

# The Full Extent of Student-College Academic Undermatch

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## *Abstract*

This paper quantifies the extent of student-college “academic undermatch,” which occurs when a student’s academic credentials permit them access to a college or university that is more selective than the postsecondary alternative they actually choose. Using a nationally representative dataset, we find that 41 percent of students undermatch in their postsecondary choice. We also find that academic undermatch affects students with a range of academic credentials, but is more common among those students from low socioeconomic status families, who live in rural areas, and whose parents have no college degree. Finally, we show that between the 1992 and 2004 high school senior cohorts, academic undermatch has decreased by nearly 20 percent. The decrease is partially due to students being more likely to apply to a matched college.

**Keywords:** College Choice, Postsecondary Education, Mismatch, Undermatch

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## 1. Introduction

Academic undermatch occurs when a student's academic credentials permit them access to a college or university that is more selective than the postsecondary alternative they actually choose.<sup>1</sup> Initial research shows that undermatching is pervasive, especially among low-income students, minorities, and first-generation college goers. In North Carolina, 40 percent of students who were highly qualified to attend a selective college in 1999 did not enroll in one (Bowen et al. 2009). In the Chicago Public Schools, about two-thirds of 2005 high school graduating class undermatched (Roderick et al. 2008). While these statistics are large, researchers still do not know the extent of academic undermatch nationally, which is the focus of this research. We also analyze which types of students are likely to undermatch, how undermatch has changed over time, and whether undermatch is likely to occur due to students' application or enrollment decisions or colleges' admission decisions.

Undermatch has garnered increasing amounts of attention from researchers and college administrators because of alarming college graduation statistics in the United States. Only 57 percent of four-year institution enrollees leave with a degree after six years and only 28 percent of two-year institution enrollees leave with a certificate or degree after 150 percent of normal time.<sup>2</sup> This is important because students with higher levels of educational attainment are observed to have higher wages, lower unemployment rates, better health insurance and pensions, greater satisfaction with their jobs, and healthier lifestyles (Baum et al. 2010). Also, students who attend relatively selective colleges are more likely to graduate (Horn and Carroll 2006; Bowen et al. 2009) and to succeed in the labor market (Hoxby 1998; Brewer et al. 1999; Long 2008). Moreover, over the past few decades, even if students manage to graduate, the average time-to-degree has increased, thus expanding the financial burden to students, families, and taxpayers (Bound et al. 2010).

In light of these challenges, researchers have begun to investigate academic undermatch as a potential source of the problem. For example, Light and Strayer (2000) find that students of all academic ability levels have a higher probability of completing a degree if the selectivity level of the

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<sup>1</sup> Academic undermatch is based on how college academic selectivity compares to a student's measured academic ability. The extent to which institutions meet other student needs, including financial and social requirements, are additional determinants of a broader measure of "fit" between students and postsecondary choices. A student may be academically undermatched to a college that is a good fit for other reasons.

<sup>2</sup> U.S. Department of Education, *NCES Digest of Education Statistics, 2010*. The four-year rate is based off of the 2002 cohort and the two-year rate is based off of the 2005 cohort.

college they attend matches their measured academic skill level. Theoretically, undermatched students are not necessarily less likely to graduate than properly matched students. Undermatched students may enjoy all other dimensions and characteristics of a college beyond its academic selectivity. Also, an undermatched student may gain utility from being the “big fish” in a “small pond.” On the other hand, undermatched students may be less likely to graduate for a variety of reasons. A student’s peers and campus culture may influence study habits and whether there is a negative stigma associated with dropping out. Also, less selective institutions typically have smaller budgets and spending per student (Hoxby 2009). This translates into less academic support and less spending on non-academics that students enjoy (e.g. sports, gyms, food, etc.), which has been shown to reduce graduation rates (Webber and Ehrenberg 2010). Thus far, the evidence suggests that undermatched students are less likely to graduate (Bowen and Bok 1998; Light and Strayer 2000; Horn and Carroll 2006; Bowen et al. 2009).

In this study, we use a nationally representative sample of the 2004 graduating high school class to examine the full extent of academic undermatch. We define colleges into the following academic selectivity groups (in order of selectivity): very selective, selective, somewhat selective, nonselective, two-year, and no college. Using a conservative definition of undermatch, we find that 40.9 percent of students enroll in a college below the selectivity level they could have attended. However, there are many dimensions to a student’s college choice beyond academic fit, and so we also consider “substantial” undermatch that occurs when students enroll in a college that is two selectivity levels below the level they could have attended. Using this definition, we find that 16.1 percent of students experience substantial undermatch.

We do not assert that there should be zero undermatch. Rather, some academically qualified students attending academically undermatched colleges may be good for both the undermatched student as well as the student’s peers at the college. However, differences in the prevalence of undermatching by subgroups may lead to differential outcomes by subgroup, such as time-to-degree or degree completion. Thus, we examine the data for evidence of heterogeneity in undermatching by socioeconomic status, race/ethnicity, urbanicity and measures of parental income and educational attainment.

We find that students below the median socioeconomic status (lower-SES) undermatch 49.6 percent of the time while their counterparts above the median SES (higher-SES) undermatch 34 percent of the time. SES gaps in substantial undermatch are also sizeable; 22.7 percent of lower-SES students enroll in a college that is two selectivity levels below the level they could have attended compared to

13.6 percent of higher-SES students. We find that, after controlling for academic achievement, black and Asian students are less likely to undermatch than their white counterparts, students whose parents graduated with a college degree are less likely to undermatch than those students whose parents are without a college degree, and students who live in rural areas are more likely to undermatch than both suburban and urban students.

After documenting the extent of academic undermatch and examining characteristics of students who undermatch, we compare the 1992 cohort with the 2004 cohort to examine cross-cohort differences in the extent of undermatch. *A priori*, whether undermatch has increased or decreased over time is ambiguous. Academic undermatch may have increased because the steady increase of tuition,<sup>3</sup> or perceived tuition, may have forced academically credentialed low-SES students to enroll in less expensive colleges, which are more likely to be nonselective, or not enroll at all. Conversely, both the growth in the internet over this time period and outreach and counseling programs may have increased a student's likelihood of attending a selective institution. We find that 48.9 percent of the 1992 cohort undermatched, which implies that there was an 8 percentage point reduction in undermatch between 1992 and 2004. Also, undermatch for students below and above the median SES has declined, but these declines are larger for lower-SES students, thereby closing the SES gap in undermatch. This is in large part due to an increase in students enrolling in nonselective and two-year colleges.

Finally, we find evidence that both changes in students' applications and enrollment decisions contribute to the decrease in undermatch over time. The number of students who undermatch because they did not apply to a properly matched college decreases from 91.6 percent to 61.3 percent over the twelve year time period. Consequently, conditional on undermatching, a larger fraction of students in 2004 cohort undermatch because they are admitted but choose not to enroll relative to 1992 cohort.

## **2. Prior Evidence of Academic Undermatch and Motivation**

Undermatch is not a new concept, but it is a relatively new term. It is well established in the literature that students of different SES but of similar academic ability often apply and enroll in different colleges (Manski and Wise 1983; Hearn 1991; Kane 1999; Cabrera and La Nasa 2001; Carnevale and Rose 2004; Pallais and Turner 2006; Hill and Winston 2010). This includes both low-SES students being more likely to enroll in two-year colleges and high-SES students being more likely to enroll in the

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<sup>3</sup> See The College Board's *Trends in College Pricing 2011* for details on tuition and net tuition increases over time.

most selective colleges. Researchers also know that low-SES students are less likely to enroll in any college (Baum et al. 2010). These pieces of evidence imply that low-SES students are undermatching. However, these older related studies do not explicitly explore the full extent of undermatching and the multiple ways in which it occurs.

To date, there exist two prominent studies with a focus on academic undermatch; one in the Chicago Public Schools (CPS) and one in North Carolina.<sup>4</sup> The research on the CPS was conducted by the Consortium on Chicago School Research producing several reports and papers on the topic.<sup>5</sup> This thorough account details 2005 CPS high school seniors' experiences, college aspirations, and their transition into and out of college. Similarly, the data on North Carolina comes from *Crossing the Finish Line*, a book that extensively documents statistics and trends on college enrollment, graduation, and time-to-degree. For the purpose of undermatching, they use the 1999 cohort of North Carolina high school seniors and focus primarily on students who are likely eligible to enroll in the most selective public colleges in the state.<sup>6</sup>

Both the CPS and North Carolina studies explore the extent of undermatching and find that, despite the different settings, academic undermatch is a large phenomenon. Perhaps the broadest finding in the CPS is that “only about one-third of CPS students that aspire to complete a four-year degree enroll in a college that matches their qualifications” (Roderick et al. 2008, p. 5). In other words, two-third of these students undermatch. Furthermore, the authors report that 28 percent of students enroll in college slightly below their academic match and more worrisome, 34 percent of students enroll in colleges far below their academic match.<sup>7</sup> In North Carolina, 40 percent of students that were eligible to enroll in the most selective in-state colleges undermatched elsewhere. Each study also discusses the undermatched students' ultimate college destinations and explores student characteristics that are positively associated with undermatch.

The source of academic undermatch is another strand of research. In a forthcoming book, *Divergent Destinations: How Social Class Shapes Even Top Students' Paths to College*, Alexandria Radford (2012), underscores the undermatch problem, especially as a social construct. She surveys high school valedictorians throughout the college admissions and enrollment process to analyze undermatch

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<sup>4</sup> The CPS studies refer to “undermatch” as “mismatch.”

<sup>5</sup> Roderick et al. 2006, 2008, 2009, 2011.

<sup>6</sup> They estimate a student's likelihood of being admitted to University of North Carolina-Chapel Hill and North Carolina State, the two colleges that account for 90 percent of all highly selective in-state enrollment, as defined in the book.

<sup>7</sup> These statistics include non-enrollees.

among this group of students. She concludes that SES plays an important factor in student-college undermatch. Dillon and Smith (2009) primarily focus on the determinants of undermatch and overmatch, but exclude two-year college enrollees and non-enrollees. The authors argue that lack of information about colleges, from parents and high schools, is a major source of undermatching. Finally, a related literature examines how low-SES students differ from high-SES students in preparation, information, and the applications process. Most of the sources are from research not referred to as “undermatch” but rather studies that focus on college choice and enrollment. Since that strand of literature is so large, any review of evidence will not be exhaustive. Instead we refer the reader to College Board (2010) and the essays in Hoxby (2004) for prior evidence and motivation on this topic.

### 3. Data

This study uses data from two nationally representative samples of students: the National Education Longitudinal Study of 1988 (NELS) and the Education Longitudinal Study of 2002 (ELS).<sup>8</sup> Both datasets contain information on students’ high school careers and their transitions into college. In NELS, students are high school seniors in 1992 and their of several follow ups through 2000. In ELS, students are high school seniors in 2004. The most recent follow up with these students was in 2006, when students who enrolled in college directly after high school would be sophomores in college. Due to the differences in NELS and ELS, we will use ELS to describe the most current state of undermatching but use NELS in our discussions on comparisons over time.

In our analyses, we only use “traditional” students. That is, we analyze students who did not drop out of high school and did not graduate early or enroll in college early. After dropping students who were missing critical information on either their background or the colleges to which they apply, we have approximately 6,480 students in NELS and 9,130 students in ELS. A list of key variables on the students’ backgrounds and summary statistics for both the ELS and NELS samples are presented in Table 1.

Throughout the analysis, we refer to colleges of varying academic selectivity. We classify colleges by selectivity using the Barron’s Admissions Competitive Index. The index categorizes colleges into the following categories:

- Most Competitive

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<sup>8</sup> Both datasets are provided by the U.S. Department of Education’s National Center for Education Statistics (NCES). We use the restricted versions so, for privacy purposes, all sample sizes are rounded to the nearest ten.

- Highly Competitive
- Very Competitive
- Competitive
- Less Competitive
- Noncompetitive
- Special

The ordinal categorization is a function of SAT/ACT scores of accepted students and the admission rate and the GPA and class rank required for admission. Barron's does not include two-year colleges, so we use NELS and ELS data to define a two-year college group as well as a group for non-enrollees. We drop all students who enrolled in a Barron's special college because they are usually art or music colleges making academics difficult to measure. We include historically black colleges and universities, though excluding the small fraction of colleges and corresponding enrolled students does not change any results. Due to thinness of data and for ease of interpretation, we further re-categorize groups as follows (Barron's categories in parenthesis):

- *Very Selective* (Most Competitive, Highly Competitive)
- *Selective* (Very Competitive)
- *Somewhat Selective* (Competitive)
- *Nonselective* (Less Competitive, Noncompetitive)
- Two-Year College
- No College

Barron's groupings do not stay constant over time and consequently, NELS and ELS can have different groupings for the same colleges.<sup>9</sup>

We assume that every student has a choice on the extensive margin (whether to enroll) by giving everyone the two-year college option. This also implies that everyone has an intensive margin (where to enroll) option.

#### **4. Measuring Academic Undermatch**

There are a variety of ways to measure academic undermatch. Our approach is similar to Bowen et al. (2009) and Roderick et al. (2008), which is a conservative approach, so that we are likely to

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<sup>9</sup> See Appendix 1 for the changes.

underestimate rather than overestimate the full extent of undermatch. We determine the highest academic selectivity college to which a student has access, given his or her academic credentials, and compare that college to where the student ultimately enrolls. We observe where a student enrolls, but the challenging part is determining the level of college selectivity to which a student has access.

To determine the level of college selectivity to which a student has access, we use data on students' applications and admission offers. We estimate students' probabilities of being admitted to each selectivity level. Formally, we use a probit model to regress whether a student is admitted by any college in a selectivity group on her academic credentials. Our measures of academic credentials include: honors-weighted GPA, ACT or SAT scores, and whether the student participates in Advanced Placement (AP) or International Baccalaureate (IB) coursework. Naturally, there are other academic credentials that predict a student's probability of being admitted. We choose this sparse specification because these are the main academic predictors of a students' likelihood of being admitted by colleges.<sup>10</sup> Also, other predictors are often correlated with these measures. Moreover, this specification will likely understate some individuals' probability of admission, such as beneficiaries of affirmative action or legacy admissions considerations, making our estimates of their probabilities of admission conservative.

To identify each student's probability of being admitted to colleges of each selectivity level, we use two types of variation in student application. First, a single student applies to colleges of different selectivities. For example, a student may apply to both a nonselective and selective college and only be admitted to the nonselective college. Second, one student applies to colleges of a certain selectivity and a second student of similar academic ability applies to colleges of another selectivity. For example, one student may apply to a selective college and not be admitted while the other student applies to a nonselective college and be admitted. This variation within students' applications and across students' applications identifies students' probabilities of admission.

In the probit model, we aggregate applications such that an observation is at the student-level. Hence, if a student applies to three very selective colleges and is admitted by one, we redefine that as a student applying and being admitted by a very selective college, despite being rejected by two.<sup>11</sup> This is

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<sup>10</sup> Including controls for race does not substantially change results using ELS. There are slight changes in NELS but only for black students, who become more likely to undermatch. We take the conservative estimate of their access, which excludes race controls.

<sup>11</sup> A student who applies to three very selective colleges that gets into all three is categorized as applying and admitted by a *very selective* college. The same is true for a student who applies to one *very selective* college and is admitted there.

important because students applying to very selective colleges often apply to many colleges and are often rejected, which indicates that they have a low-probability of being admitted. On the other hand, students applying to nonselective colleges often apply to very few colleges and are admitted, which indicates a high-probability of being admitted. To overcome this challenge, we aggregate the student's applications.

After aggregating applications to a student-level, we predict each student's probability of admission to each college selectivity level. We do not require that a student applied to each college selectivity level, but rather rely on the student's academic qualifications and the estimated coefficients from the probit to see how academic indicators affect the student's probability of admission.

After predicting each student's probability of admission to each college selectivity level, we group students into academic ability levels based on the highest college selectivity to which they likely had access. To do so, we use a threshold of 90 percent. That is, if a student has an estimated 90 percent or greater chance of being admitted by a *very selective* college, then they had access to a *very selective* college. If the student has below a 90 percent chance of being admitted by a *very selective* college, but over a 90 percent chance of being admitted by a *selective* college, then they had access to a *selective* college, and so on.<sup>12</sup> If students have below a 90 percent chance of being admitted to a *nonselective* college, they are assumed to have access to a two-year college.

The final step is categorizing students as undermatched. If students enroll in a college selectivity that is below the college selectivity to which they had access, they are defined to be "academically undermatched." This includes students qualified to go to any selectivity level that enrolled in a two-year college. It also includes all students who did not enroll anywhere because they had the option to enroll in at least a two-year college. However, we recognize that this last group of students may be a somewhat different group. That is, students who are qualified to enroll in a four-year college and undermatch may be different than students who are qualified for a two-year college and do not enroll. Moving forward, we frequently consider just the subsample of students that have access to at least a four-year college. Finally, we also define a "substantial academic undermatch" to be when a student has access to a certain college selectivity level but instead enrolls in a college two selectivity levels below.

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Conditional on student characteristics, the estimation process considers all of these students to be equivalent. Hence, the estimated probability of admission depends on the distribution of students' application sets.

<sup>12</sup> Due to estimation error, some students have a greater than 90 percent predicted probability of getting into a college selectivity level but less than 90 percent predicted probability of getting into the next lower college selectivity level. In these very rare cases, students are determined to have access to the lower of the two college selectivities.

While there is no formal justification for using 90 percent, it is a threshold that connotes a student being very likely to have access.<sup>13</sup> Lower thresholds are attempted and presented in the appendix. As expected, lower thresholds increase the degree of undermatch because students, under this scenario, have more access but their enrollment choices remain unchanged. Thus, the 90 percent threshold is taken to provide a conservative estimate of undermatch.<sup>14</sup>

## 5. Extent of Academic Undermatch

The purpose of this section is to document the full extent of academic undermatch. Our broadest analysis is best documented in Table 2. The rows of the matrix represent to which selectivity level a student has access. The columns of the matrix represent the college selectivity level to which a student enrolls. The matrix in Table 2 represents the entire picture of where students of varying abilities enroll.

The broadest statistic from the table is that 40.9 percent of students undermatch.<sup>15</sup> Also, 16.1 percent of students attend a college that is at least two selectivity levels below a level to which they have access. The cells below the diagonal represent overmatched students. We estimate a sizeable amount of overmatch which is possible because our definition of access relies on a typical student's application set. That is, if the average student applies to one overmatched college (a reach) and is not admitted, then the predicted probability of admission to an overmatch is low. However, there exist many atypical students who apply to numerous overmatch colleges and, despite reaching for selective colleges, the act of applying to many colleges will increase the student's probability of admission to at least one overmatched college.<sup>16</sup>

The undermatch statistics vary substantially by the colleges to which students have access to and colleges they ultimately enroll. The first row includes only students who are predicted to have access to *very selective* colleges. The results to follow should be taken into context in that these are the students with the highest academic credentials, but only account for an estimated 5.1 percent of the student body. As the first cell indicates, 58.5 percent of those students enroll in a *very selective* college. In other

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<sup>13</sup> 90 percent is used in Bowen et al. (2009).

<sup>14</sup> Alternatively, we could use SAT and ACT scores of the student and compare it to the college to which they enroll. The main reason we avoid this alternative methodology is to be consistent with previous literature. In addition, we do not have detailed SAT and ACT college-level data for the 1992 cohort.

<sup>15</sup> As a sensitivity test, we use more liberal definitions of access. We assume that students have access to a college selectivity level if they have an 80 percent chance of being accepted and then an 85 percent chance, as opposed to 90 percent. Results are presented in Appendix 2 and we find that 56.2 percent and 48.9 percent of students undermatch, using the 80 percent and 85 percent thresholds, respectively.

<sup>16</sup> In both cohorts, overmatched students apply to more colleges than matched and undermatched students.

words, they match. It immediately follows that 41.5 percent of these students undermatch. The bulk of students undermatch at either *selective* colleges (25.7 percent) or *somewhat selective* colleges (13.1 percent). Once accounting for the small percent of students who enroll in *nonselective* colleges, two-year colleges, or do not enroll at all, 15.8 percent of students have a substantial undermatch.

Nearly 20 percent of students are estimated to have access to *selective* colleges. Overall, relative to the most academically qualified students, these students have a greater undermatch rate of 47.3 percent and a similar substantial undermatch rate of 16 percent. In fact, 20.8 percent of students overmatch at the *most selective* colleges. However, 31.3 percent enroll in *somewhat selective* colleges. Also, 16 percent of students who have access to *selective* colleges enroll in *nonselective* colleges, two-year colleges, or no college at all.

As we move to the next most academically credentialed students, we see a dramatic shift in the type of undermatch. Students who are qualified to attend *somewhat selective* colleges undermatch 35.1 percent of the time, which is lower than the more credentialed students. However, 25.9 percent are substantial undermatches. Restated, 74 percent of the undermatch is substantial undermatch. In comparison, for the first two groups of students substantial undermatch represents 38 percent and 34 percent of total undermatch, respectively. As the Table 2 shows, for students who are qualified to attend *somewhat selective* colleges, the large undermatch is mainly driven by a large amount of students enrolling in two-year colleges.

Turning to students with access to *nonselective* colleges, there is also about 35 percent undermatch. The majority of students who undermatch enroll in two-year colleges, which implies a relatively small percent (24.3) of the undermatch being substantial undermatch. Interestingly, there is not much match but a great deal of overmatch.

The final group examined in Table 2 is students who are not predicted to have sufficient academic credentials to gain admission to a four-year college. They also account for nearly 50 percent of all students. This group is quite a bit different from previous groups and the only source of undermatch is not enrolling, which occurs 41.2 percent of the time.

## **6. Characteristics of an Undermatched Student**

This section examines characteristics that are likely to be strong predictors of academic undermatch. Based on previous research, we focus on students' SES, race/ethnicity, parental education

and income, and high school urbanicity. These characteristics are not an exhaustive list of potential sources of undermatch, but we believe they are likely the most important indicators.

We first re-examine the extent of academic undermatch, as in Table 2, by comparing lower-SES and higher-SES students. Lower-SES students are defined to be below the median SES. After presenting the undermatch matrix separately for lower-SES and higher-SES, we use regression analysis to test for statistical differences in undermatch by SES and also by the aforementioned characteristics. In the regressions, the outcome variable is an indicator of whether the student undermatches (equal to one if undermatched, zero otherwise). We use a linear probability model, but results are also consistent with non-linear specifications. In our analyses, we start with a sparse specification that regresses whether the student undermatches on the characteristics and then add controls. We believe the multiple specifications, from sparse to saturated, are informative because many statements that the literature and this research make are about unconditional relationships. Often times, apparent relationships disappear with the inclusion of certain control variables and if undermatch is to be addressed with policy, it is important to target the appropriate area. Finally, we also run specifications where the outcome variable equals one if the student has a substantial undermatch and zero otherwise.

### **6.1. Socioeconomic Status**

Table 3 displays the differences in the extent of academic undermatch by SES. Lower-SES students undermatch 49.6 percent of the time whereas higher-SES students undermatch 34 percent of the time. Similarly, lower-SES students have substantial undermatch 22.7 percent of the time compared to 13.6 percent of the time for higher-SES students. Almost 50 percent of lower-SES students who have the option to enroll in two-year colleges do not enroll compared to 29 percent of higher-SES students. This is one of the biggest contributors to the aggregate differences in undermatch across SES levels. Also, lower-SES students have higher undermatch rates at each level of access.

Table 4 presents results on the statistical relationship between SES and academic undermatch. The omitted variable is SES quartile 4, the wealthiest quartile indicator. The first specification shows an unconditional 24 percentage point greater probability of being undermatched for SES quartile 1, relative to SES quartile 4. There are greater, but increasingly smaller, probabilities of being undermatched between the next two quartiles, relative to quartile 4 as well.

The second specification adds controls for academic achievement (GPA, AP/IB participation, SAT/ACT scores and participation) and the third specification adds controls for the student's

race/ethnicity and urbanicity of the student's high school (rural, suburban, or urban). The coefficients on all SES quartile indicators remain fairly consistent in both specifications. The fourth specification uses the subsample of students who have access to at least a *nonselective* (four-year) college, but the results are relatively unchanged. This last result is a test that previous results, such as specification three, are not driven by people who choose the labor force and are labeled undermatch because we assumed they have access to a two-year college.

Specifications five, six, and seven present results similar to the first three specifications but instead use substantial undermatch as outcomes variable. A similar pattern arises in that students in lower SES quartiles are more likely to have substantial undermatch, regardless of the set of controls. However, the magnitudes of the coefficients are smaller than the left panel, suggesting that there exist greater differences in undermatch by SES than the differences in substantial undermatch.

## **6.2. Race/Ethnicity, Parental Education and Income, High School Urbanicity**

Table 5 displays results on the relationship between several student characteristics and academic undermatch.<sup>17</sup> In the first four unconditional specifications, black and Asian students are less likely to undermatch than white students, rural and suburban high school students are more likely to undermatch than urban high school students, students whose parents have a high school degree or less and some college are more likely to undermatch than students whose parents have a college degree or more, and students whose parents have incomes of less than \$100,000 are more likely to undermatch than students whose parents have incomes of more than \$100,000.

Specifications five and six include all the previously mentioned student characteristics as well as the measures of academic achievement. This will eliminate some of the potential biases in the previous specifications. Specification six excludes students who only have access to two-year colleges, in case there are substantial differences between these students and those eligible for four-year colleges.

As exhibited, specification five implies that black students are 8.9 percent less likely to undermatch than white students after controlling for other student characteristics. Specification six has an estimated coefficient on black students of -0.157, an even greater difference. Similarly, even with a full set of controls, Asian students are less likely to undermatch than white students and there is

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<sup>17</sup> We exclude student SES because it is a function of parents' education and income, which we are separately interested in.

marginal evidence that the same is true for Hispanic students although the magnitude of the coefficient is much smaller relative to coefficients obtained for black and Asian students.

The estimated coefficients on a rural high school location are 0.063 and 0.09 and are statistically different than an urban high school location. However, unlike the unconditional estimates, a suburban high school location is not statistically different. Hence, rural high school students are much more likely to undermatch than suburban high school students.

In specifications five and six, students whose parents have a high school education or less and some college are approximately 10 percentage points more likely to undermatch than students whose parents have a college degree or more. Even conditional on these educations, parents' incomes also predict whether a student undermatches. The first two coefficient estimates, income less than \$25,000 and income between \$25,000 and \$50,000, are large in magnitude and statistically different than the omitted variable, income of more than \$100,000. Some estimates are as high as 20 percentage points more likely to undermatch. Also, students whose parents' income is a little bit higher, between \$50,001 and \$100,000, are also more likely to undermatch, but not as likely as the lower income groups.

Specifications seven through eleven have results for the same regression but using substantial undermatch as the outcome variable. Most of the results are very similar to the left panel. The notable exception is that the coefficient on rural high school is not statistically different than zero, implying that high school location is not a good predictor of substantial undermatch.

### **6.3. Remarks on Students' Characteristics**

Though none of the regressions show a causal relationship between undermatching and student characteristics, some interesting results appear, as well as some unanswered questions. As for race/ethnicity, black and Asian students are less likely to undermatch than white students. But these are for very different reasons. Asian students are less likely to undermatch because they have access to relatively selective colleges and are very likely to enroll in one of those selective colleges. Black students are estimated to have little access to selective colleges and so mechanically, they have less of an opportunity to undermatch.<sup>18</sup> In addition, research on affirmative action confirms that black students apply and are admitted to (Long 2004). But why are Hispanic students less likely to undermatch than

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<sup>18</sup> Appendix 3 separately presents the matrices of college access and college choice for Asian, black, Hispanic, and white students.

black students when excluding students with access to only two-year colleges? This remains an open question.

Also, students whose parents have a college education are much less likely to undermatch. This may be because relatively more educated parents have more information on the college going process. It could also mean that these students have stronger networks of friends and alumni, who may also provide information. Similarly, students who live in rural areas have fewer colleges nearby than students who live in urban or suburban areas. The lack of a nearby college may influence a student's desire to attend college and qualified non-enrollees increase the extent of undermatch. Rural students may also have a lack of information on college options, whereas an urban student may know several local options. Most of these stories are consistent with information playing an important role in undermatch.

## 7. Academic Undermatch Over Time

This section investigates whether the extent of undermatch has changed over time. We compare the 1992 cohort of graduating high school seniors with the previously estimated 2004 cohort. As mentioned, the direction of the change in undermatch is ambiguous and, consequently, an empirical question. Understanding the temporal changes and how these changes arise may shed light on future policy.

Similar to Table 2, the top panel of Table 6 displays the distribution of the 1992 cohort by which college selectivity level they had access to and which college selectivity level they enrolled in. The bottom panel calculates the difference (2004 cohort minus 1992 cohort) between the two cohorts. The broadest measure in the top panel states that 48.9 percent of students in the 1992 cohort undermatch. This implies that, over the 12 year span, there is an 8.0 percentage point (16.4 percent) reduction in academic undermatch. The next broad statistic states that 19.8 percent of students experienced substantial undermatch in 1992, compared to 16.1 percent in 2004, which is a decrease in substantial undermatch of 3.6 percentage points (18.7 percent).

There have been decreases in both undermatch and substantial undermatch over the time span, but the details on where the reductions occur are masked in these aggregate statistics. As Table 6 also shows, there is an 11.7 percentage point increase in undermatch for students with access to the *most selective* category and 7.1 percentage point increase in substantial undermatch. This is the only academically credentialed group of students that have a large increase in undermatch over time, which is

partially because of the increase in access. Among students who have access to *selective* colleges, 53.8 percent undermatch and 19.8 percent have substantial undermatch. These statistics decrease by 2004. There is relatively little change in the number of students who have access to *somewhat selective* colleges between 1992 and 2004. On the other hand, there is a large decrease in the number of undermatched students for those with access to both *nonselective* and two-year colleges. In fact, 56 percent of students who could have enrolled in two-year colleges in 1992 chose not to do so. In comparison, this statistic is 41.2 percent for the 2004 cohort (a 14.8 percentage point change). This may represent a change in student actions, with more students choosing to attend two-year schools in 2004 compared to 1992, or signify an expansion of outreach by the two-year colleges.

The results in Table 6 do not provide any information on the student characteristics associated with undermatch beyond their academic qualifications, yet the decrease in undermatch over time could be concentrated in any type of student. To investigate this in a broad but meaningful way, Table 7 disaggregates the Table 6 results for students above and below the median SES. The bottom two panels of the table show how these numbers compare to the 2004 cohort. In 1992, 61.2 percent of lower-SES students undermatch whereas only 38.9 percent of higher-SES students undermatch. This implies that there was an 11.6 percentage point decrease in undermatch for lower-SES students and a 4.9 percent decrease for higher-SES students. Among lower-SES students, most of these decreases over time stem from students with access to *nonselective* and two-year colleges. Among higher-SES students, the decrease over time also comes from students with access to two-year colleges.<sup>19</sup>

### **7.1. Why Has Academic Undermatch Changed Over Time**

This section investigates the mechanisms behind the documented change in academic undermatch over time. Generally speaking, there are several reasons undermatch may have become less prevalent between 1992 and 2004. First, student decisions may have changed. That is, students may have changed the way they apply to colleges and, conditional on being admitted, where they choose to enroll. Second, colleges may have changed their enrollment processes. For example, colleges may have become more selective, which has been documented over the last several decades (Hoxby 2009). As Appendix 1 indicates, *Barron's*, and consequently data employed in this paper, have seen an increase in

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<sup>19</sup> Appendices 4 and 5 present results of regressions on the characteristics of an undermatched student, analogous to those in Tables 4 and 5, but using NELS data. There are no substantial changes in the predictors of being undermatched across the two cohorts.

college selectivity over the period of interest. However, many of the metrics used to estimate selectivity are a function of student decisions, such as applications and enrollment. Hence, it is impossible to isolate the effect of changing college selectivity on undermatching without considering student decisions. Therefore we focus on the student side of the problem.

To investigate where academic undermatch occurs in the student-college matching process, we decompose students who undermatch in each cohort into three parts. First, undermatch can occur because students do not apply to more selective colleges. Second, students may not be admitted to the colleges to which they apply, even if we predict them to be accessible. Theoretically, this should be a small portion of the undermatched. Yet, a reasonably qualified student may only apply to one very selective college when our accessibility estimates are based on observed behavior, which may include multiple applications to very selective colleges. In addition, estimation error contributes to this portion. Third, students may be admitted to a matched college, but choose not to enroll. Because we observe application, admission and enrollment decisions in the data, we can decompose the process to better understand where in the pipeline researchers and policymakers should focus their attention. We can also learn whether students' actions that contribute to undermatch have changed over the period of interest.

Figure 1 presents the results of this decomposition.<sup>20</sup> The left side of the bar chart uses all students in the 1992 cohort and shows that 91.6 percent of students undermatched because they did not apply to a college selectivity that matches their academic credentials. Approximately 1.9 percent of students applied to a matched or overmatched college but were not admitted. The residual 6.5 percent is from students who apply, are admitted, but choose not to enroll in a matched college.

The right side of the figure presents the same decomposition for the 2004 cohort and finds striking differences. Overall, 61.3 percent of students undermatched because they did not even apply to a matched college, which implies a dramatic 30 percentage point drop in undermatching at the college application stage between the 1992 and 2004 cohorts. Most of the decrease in students not applying to matched schools over this time is redistributed to students who are admitted to a matched college, but choose not to enroll (30.5 percent).

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<sup>20</sup> The 1992 cohort lists up to three applications and the 2004 cohort has no limit. We conduct sensitivity tests and rule out that the differences in the table across cohorts are driven by data differences. Results of the sensitivity tests are in Appendix 6. For example, we know in each cohort when a student applies to exactly zero or one college and can perform the decomposition on this subset of students.

Figure 2 shows the decomposition in application, admission and enrollment by SES. We see important differences by SES: 55.5 percent of students above the median SES undermatch because they did not apply compared to 66.4 percent of students below the median SES. This means that students above the median SES had an 11 percentage point greater increase in applying to matched colleges over the twelve years dividing these two cohorts than lower-SES students. Figure 3 presents the same information by parental education, which looks very similar to student SES. Students whose parents have a college degree saw greater improvements in applying to matched colleges than students whose parents have no college degree.

The observed changes over time indicate that there has been a substantial increase in students applying to matched colleges, which may account for the corresponding decrease in undermatch. It is not particularly surprising that we see more applications to matched colleges because there have been substantial national, state, and institutional efforts to get more people to apply and enroll in college. Moreover, this time period corresponds to the rise of the internet, which dramatically changed the way students search for and apply to colleges.

## 8. Conclusion

This research has shown several important points. First, academic undermatch is pervasive; over 40 percent of students undermatch. Second, undermatch manifests itself in many ways. Sometimes students go to colleges just below what their academic credentials would predict, but quite often students enroll in colleges that are substantially below their measured academic achievements. Even among the most academically credentialed students, academic undermatch exists. However, almost mechanically, less credentialed students are much more likely to undermatch into two-year colleges or no college at all. Third, academic undermatch is more common among students from rural areas and low-SES families with relatively less educated parents. Finally, we find that undermatch has decreased between 1992 and 2004, in part because of changing student decisions, especially the decision to enroll in *nonselective* and two-year colleges, and in part because of changing college selectivity over this time period.

We view this paper as setting the stage for future research and policy on this topic. We have presented some much-needed evidence on undermatching, but many unanswered questions remain. First and foremost, what are the consequences of this substantial amount of undermatching? That is, how does undermatch affect student outcomes, such as college graduation, time-to-degree, and labor

market earnings? Evidence on the answers to these questions should shape how much time and resources researchers and policy makers are willing to dedicate to ameliorating the undermatch phenomenon. Researchers can further the discussion by providing evidence on potential solutions to undermatch.<sup>21</sup> Why has undermatch decreased over time? Additional understanding of why the extent of undermatch declined between 1992 and 2004, especially due to changes in student decision-making, may reveal more about the sources of undermatching.

Finally, what can we learn about the delicate interplay between academic match and overall fit between a student and a postsecondary choice. It is important to stress that, in many instances, the behavior labeled “academic undermatch” in this paper may be a good decision for the student. A good academic match between student and institution may result in a poor “fit” for the student for a variety of reasons that are not purely academic (e.g. financial factors, geography, field of study, extracurricular activities, student support systems, etc.). Attending a less selective college that very likely carries a smaller net price may offer many students an inexpensive way to determine if college is the right choice for them, thereby allowing non-completers to leave without excessive student loan debt for having explored postsecondary education. We know relatively little about this trade-off between match and fit and cost, and how it all relates to the probability of student success.

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<sup>21</sup> Caroline Hoxby and Sarah Turner have a large-scale project underway to assess strategies to reduce undermatch.

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**Table 1: Summary Statistics**

Variable	2004 Cohort of High School Seniors (9,130 obs)				1992 Cohort of High School Seniors (6,480 obs)			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
High School GPA <sup>1</sup>	2.80	0.81	0	4.59	14.03	28.00	0	104.06
Participate in AP/IB	0.33	0.47	0	1	0.15	0.35	0	1
SAT <sup>2</sup>	1044	201	420	1600	920	202	400	1530
ACT <sup>3</sup>	20.27	4.52	9	34	20.95	4.39	4	35
Male	0.48	0.50	0	1	0.51	0.50	0	1
Race								
White	0.67	0.47	0	1	0.77	0.42	0	1
Black	0.12	0.33	0	1	0.09	0.29	0	1
Hispanic	0.12	0.33	0	1	0.09	0.28	0	1
Asian	0.05	0.21	0	1	0.04	0.19	0	1
Other	0.05	0.21	0	1	0.01	0.09	0	1
Parents' Education								
High School or Less	0.24	0.42	0	1	0.26	0.44	0	1
Some College or Two-Year	0.34	0.47	0	1	0.38	0.49	0	1
Graduated College or More	0.42	0.49	0	1	0.27	0.44	0	1
Parent's Income								
Less Than \$25,000	0.18	0.38	0	1	0.23	0.42	0	1
\$25,000 - \$50,000	0.31	0.46	0	1	0.31	0.46	0	1
\$50,001 - \$100,000	0.37	0.48	0	1	0.25	0.43	0	1
More Than \$100,000	0.15	0.36	0	1	0.05	0.23	0	1
Socioeconomic Status								
Quartile 1 (Lowest)	0.20	0.40	0	1	0.19	0.39	0	1
Quartile 2	0.24	0.43	0	1	0.26	0.44	0	1
Quartile 3	0.26	0.44	0	1	0.27	0.45	0	1
Quartile 4 (Highest)	0.30	0.46	0	1	0.28	0.45	0	1
High School Location								
Rural	0.20	0.40	0	1	0.34	0.47	0	1
Suburban	0.53	0.50	0	1	0.43	0.50	0	1
Urban	0.27	0.44	0	1	0.22	0.42	0	1
High School Percent Free Lunch <sup>4</sup>	19.93	16.66	0	95.17	20.06	19.69	0	100

Notes: Data are from Education Longitudinal Study (2002) and students graduate high school in 2004. All results use sampling weights. Observations rounded to the nearest ten. Some students did not take the SAT or ACT. High school percent free lunch is not reported for many students.

1. High School GPA in NELS is not in a traditional scale, but retains relative properties.
2. Not everyone takes the SAT so there are only 4,020 obs in ELS and 2,150 obs in NELS.
3. Not everyone takes the ACT so there are only 2,540 obs in ELS and 2,150 obs in NELS.
4. Only 6,010 obs in ELS.
5. 1,090 students in NELS miss information on parent's education, family income, or high school percent free lunch.

**Table 2: Extent of Academic Undermatching - College Access versus College Choice**

		Enrolled in:								
		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College	Total (by access)	Percent Undermatch	Percent Substantial Undermatch
Access to:	Very Selective	58.5	25.7	13.1	1.4	1.0	0.3	5.1	41.5	15.8
	Selective	20.8	31.9	31.3	4.5	8.6	2.9	19.7	47.3	16.0
	Somewhat Selective	6.0	21.5	37.4	9.2	21.0	4.9	16.1	35.1	25.9
	Nonselective	2.5	8.4	40.7	13.0	26.8	8.6	9.5	35.4	8.6
	Two-Year	1.1	2.6	9.5	6.2	39.4	41.2	49.7	41.2	--
	Total (by enrolled)	8.8	13.1	21.5	6.8	27.2	22.7	100.0	40.9	16.1*

Notes: Table created using the 2004 cohort of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*This statistic excludes students with access to two-year colleges since by definition they cannot have a substantial undermatch.

**Table 3: Extent of Academic Undermatching - College Access versus College Choice  
By Socioeconomic Status**

*Lower-SES Students*

Enrolled in:

Access to:

	Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College	Total (by access)	Percent Undermatch	Percent Substantial Undermatch
Very Selective	47.3	31.2	15.5	3.3	2.2	0.6	1.1	52.8	21.6
Selective	14.6	25.4	34.9	6.1	14.1	4.9	10.8	60.0	25.1
Somewhat Selective	4.0	16.1	29.5	12.0	30.1	8.3	10.8	50.4	38.4
Nonselective	3.1	7.1	37.5	13.1	29.8	9.5	8.5	39.2	9.5
Two-Year	0.3	1.3	6.0	5.7	37.7	49.1	68.9	49.1	--
Total (by enrolled)	3.0	6.3	14.4	7.0	33.2	36.1	100.0	49.6	22.7*

*Higher-SES Students*

Enrolled in:

Access to:

	Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College	Total (by access)	Percent Undermatch	Percent Substantial Undermatch
Very Selective	59.7	25.2	12.9	1.2	0.9	0.3	8.3	40.4	15.2
Selective	22.7	34.0	30.2	4.0	6.8	2.3	26.6	43.3	13.1
Somewhat Selective	6.9	23.7	40.7	8.0	17.3	3.4	20.2	28.7	20.7
Nonselective	2.1	9.2	42.8	13.0	24.9	8.0	10.3	32.9	8.0
Two-Year	2.3	4.7	15.1	7.0	42.1	28.8	34.6	28.8	--
Total (by enrolled)	13.4	18.5	27.0	6.6	22.5	12.1	100.0	34.0	13.6*

Notes: Table created using the 2004 cohort of graduating seniors and uses sample weights. Lower-SES students are below the median SES. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*This statistic excludes students with access to two-year colleges since by definition they cannot have a substantial undermatch.

**Table 4: Academic Undermatching by Socioeconomic Status**  
*Linear Probability Model, Outcome Variable = 1 if Student Undermatches*

<u>Variable</u>	<u>Undermatch</u>				<u>Substantial Undermatch</u>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SES quartile 1	0.242*** (0.017)	0.240*** (0.019)	0.255*** (0.019)	0.203*** (0.032)	0.137*** (0.025)	0.141*** (0.026)	0.145*** (0.026)
SES quartile 2	0.170*** (0.017)	0.169*** (0.018)	0.169*** (0.018)	0.156*** (0.026)	0.118*** (0.019)	0.111*** (0.020)	0.112*** (0.020)
SES quartile 3	0.101*** (0.016)	0.105*** (0.017)	0.105*** (0.017)	0.108*** (0.021)	0.084*** (0.016)	0.083*** (0.016)	0.082*** (0.016)
Constant	0.293*** (0.011)	0.431*** (0.029)	0.450*** (0.031)	0.107 (0.128)	0.103*** (0.008)	0.147 (0.102)	0.165 (0.102)
Controls for Academic Achievement	No	Yes	Yes	Yes	No	Yes	Yes
Controls for Race and HS Urbanicity	No	No	Yes	Yes	No	No	Yes
Excluding Students With Access to Two-Year Colleges	No	No	No	Yes	Yes	Yes	Yes
Observations	9,130	9,130	9,130	4,920	4,920	4,920	4,920
R-squared	0.033	0.074	0.082	0.062	0.021	0.045	0.053

Notes: Observations rounded to the nearest ten. Robust standard errors in parenthesis. \*\*\* means significant at 1% level, \*\* is 5%, and \* is 10%. Undermatch is when a student enrolls in a college one selectivity level below where the student could enroll. Substantial undermatch is two selectivity levels below and excludes students with access to only two-year colleges, since they cannot have a substantial undermatch. Controls for academic achievement include GPA, AP/IB participation, SAT and ACT scores and participation dummies. SES quartile 4 is the omitted dummy variable.

**Table 5: Academic Undermatching by Student Characteristics**  
*Linear Probability Model, Outcome Variable = 1 if Student Undermatches*

Variable	Undermatch						Substantial Undermatch				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Black	-0.084*** (0.019)	--	--	--	-0.089*** (0.020)	-0.157*** (0.034)	-0.121*** (0.015)	--	--	--	-0.107*** (0.019)
Hispanic	0.017 (0.020)	--	--	--	-0.053** (0.021)	-0.022 (0.037)	0.038 (0.029)	--	--	--	0.030 (0.030)
Asian	-0.103*** (0.024)	--	--	--	-0.082*** (0.025)	-0.063** (0.031)	-0.070*** (0.017)	--	--	--	-0.053*** (0.019)
Other Race	0.031 (0.030)	--	--	--	0.010 (0.028)	-0.039 (0.039)	0.003 (0.031)	--	--	--	0.010 (0.031)
HS Location - Rural	--	0.115*** (0.018)	--	--	0.063*** (0.018)	0.090*** (0.026)	--	0.065*** (0.019)	--	--	0.018 (0.020)
HS Location - Suburban	--	0.029** (0.015)	--	--	0.014 (0.014)	0.012 (0.020)	--	0.040*** (0.015)	--	--	0.023 (0.015)
Parents' Educ. - HS or Less	--	--	0.215*** (0.016)	--	0.141*** (0.018)	0.110*** (0.028)	--	--	0.148*** (0.022)	--	0.120*** (0.024)
Parents' Educ. - Some College	--	--	0.140*** (0.014)	--	0.095*** (0.015)	0.118*** (0.021)	--	--	0.097*** (0.016)	--	0.078*** (0.017)
Parents' Income Less Than \$25,000	--	--	--	0.262*** (0.020)	0.210*** (0.024)	0.148*** (0.037)	--	--	--	0.218*** (0.034)	0.062** (0.030)
Parents' Income \$25,000 - \$50,000	--	--	--	0.241*** (0.018)	0.189*** (0.020)	0.189*** (0.026)	--	--	--	0.256*** (0.024)	0.078*** (0.020)
Parents' Income \$50,001 - \$100,000	--	--	--	0.150*** (0.017)	0.119*** (0.018)	0.122*** (0.022)	--	--	--	0.164*** (0.021)	0.038** (0.015)
Constant	0.420*** (0.008)	0.310*** (0.009)	0.370*** (0.012)	0.234*** (0.014)	0.358*** (0.033)	-0.017 (0.127)	0.170*** (0.008)	0.127*** (0.012)	0.112*** (0.007)	0.251*** (0.016)	0.113 (0.102)
Controls for Academic Achievement	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Excluding Students With Access to Two-Year Colleges	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,130	9,130	9,130	9,130	9,130	4,920	4,920	4,920	4,920	4,920	4,920
R-squared	0.005	0.007	0.033	0.031	0.093	0.081	0.009	0.004	0.025	0.035	0.060

Notes: Observations rounded to the nearest ten. Robust standard errors in parenthesis. \*\*\* means significant at 1% level, \*\* is 5%, and \* is 10%. Undermatch is when a student enrolls in a college one selectivity level below where the student could enroll. Substantial undermatch is two selectivity levels below and excludes students with access to only two-year colleges, since they cannot have a substantial undermatch. Controls for SAT and ACT participation dummies. White student is the omitted dummy variable as is urban, college educated parents, the parents income greater than \$100,000.

**Table 6: Extent of Academic Undermatching - College Access versus College Choice  
Changes Over Time - 1992 Cohort**

	Enrolled in:						Total (by access)	Percent Undermatch	Percent Substantial Undermatch
	Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College			
Very Selective	70.2	21.2	4.5	1.6	0.0	2.6	2.4	29.8	8.7
Selective	21.7	24.5	34.0	10.0	6.5	3.3	16.4	53.8	19.8
Somewhat Selective	7.2	21.7	36.2	11.4	16.9	6.7	18.0	35.0	23.6
Nonselective	4.2	10.0	29.3	12.8	26.1	17.6	19.1	43.7	17.6
Two-Year	0.6	2.1	6.7	4.8	29.8	56.0	44.1	56.0	--
Total (by enrolled)	7.6	11.3	20.8	8.2	22.2	29.9	100.0	48.9	19.8*

*Difference Between 2004 Cohort (2004 minus 1992)*

	Enrolled in:						Total (by access)	Percent Undermatch	Percent Substantial Undermatch
	Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College			
Very Selective	-11.7	4.5	8.7	-0.2	1.0	-2.3	2.7	11.7	7.1
Selective	-0.9	7.4	-2.7	-5.4	2.0	-0.4	3.3	-6.5	-3.8
Somewhat Selective	-1.2	-0.3	1.2	-2.2	4.1	-1.8	-2.0	0.1	2.3
Nonselective	-1.8	-1.6	11.4	0.2	0.7	-9.0	-9.6	-8.3	-9.0
Two-Year	0.5	0.5	2.8	1.4	9.6	-14.8	5.6	-14.8	--
Total (by enrolled)	1.2	1.8	0.6	-1.5	5.0	-7.3	0.0	-8.0	-3.7*

Notes: Table created using the 1992 cohort of graduating seniors (n=6,490) and uses sample weights. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*This statistic excludes students with access to two-year colleges since by definition they cannot have a substantial undermatch.

**Table 7: Extent of Academic Undermatching - College Access versus College Choice  
Changes Over Time - 1992 Cohort**

*Lower-SES Students*

		Enrolled in:						Total (by access)	Percent Undermatch	Percent Substantial Undermatch
		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College			
Access to:	Very Selective	59.6	34.0	0.0	0.0	0.0	6.5	0.6	40.5	6.5
	Selective	10.8	19.7	33.8	16.4	9.9	9.4	7.8	69.5	35.7
	Somewhat Selective	1.0	21.6	33.6	13.0	22.5	8.4	11.6	43.9	30.9
	Nonselective	2.0	6.6	21.7	13.5	30.7	25.5	17.8	56.2	25.5
	Two-Year	0.4	0.6	3.4	4.1	26.5	65.0	62.3	65.0	--
	Total (by enrolled)	1.9	5.8	12.5	7.7	25.3	46.8	100.0	61.2	29.0*

*Higher-SES Students*

		Enrolled in:						Total (by access)	Percent Undermatch	Percent Substantial Undermatch
		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College			
Access to:	Very Selective	71.5	19.6	5.0	1.8	0.0	2.2	3.8	28.5	8.9
	Selective	24.7	25.8	34.0	8.2	5.6	1.7	23.4	49.5	15.5
	Somewhat Selective	9.3	21.5	37.6	10.8	14.7	6.0	23.1	31.5	20.7
	Nonselective	5.8	12.5	34.7	12.2	22.9	11.9	20.2	34.8	11.9
	Two-Year	1.0	4.7	12.3	6.0	35.5	40.4	29.5	40.4	--
	Total (by enrolled)	12.1	15.7	27.5	8.7	19.8	16.2	100.0	38.9	15.8*

*Difference Between 2004 Cohort (2004 minus 1992) - Lower-SES Students*

		Enrolled in:						Total (by access)	Percent Undermatch	Percent Substantial Undermatch
		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College			
Access to:	Very Selective	-12.3	-2.8	15.5	3.3	2.2	-5.8	0.5	12.3	15.1
	Selective	3.8	5.7	1.2	-10.3	4.2	-4.5	3.0	-9.4	-10.6
	Somewhat Selective	3.0	-5.5	-4.1	-1.1	7.6	-0.1	-0.8	6.5	7.5
	Nonselective	1.1	0.5	15.8	-0.4	-1.0	-16.0	-9.3	-17.0	-16.0
	Two-Year	-0.1	0.7	2.6	1.6	11.2	-15.9	6.6	-15.9	--
	Total (by enrolled)	1.1	0.5	1.9	-0.7	7.9	-10.7	0.0	-11.6	-6.3*

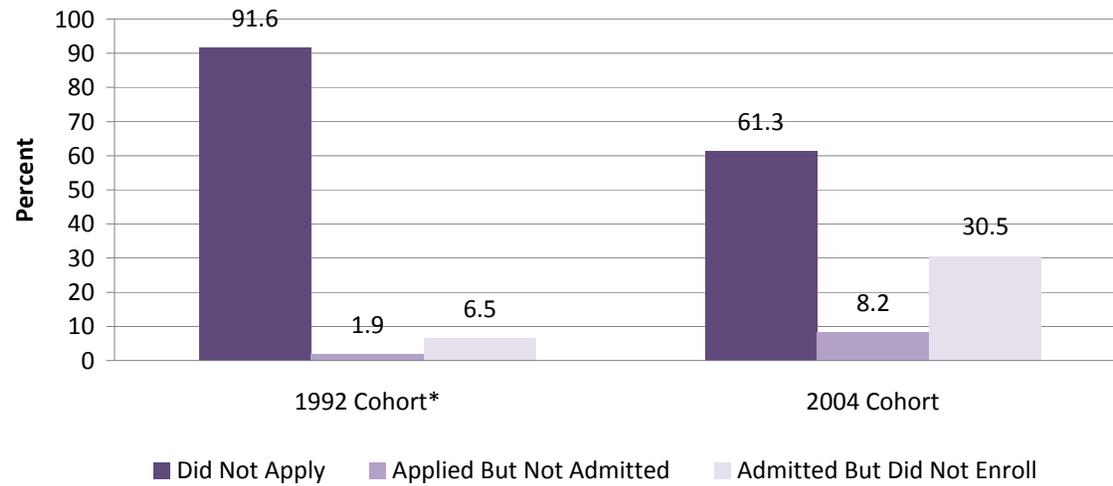
*Difference Between 2004 Cohort (2004 minus 1992) - Higher-SES Students*

		Enrolled in:						Total (by access)	Percent Undermatch	Percent Substantial Undermatch
		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College			
Access to:	Very Selective	-11.8	5.6	7.9	-0.6	0.9	-1.9	4.5	11.8	6.3
	Selective	-2.0	8.2	-3.8	-4.2	1.2	0.6	3.2	-6.2	-2.4
	Somewhat Selective	-2.5	2.2	3.1	-2.8	2.6	-2.6	-2.9	-2.7	0.0
	Nonselective	-3.7	-3.3	8.1	0.8	2.0	-3.9	-9.9	-1.9	-3.9
	Two-Year	1.3	0.0	2.8	1.0	6.6	-11.6	5.1	-11.6	--
	Total (by enrolled)	1.3	2.8	-0.6	-2.1	2.7	-4.1	0.0	-4.9	-2.2*

Notes: Table created using the 1992 cohort of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*This statistic excludes students with access to two-year colleges since by definition they cannot have a substantial undermatch.

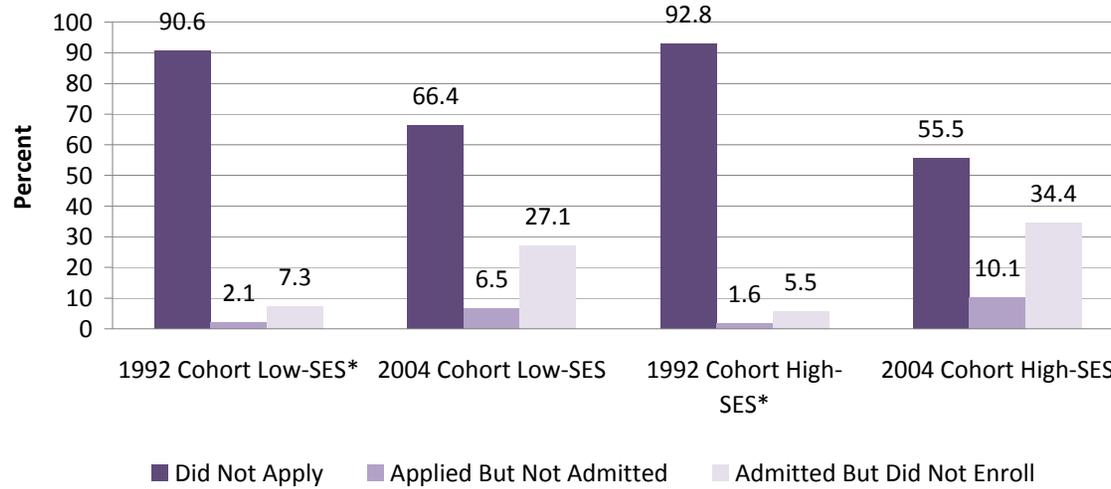
**Figure 1: Academic Undermatching in the College-Going Process by Cohort**



Notes: Figure created using the 1992 and 2004 cohorts of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and admission rates of applicants and enrollees. Students' access to college selectivity levels is predicted by their academic credentials.

\* The 1992 cohort provides the institutional identities of up to three college applications while the 2004 cohort provides their full set of college applications. We conduct sensitivity tests and rule out the explanation that the cross-cohort differences observed here are driven by these differences in the surveys.

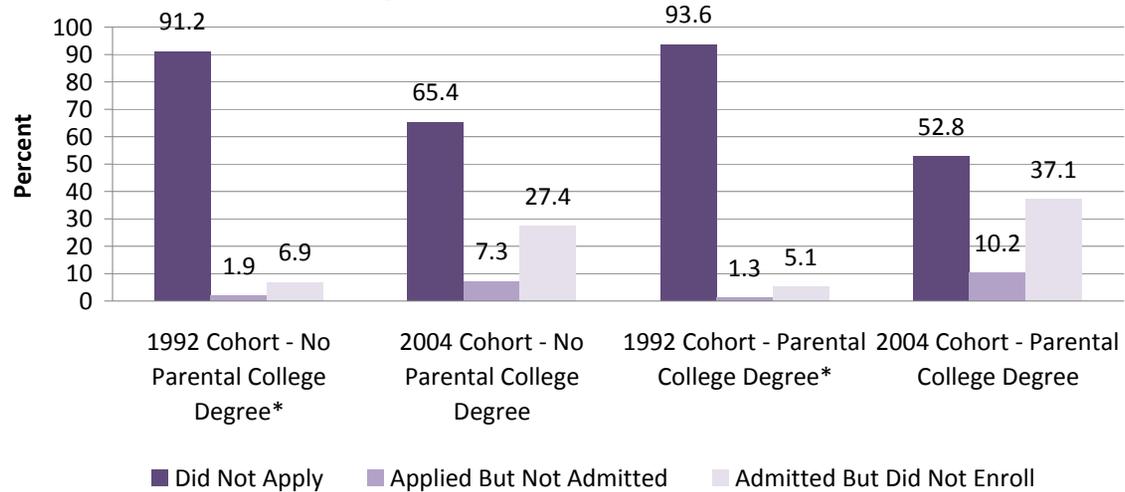
**Figure 2: Academic Undermatching in the College-Going Process by Cohort and SES**



Notes: Figure created using the 1992 and 2004 cohorts of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and admission rates of applicants and enrollees. Students' access to college selectivity levels is predicted by their academic credentials.

\* The 1992 cohort provides the institutional identities of up to three college applications while the 2004 cohort provides their full set of college applications. We conduct sensitivity tests and rule out the explanation that the cross-cohort differences observed here are driven by these differences in the surveys.

**Figure 3: Academic Undermatching in the College-Going Process by Cohort and Parental Education**



Notes: Figure created using the 1992 and 2004 cohorts of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and admission rates of applicants and enrollees. Students' access to college selectivity levels is predicted by their academic credentials.

\* The 1992 cohort provides the institutional identities of up to three college applications while the 2004 cohort provides their full set of college applications. We conduct sensitivity tests and rule out the explanation that the cross-cohort differences observed here are driven by these differences in the surveys.

**Appendix 1: Changes in College Selectivity Between 1992 and 2004**

<u>1992 Selectivity Level</u>	<u>2004 Selectivity Level</u>				<u>1992 Total</u>	<u>1992 to 2004 Changes</u>		
	<u>Very Selective</u>	<u>Selective</u>	<u>Somewhat Selective</u>	<u>Nonselective</u>		<u>In</u>	<u>Out</u>	<u>Net</u>
Very Selective	106	5	0	0	111	65	5	60
Selective	49	108	40	2	199	173	91	82
Somewhat Selective	14	139	337	73	563	265	226	39
<u>Nonselective</u>	<u>2</u>	<u>29</u>	<u>225</u>	<u>225</u>	481	<u>75</u>	<u>256</u>	<u>-181</u>
2004 Total	171	281	602	300	1354	578	578	0

Note: Selectivity levels aggregate Barron's selectivity levels, which are determined by SATs, GPA, and acceptance rates of applicants and enrollees.

**Appendix 2: Extent of Academic Undermatching - College Access versus College Choice**  
**Alternative Definitions of Access**

*80 percent chance of access*

Enrolled in:

Access to:

	Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College	Total (by access)	Percent Undermatch	Percent Substantial Undermatch
Very Selective	39.6	30.6	21.8	2.7	3.3	1.9	14.5	60.4	29.8
Selective	9.7	26.4	36.3	7.1	17.0	3.5	23.5	63.9	27.6
Somewhat Selective	2.2	10.3	39.3	12.2	27.5	8.5	15.5	48.2	36.1
Nonselective	1.0	3.1	18.2	16.5	44.8	16.5	10.6	61.2	16.5
Two-Year	0.8	1.6	4.8	2.9	38.3	51.5	35.9	51.5	--
Total (by enrolled)	8.8	13.1	21.5	6.8	27.2	22.7	100.0	56.2	25.6*

*85 percent chance of access*

Enrolled in:

Access to:

	Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year	No College	Total (by access)	Percent Undermatch	Percent Substantial Undermatch
Very Selective	47.5	29.1	18.5	1.7	2.0	1.2	9.4	52.5	23.4
Selective	14.5	30.2	34.4	6.0	11.9	3.1	21.8	55.4	20.9
Somewhat Selective	3.1	13.7	39.9	11.3	25.6	6.4	16.7	43.3	32.0
Nonselective	1.4	5.9	27.7	15.1	36.9	13.1	10.7	50.0	13.1
Two-Year	1.2	2.2	6.3	4.3	39.2	46.8	41.5	46.8	--
Total (by enrolled)	8.8	13.1	21.5	6.8	27.2	22.7	100.0	48.9	20.6*

Notes: Table created using the 2004 cohort of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*This statistic excludes students with access to two-year colleges since by definition they cannot have a substantial undermatch.

**Appendix 3: Extent of Academic Undermatching - College Access versus College Choice  
By Race**

*Asian (920 observations)*

		Enrolled in:					Total (by access)	Percent Undermatch	Percent Substantial Undermatch	
Access to:		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year				No College
Very Selective		73.2	23.0	2.6	0.0	0.6	0.5	12.5	26.8	3.8
Selective		34.7	30.2	26.7	2.3	4.7	1.5	25.7	35.1	8.4
Somewhat Selective		12.0	26.3	34.0	5.5	19.7	2.6	16.3	27.8	22.3
Nonselective		0.5	2.9	43.5	9.4	35.8	7.9	8.6	43.7	7.9
Two-Year		7.0	6.4	10.8	2.9	43.1	29.9	37.0	29.9	--
Total (by enrolled)		22.6	17.5	20.4	3.4	23.5	12.6	100.0	31.7	10.0

*Hispanic (1,050 observations)*

		Enrolled in:					Total (by access)	Percent Undermatch	Percent Substantial Undermatch	
Access to:		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year				No College
Very Selective		58.4	33.7	7.9	0.0	0.0	0.0	1.5	41.7	7.9
Selective		28.2	26.7	21.5	5.0	11.9	6.7	7.9	45.1	23.6
Somewhat Selective		4.9	17.6	31.9	12.1	28.2	5.3	10.2	45.6	33.5
Nonselective		8.9	5.3	40.0	13.7	27.6	4.7	6.4	32.3	4.7
Two-Year		0.9	1.0	3.4	4.1	46.3	44.4	74.1	44.4	--
Total (by enrolled)		4.8	5.4	10.1	5.5	39.9	34.3	100.0	43.8	20.8

*Black (1,030 observations)*

		Enrolled in:					Total (by access)	Percent Undermatch	Percent Substantial Undermatch	
Access to:		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year				No College
Very Selective		20.5	0.0	79.5	0.0	0.0	0.0	0.5	79.5	79.5
Selective		26.9	35.2	35.2	2.7	0.0	0.0	4.5	38.0	2.7
Somewhat Selective		8.2	18.5	45.5	19.0	5.1	3.7	8.0	27.8	8.8
Nonselective		6.3	11.7	36.9	27.1	12.3	5.8	11.4	18.0	5.8
Two-Year		0.5	1.7	13.4	14.3	34.1	36.0	75.7	36.0	--
Total (by enrolled)		3.1	5.7	19.9	15.5	27.6	28.2	100.0	33.6	4.9

*White (5,670 observations)*

		Enrolled in:					Total (by access)	Percent Undermatch	Percent Substantial Undermatch	
Access to:		Very Selective	Selective	Somewhat Selective	Nonselective	Two-Year				No College
Very Selective		56.9	26.4	13.7	1.6	1.1	0.3	6.4	43.1	16.8
Selective		18.8	32.6	32.3	4.7	8.8	2.9	24.4	48.6	16.3
Somewhat Selective		5.4	21.4	37.7	8.6	22.3	4.6	18.4	35.6	26.9
Nonselective		1.2	8.7	40.4	10.9	29.2	9.7	9.8	38.9	9.7
Two-Year		1.0	3.2	10.0	4.6	39.5	41.6	41.1	41.6	--
Total (by enrolled)		9.7	15.8	23.7	5.8	25.4	19.6	100.0	42.0	17.0

Notes: Table created using the 2004 cohort of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*This statistic excludes students with access to two-year colleges since by definition they cannot have a substantial undermatch.

**Appendix 4: Academic Undermatching by Socioeconomic Status**  
**1992 Cohort of High School Seniors**

*Linear Probability Model, Outcome Variable = 1 if Student Undermatches*

<u>Variable</u>	<u>Undermatch</u>				<u>Substantial Undermatch</u>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SES quartile 1	0.328*** (0.022)	0.277*** (0.024)	0.287*** (0.025)	0.152*** (0.030)	0.218*** (0.031)	0.177*** (0.030)	0.182*** (0.030)
SES quartile 2	0.246*** (0.022)	0.203*** (0.024)	0.203*** (0.024)	0.147*** (0.022)	0.142*** (0.024)	0.105*** (0.024)	0.104*** (0.024)
SES quartile 3	0.116*** (0.021)	0.099*** (0.021)	0.100*** (0.022)	0.081*** (0.019)	0.079*** (0.018)	0.067*** (0.018)	0.067*** (0.018)
Constant	0.332*** (0.015)	0.393*** (0.020)	0.400*** (0.026)	0.407*** (0.031)	0.125*** (0.010)	0.209*** (0.023)	0.180*** (0.026)
Controls for Academic Achievement	No	Yes	Yes	Yes	No	Yes	Yes
Controls for Race and HS Urbanicity	No	No	Yes	Yes	No	No	Yes
Excluding Students With Access to Two-Year Colleges	No	No	No	Yes	Yes	Yes	Yes
Observations	6,480	6,480	6,480	3,650	3,650	3,650	3,650
R-squared	0.060	0.101	0.111	0.112	0.032	0.065	0.073

Notes: Observations rounded to the nearest ten. Robust standard errors in parenthesis. \*\*\* means significant at 1% level, \*\* is 5%, and \* is 10%. Undermatch is when a student enrolls in a college one selectivity level below where the student could enroll. Substantial undermatch is two selectivity levels below and excludes students with access to only two-year colleges, since they cannot have a substantial undermatch. Controls for academic achievement include GPA, AP/IB participation, SAT and ACT scores and participation dummies. SES quartile 4 is the omitted dummy variable.

**Appendix 5: Academic Undermatching by Student Characteristics**  
**1992 Cohort of High School Seniors**  
*Linear Probability Model, Outcome Variable = 1 if Student Undermatches*

<i>Variable</i>	<i>Undermatch</i>						<i>Substantial Undermatch</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Black	-0.028 (0.031)	--	--	--	-0.075** (0.031)	-0.141*** (0.048)	-0.110*** (0.022)	--	--	--	-0.118*** (0.025)
Hispanic	-0.018 (0.027)	--	--	--	-0.073*** (0.028)	0.007 (0.039)	0.013 (0.033)	--	--	--	-0.014 (0.032)
Asian	-0.174*** (0.034)	--	--	--	-0.098*** (0.034)	-0.030 (0.040)	-0.082*** (0.030)	--	--	--	-0.024 (0.028)
Other Race	-0.061 (0.092)	--	--	--	-0.120 (0.086)	-0.013 (0.123)	0.030 (0.107)	--	--	--	-0.031 (0.115)
HS Location - Rural	--	0.143*** (0.022)	--	--	0.059*** (0.021)	0.067** (0.028)	--	0.128*** (0.021)	--	--	0.055*** (0.021)
HS Location - Suburban	--	-0.001 (0.022)	--	--	-0.018 (0.021)	-0.022 (0.026)	--	0.046*** (0.018)	--	--	0.029 (0.018)
Parents' Educ. - HS or Less	--	--	0.275*** (0.021)	--	0.185*** (0.025)	0.074** (0.035)	--	--	0.152*** (0.027)	--	0.090*** (0.029)
Parents' Educ. - Some College	--	--	0.165*** (0.019)	--	0.107*** (0.020)	0.085*** (0.024)	--	--	0.094*** (0.017)	--	0.058*** (0.018)
Parents' Income Less Than \$25,000	--	--	--	0.321*** (0.032)	0.128*** (0.035)	0.122*** (0.042)	--	--	--	0.191*** (0.028)	0.092*** (0.031)
Parents' Income \$25,000 - \$50,000	--	--	--	0.257*** (0.032)	0.100*** (0.033)	0.091** (0.038)	--	--	--	0.141*** (0.024)	0.058** (0.026)
Parents' Income \$50,001 - \$100,000	--	--	--	0.141*** (0.032)	0.049 (0.032)	0.076** (0.035)	--	--	--	0.083*** (0.023)	0.036 (0.023)
Constant	0.501*** (0.009)	0.441*** (0.018)	0.338*** (0.014)	0.258*** (0.028)	0.344*** (0.036)	0.337*** (0.049)	0.209*** (0.009)	0.136*** (0.014)	0.131*** (0.010)	0.082*** (0.019)	0.143*** (0.034)
Controls for Academic Achievement	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Excluding Students With Access to Two-Year Colleges	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,480	6,480	6,480	6,480	6,480	3,650	3,650	3,650	3,650	3,650	3,650
R-squared	0.005	0.019	0.041	0.029	0.102	0.112	0.006	0.015	0.021	0.017	0.070

Notes: Observations rounded to the nearest ten. Robust standard errors in parenthesis. \*\*\* means significant at 1% level, \*\* is 5%, and \* is 10%. Undermatch is when a student enrolls in a college one selectivity level below where the student could enroll. Substantial undermatch is two selectivity levels below and excludes students with access to only two-year colleges, since they cannot have a substantial undermatch. Controls for SAT and ACT participation dummies. White student is the omitted dummy variable as is urban, college educated parents, the parents income greater than \$100,000.

**Appendix 6: Decomposition of Academic Undermatch  
Sensitivity Analysis**

1992 Cohort of Graduating High School Seniors				
<i>Undermatch</i>				
Source of Undermatch:	<u>All</u>	<u>Four or Fewer Applications*</u>	<u>Two or Fewer Applications**</u>	<u>Zero or One Application</u>
Did Not Apply	91.6	91.7	90.9	94.0
Applied But Not Accepted	1.9	1.8	2.0	0.9
Accepted But Did Not Enroll	<u>6.5</u>	<u>6.5</u>	<u>7.1</u>	<u>5.1</u>
	100	100	100	100
Percent Who Undermatch	48.9	51.6	62.5	61.8
2004 Cohort of Graduating High School Seniors				
<i>Undermatch</i>				
Source of Undermatch:	<u>All</u>	<u>Four or Fewer Applications*</u>	<u>Two or Fewer Applications**</u>	<u>Zero or One Application</u>
Did Not Apply	61.3	64.5	73.0	83.3
Applied But Not Accepted	8.2	7.6	5.8	2.5
Accepted But Did Not Enroll	<u>30.5</u>	<u>28.0</u>	<u>21.3</u>	<u>14.2</u>
	100	100	100	100
Percent Who Undermatch	40.9	43.8	49.3	56.0

Notes: Table created using the 1992 and 2004 cohorts of graduating seniors and uses sample weights. College selectivity levels are determined by SATs, GPA, and acceptance rates of applicants and enrollees. Students access to college selectivity levels is predicted by their academic credentials (see Section 4 of text for details).

\*In the 1992 cohort, there is a categorical variable for the number of applications and one category in two to four applications. Although, our analysis is based on the up to three observable applications, we exclude students with five or more applications. This implies that we may not observe the fourth application for those who applied to four. In the 2004 cohort, we know the exact number of applications and exclude anyone with five or more applications.

\*\*In the 1992 cohort, we assume the student only applied to two colleges if we observe only two colleges because they could have listed up to three colleges.