Early Identification of High-Achieving, Low-income Students and Their College Participation Rates

Lena Shi

Using the 1997-2007 National Longitudinal Survey of Youth (NLSY), I analyze the effects of socioeconomic status (SES) risk factors, specifically mother’s high school graduation and poverty status, on students’ participation in college entrance exams, college enrollment, and college completion. In particular, I evaluate whether socioeconomic factors disadvantage early high-performing students, defined as those scoring above average on the Peabody Individual Assessment Test (PIAT) in middle school or early in high school. I find that having each additional risk factor decreases the probability of taking the SAT or ACT, enrolling in college, and completing college, even for early high-performers. Many students who show strong academic potential as early as middle school actually drop off the college admissions path altogether. This research also suggests that an accurate cognitive indicator like PIAT can help policymakers identify and engage high-achieving, low-income students in the challenging college preparedness process at an earlier age.

Background

A symbolic ladder for social mobility, higher education significantly expands postgraduate opportunities.¹ Low-income children, however, are 80 percent less likely to attend college than high-income children.² Unequal access and participation in quality education largely explains why children predominantly inherit the same economic position as their parents today.³ Despite decades of efforts to remedy socioeconomic inequalities in college participation, low-income students remain underrepresented at selective post-secondary institutions across the nation. Even among high-achieving students, only 34 percent attend one of the country’s most selective universities if they come from low-income families, even though selective institutions, on average, offer students a lower net-tuition rate, better match their abilities, and increase future earnings.⁴ Low-income students are under-participating in higher education opportunities.

² Raj Chetty, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez, “Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States,” National Bureau of Economic Research, no. w19843 (2014);
A lack of qualifications, however, has not alone caused the group’s low college participation rate. Studies show that primary indicators of successful college preparedness are information and encouragement, two factors that high-achieving, low-income students have less exposure to compared to their middle-income and higher-income peers. Being under-informed about college affordability, for example, represents a significant barrier to participation. Recent research suggests that a misunderstanding of the high tuition rates and financial aid resources deter many high-achieving, low-income students from believing they can attend colleges, especially the top-ranking institutions. Those schools’ published annual tuition and fees rates often exceed the nation’s average household income; selective private schools often have the highest sticker tuition price. However, low-income students would pay the lowest net tuition price at these schools, given the school’s available financial aid resources, particularly grants and scholarships, etc. Another deterrent is low-income students’ low expectations about college participation because they have weaker guidance counseling programs, less community encouragement about college participation, and less exposure to college alumni. Compared to their middle- and upper-income peers, low-income students have less access to quality college information and support throughout the complex admissions process.

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5 Hoxby and Avery.


8 Hoxby and Avery.
Today, successful college preparedness heavily involves both the schools and parents, leaving low-income students at an even greater disadvantage. Parents are the strongest influences in students’ postsecondary decisions, but low-income and first-generation students often receive less personalized academic advising from family members.\(^9\) Low-income parents often cannot provide accurate information about course planning or about financial planning. In fact, low-income parents often under-participate in college savings programs and are often not fully aware of the various forms of available financial assistance.\(^{10}\) The increasing complexity of the admissions process, academic planning, and financial aid application represents a growing challenge for high-achieving, low-income students to overcome alone.

**Motivation**

College is not for everyone. However, low-income students with high academic potential miss or do not consider college opportunities because of socioeconomic disadvantages beyond their control. Rather than increasing college enrollment for everyone, a suitable policy should aim to remove the barriers to college enrollment for students who desire to participate.

Important college admissions decisions now start as early as middle school. Successful college admissions heavily depend on academic planning, as the primary admissions criteria heavily stress college prep classes’ GPA, standardized tests, and course rigor.\(^{11}\) Although lower-income students are more frequently misplaced out of high-level classes, better identification of high-achieving low-income students can help open more opportunities to higher education.\(^{12}\) For example, 71 percent of low-income students who were placed in geometry class by ninth grade went to college.\(^{13}\) Therefore, today’s policy interventions that occur in high school are helpful, but exclude the importance of identifying and supporting low-income students throughout their K-12 career.

Most of today’s interventions primarily identify high-performing students in high school, after they have taken the PSAT, SAT, or ACT and disclosed their GPAs. For example, QuestBridge matches low-income students with high college entrance exam scores while highly ranked and selective universities offer free tuition for admitted students with annual family income of $40,000 (some even $80,000) and below. Some of the most common policies to improve college access may only benefit the small group of high-achieving low-income students who have successfully planned academically, as well as performed well in high school and on college entrance exams.

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By the time policymakers identify high school juniors and seniors from college entrance scores and GPAs, they have already excluded the population of high potential students who lowered their academic engagement because they never considered college as an option. By late high school, students may find it too late to drastically commit to the college preparation and admissions process. College eligible and high-performing sophomores and juniors, for example, may be overwhelmed: there are too many choices to navigate; there are high tuition rates that they have not saved for; there are too many documents and applications to keep track of alone etc. Policies that use GPA and college entrance exam scores to engage students in college preparedness will likely exclude high-potential students.

Therefore, I use the Peabody Individual Assessment Test (PIAT), which is an alternative tool to identify high-achieving low-income students. Students may begin taking the PIAT after age five, giving schools and policymakers more time to effectively engage high-performing students and their families throughout the complex and challenging college-preparedness process. The PIAT is an academic performance indicator that has high reliability and re-testing results, and has not yet been utilized by many higher education policy researchers as a tool for increasing college participation among low-income students.

Research Questions

Using the 1997-2007 National Longitudinal Survey of Youth (NLSY), I explore the relationship between explanatory variables, early academic performance and socioeconomic status (SES) risk levels, and their effects on college participation. The two explanatory variables are the 1) PIAT score, which indicates students’ academic potential, and 2) the SES risk levels. SES risk levels are determined by whether the mother has graduated from high school and/or if the student lives in, at, or below the poverty line. The outcomes of interest are 1) whether the student takes a college entrance exam (specifically the SAT or ACT), 2) whether the student enrolls in college, and 3) whether the student completes college. The central research questions guiding the research study are the following:

- Is there a relationship between students’ SES risk factors and their academic performance on the PIAT?
- Is there a relationship between students’ SES risk factors and their college participation?
- Among high-performers on the PIAT, how does SES risk affect college performance?

Empirical Approach

Using the NLSY, I measure the students’ explanatory variables during childhood in 1997. I then evaluate the students’ college participation outcomes by 2007. I only include the students who would have reached college graduation age by 2007.

Dependent Variables. I evaluate three primary college participation outcomes through indicator variables for whether or not an individual completed a specific outcome (1 = yes, 0 = no). First I evaluate whether the student took the SAT or ACT by 2007, demonstrating their participation in the college admissions process. Second, I evaluate whether the student has enrolled in a two-year

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14 The poverty level is determined by Health and Human Services ASPE.
or four-year higher education institution. Finally, I evaluate whether the student has completed a two-year or four-year higher education institution by 2007.\textsuperscript{15}

**Explanatory Variables.** The explanatory variables are academic performance and three levels of SES risk. Academic performance is measured by whether the student performed above or below the average PIAT score of 93.90. SES risk level reflects whether the student satisfies zero, one, or two risk factors; they are illustrated in the matrices below. A ‘high SES risk’ level identifies a student whose mother did not graduate high school \textit{and} who lives at or below the poverty line. An ‘SES risk’ level corresponds to a student whose mother did not graduate high school \textit{or} who lives at or below the poverty line. A ‘no SES risk’ level corresponds to a student who lacks both factors. I also created an interaction variable between whether the mother graduated from high school and whether the students come from households living below the poverty line. The following matrices explain the construction of the explanatory variables.

**Matrix 1. Interaction term**

\begin{center}
\begin{tabular}{c|c|c}
 & HS Grad Mom & Not HS Grad Mom \\
\hline
At or above poverty & 0 & 1 \\
Below poverty line & 1 & 2 \\
\end{tabular}
\end{center}

**Matrix 2. SES Risk Level**

\begin{center}
\begin{tabular}{c|c}
Score & Risk Level \\
\hline
0 & No SES Risk \\
1 & SES Risk \\
2 & High SES Risk \\
\end{tabular}
\end{center}

**Covariates.** I controlled for student characteristics, including age, gender, race/ethnicity, geography, and background factors like household income, household size, home language, etc.

**Methods.** To determine the relationship in question, I used a basic multi-variable regression. The basic model is shown:

\[ Y_i = \alpha + \beta \text{SES} + \gamma X_i + \delta \text{Interaction}_i + \epsilon_i \]

In the model above, \(Y_i\) represents the college participation outcome in question, \(\beta\) is the coefficient for the SES risk level, \(\gamma\) is the coefficient for the covariates, and \(\delta\) is the coefficient for the SES interaction variable. I ran models for all the outcomes of interest. \(\epsilon\) is the error term. The analyses also considered the correlation between explanatory variables and covariates. Finally, I ran the regressions to discover differential effects in college participation outcomes among individuals who possessed different explanatory variables.

\textsuperscript{15} The study evaluates whether the students who took the PIAT score in 1997 participated in college by 2007; which evaluates their direct transition from high school to college. Theoretically, those students could have gone back to earn their degree since 2007.
Hypotheses

First, each additional SES risk factor will decrease the likelihood of high academic performance (using PIAT as a proxy). Second, each additional SES risk factor will lower the student’s probability of taking a college entrance exam, enrolling, and completing college. Third, this study can show that PIAT is an effective indicator for academic achievement at an early age and predictor for later college enrollment.

Results

Figure 2. Regression, SAT and ACT performance by controls.

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Dependent Variable</th>
<th>Math SAT score</th>
<th>Verbal SAT Score</th>
<th>ACT Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>-0.338 ***</td>
<td>0.016</td>
<td>-0.037</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.061)</td>
<td>(0.060)</td>
<td>(0.047)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>0.348</td>
<td>0.048</td>
<td>0.158</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.771)</td>
<td>(0.221)</td>
<td>(0.301)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>-0.428</td>
<td>-0.601 ***</td>
<td>-0.475</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.776)</td>
<td>(0.233)</td>
<td>0.305</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>-0.516</td>
<td>-0.516</td>
<td>-0.530</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.787)</td>
<td>(0.787)</td>
<td>0.396</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0.591</td>
<td>0.516</td>
<td>0.367</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.801)</td>
<td>(0.787)</td>
<td>(0.383)</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>0.154 **</td>
<td>0.153 **</td>
<td>0.123 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.069)</td>
<td>(0.068)</td>
<td>(0.049)</td>
<td></td>
</tr>
<tr>
<td>ESL</td>
<td>-0.295 **</td>
<td>-0.178</td>
<td>0.058</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.121)</td>
<td>(0.121)</td>
<td>(0.111)</td>
<td></td>
</tr>
<tr>
<td>Low-income</td>
<td>-0.270 ***</td>
<td>-0.141</td>
<td>-0.169 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.098)</td>
<td>(0.096)</td>
<td>0.070</td>
<td></td>
</tr>
<tr>
<td>Household Size</td>
<td>-0.040</td>
<td>-0.107 ***</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.028)</td>
<td>-0.0206</td>
<td></td>
</tr>
<tr>
<td>Educated mom</td>
<td>0.230</td>
<td>0.281</td>
<td>0.281</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.146)</td>
<td>(0.144)</td>
<td>(0.144)</td>
<td></td>
</tr>
</tbody>
</table>

Note. The reference group for race is “other.” Math's constant is about 4 and Verbal is 4.42, which both correspond to a performance range of 501-600. The ACT constant is 4, which corresponds to a performance range of 19-24. Figures in parentheses are standard errors: * p < 0.10, ** p < 0.05, ***p <= 0.01.
Students who have high SES risk factors are more likely to live in urban areas and speak a home language other than English (ESL). Poverty and uneducated mothers have the greatest correlations with having one or more SES risk factor. Although comparatively, race has a weaker correlation with SES risk, black and American Indian individuals show positive correlations with SES, while white and Asian individuals show negative correlations with SES.

Students with SES factors are less likely to perform above average on the PIAT. Compared to students without SES risk, three groups perform worse: high SES students (9 percent worse), SES students (4 percent worse), and ESL students (3 percent worse). Thus, I can conclude that students with one or more SES factor face challenges to performing well academically.

**Figure 3.** Took SAT/ACT, Enroll, Completed by controls.

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Dependent Variable</th>
<th>SAT/ACT</th>
<th>ENROLL</th>
<th>COMPLETED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>0.105***</td>
<td>0.118***</td>
<td>0.102***</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>0.613***</td>
<td>0.124</td>
<td>0.307*</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.612***</td>
<td>0.097</td>
<td>0.235</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>0.417*</td>
<td>0.027</td>
<td>0.189</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0.868***</td>
<td>0.355*</td>
<td>0.576***</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>-0.016</td>
<td>0.030*</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>ESL</td>
<td>0.011</td>
<td>0.013</td>
<td>-0.042</td>
<td></td>
</tr>
<tr>
<td>Low-income</td>
<td>-0.183***</td>
<td>-0.260***</td>
<td>-0.194***</td>
<td></td>
</tr>
<tr>
<td>Household Size</td>
<td>-0.025***</td>
<td>-0.018***</td>
<td>-0.008***</td>
<td></td>
</tr>
<tr>
<td>Educated mom</td>
<td>0.272***</td>
<td>0.272***</td>
<td>0.150***</td>
<td></td>
</tr>
</tbody>
</table>

Note. The reference group for race is “other.” Figures in parentheses are standard errors; * p < 0.10, ** p < 0.05, ***p <= 0.01.

There is a positive correlation between PIAT scores and SAT-Math, SAT-Verbal, ACT, and ASVAB scores. PIAT has the greatest correlation with ASVAB (0.70) showing that these two early cognitive tests are similar. Thus, PIAT corresponds with similar cognitive tests for middle
and high school students. PIAT also positively correlates with college entrance exams. Thus, performance on PIAT is likely to help predict the performance on college entrance exams later in the students’ academic career.

The following results evaluate how SES risk factors affect high-achieving students, who score above average on the PIAT:

High-performing, high SES risk students are less likely to take the SAT and ACT. Each additional SES factor correlates with an increasingly lower probability of taking the SAT and ACT. Thirty-three percent of high SES students take college entrance exams, compared to 55 percent of SES risk students and 72 percent of no SES risk students. High SES risk produces a greater negative effect than that in the SES interaction variable. SAT math scores are lower among females, ESL students, and poor students while SAT verbal scores are lower among students who are black and have a larger household size. Students living in urban areas do better on both tests. Overall, the individual variables of being low-income and having an uneducated mom lead to a lower probability of taking the SAT and ACT, but the SES risk interaction variable leads to an even lower probability of taking college entrance exams.

Figure 4. Summary Table of SES impact on High-Achieving Students’ College Participation Rates. All p-values < 0.01.

High-performing, high SES risk students are less likely to enroll in college. Less than half of high-performing, high SES risk students will enroll in college, compared to 80 percent of students without SES-risk. The SES interaction variable shows a college enrollment probability closer to that of no SES-risk group. Female, Asians, urban, and educated mom variables show higher probabilities with college enrollment. Overall, being low-income and having an uneducated mom are each factors that individually lead to a lower probability of enrolling in college. The combined effects of SES-risk lead to an even worse probability of enrolling in college.

High-performing, high SES-risk students are less likely to complete college. High-performing students with high SES risk have the highest college dropout rate, and therefore lowest college completion rate at approximately 26 percent, which is more than double that of high-achieving
students with no SES-risk. Female, Asians, white, and educated mother variables show higher probabilities with college completion. Overall, the individual variables of being low-income and having an uneducated mom lead to a lower probability of completing college, but the combined effects of SES-risk lead to an even lower probability of completing college.

**Discussion and Limitations**

Through this research, I have drawn the conclusion that SES-risk lowers the level of PIAT performance as an adolescent. Even among those who performed above average on the PIAT, showing early potential for high cognitive performance, SES-risk lowers the probability of taking a college entrance exam, enrolling in college, and ultimately completing college. This finding suggests that PIAT is an alternative, and potentially stronger academic indicator for higher education policy-makers, who can target and engage high-achieving, SES-risk students at an earlier age to prepare them for college education.

This research also suggests that poverty and uneducated mothers affect students’ participation differently. A mother’s education affects the amount of support that the student receives; an uneducated mother correlates with low rates of student participation in taking college entrance exams, as well as with college enrollment and completion. A student’s poverty status, on the other hand, affects academic performance; low-income students have the lowest performance on early cognitive and college exams. ESL students are more likely to possess both these factors. Depending on the schools’ and policymakers’ priorities of participation versus performance, policies will need to be different. For instance, for students with uneducated mothers, policymakers may consider school-based strategies to encourage and support college entrance exam preparation and preparedness. For low-income students, policymakers may want to focus on improving educational and teacher quality. Both poverty and an uneducated family reinforce academic disadvantages for youth.

Additionally, this research shows that admissions and college fail to include and produce successful academic outcomes for low-income students. Policies to increase college participation among high-achieving, low-income high school students – such as college admissions recruiting, campus visits, and college mentoring programs – will likely be ineffective if students have no prospect of participating in college. In addition, early identification of high-achieving, SES-risk students can catalyze new K-8 initiatives for higher enrollment, particularly in earlier and more personalized college identification and preparation programs. For example, policymakers could also offer guaranteed financial aid packages to young students contingent on academic performance. Informed of the disadvantageous effects of SES on high-performing students, policymakers can better engage students to be more academically and financially prepared at an earlier age. Furthermore, knowing the unequal admissions, enrollment, and completion rates, colleges should not limit their support to the application process, but should also consider ways to support high-achieving, low-income students throughout their time at the institution.

It is important to note, however, that this research suggests a correlation, not causation, in the relationship between explanatory and outcome variables. The NLSY data shows that only 25 percent of those not labeled an SES-risk, which is significantly lower than national
demographics.\textsuperscript{16} Further, the study only measured the college participation of high-achieving low-income students, which had a sample size of 176 students, which is approximately ten percent of the high SES population. Although this study appears to be randomized, the sample size is not representative of national trends.

Additionally, many recent policies have taken place to support high-income low-income students. The participants in the 1997-2007 survey are now in their thirties, and did not benefit from today’s wave of college preparedness reform, so more relevant data is available than at the time of the survey. Today’s K-12 reform strategies and existing higher education initiatives to promote enrollment and completion among high-achieving, SES risk students may be more effective today. Further, I used a ten-year lapse of NLSY data, which requires a long length of time to measure kids’ later outcomes. The longitudinal aspect of this data, required for analysis of the effects of intervention on long-term outcomes, challenges the need to find urgent solutions. Today’s policy-makers must respond swiftly to the current higher education initiatives and therefore need a faster turn-around for outcomes. An alternative could be to set earlier and follow-up interim outcomes, such as enrollment in a college savings account or meeting with guidance counselors after intervention.

Overall, this evidence suggests that PIAT can be a reliable academic indicator policymakers can use to identify high-achieving students with SES risk, especially now that research has shown that even students who score highly on the PIAT have lower participation than their peers because of socioeconomic factors outside of their control. Given the available research, policymakers can more effectively work to break down the barriers that impede high-achieving students’ participation in higher education opportunities.

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