

Selectivity and the College Experience: How Undermatching Shapes
the College Experience among High-Achieving Students

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Author's Note

Paper presented at the annual meeting of the American Educational Research Association in Philadelphia, PA, April 2014. Please do not quote or cite this paper without permission from the author.

Abstract

This study examined the first-year college experiences of high achieving academic undermatches. Confirming previous research, it finds that undermatching is a common outcome of the college choice process for high achieving students. The results indicate that students who undermatch have different college experiences than similar peers who did not undermatch. Using propensity score modeling to estimate the impacts of undermatching, the study found that attending less selective institutions was associated with a less academically challenging academic environment, fewer self-perceived gains, and lower levels of college satisfaction during the first college year. However, students who attended less selective institutions had more frequent interactions with faculty and engaged in more active and collaborative learning activities. The implications of undermatching and how to reduce its prevalence are discussed.

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America's level of educational attainment was a primary source of its prosperity over the past century; however, this advantage has been eroded over time and threatens the nation's economic future (Goldin & Katz, 2008). Since the average American already receives at least 12 years of education, future gains must be derived from increased postsecondary education. Due to the relatively high rates of degree completion by White and high socio-economic status (SES) students and changing demography (Bowen, Chingos, & McPherson, 2009; U.S. Department of Education, 2009; Western Interstate Commission for Higher Education, 2008), reducing disparities in baccalaureate completion present the best opportunity to improve America's educational attainment rate.

Policymakers have historically attempted to close gaps in postsecondary educational attainment by focusing their efforts on providing financial aid to students and more recently by improving students' academic preparation for college. However, researchers recently have identified academic undermatching, where a student chooses to attend a less selective postsecondary institution than permitted by their academic credentials¹ as a contributing factor to disparities observed in baccalaureate attainment rates. Previous research has found that low SES, underrepresented minority (URM) and rural students frequently undermatch and negative correlations between undermatching and degree completion (Bowen et al., 2009; Hoxby & Avery, 2012; Roderick et al., 2008; Smith, Pender, & Howell, 2013). In contrast to these studies, this paper examines how first-year college experiences of high achieving undermatches differed from their peers attending more selective institutions by investigating how undermatching effects

¹ It should be noted that a student's college search should go beyond searching for the most selective institution possible. Their search should include other aspects of fit such as cost, location, the social environment and academic offerings.

freshmen's college engagement, satisfaction, and perceived gains, factors informing students' persistence decisions.

Literature Review

A series of research reports and papers by researchers at the Consortium on Chicago Schools Research recently popularized the concept of academic matching² (Roderick, Coca, & Nagaoka, 2011; Roderick et al., 2006; Roderick, Nagaoka, Coca, & Moeller, 2009; Roderick et al., 2008). The majority of their work tracks the 2005 senior cohort attending Chicago Public Schools (CPS). They found that over 60 percent of CPS graduates who enrolled in college did so at an institution below their academic match. Furthermore, they frequently observed undermatching among students with strong academic credentials, as only 38 percent of students with access to a "very selective" institution enrolled in that college type. This trend concerned the authors due to the correlation between institutional selectivity and graduation rates.

Subsequent research examined the impact of undermatching on degree attainment (Bowen et al., 2009). This study found that undermatching commonly occurred in North Carolina and correlated it to family income, parental education, and being Black. However, they went beyond the CPS study and compared the graduation rate of students who matched and undermatched among those that had access to the most selective public institutions in North Carolina. After controlling for a number of characteristics, students who undermatched were 10 percentage points less likely to graduate than students who attend a more selective institution.

Subsequent studies focusing on undermatching used nationally representative samples to assess its prevalence (Hoxby & Avery, 2012; Smith et al., 2013). Among the 2004 senior cohort, approximately 40 percent of students undermatched (Smith et al., 2013). This study found that

² The Consortium on Chicago Schools Research used the term mismatch to describe students who do not enroll in an institution that matches their expected selectivity. This paper will use variations of the term undermatch, as preferred by Bowen et al. (2009), to explicitly delineate it from overmatch which is used in debates over affirmative action.

students from low SES backgrounds were more likely to undermatch than students from higher SES families; however, African Americans and Asians were less likely to undermatch than Whites, after controlling for other factors. Additionally, students with parents without a college degree and living in rural areas were more likely to undermatch. The authors also compared undermatching rates between senior cohorts from 1992 and 2004 and observed that the undermatching rate declined by 8 percentage points over this time span.

A second study using nationally representative data utilized information on students in the 2008 graduating class who took the ACT or SAT I (Hoxby & Avery, 2012). This study focused on the application and enrollment behavior of high-achieving, low-income students and identified three patterns of behavior in students' application decisions. About half of the low-income, high-achieving students fit an *income-typical* profile and applied to no college with a median ACT or SAT test score within 15 percentiles of their own score and applied to at least one non-selective institution. The second group, *achievement-typical*, contained 8 percent of high-achieving, low-income students, and these students applied to at least one school with a median test score similar to their own and an institution with a median score lower than their own, but not dramatically lower. The remaining high-achieving, low-income students had "odd" application behaviors and applied to a single Ivy League institution or one institution that is selective, but less selective than their state's flagship public university. The study compared the characteristics of income- and achievement-typical groups. The groups had roughly equivalent family incomes and parental education levels, but the income-typical students were more likely to be White and their neighborhoods had higher proportions of Whites, fewer adults possessing a bachelor's degree, and were located in areas with small populations and away from large cities.

Despite these differences, the study found that, after applying to college, low and high-income, high achieving students make similar enrollment and persistence decisions.

The above results led to the creation of the Expanding College Opportunities (ECO) project, a randomized controlled trial that investigated the efficacy of providing information about the college choice process to high achieving, low income students and their parents (Hoxby & Turner, 2013). The experiment found that providing students with information about college impacted a wide variety of behaviors. Students who acknowledged receiving the information were over 50 and 75 percent more likely to apply and be admitted to an institution that matched their academic credentials, respectively. Furthermore, students who received the treatment were 46 percent more likely to enroll in a selective institution that matched their credentials. The study also found that the intervention had no significant effect on first-year grades or persistence through the middle of the sophomore year for students induced to enroll at a more selective institution. The authors assert that these findings indicate that students induced to enroll at more selective institutions actually learned more due to the higher standards at selective colleges. Finally, this intervention was rather inexpensive at \$6 per student, indicating it has substantial impacts for a relatively low cost.

Other studies examining college matching have focused upon the effects of overmatching, typically in the context of evaluating affirmative action policies. This occurs when a student attends an institution with a selectivity greater than would be predicted by their academic characteristics. Nearly uniformly these studies found that the benefits of attending a selective institution on college completion for URM students is equivalent or greater than the benefit for Whites (Alon & Tienda, 2005; Long, 2008; Melguizo, 2008).

Conceptual Framework

Human capital theory guided this study. The theory equates investments of time, money and opportunity costs to develop a more productive self to traditional forms of capital (Becker, 1993). Individuals create human capital through education, occupational training, and health care and it defines an individual's productivity level, which determines their wages. The theory assumes that individuals are rational actors attempting to maximize their utility and make cost-benefit decisions when deciding to invest in their human capital. It also predicts that individuals will make the most beneficial decision for themselves when they have access to perfect information about their potential choices. However, in situations with imperfect information, an individual may make what appears to be the best choice, but in reality is not optimal.

Imperfect information is prevalent in the college choice process. To choose a college, students typically must develop a predisposition to attend college, search for information about possible institutions to develop a manageable choice set, and finally choose a college to attend (Hossler, Braxton, & Coopersmith, 1989; Hossler & Gallagher, 1987). Given the multitude of postsecondary institutions, it is virtually impossible for students to consider all possible colleges. Furthermore, students typically do not receive important information, such as the net cost after financial aid, until after they apply and are admitted to an institution.

While virtually all students face these problems, low-SES, URM, and rural students face additional information barriers in the college choice process, as information on higher education is structured by schools (McDonough, 1997) and not equally distributed through society (Oakes et al., 2006). Therefore, many high school students are unaware of the distinctions between postsecondary institutions and the earnings premium associated with attending a highly selective institution (Brewer, Eide, & Ehrenberg, 1999; Thomas & Zhang, 2005). Consequently, the

college choice process results in non-optimal outcomes for many students, particularly those with little knowledge of the broad diversity postsecondary institutions found in America.

Research Questions

Guided by human capital theory, this study investigated the following questions:

1. What student characteristics are associated with undermatching among high-achieving students?
2. How does undermatching influence college engagement among high-achieving students with access to very selective colleges?
3. How does undermatching influence these students' self-perceived gains in learning and development?
4. How does undermatching influence these students' college satisfaction?

Methods

Data

To answer the aforementioned questions, I utilized data from first-year undergraduates who responded to the 2010 Beginning College Survey of Student Engagement (BCSSE) and the 2011 National Survey on Student Engagement (NSSE). BCSSE examines students' high school experiences and college expectations upon college entry and is typically administered during summer orientation. NSSE asks about baccalaureate students' engagement in educationally beneficial activities, perceptions of the institutional emphasis on various activities, the perceived institutional contribution to their growth and development, and satisfaction with the college experience. Students included in this sample responded to NSSE in the winter of their first year in college. A total of 16,820 students at 117 U.S. bachelor's-granting institutions responded to both surveys.

I defined high achieving students as those with the academic credentials competitive for admission at an institution with a Barron's Admissions Competitive Index of *most* or *highly competitive*. To identify students these students with access to very selective colleges, I followed the approach of the CPS studies and assigned students an admissions competitiveness score based upon an admissions competitiveness matrix (see Appendix A) containing students' high school grades and SAT I (Math + Verbal) or equivalent ACT score. The matrix had four selectivity categories recoded from Barron's ratings (in parentheses):

1. Very selective (most competitive & highly competitive)
2. Selective (very competitive)
3. Somewhat selective (competitive)
4. Nonselective (less competitive & noncompetitive).

Additionally, I automatically assigned students who completed five honors and two Advanced Placement courses to the *very selective* category. The majority of the standardized test score data was obtained from students' institutions; however, for respondents without administrative data, I used students' self-reported scores. The data on high school grades and AP and honors courses were self-reported by students on BCSSE. A total of 7,165 students received a rating of *very selective* and formed the analytic sample for the study.

The key variable in the study was undermatch status. I coded students who did not attend an institution with Barron's rating of most or highly competitive as undermatching. The study also examined three types of college outcomes, all derived from the NSSE instrument. The first, student engagement, was represented by the five NSSE benchmarks: Level of Academic Challenge (LAC), Active and Collaborative Learning (ACL), Student-Faculty Interaction (SFI), Enriching Educational Experiences (EEE), and Supportive Campus Environment (SCE). The

benchmarks have been found to be valid and reliable measures of student engagement (National Survey of Student Engagement, 2012a). I also examined three measures indicating students' perception of the extent to which their college experiences improved their knowledge, skills, and personal development: gains in personal and social development, practical competence, and general education. Finally, I used NSSE's overall satisfaction scale to measure student satisfaction with their institution. I standardized all of the college outcome variables to have a mean of 0 and a standard deviation (SD) of 1.

In addition to these variables, I utilized a number of control variables to control for students' demographic and academic characteristics and their expectations for college. The demographic and academic characteristics controlled for included gender, parental education, race/ethnicity, distance between college and home, high school grades, SAT I (Math + Verbal) or ACT equivalent score, degree aspirations, and the number of friends attending the same college. I used the following BCSSE scales to control for high school experiences and pre-college expectations: High School Academic Engagement, Expected First-Year Academic Engagement, Academic Perseverance, Perceived Academic Preparation, Expected Academic Difficulty, and Importance of Campus Environment (see National Survey of Student Engagement (2012b) for information on BCSSE scale validity; the BCCSE scales were standardized with a mean of 0 and a SD of 1). I also utilized data on the students' home communities. From the 2007-2011 American Community Survey 5-year estimates, I used data on the racial demography, educational attainment, poverty rate, and household income at the zip code level. Additionally, I used the United States Department of Agriculture's 2013 Rural-Urban Continuum Codes to account for the urbanization of the students' home communities.

Finally, I utilized multiple imputation by chained equations to impute missing data (Rubin, 1987). Multiple imputation uses other variables to predict missing data and allows for the researcher to account the uncertainty of the imputation when calculating standard errors. I imputed continuous variables using predictive mean matching, while binary, ordinal, and categorical variables utilized logistic, ordinal logistic, and multinomial logistic regression, respectively. I choose to impute each missing data point 20 times to minimize the loss of statistical power and keep the computational speed reasonable (Graham, Olchowski, & Gilreath, 2007).

Analyses

I answered the research questions by using propensity score modeling. The technique allows for the unbiased estimation of treatment effects using observational data (Rosenbaum, 2002; Rosenbaum & Rubin, 1983). It does so by comparing the outcomes of individuals with similar probabilities of receiving a treatment (attending a less selective college in the case of this study), but received different treatments. As recommended by Sosin (2002), I used multiple propensity score techniques to estimate the treatment effects: nearest-neighbor matching and augmented inverse probability weighting. Both techniques first required estimating the propensity score, the probability of receiving a treatment or undermatching in the case of this study. I estimated the propensity score by using logistic regression to regress undermatch status on student characteristics.

Next, I used nearest neighbor matching to estimate the effect of undermatching on student outcomes. Students who undermatched were paired with a peer who did not undermatch with the nearest propensity score. Functionally, the matched peer imputes the unobservable potential outcomes for when the student did not undermatch. Thus, the average treatment effect

is simply difference in means between the treated (undermatched) group and the control group. Additionally, I checked the sample balance after matching to ensure that both groups had the same mean and distribution of observable characteristics.

Then, I re-estimated the treatment effects using an alternative technique: augmented inverse propensity weights (AIPW). This method simultaneously estimates both the propensity score and the outcome models. Therefore, it has the advantage of “double robustness”, as it consistently estimates treatment effects if either the propensity score or regression adjustment model is misspecified, but the other is correct (Tsiatis, 2006). Additionally, simulation studies indicate that AIPW outperforms other propensity score methods (matching and inverse propensity weights) and regression adjustment (Glynn & Quinn, 2010).

I used STATA 13 to perform all of the analyses. Due to the use of multiple imputation, all of the models were run separately on each of the imputed samples. The estimates reported in the next section are the means from the 20 separate estimates. The standard errors reported were adjusted to account for the uncertainty of the imputations (Rubin, 1987).

Results

Approximately, 60 percent of the high achieving students in the sample undermatched. Table 1 contains the logistic regression estimates predicting undermatch status. Students with high school grades of B+ or lower undermatched at higher rates than students with A grades. Similarly, students with higher SAT scores were less likely to undermatch, holding other factors constant. High school academic engagement, the expected level of engagement in college and the expected academic difficulty were negatively correlated with undermatching. However, students with higher levels of perceived academic preparation were more likely to undermatch.

Students who had two or more close friends attending the same institution at the time of entry were less likely to undermatch. Students who were uncertain of their degree aspirations undermatched at lower rates than students who aspired to earn a bachelor's degree. There was no significant difference for those aspiring for a master's or doctoral degree, controlling for other factors. Students undermatched at roughly equivalent rates by race holding constant other characteristics. The exception, the other category, was less likely to undermatch than White students. Undermatching varied by parental education. Students with a parent who achieved a doctoral degree undermatched at lower rates than students with a parental education level of bachelor's. However, students with a parental education of associate's undermatched at higher rates. Additionally, the largest estimate in magnitude was for students with parents who did not complete high school. These students undermatched at lower rates, but the estimate was not significant due to the small number of these students in the sample. Finally, students who attended an institution within 20 miles of home undermatched at higher rates than other students.

A number of community characteristics were also related to undermatching. Students from communities with higher household incomes undermatched at lower rates. The prevalence of Asian and Hispanics in the community was also negatively related to undermatching. Additionally, students who lived in communities with high percentages of high school or graduate degree holders were less to undermatch. Finally, undermatch status varied by urbanity. Students residing in medium sized metropolitan counties and large nonmetropolitan counties adjacent to a metropolitan area undermatched at lower rates than students from large metropolitan counties. While not significant at $p < .05$, the estimated coefficients for rural communities and nonmetropolitan areas not adjacent to a metropolitan area were positive and sizable.

Table 2 contains the estimated average treatment effects of undermatching on the nine outcomes examined. Students who attended a less selective institution than permitted by their academic credentials reported experiencing a less challenging academic environment during their first college year than peers who attended more selective institutions. The magnitude of this difference was approximately .2 SDs and the estimates yielded from the two propensity score approaches were nearly identical. However, students that undermatched appear to have engaged in more active and collaborative learning activities than their matched peers. The mean of estimated effects was .14 SDs. Students who undermatched appeared to have more frequent interactions with faculty as the SFI estimates were .10 and .13 SDs. For EEE, the two estimated effects were substantially different. The nearest-neighbor matching estimate was -.07 and significant at $p < .05$. In contrast, the AIPW estimate was .03 and not significant. Due to the disparity, I re-estimated the effect using inverse probability weights without the augmentation to see if controlling for student characteristics in the outcome models led to different results. This estimate comported with the AIPW estimate at .03 and was also non-significant. Undermatch status does not appear to substantially influence students' perceptions of the campus environment

Students who undermatched perceived fewer gains derived from attending their institution. The estimates for gains in practical competence were -.07 and -.10, for the nearest-neighbor matching and AIPW approaches, respectively. For improvements in students' perceived personal and social development, the estimated effects were -.06 and -.10 SDs. Of the three gains scales examined, undermatching had the largest influence on gains related to general education. The estimated effects of undermatching on general education gains were -.14 and -.16 SDs. Finally, high achieving students who attended less selective institutions had lower levels of satisfaction with their institution. The magnitude of this effect was approximately .2 SDs.

Discussion

This study examined the phenomenon of undermatching, which occurs when a student attends a less selective institution than permitted by their academic characteristics. It investigated the prevalence and correlates of undermatching and its influence on high achieving first-year students' academic engagement, self-perceived gains, and college satisfaction. It found that undermatching was common among this population, as about 60 percent of the sample attended an institution with a selectivity lower than possible, confirming previous research (Bowen et al., 2009; Hoxby & Avery, 2012; Roderick et al., 2008; Smith et al., 2013). This finding is troubling as selectivity is not just a barometer of institutional status. Even after controlling for student characteristics, selectivity influences important outcomes including persistence and graduation (Long, 2008; Smith, 2013; Titus, 2004), graduate school enrollment and degree attainment (Zhang, 2005), and future earnings (Brewer et al., 1999; Long, 2008; Thomas & Zhang, 2005). Thus, undermatching has the potential to reinforce social stratification.

The most important contribution of this study is that undermatching appears to influence high achieving first-year students' engagement, perceived gains, and institutional satisfaction. The results indicate that students who attended less selective institutions experienced a less challenging academic environment. They also perceived fewer gains related to their practical competence, general education, and personal and social development than their peers attending more selective institutions. Undermatches also were less satisfied with their institution. In combination, these results suggest that less selective institutions failed to academically challenge the high achieving students examined. The lack of academic rigor may be a result of a less rigorous curriculum, but more likely due to the differences in the student body composition. As peers are "the single most potent sources of influence on growth and development during the

undergraduate years” (Astin, 1993, p. 398), high achieving students may feel out of place at less selective institutions and believe that they could achieve more growth in a different college environment.

Despite the root cause, undermatches clearly perceived fewer benefits from attending college and were less satisfied with their experience. The lower levels of academic challenge experienced by undermatches and its impact on student perceptions may explain why North Carolina students who undermatched were less likely to graduate than their peers who attended more selective institutions (Bowen et al., 2009). Simply, if a student perceives that the costs of college outweigh the benefits, they will drop out.

However, the results also show that undermatching may have some benefits. Undermatches had more frequent interactions with faculty and engaged in more active and collaborative learning activities. These findings are not particularly surprising. High achieving students at less selective institutions should be the most capable students at their institutions. Thus, it appears that they may be more inclined to contribute to class discussions and their peers more likely to seek them out to collaborate on projects and for assistance with their coursework. Similarly, faculty may seek out the best students to mentor and assist with their research.

The study found no significant differences on the SCE benchmark. This is somewhat surprising as SCE was substantially correlated (approximately $r = .50$) with the three gains measures and institutional satisfaction that were negatively associated with undermatching. A possible explanation for this discrepancy is that being a high achieving student in a lower selectivity environment leads to more involvement with peers and faculty and a greater sense of belonging, thus offsetting the negative effects of fewer gains and institutional satisfaction. Alternatively, high achieving students may receive scholarships or have access to special

programs like honors programs that may signal to students that they are a valued member of the campus community.

The estimates for EEE differed between the two approaches used to estimate the treatment effects. The nearest-neighbor approach estimated the effect as negative and significant, while the AIPW approach yielded estimates that were positive and non-significant. I reran the analysis using inverse probability weights without the augmentation. The results were nearly identical to the AIPW method, indicating that the disparity was not due to controlling for student and community characteristics in the potential outcome models. Thus, it is unclear why the disparate results occurred. The most likely cause is due to the EEE benchmark itself, as it includes a number of binary items indicating participation in high impact practices and maybe particularly sensitive to the students included in the analysis. Regardless of the cause, these findings reinforce the need to use multiple techniques when utilizing propensity scores to estimate treatment effects.

The results also provide further insight into the student characteristics associated with undermatching. The key insight from Hoxby and Avery's (2012) study was that many undermatches hail from smaller, rural areas far away from major metropolitan areas. This study found a similar relationship, but the estimated coefficients were not significant. A possible reason for the difference may be due to the inclusion of a variable that indicated the number of *close* friends who attended the same institution. Controlling for other factors, students with at least two close friends at their institution were less likely to undermatch. As this measure was gathered prior to the start of classes, these friends most likely attended the same high school and the variable appears to act as a proxy indicating if the student attended "feeder school"³ for the

³ Feeder school is a college admissions term indicating that a high school sends large numbers of graduates to a specific institution.

college. Consequently, it appears that these feeder networks between high schools and colleges may help students find their college match, by helping to provide students with detailed information about the college through counselors or informal peer networks.

A similar finding occurred for race. Previous work indicates Asian and Black students undermatch at lower rates than Whites (Smith et al., 2013). The propensity score model found negative coefficients for these variables, but they were not significant. However, this study included a number of variables indicating the racial demographics of the students' home communities, which were significant. Therefore, the results suggest that the racial composition of a community may be a more salient factor in undermatch status than the students' race. This insight further highlights the importance of information flows within a community that help students find a college match.

The importance of knowledge about the college going process also explains the relationship between the BCSSE scales and undermatching. Perceived academic preparation was positively correlated with undermatching. In contrast, students who expected a difficult time during college were less likely to undermatch. These results suggest that students who undermatch may not fully understand the differences between high school and college. This lack of understanding may result from lower levels of knowledge about college in their communities.

Despite the findings above, it is important to note that there are many valid reasons why students choose to attend a less selective institution than possible. Some may be attracted to a highly competitive, but specialized program within an institution, such as art or music. Others may have family responsibilities requiring them to stay or live close to home. However, lack of information on the variety of college choices is not a valid reason to attend a less selective institution. Unfortunately, previous research on undermatching indicates that the latter is

responsible for the majority of undermatching (Hoxby & Avery, 2012; Hoxby & Turner, 2013; Roderick et al., 2011; Roderick et al., 2008).

The best solution to reduce undermatching is to improve students' knowledge about their college and career choices. In particular, the ECO project demonstrates the efficacy of providing students information about their college choices (Hoxby & Turner, 2013). Alternately, this can be achieved by improving college counseling within middle and high schools. In 2010, there were 471 students per guidance counselor at public K-12 schools (U.S. Department of Education, 2013), a ratio twice as large as what is recommended by the profession (American School Counselor Association, n.d.). The high ratio, when combined with the other responsibilities of counselors, prevents many counselors from spending much time advising students on their potential college choices. Furthermore, counselors are typically not trained to advise students through the college choice process (McDonough, 2005). Consequently, many counselors are ill-equipped to properly advise unique students, particularly those with high abilities in small locales.

Very selective colleges and universities can also help to reduce undermatching by dissemination more knowledge about the college choice process to students. In the name of efficiency, institutions typically make in person visits feeder institutions and mail out generic materials to potential students, despite receiving a wealth of knowledge on potential applicants from the standardized testing organizations. Consequently, high achieving students at non-feeder high schools may not interact with an admissions counselor from a match school and their printed materials may not stand out from other less selective institutions. Very selective institutions should take affirmative steps to engage high achieving students from rural and non-traditional backgrounds, particularly within their region. This could take the form of personalized

messages to students, inviting targeted students to campus for a special event, or other innovative techniques. Institutions could also collaborate with counselors to inform the student of their interest in a student.

This study suffers from a number of limitations. First, unlike previous studies on undermatching, it lacks data on the college choice process. However, the matrix used to assign students to a selectivity level followed the practices of the Consortium on Chicago Schools Research studies (Roderick et al., 2011; Roderick et al., 2009; Roderick et al., 2008), which had access to this data. Also, the undermatch rate of 60 percent found in this study is nearly identical to the national estimates of undermatching among students with access to very selective institutions using a probability of admission threshold of 80 percent contained in an earlier version of Smith, Pender, and Howell's (2012) study. This level is less conservative than the 90 percent bar to identify undermatches used in their published article (Smith et al., 2013) and by Bowen, Chingos, and McPherson (2009). Since the level used to determine undermatching was less conservative than other studies, the estimated effects of undermatching in this study should conversely be viewed as conservative, as higher bar most likely would have resulted in larger differences between students who did and did not undermatch.

Undermatching studies have been criticized for overstating their ability to accurately predict the probability of admission, particularly at highly selective institutions practicing holistic admissions (Bastedo & Flaster, 2014). This critique is particularly potent for students possessing a unique talent such as in the arts or athletics. However, it fails to acknowledge that students undermatch to a broad class of institutions with varying preferences, not a single institution. If a student has a 25 percent chance of admission to just five highly selective institutions, the probability of admission to at least one is over 75 percent. If the number of

institutions is increased to ten, the probability increases to nearly 95 percent. As a former admissions counselor at a highly selective university that utilized holistic admissions standards, my personal experience indicates the assumptions underlying the undermatching studies are not unreasonable.

I utilized a quasi-experimental methodology, propensity scores, to estimate the effect of undermatching on college outcomes. This method in theory produces unbiased estimates, but can be sensitive to omitted variable bias (Rosenbaum, 2002). In particular, this study lacked data on parental income, which has been associated with undermatching (Smith et al., 2013). However, others have found student-reported parental income data to be unreliable and that community characteristics, like those utilized by this study, were the best predictors of parental income when used to analyze accurate administrative data (Hoxby & Avery, 2012). Despite this, the estimates reported may be biased due to the inability to include other unobserved variables related to undermatching.

Additionally, the self-perceived gains scales should not be viewed as having the same level of validity as a longitudinal evaluation of students' skills development. However, previous research has correlated similar measures with alternative measures of student growth and development (Anaya, 1999; Astin, 1993) and this study controlled for a variety of pre-college characteristics and expectations. Finally, while both BCSSE and NSSE were administered using census or random sampling, the surveys were only administered to students attending institutions that choose to administer them. Therefore, the sample of students used in this study may deviate from the national population of first-year students in unknown ways.

Future research should continue to investigate the undermatching phenomenon. Further research needs to examine how undermatching influences outcomes such as persistence, college

completion, transferring, and long-term labor market outcomes. More research should also investigate why students undermatch and interventions to prevent it.

Conclusion

Students frequently attend colleges less selective than their academic credentials permit. Increasing evidence suggests that this choice impacts their college experience. This study found that undermatches encounter a less challenging academic environment, report fewer gains in their learning and development, and have less satisfaction with their institution. Thus, it is not surprising that undermatches are less likely to complete college (Bowen et al., 2009). Due to the frequency of undermatching, these negative outcomes may be instrumental in reproducing inequality and harming America's future economic prospects.

References

- Alon, S., & Tienda, M. (2005). Assessing the “mismatch” hypothesis: differences in college graduation rates by institutional selectivity. *Sociology of Education*, 78(4), 294-315.
- American School Counselor Association. (n.d.). Student-to-school-counselor ratios Retrieved April 10, 2013, from <http://www.schoolcounselor.org/content.asp?contentid=658>
- Anaya, G. (1999). College impact on student learning: Comparing the use of self-reported gains, standardized test scores, and college grades. *Research in Higher Education*, 40(5), 499-526.
- Astin, A. W. (1993). *What matters in college?: Four critical years revisited*. San Francisco: Jossey-Bass
- Bastedo, M. N., & Flaster, A. (2014). Conceptual and methodological problems in research on college undermatch. *Educational Researcher*, 43(2), 93-99.
- Becker, G. S. (1993). *Human capital: A theoretical and empirical analysis, with special reference to education* (3rd ed.): University of Chicago Press.
- Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). *Crossing the finish line: Completing college at America's public universities*. Princeton, N.J.: Princeton University Press.
- Brewer, D. J., Eide, E. R., & Ehrenberg, R. G. (1999). Does it pay to attend an elite private college? Cross-cohort evidence on the effects of college type on earnings. *Journal of Human Resources*, 34(1), 104-123.
- Glynn, A. N., & Quinn, K. M. (2010). An Introduction to the Augmented Inverse Propensity Weighted Estimator. *Political Analysis*, 18(1), 36-56.
- Goldin, C. D., & Katz, L. F. (2008). *The race between education and technology*. Cambridge, MA: Belknap Press of Harvard University Press.
- Graham, J. W., Olchowski, A. E., & Gilreath, T. D. (2007). How many imputations are really needed? Some practical clarifications of multiple imputation theory. *Prevention Science*, 8(3), 206-213. doi: 10.1007/s11121-007-0070-9
- Hossler, D., Braxton, J., & Coopersmith, G. (1989). Understanding student college choice. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. V, pp. 231-288). New York: Agathon Press.
- Hossler, D., & Gallagher, K. S. (1987). Studying student college choice: A three-phase model and the implications for policymakers. *College and University*, 62(3), 207-221.
- Hoxby, C. M., & Avery, C. (2012). The missing "one-offs": The hidden supply of high-achieving, low-income students (NBER 18586). Cambridge, MA: National Bureau of Economic Research.
- Hoxby, C. M., & Turner, S. (2013). Expanding college opportunities for high-achieving, low income students (SIEPR 12-014). Stanford, CA: Stanford Institute for Economic Policy Research.
- Long, M. C. (2008). College quality and early adult outcomes. *Economics of Education Review*, 27, 588-602.
- McDonough, P. M. (1997). *Choosing colleges: How social class and schools structure opportunity*. New York: University of New York Press.
- McDonough, P. M. (2005). Counseling and college counseling In America's high schools. Alexandria, VA: National Association for College Admission Counseling.

- Melguizo, T. (2008). Quality matters: Assessing the impact of attending more selective institutions on college completion rates of minorities. *Research in Higher Education*, 49(3), 214-236.
- National Survey of Student Engagement. (2012a). Psychometric portfolio. Retrieved May 1, 2012, from http://nsse.iub.edu/_/?cid=154
- National Survey of Student Engagement. (2012b). Validity: BCSSE-NSSE relationships. Retrieved April 10, 2013, from http://nsse.iub.edu/pdf/psychometric_portfolio/Validity_BCSSE-NSSE%20Relationships.pdf
- Oakes, J., Rogers, J., Silver, D., Valladares, S., Terriquez, V., McDonough, P. M., . . . Lipton, M. (2006). Roadblocks to college: Fair college opportunities for all California students. Los Angeles: UC/ACCORD and UCLA/IDEA.
- Roderick, M., Coca, V., & Nagaoka, J. (2011). Potholes on the road to college. *Sociology of Education*, 84(3), 178-211.
- Roderick, M., Nagaoka, J., Allensworth, E., Coca, V., Correa, M., & Stoker, G. (2006). From high school to the future: A first look at Chicago public school graduates' college enrollment, college preparation, and graduation from four-year colleges. Chicago: Consortium on Chicago School Research.
- Roderick, M., Nagaoka, J., Coca, V., & Moeller, E. (2009). From high school to the future: Making hard work pay off. Chicago: Consortium on Chicago School Research.
- Roderick, M., Nagaoka, J., Coca, V., Moeller, E., Roddie, K., Gilliam, J., & Patton, D. (2008). From high school to the future: Potholes on the road to college. Chicago: Consortium on Chicago School Research.
- Rosenbaum, P. R. (2002). *Observational studies* (2 ed.). New York: Springer.
- Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41-55.
- Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.
- Smith, J. (2013). Ova and out: Using twins to estimate the educational returns to attending a selective college. *Economics of Education Review*, 36(0), 166-180.
- Smith, J., Pender, M., & Howell, J. (2012). *The full extent of student-college academic undermatch*. Paper presented at the Annual Conference of the Association for Education Finance and Policy, Boston, MA.
- Smith, J., Pender, M., & Howell, J. (2013). The full extent of student-college academic undermatch. *Economics of Education Review*, 32, 247-261.
- Sosin, M. R. (2002). Outcomes and sample selection: The case of a homelessness and substance abuse intervention. *British Journal of Mathematical and Statistical Psychology*, 55(1), 63-91.
- Thomas, S. L., & Zhang, L. (2005). Post-baccalaureate wage growth within four years of graduation: The effects of college quality and college major. *Research in Higher Education*, 46(4), 437-459.
- Titus, M. A. (2004). An examination of the influence of institutional context on student persistence at 4-year colleges and universities: A multilevel approach. *Research in Higher Education*, 45(7), 673-699.
- Tsiatis, A. A. (2006). *Semiparametric theory and missing data*. New York: Springer.
- U.S. Department of Education. (2009). Digest of education statistics, 2008. Washington: U.S. Government Printing Office.

- U.S. Department of Education. (2013). Digest of education statistics, 2012. Washington: U.S. Government Printing Office.
- Western Interstate Commission for Higher Education. (2008). Knocking at the college door: Projections of high school graduates by state and race/ethnicity, 1992-2022. Boulder, CO: Author.
- Zhang, L. (2005). Advance to graduate education: The effect of college quality and undergraduate majors. *The Review of Higher Education*, 28(3), 313-338.

Table 1. Factors associated with undermatching (N= 7,165)

	B	Std. err.	Exp(B)
<i>Student Characteristics</i>			
High school grades (reference = A)			
B-	2.20	.68	9.03 **
B	1.22	.21	3.38 ***
B+	.46	.10	1.58 ***
A-	-.11	.07	.90
SAT I (100s)	-.59	.03	.55 ***
High School Academic Engagement	-.24	.04	.79 ***
Expected First-year Academic Engagement	-.07	.04	.93 *
Academic Perseverance	-.03	.04	.97
Expected Academic Difficulty	-.23	.03	.79 ***
Perceived Academic Preparation	.21	.03	1.23 ***
Importance of Campus Environment	.01	.03	1.01
Female	.06	.06	1.06
Race/ethnicity (reference = White)			
Asian	-.27	.15	.77
Black	-.08	.18	.92
Hispanic	.04	.18	1.04
Other	-.28	.10	.75 **
Parental Education (reference = Bachelor's)			
Did not finish high school	-.55	.29	.58
High school grad.	.23	.15	1.26
Some college	.11	.13	1.12
Associate's	.29	.13	1.33 *
Master's	-.09	.07	.92
Doctoral	-.42	.10	.66 ***
# of close friends at institution (reference = None)			
1	.02	.08	1.02
2	-.21	.10	.81 *
3	-.33	.13	.72 *
4 or more	-.37	.09	.69 ***
Degree Aspirations (reference = Bachelor's)			
Master's	.05	.08	1.05
Doctoral	-.15	.09	.86
Uncertain	-.23	.10	.79 *
College distance from home (reference = Less than 20 miles)			
21-50 miles	-.77	.13	.46 ***
51-100 miles	-1.78	.12	.17 ***
101-201	-1.33	.12	.26 ***
201-400 miles	-1.30	.12	.27 ***
More than 400 miles	-1.41	.13	.24 ***

Table 1. Continued.

	B	Std. err.	Exp(B)
<i>Community Characteristics</i>			
Med. Household Income (\$10,000s)	-.09	.02	.91 ***
Poverty Rate	-.33	.79	.72
% Black	-.50	.27	.61
% Asian	-1.61	.51	.20 **
% Other Race	-1.08	.91	.34
% Hispanic	-1.77	.52	.17 **
% < High School	-.50	1.01	.60
% High School Deg.	-1.93	.69	.15 **
% Some College	1.35	.92	3.87
% Graduate Deg.	-4.14	1.04	.02 ***
Rural-Urban Continuum (reference = Metro, >1M)			
Metro, 250k-1M	-.23	.08	.79 **
Metro, <250k	-.06	.11	.95
Nonmetro, urban 20k+ adjacent	-.38	.15	.69 *
Nonmetro, urban 20k+ not adjacent	.62	.35	1.86
Nonmetro, urban <20k adjacent	-.05	.19	.95
Nonmetro, urban <20k not adjacent	.31	.25	1.37
Rural, adjacent	.25	.48	1.28
Rural, not adjacent	.70	.42	2.02
Constant	11.25	.74	

Notes: Table presents results from logistic regression estimations of undermatch status. Estimates are logistic regression coefficients derived from analyses of 20 imputed datasets. Standard errors adjusted to account for the uncertainty in the imputation.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 2. Average Treatment Effect Estimates of the Impact of Undermatching on First-year Outcomes (N=7,165)

	Nearest-Neighbor Matching			Augmented Inverse Propensity Weights		
	Est.	Std. err.	Sig.	Est.	Std. err.	Sig.
Level of Academic Challenge	-.208	.030	.000	-.202	.032	.000
Active & Collaborative Learning	.126	.030	.000	.147	.038	.000
Student-Faculty Interaction	.100	.031	.001	.126	.036	.001
Enriching Educational Experiences	-.074	.032	.022	.025	.034	.462
Supportive Campus Environment	-.042	.032	.192	-.067	.047	.154
Gains: Practical Competence	-.073	.032	.022	-.098	.034	.004
Gains: Personal & Social Dev.	-.061	.033	.061	-.103	.040	.010
Gains: General Education	-.138	.031	.000	-.163	.036	.000
Satisfaction with Institution	-.214	.030	.000	-.204	.036	.000

Notes: Estimates derived from analyses of 20 imputed datasets. Standard errors adjusted to account for the uncertainty in the imputation.

Appendix A. Matched selectivity by high school grades and SAT score

SAT Score	High School Grades							
	C-	C	C+	B-	B	B+	A-	A
<800	NS	NS	NS	NS	SS	SS	SS	SS
800-890	NS	NS	NS	SS	SS	SS	SS	SS
900-990	NS	NS	NS	SS	SS	SS	SS	SS
1000-1090	NS	NS	SS	SS	SS	SL	SL	SL
1100-1190	NS	SS	SS	SS	SL	SL	SL	SL
1200-1290	SS	SS	SS	SL	SL	VS	VS	VS
1300-1390	SS	SS	SS	SL	SL	VS	VS	VS
1400-1490	SS	SS	SS	SL	VS	VS	VS	VS
1500-1600	SS	SS	SS	SL	VS	VS	VS	VS

Notes: NS=Nonselective, SS=Somewhat Selective, SL=Selective, VS=Very Selective