influence across all outcomes. Specifically, students with stronger qualifications were more likely to undermatch—an obvious finding, given what undermatch denotes; however, significant interaction terms across models suggest that the association between access to selectivity and undermatch was conditioned by SES. Interestingly, estimating the models without an interaction term produced a positive, yet spurious, relationship between SES and undermatch; while the correctly specified models showed that college-qualified students of lower SES were indeed more likely to undermatch than their equally qualified yet more socioeconomically advantaged peers. As further evidence, Figure 3 presents predicted probabilities of undermatch among students with access to nonselective, less selective, selective, and very selective institutions, and reveals that students at lower ends of the socioeconomic scale possessed higher probabilities of undermatch—at all levels of access.

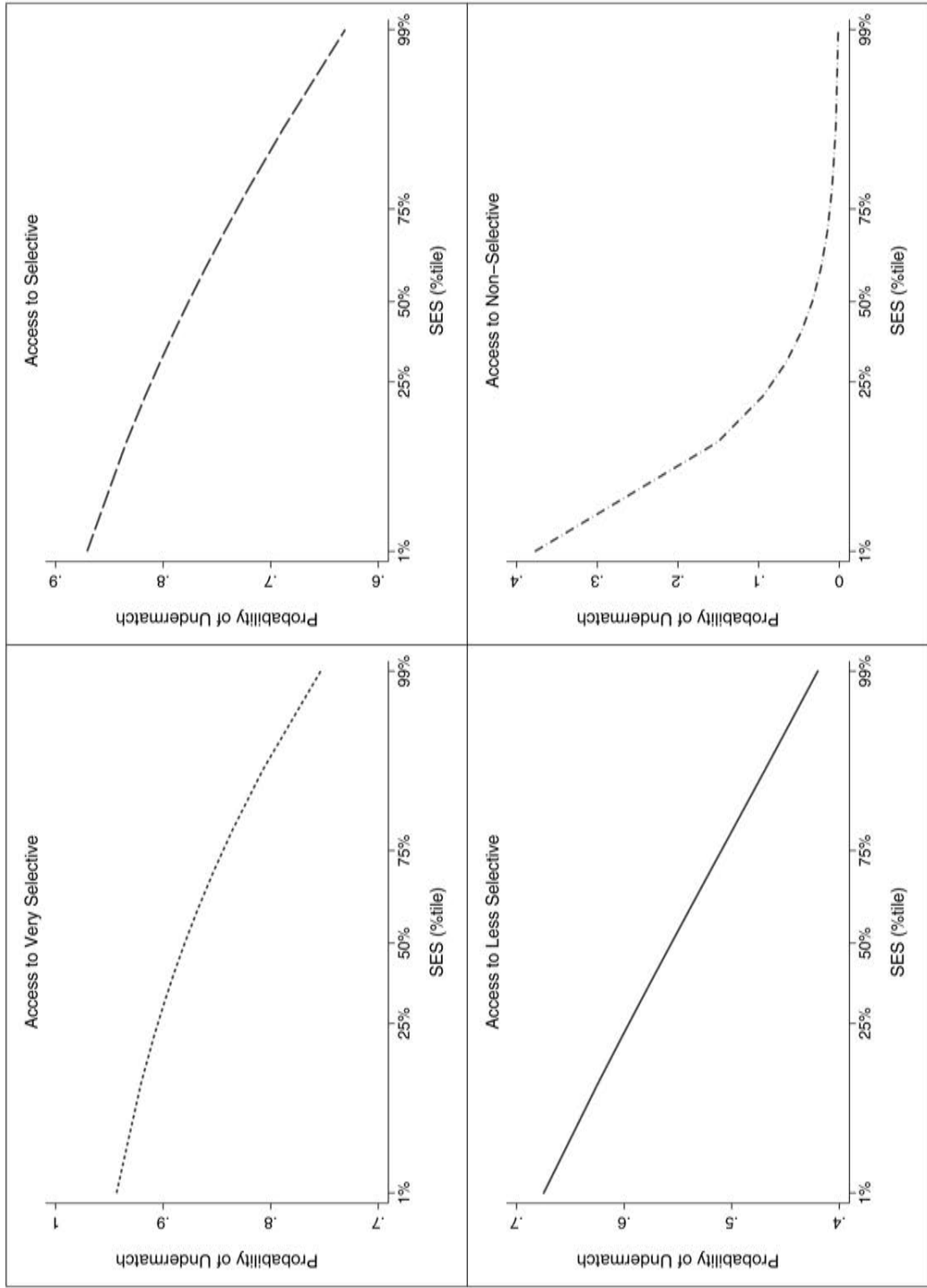


FIGURE 3. Predicted Probabilities of Undermatch (by SES)

Aside from background and achievement, there appeared to be attitudinal determinants of undermatch. For example, students attaching higher importance to low college tuition and living at home were more likely to undermatch, while students attaching high importance to college social life were less likely to undermatch. These findings reinforce the role of college-related dispositions, and suggest that elements of social class may indeed play a role in determining the postsecondary destinations of students, which are distinct from that determined by socioeconomic and other background indicators (Nora, 2004; Paulsen & St. John, 2002). Postsecondary expectations also played a factor, as students expecting to earn a four-year or graduate degree were less likely to undermatch, and especially less likely to undermatch by level.

Like college-related outlooks, admissions-related activities also seemed to exhibit influence, as visiting a school counselor, completing a FAFSA, and submitting a higher number of applications were all associated with a lower likelihood of undermatch—with the significance of counselor visitations being attributed to undermatch by selectivity and FAFSA completion to undermatch by level. These findings are strengthened by effects related to the college-going climate of high schools. Results show that students attending schools with higher scores on the college-going composite (detailed above) were less likely to undermatch, by selectivity and by level, and lend support to the growing body of evidence linking school environment to postsecondary outcomes (Engberg & Wolniak, 2010; Roderick et al., 2011). In contrast, and as intimated above, students attending suburban and rural high schools were more likely to undermatch overall and by level—a finding that may be attributed to geographical distance from four-year institutions and from the human and social capital that facilitates selective college enrollment (Hoxby & Avery, 2013; Hu, 2003).

Discussion and Implications

The results of this study reveal that postsecondary undermatch is indeed a pervasive phenomenon, albeit to a slightly lesser extent than other studies have concluded. In addition, our analysis finds that more than half of all students who undermatch do not enroll in postsecondary education or at an institutional level that is commensurate with their academic qualifications—a potentially troubling finding given relatively low degree completion rates at two-year institutions (Goldrick-Rab & Pfeffer, 2009; B. Long & Kurlaender, 2009) and given the significant need for a more college-educated workforce (Lumina Foundation, 2012). The results presented above also reveal that undermatch

is especially widespread among low-SES and nonurban populations, which supports previous research on the relationship between these variables (Hoxby & Avery, 2013; Roderick et al., 2011) and suggests that a critical mass of underrepresented students is failing to procure the economic and social benefits that are likely to come from attending appropriately selective institutions (Arum, Roska, & Budig; Dale & Krueger, 2011; Light & Strayer, 2000).

Given clear returns to selectivity, this study should compel others to examine how interventions and future research might move more students to attend “match” colleges. As indicated previously, the majority of undermatched students failed even to apply at suitably competitive schools, with socioeconomically disadvantaged and rural students particularly prone to undermatching. In light of these findings, and in light of the positive relationship between admissions-related activities and college match, we argue that interventions at the application stage, and which focus on low-SES and geographically remote populations, may prove especially effective.

Hoxby and Turner (2013), for example, demonstrate that such interventions can be implemented both at a low cost and large scale, and can generate significant individual and social returns. Their randomized controlled evaluation of the Expanding College Opportunity (ECO-C) project showed that low-income, high achieving students receiving ECO-C mailings, consisting of application fee waivers and application-related information, were 20% more likely to apply and enroll at appropriately selective colleges, where instructional spending, graduation rates and postgraduate earnings were relatively high. In response to Hoxby and Turner’s influential study, the College Board has recently committed to similar mailings targeting approximately 28,000 low-income, high-achieving twelfth-graders.

These initiatives constitute an important first step in improving post-secondary match; however, more can be done. In particular, future initiatives may consider targeting students earlier in their high school career, as several studies suggest that perceptions of college affordability are linked to high school achievement and college-related behaviors (Elwood & Kane, 2000; McDonough & Calderone, 2006), and that post-secondary choice is a function of attitudes and behaviors that occur well before students reach their senior year of high school (Perna, 2006).

In addition, it is necessary to further consider how target populations are identified and assessed. The interventions detailed above rely on College Board data, but data from other entities may prove more illuminating. For example, ACT administers standardized tests to more students residing in geographically remote regions than does the

College Board (C. B. Hill & Winston, 2010). Further, partnerships with state governments and local school districts may enable access to data on student grades and curriculum, two important indicators of selective college admission (Clinedinst, Hurley & Hawkins, 2011) and success (Adelman, 2006), and may provide a better picture of where (i.e., at which institutions) students are really qualified to attend.

Our findings may also offer insight into the activities and attitudes that future interventions should advance. Positive effects related to counselor visitations, FAFSA completion, and quantity of applications suggest that concentrating on the “nuts and bolts” of the college admissions process is essential to achieving a greater rate of college match. However, given our findings on the role of college-related attitudes, it appears necessary that future interventions also focus on the perceptions and expectations that facilitate college choice. This includes content promoting postsecondary aspirations (Choy, 2001), campus integration (Tinto, 1993), and net cost information. The latter is particularly important, as low-SES students seem unaware of the financial benefits associated with selective college attendance. Interestingly, this study discovered that students perceiving low college expenses as very important were more likely to undermatch, and as a result, attended relatively less selective institutions. However, low-SES students—who are most likely to attach high importance to low college expenses—often incur lower out-of-pocket expenses at selective institutions than they do at less competitive colleges in the private and public sectors (C. B. Hill, Winston, & Boyd, 2005; Hoxby & Avery, 2012), and need to be made aware of this fact.

Finally, although our study affirms the prevalence of postsecondary undermatch and discusses interventions that may reduce the rate of this enrollment outcome among low-SES students in particular, it does not and cannot argue that *all* students maximize their access to postsecondary selectivity. While the returns to selective college attendance are well-documented, additional research is needed to examine the effects of undermatch specifically, and whether the benefits of undermatching—which may include greater savings (especially for more affluent students), greater extracurricular opportunities, or more social and/or family support—compensate for, or exceed, the costs that may result.

Additionally, and as indicated in Table 5, there was a sizable proportion of students who *overmatched*, and enrolled at institutions more competitive than those to which they presumably had access. In light of recent commentary on the potential harms of overmatch (Sander & Taylor, 2012; Will, 2011), and at least one contradictory study (of California students) revealing *no* significant differences in credit accumulation,

grades, and persistence between matched and overmatched students (Kurlaender & Grodsky, 2013), we believe that there is a definite need for further inquiry into this topic as well.

Conclusion

Until updated data becomes available, particularly at the national level, which allows researchers to assess the short-term and long-term consequences of postsecondary undermatch, it is prudent to evaluate the individual and contextual factors that may contribute to this phenomenon. As predicted, this study finds a negative and significant relationship between SES and undermatch; however, it also reveals the influence of several other determinants that are potentially more malleable. Although college-related attitudes and activities are often tied to an individual's socioeconomic context, they are not predetermined. In sum, the findings yielded from this study propose that proactive strategies encouraging students to more deeply engage the college admissions process may generate returns in the form of greater postsecondary enrollment and more appropriate institutional match. More specifically, this study adds to a growing body of literature demonstrating the positive influence that high school environment, college information, and other college-related interventions may have on the postsecondary enrollment and choice of students (Belasco, 2013; Engberg & Wolniak, 2010; Hoxby & Turner, 2013). This corpus of research suggests that increased attention to the college knowledge of students and the college-ready focus of schools can help disadvantaged populations overcome the material, cultural, and attitudinal barriers that have traditionally prevented them from realizing their postsecondary potential.

Notes

¹ Smith et al. relied on listwise deletion and one-level linear probability models to assess the effect of student- and school-level variables. These methodological approaches are likely to produce bias, inconsistent and inefficient estimates (Enders, 2010; Horrace & Oaxaca, 2006; Raudenbush & Bryk, 2002).

² To measure the SES of ELS respondents, we rely on an SES composite variable featured in ELS:2002/2006 and other NCES large-scale studies, and that is based on five equally weighted components of information: father's education; mother's education; family income; father's occupation; and mother's occupation. The SES composite variable is continuous, with higher calculated student SES scores assigned to students of higher SES.

³ Details regarding how this variable was constructed are discussed below in the **Determining Selectivity** and **Determining Undermatch** subsections.

⁴ The confirmatory factor model yielded the following fit statistics: $\chi^2 = 7.284$ ($p > \chi^2 = 0.200$); RMSEA = 0.0207; CFI = 0.994; TLI = 0.989.

⁵ Although Bowen et al. do not devise selectivity groupings identical to those used in our study and in Smith et al., they do adopt identical strategies to address uneven distribution (of institutions) across the “selectivity” spectrum—for example, by indicating as most selective all institutions categorized by Barron’s as *Most Competitive*, *Highly Competitive* and *Very Competitive*.

⁶ We employed chained equation imputation to impute test scores for respondents who did not indicate taking an SAT/ACT (22.1% of our analytic sample), using variables measuring high school GPA, curricular intensity, AP or IB credits, and performance on a standardized math and reading assessment administered to all ELS respondents in tenth grade.

⁷ Tables indicating admissions eligibility frontiers for access to *Selective* and *Less Selective* institutions are available upon request.

⁸ As a robustness check, we estimated models using the nonimputed dataset and checked for consistency between results. Coefficient values yielded from the nonimputed dataset were different from those yielded by the imputed dataset; however, our substantive findings were the same across datasets.

References

- Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: US Department of Education.
- Allison, P. (2002). *Missing data*. Thousand Oaks, CA: Sage.
- Alon, S., & Tienda, M. (2005). Assessing the mismatch hypothesis: Differences in college graduation rates by institutional selectivity. *Sociology of Education*, 78(4), 294–315.
- Arum, R., Roksa, J., & Budig, M. J. (2008). The romance of college attendance: Higher education stratification and mate selection. *Research in Social Stratification and Mobility*, 26(2), 107–121.
- Aud, S., KewalRamani, A., & Frolich, L. (2011). *America’s youth: Transitions into adulthood (NCES 2012–026)*. Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Bastedo, M., & Jaquette, O. (2011). Running in place: Low-income students and the dynamics of higher education stratification. *Educational Evaluation and Policy Analysis*, 33(3), 318–339.
- Baum, S., Ma, J., & Payea, K. (2010). *Education Pays 2010*. New York: The College Board.
- Belasco, A. (2013). Creating college opportunity: School counselors and their influence on postsecondary enrollment. *Research in Higher Education*, 54(7), 781–804.
- Bourdieu, P. (1996). *The state nobility: Elite schools in the field of power*. Stanford, CA: Stanford University Press.
- Bowen, W., Chingos, M., & McPherson, M. (2009). *Crossing the finish line: Completing College at America’s public universities*. Princeton, NJ: Princeton University Press.
- Cabrera, A., & La Nasa, S. (2001). On the path to college: Three critical tasks facing America’s disadvantaged. *Research in Higher Education*, 42(2), 119–150.
- Carnevale, A., & Strohl, J. (2010). How in access is increasing inequality in postsecondary education. In R. Kahlenberg (Ed.), *Rewarding the strivers: Helping low income students succeed in college* (pp. 225–256). New York: Century Foundation.

- Choy, S. (2001). *Students whose parents did not go to college: Postsecondary access, persistence, and attainment (NCES 2001-126)*. Washington, DC: U.S. Department of Education.
- Clinedinst, M., Hurley, S., & Hawkins, D. (2011). *State of college admission 2011*. Washington, DC: National Association for College Admission.
- Coleman, J. C. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*, 95-120.
- Conley, D. (2007). *Redefining college readiness*. Eugene, OR: Educational Policy Improvement Center.
- Dale, S., & Krueger, A. (2011). *Estimating the return to college selectivity over the career using administrative earnings data*. Cambridge, MA: National Bureau of Economic Research.
- Dillon, E., & Smith, J. (2009). The determinants of mismatch between students and colleges. *Unpublished working paper*. Ann Arbor, MI: University of Michigan.
- Eide, E., Brewer, D., & Ehrenberg, R. (1998). Does it pay to attend an elite private college? Evidence on the effects of undergraduate college quality on graduate school attendance. *Economics of Education Review, 17*(4), 371-376.
- Enders, C. (2010). *Applied missing data analysis*. New York: The Guilford Press.
- Engberg, M., & Wolniak, G. (2010). Examining the effects of high school context on post-secondary enrollment. *Research in Higher Education, 51*, 132-153.
- Goldrick-Rab, S., & Pfeffer, F. (2009). Beyond access: Explaining socioeconomic differences in college transfer. *Sociology of Education, 82*(2), 101-125.
- Grodsky, E., & Jones, M. (2007). Real and imagined barriers to college entry: Perceptions of cost. *Social Science Research, 36*(2), 745-766.
- Hamrick, F., & Stage, F. (2004). College predisposition at high-minority enrollment, low-income schools. *The Review of Higher Education, 27*(2), 151-168.
- Hearn, J. (1991). Academic and nonacademic influences on the college destinations of 1980 high school graduates. *Sociology of Education, 63*(4), 158-171.
- Hill, C. B., & Winston, G. C. (2010). Low-income students and highly selective private colleges: Geography, searching, and recruiting. *Economics of Education Review, 29*(4), 495-503.
- Hill, C. B., Winston, G. C., & Boyd, S. A. (2005). Affordability family incomes and net prices at highly selective private colleges and universities. *Journal of Human Resources, 40*(4), 769-790.
- Hill, L. (2008). School strategies and the 'college-linking' process: Reconsidering the effects of high schools on college enrollment. *Sociology of Education, 81*(1), 53-76.
- Horn, L. (2006). *Placing college graduation rates in context: How 4-year college graduation rates vary with selectivity and the size of low-income enrollment (NCES 2007-161)*. Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Horrace, W., & Oaxaca, R. (2006). Results on the bias and inconsistency of ordinary least squares for the linear probability model. *Economics Letters, 90*(3), 321-327.

- Hoxby, C., & Avery, C. (2013). *The missing "one-offs": The hidden supply of high-achieving, low income students* (Tech. Rep.). Cambridge, MA: National Bureau of Economic Research.
- Hoxby, C., & Turner, S. (2013). *Expanding College Opportunities for High-Achieving, Low Income Students* (No. 12-014). Stanford, CA: Stanford Institute for Economic Policy Research.
- Hu, S. (2003). Educational aspirations and postsecondary access and choice: Students in urban, suburban, and rural schools compared. *Education Policy Analysis Archives*, 11(14), 14.
- Hurwitz, M., Smith, J., Howell, J., & Pender, M. (2012). *The role of high schools in students' postsecondary choices*. New York: The College Board.
- Immerwahr, J. (2003). *With diploma in hand: Hispanic high school seniors talk about their future*. San Jose, CA: National Center for Public Policy and Higher Education and Public Agenda.
- Ishitani, T. (2006). Studying attrition and degree completion behavior among first-generation college students in the United States. *The Journal of Higher Education*, 77(4), 861-885.
- Kim, D., & Schneider, B. (2005). Social capital in action: Alignment of parental support in adolescents' transition to postsecondary education. *Social Forces*, 84(2), 1181-1206.
- Kurlaender, M., & Grodsky, E. (2013). Mismatch and the paternalistic justification for selective college admissions. *Sociology of Education*, 86(4), 294-310.
- Light, A., & Strayer, W. (2000). Determinants of college completion: School quality or student ability? *Journal of Human Resources*, 39(3), 299-332.
- Long, B., & Kurlaender, M. (2009). Do community colleges provide a viable pathway to a baccalaureate degree? *Educational Evaluation and Policy Analysis*, 31(1), 30-53.
- Long, M. (2008). College quality and early adult outcomes. *Economics of Education Review*, 27(5), 588-602.
- The Lumina Foundation. (2012). *A stronger nation through higher education: How and why Americans must meet a big goal for college attainment*. Indianapolis, IN: Author.
- Luna De La Rosa, M. (2006). Is opportunity knocking? Low income students' perceptions of college and financial aid. *American Behavioral Scientist*, 49(12), 1670-1686.
- Maton, K. (2008). Habitus. In M. Greenfell (Ed.), *Pierre Bourdieu: Key concepts* (pp. 49-66). Durham, UK: Acumen Publishing Limited.
- McDonough, P. (1997). *Choosing colleges. How social class and schools structure opportunity*. Albany: State University of New York Press.
- McDonough, P. (2005). *Counseling and college counseling in America's high schools*. Alexandria, VA: National Association for College Admissions Counseling.
- McDonough, P., & Calderone, S. (2006). The meaning of money: Perceptual differences between college counselors and low-income families about college costs and financial aid. *American Behavioral Scientist*, 49, 1703-1718.
- National Center for Education Statistics. (2011). *Digest of education statistics, 2010*. Washington, DC: National Center for Education Statistics.

- Nora, A. (2004). The role of habitus and cultural capital in choosing a college, transitioning from high school to higher education, and persisting in college among minority and nonminority students. *Journal of Hispanic Higher Education*, 3(2), 180–208.
- Paulsen, M., & St. John, E. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *The Journal of Higher Education*, 73(3).
- Perna, L. (2004). *Impact of student aid program design, operations, and marketing on the formation of family college-going plans and resulting college-going behaviors of potential students*. Boston: The Education Resources Institute, Inc. (TERI).
- Perna, L. (2006). Studying college choice: A proposed conceptual model. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 21, pp. 99–157). Boston: Kluwer Academic Publishers.
- Perna, L., & Thomas, S. (2009). Barriers to college opportunity: The unintended consequences of state-mandated testing. *Educational Policy*, 23(3), 451–479.
- Perna, L., & Titus, M. A. (2005). The relationship between parental involvement as social capital and college enrollment: An examination of racial/ethnic group differences. *The Journal of Higher Education*, 76(5), 485–518.
- Rabe-Hesketh, S., & Skrondal, A. (2006). Multilevel modeling of complex survey data. *Journal of the Royal Statistical Society*, 169, 805–827.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park, CA: Sage.
- Roderick, M., Coca, V., & Nagaoka, J. (2011). Potholes on the road to college: High school effects in shaping urban students' participation in college application, four-year college enrollment, and college match. *Sociology of Education*, 84(3), 178–211.
- Roderick, M., Nagaoka, J., Coca, J., & Moeller, E. (2009). *From high school to the future: Making hard work pay off*. Chicago, IL: Consortium on Chicago School Research.
- Royston, P. (2005). Multiple imputation of missing values: Update. *The Stata Journal*, 5(2), 188–201.
- Sander, R., & Taylor, S. (2012). *Mismatch: How affirmative action hurts students it's intended to help, and why universities won't admit it*. New York: Basic Books.
- Smith, J., Pender, M., & Howell, J. (2013). The full extent of student-college academic undermatch. *Economics of Education Review*, 32, 247–261.
- Stanton-Salazar, R., & Dornbusch, S. (1995). Social capital and the reproduction of inequality: Information networks among Mexican-origin high school students. *Sociology of Education*, 68, 116–135.
- Thomas, S., & Heck, R. H. (2001). Analysis of large-scale secondary data in higher education research: Potential perils associated with complex sampling designs. *Research in Higher Education*, 42(5), 517–540.
- Thomas, S., & Perna, L. (2004). The opportunity agenda: A reexamination of postsecondary reward and opportunity. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 19, pp. 43–84). Boston: Kluwer Academic Publishers.
- Tierney, W., & Venegas, K. (2006). Fictive kin and social capital: The role of peer groups in applying and paying for college. *American Behavioral Scientist*, 49(12), 1687–1702.
- Tierney, W., & Venegas, K. (2009). Finding money on the table: information, financial aid, and access to college. *The Journal of Higher Education*, 80(4), 363–388.

- Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition*. Chicago: University of Chicago Press.
- Tomás Rivera Policy Institute. (2004). *Caught in the financial aid information divide: A national survey of Latino perspectives on financial aid*. Los Angeles: University of Southern California.
- Walpole, M. (2003). Socioeconomic status and college: How SES affects college experiences and outcomes. *Review of Higher Education*, 27, 45–73.
- Will, G. (2011, November 30). The unintended consequences of racial preferences. *The Washington Post*. Retrieved from http://www.washingtonpost.com/opinions/the-unintended-consequences-of-racial-preferences/2011/11/29/gIQAbuoPEO_story.html
- Wyatt, J., & Mattern, K. (2011). *Low-SES students and college outcomes: The role of AP fee reductions*. New York: College Board.