College Preparation Intensity and Socioeconomic Background: Social Closure and Horizontal Stratification

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Abstract: *This research examines the relationship between college preparation intensity (CPI), social class and subsequent college enrollment using the High School Longitudinal Study of 2009. Using Item Response Theory and the number of college preparatory activities in which students participate, this study generates a new measure reflecting students' intensity of college preparation. Results show that high SES students prepare more intensely for college than their counterparts and college preparation intensity is positively associated with both college enrollment and the selectivity of the school students enroll in. Average marginal effects demonstrate that the returns to CPI are not equal across social classes. Predicted probabilities show that increased college preparation intensity is unlikely to alleviate socioeconomic differences in college enrollment and may expand these differences when examining highly selective college enrollment. These results suggest that CPI may be used as a mechanism of social closure to effectively maintain inequality in higher education access.*

1. Introduction

Enrollment and completion of a college degree provides a host of economic and social benefits, from higher earnings to better health (Avery and Turner 2012; Carnevale, Rose, and Cheah 2011; Oreopoulos and Petronijevic 2013; Schafer, Wilkinson, and Ferraro 2013). The U.S. has witnessed substantial expansion of college enrollment and educational expectations in recent decades, especially among low-income students (Goyette 2008). Despite this increase, U.S. higher education is still characterized by high rates of socioeconomic inequality in college enrollment (Roderick et al. 2011) as well as the selectivity of the college in which students enroll (Radford 2013). These socioeconomic disparities highlight a need to understand the processes of college access and the factors that increase students' odds of enrolling in college and specific types of institutions.

Given the increasing demand and competition for college enrollment, some students may attempt to increase their odds of college enrollment through participation in activities related to college preparation like going on a college tour, searching for colleges online, or taking a college class. College preparatory activities are defined as actions that students take to prepare for post-secondary education and may occur either outside of formal schooling (Liu 2011) or in addition to the standard curriculum in high school (Klugman 2012). Research suggests that participation in individual college preparatory activities varies based on social class, whereby more socioeconomically advantaged students are more likely to engage in these activities than others (Buchman, Condron, and Roscigno 2010; Liu 2011). Thus, differences in participation in college

preparatory activities may contribute to the social stratification that characterizes enrollment in higher education in the United States.

Existing research offers evidence on the relationship between socioeconomic background and participation in *individual* college preparatory activities. Yet, we know less about how social class impacts students' *intensity* of college preparation and how that intensity relates to college enrollment decisions. By intensity, I refer to the number of college preparation activities that students engage in rather than focusing on a specific aspect of college prep. This approach offers an alternative understanding of differences in the way that students prepare for college by exploring four research questions: First, how does students' intensity of college preparation impact their likelihood to enroll in college, and how does it relate with the specific type of institution they enroll in? Second, how does socioeconomic status impact students' college preparation intensity. Third, are the returns to the intensity of college preparation equal across social classes? Fourth, does increased college preparation intensity mitigate socioeconomic differences in the odds of college enrollment and enrollment in highly selective colleges?

These analyses extend the literature on college preparation and social stratification in multiple ways. Methodologically, Item Response Theory (IRT) develops a continuous scale that reflects students' intensity of college preparation (CPI) by incorporating several different activities or actions that relate to academic preparation for college and the college application process. With this, scholars can assess the *additive* effects of increased college preparation rather than focusing on individual college prep activities. Theoretically, I examine CPI as a mechanism of *social closure* (Alon 2009);

whereby high SES students use their resource advantages to prepare more intensely for college and *effectively maintain* the inequality that exists in higher education (Lucas 2001). I also evaluate the *returns* that students gain from increased CPI, and if these returns are equal across social classes. Then, I examine socioeconomic differences in students' probabilities of enrollment in college and highly selective colleges along each point of the CPI scale to understand the potential for increased college preparation to alleviates socioeconomic disparities in these outcomes (Hoxby and Avery 2013; Roderick et al. 2011; Radford 2013). Lastly, to overcome issues of selection bias I use propensity score matching to analyze the treatment effects of college preparation on college enrollment.

1. College Enrollment and College Preparatory Activities

College enrollment has increased in the United States in recent decades, with the number of college applicants up by nearly 50% since 1970 (Bound et al. 2009). Much of this increase can be attributed to students' desires to attend college, as educational expectations have steadily increased with college enrollment (Goyette 2008; Grodsky and Riegle-Crumb 2010). In response to the increasing number of college applicants, some colleges and universities today – especially private and prestigious institutions – are more selective than they were in the past (Alon and Tienda 2007; Bound et al. 2009; Hoxby 2009).

Research shows that college preparation by high school students has also become more competitive in recent decades. Students today take more Advanced Placement (AP)

and International Baccalaureate (IB) classes, participate in more extracurricular activities, and are applying to more schools than they did in the past (Bound et al. 2009; Holland 2014). Mean SAT scores also have increased steadily since the 1980s, suggesting that students are responding to increasing demands in the market of college enrollment (Alon and Tienda 2007). College preparation today is more competitive than it was in the past as students respond to increasing numbers of college applicants. Therefore, examining students' CPI provides an additional measure that has not been fully explicated in existing research.

One way in which students try to increase their odds of acceptance in an increasingly competitive market is through participation in college preparatory activities. These activities are designed for students to prepare for college-related tasks such as standardized test preparation or preparing a college application, and typically take place between 9th and 12th grade (Tierney, Hallett, and Venegas 2007). Examples of college preparatory activities include hiring a college counselor, searching for colleges online, taking college tours, taking a course to prepare for a college entrance exam, taking college classes or classes for college credit, attending a college camp, and meeting with a high school counselor to discuss post-secondary plans (Bound, Hershbein, and Long 2009; Liu 2011; Roderick, Coca, and Nagaoka 2011). Empirical evidence shows that these activities have a variety of benefits related to college enrollment, including specialized knowledge about the college application process (Liu 2011), a signal of strong academic ability to potential colleges (Klugman 2012), increased standardized test scores (Alon and Tienda 2007), and integration into college culture (Radcliffe and Bos

2011). This research suggests that engaging in college preparatory activities increases students' odds of post-secondary enrollment.

2.1 College Preparation Intensity

Existing research focuses on how participation in *individual* college preparatory activities provide high school students with a competitive advantage, through specific benefits that may increase their odds of college enrollment. Given this, it is possible that participation in an increasing number of college preparatory activities may have an *additive* effect on college enrollment, whereby each additional activity increases students 'odds of enrollment. Thus, the number of college preparatory activities that a student engages in throughout high school also measures students' *intensity* of college preparation. By analyzing CPI rather than participation in specific aspects of college prep, researchers gain an alternate understanding of the benefits of this preparation and potential differences across socioeconomic groups.

H1: *As the intensity of students' college preparation increases, their odds of college enrollment will increase.*

Students' CPI may also help explain the type of institution that they enroll in. Empirical evidence shows that the type of college students attend has direct impacts on future educational and economic outcomes. Students who initially attend two-year institutions and community colleges are less likely to complete their bachelor's degrees compared to students at four-year colleges (Brint and Karabel 1989; Doyle 2009; Leigh and Gill 2003). Additionally, students who enroll in selective universities have greater

odds of degree completion, higher earnings, and better job prospects compared to those from less selective universities (Brand and Halaby 2006; Gaddis 2014; Shamsuddin 2016; Thomas and Zhang 2005). This paper examines the relationship between CPI and the selectivity of the institution that students enroll in, positing that net of other factors, students who prepare more intensely for college will enroll in more selective schools.

H2: *As students' intensity of college preparation increases, the selectivity of the institution they enroll in will increase.*

2. College Preparation Intensity and Social Closure

Despite massive increases in the number of college applicants, enrollment in higher education in the U.S. remains stratified by social class (NCES 2017). Students from higher socioeconomic backgrounds are considerably more likely to enroll in college than low SES students, even after controlling for academic achievement (Belley and Lochner 2007; Crosnoe and Muller 2014; Grodsky 2007). This gap has increased in recent decades (Bailey and Dynarski 2011). The widening gaps between socioeconomic groups are surprising, given the returns to a college education, the policy focus to improve access for disadvantaged students, and the increasing educational expectations of low SES students (Goyette 2008; Page and Scott-Clayton 2016). As such, this gap points to disparities in the process whereby students move from high school to college (Hoxby and Avery 2013; Stephan, Rosenbaum, and Person 2009).

College preparatory activities provide a variety of benefits for participants, but evidence shows that students from lower socioeconomic backgrounds participate at a lower rate than students from higher socioeconomic backgrounds. Low SES students

have less knowledge about the college application process than their socioeconomically advantaged peers, resulting in less comprehensive college searches (Holland 2014; Roderick et al. 2008; Roderick, Coca, and Nagaoka 2011). Further, some college preparatory activities require economic resources that some students may not have (Briggs 2001; Buchmann, Condron, and Roscigno 2010; Liu 2011). Additionally, high SES students may have more opportunities to take college level courses in high school (Klugman 2012). Lastly, while research on the topic is sparse, differences in both specialized knowledge and resources sometimes lead low SES students to engage in lower *quality* college preparation compared to high SES students (Hallett and Venegas 2011). These studies show that regardless of students' ability to succeed in college, high SES students use their economic and social resources to be *more prepared* for college than low SES students.

H3: *High SES students will prepare for college with greater intensity than low SES students.*

Students' CPI may serve as a mechanism of social closure for socioeconomically advantaged students, given the increasingly large numbers of college applicants and increasing competition at top universities (Alon and Tienda 2007; Bound et al. 2009; Hoxby 2009). Lucas (2001) proposes a theory of *effectively maintained inequality* (EMI) via which socioeconomically advantaged students look for points of social closure in the process of higher education, such as admittance to a prestigious university. Advances to EMI posit that two mechanisms link class hierarchies to higher education: exclusion and adaptation (Alon 2009). In this paper, I examine the intensity of students' college

preparation as a form of adaptation through which high SES students use their economic and educational resource advantage to prepare more intensely for college, and thereby have more competitive college resumes than their less advantaged counterparts.

H4: *The returns to college preparation intensity are higher for high SES students compared to low SES students.*

3.1 Horizontal Stratification in College Enrollment

Students' CPI may also act as a mechanism of social closure for the type of institution in which students enroll. Following the theory of EMI, educational expansion has reduced the relative advantages of a college degree (Alon 2009; Lucas 2001; Horowitz 2018). In response, high SES students seek *qualitative* advantages in their educational credentials, such as enrollment in a selective university.

Existing literature shows that higher education in the United States is characterized by what is known as *horizontal stratification* (Gerber and Cheung 2008), whereby social class not only shapes whether students enroll in college, but also the type of college they choose to enroll in. High SES students make up a disproportionate share of students at highly selective universities (Espenshade and Radford 2009; Reardon, Baker, and Klasik 2012) and are considerably less likely than low SES students to enroll in two-year institutions (Plank and Jordan 2001). These socioeconomic differences in enrollment have expanded since the 1980s (Astin and Oseguera 2004; Brint 2003) and exist even among the highest achieving students (Hoxby and Avery 2013; Radford 2013). This study explores the relationship between CPI and the horizontal stratification that

characterizes higher education enrollment. Further, it evaluates if increased CPI can mitigate these inequalities.

H5: *Increased CPI is unlikely to mitigate socioeconomic differences in college enrollment and enrollment in selective universities*

5.1 Data

Data are analyzed from the publicly available High School Longitudinal Study of 2009, a nationally representative longitudinal survey of U.S high school students. All data from this project come from the 1st (2009), 2nd (2012), and 3rd (2013) waves of the study. These waves correspond to students' 9th and 12th grade year in high school and their first year out of high school (if they graduated on time). The HSLS is advantageous for the purposes of this research because it provides a large amount of information on students' preparation and planning for post-secondary education (HSLS 2009). Further, it collects data on students at different points in their high school careers, which is useful for identifying college preparation at various stages of high school. This paper also includes some data from parents' interviews in the 1st and 2nd wave of the survey.

5.2 Dependent and Independent Measures

College Preparation Intensity

This analysis uses students' CPI in two distinct ways. First, I use CPI as a dependent variable in assessing how socioeconomic background associates with it. Then, I use CPI as an independent variable to examine its relation to college enrollment and

specific enrollment decisions. This measure captures the number of college preparatory activities that students participate in throughout high school. It includes variables from both the 2nd and 3rd wave of the HSLS. I define college prep activities broadly, to reflect both formal and informal actions from the literature on college enrollment. First, they include taking advanced placement (AP), international baccalaureate (IB), or other college classes either on college campuses or in high school, which signifies students' rigor in academic achievement. Second, they include actions that show that students are preparing for the college admission process, such as taking SAT/ACT prep courses, hiring a private college counselor, or going to a college prep camp. Lastly, they include activities that suggest students are thinking about higher education after high school, such as: searching for colleges online, meeting with high school counselors to discuss college, and touring college campuses. Collectively, these actions broadly reflect the *intensity* of students' preparation for college. Each activity may impact students' college enrollment odds. Table 1 below provides a list and participation rate for each of the activities in the analysis.[1]

Table 1 here

One way to measure CPI would be an index (or sum of the items in Table 1), however this method makes the flawed assumption that each activity is representative of the same level of intensity in college preparation. Logically, this is not the case, students

[1] Due to their similarity, I ran analyses with the college class and college credit items separately. Results were robust to those presented and available upon request. The items are distinct from one another in the survey questionnaire and treated as such in the present analysis.

must put in more effort and resources to enroll in a college prep course than they would to simply search for colleges online. Put differently, each these activities signifies some college preparation, but they do not all reflect the same level of intensity. As such, this paper utilizes Item Response Theory (IRT) and specifically a two-parameter logistic IRT model to estimate a CPI scale.[2] Two-parameter IRT models account for each item's *difficulty*: the probability of "success" on a given item and *discrimination:* or how well each item distinguishes between high and low levels of the latent trait (Embretson and Reise 2013).[3] Items with negative difficulties are considered to be "easy" to participate in while items with positive difficulties are considered to be harder to participate. In this analysis hiring a college counselor has the highest difficulty parameter (3.8), while searching for colleges has the lowest (-1.553). Items with high discrimination parameters suggest that they are highly predictive of CPI, so enrolling in a college camp (discrimination = 1.413) is more indicative of CPI than meeting with a high school counselor to discuss college (discrimination = 0.793). Thus, unlike an index, IRT scales allow for a measure that accurately accounts for the strength (or intensity) of each item and how well each item predicts the latent trait (CPI) (Embretson and Reise 2013). The result is a continuous measure of CPI with a minimum value slightly above 0 and maximum value of approximately 5.09.[4]

[2] Likelihood ratio tests indicate that a two-parameter logistic model was the best fitting IRT model for the data.
[3] Difficulty and discrimination parameters for each item available upon request
[4] Additionally, I used the items listed in in Table 1 to generate an index (or count) of college preparation intensity. Results were congruous with those presented.

College Enrollment and Selectivity of Institution

A 3rd wave measure identifies the selectivity of the institution that students enroll in. This measure uses the integrated post-secondary education data system (IPEDS) selectivity codes to classify the institutions students attend by their level of selectivity in admissions (NCES 2017). It has several categories including: no college, inclusive two-year college, inclusive 4-year college, moderately selective 4-year college, and highly selective 4-year college. This indicator was assessed during what would be students' first year in college if the student completed high school and enrolled in college on time (November 2013). The HSLS does not currently have data on students who delayed their transition to college.

Parental Education

Data for parental education was gathered from parents during the first wave of data collection. This variable was created by comparing mother's and father's education and utilizing data from whichever parent had the higher level of education.[5] Educational information from the children's guardian was used in cases where the child did not live with the biological parent.

[5] Models were also examined with both parents' education and results were consistent. Available upon request.

Family Income

Data for family income was gathered from parents in the second wave of data collection.[6] Income is coded as an ordinal variable that indicates the respondent's family income from all sources in 2011 (HSLS 2009). For this analysis, the variable is collapsed into three categories: "less than $35,000", "$35,000-$75,000", and "more than $75,000." I collapse the variables to represent the lower, middle, and upper third of the U.S. income distribution (DeNavas-Walt, Proctor, and Smith 2014). One objective in this paper it to make comparisons of socioeconomic groups. Measuring income in this way facilitates the comparison of low, middle, and high SES groups.

An additional measure of family income is also used, by not collapsing categories as described above. This measure has a total of 13 categories (in $20,000-dollar increments) beginning with family income less than $15,000 dollars and ending with family income greater than $235,000 dollars and is used as a continuous variable. Previous research shows that ordinal variables can be treated as continuous variables, especially when the differences between the categories are equal (Long and Freese 2006; Williams 2017).[7]

[6] I use second wave family income data because there is substantially less unit-non-response than in the first wave measure of family income. However, results are consistent when using first wave income data.
[7] AIC and BIC tests show that treating the un-collapsed version of family income as continuous produces a better fitting model than when using it as an ordinal outcome with 13 categories.

Socioeconomic Status Composite

HSLS provides two socioeconomic status composite variables from the 1st wave of data. These are derived using data from parents and guardians on family income, education, and occupation. Two measures are used in this analysis: one continuous measure and one that breaks down the socioeconomic groups into quintiles.

5.3 Controls

Students who participate in college prep activities and enroll in college likely differ from students who do not make these decisions. This paper includes control variables to account for factors besides socioeconomic background and CPI that likely impact the outcomes of interest in this study. Unless otherwise specified, all control variables are measured when students were in 9th grade. First, several demographic factors are controlled for including students' self-reported race/ethnicity and gender. Second, I include several controls to reflect the academic profile of the student. *Student's Educational Expectations* are controlled for using a dichotomous measure with the categories "doesn't expect bachelor's degree or doesn't know" (ref category) and "expects bachelor's degree or more". This variable helps to guard against issues of selection bias by examining the relationship between CPI and college enrollment net of students' educational expectations in their freshman year of high school. While not identical, this measure of educational expectations is the closest approximation of *college-going habitus* available in the survey that Grodsky and Riegle- Crumb (2010) identify as crucial to students' college enrollment decisions. Students' *Math Score* is an

estimate of their math skills relative to other students when entering 9th grade, the score in standardized. *GPA* at the end of high school is controlled for on a 0-4 scale. *Parental Involvement* is controlled for via an index using seven different school activities that parents were asked if they engaged in. *Household Composition* is a dummy variable with two-parent households (ref category) and one-parent households. Lastly, students' *household size* is controlled for to more accurately reflect socioeconomic status.

2.4. Analytic Strategy

The first section of the analysis examines the relationship between CPI and enrollment in college as well as enrollment at specific types of institutions. To assess *hypothesis 1 and 2,* I present a multinomial logistic regression model that uses the level of selectivity of the institution students enroll in as the dependent variable with not enrolling in college as the reference category. In doing this, this multinomial model shows how decisions like enrolling in college and the selectivity of the college students enroll in are related and both part of the broader issue of college access.[8]

Second, OLS regression models test *hypothesis 3* and examine the relationship between socioeconomic status and CPI. I operationalize socioeconomic status in several ways to ensure findings are robust. *Hypothesis 3* provides an exploratory look at the factors associated with college preparation intensity scale generated via IRT.

[8] As a robustness check, I examined logistic regression models with each outcome of this variable using a subset of only college enrollees. Results are robust and available upon request.

Third, I examine the returns to CPI, and if those returns are equal across social classes. I present the average marginal effects (AME) of CPI for each outcome in the multinomial logistic model described above. AMEs can be interpreted in a similar fashion to OLS regression coefficients and show the average change in the odds of the outcome variable for a one unit increase in CPI (for further details on the calculation of AMEs see Williams 2012). Then, I compare the AMEs for high SES (parent education of at least a bachelor's degree and family income over $75,000 a year) and low SES (parent education of a high school degree or less and family income of less than $35,000 a year) students for each of the outcomes. Statistically significant AMEs that are different from one another provide support for *Hypothesis 4*.

Next, I present predicted probabilities from the multinomial logistic model discussed above to assess whether increased CPI can mitigate socioeconomic differences in students' odds of college enrollment and enrollment in specific institutions. I compare high SES and low SES students' probabilities of enrollment at each value of the college preparation scale while holding all other variables at their mean. Specifically, this paper focuses on two outcomes that have been characterized by high levels of socioeconomic inequality: enrollment in college generally (Bailey and Dynarski 2011; Belley and Lochner 2007; Crosnoe and Muller 2014) and enrollment in highly selective institutions (Hoxby and Avery 2013; Radford 2013). I test for statistically significant differences using STATA's *contrast* command. Support for *Hypotheses 5* come from significant differences between socioeconomic groups' predicted probabilities as scores on the college preparation scale increase.

Lastly, in examining the relationship between college enrollment and participation in college preparatory activities there are concerns over selection bias and "reverse causality". That is, is college preparation associated with increases in students' odds of college enrollment or do students self-select into participation in college prep? This study uses propensity score matching (PSM) to estimate the average treatment effects of participation in college preparation on college enrolment and reduce bias in the observable academic and demographic characteristics.[9] PSM reduces selection bias by estimating the probability of receiving "treatment" (a propensity score) and matching treated cases to control cases that are similar in every way except treatment status (Guo and Fraser 2015). This study uses nearest neighbor matching (one match per each treated case) with robust standard errors (Abadie et al. 2004; Guo and Fraser 2015).[10] The use of continuous treatment variables is underdeveloped in the literature, as scholars typically use binary treatment variables. As such, I breakdown the number of college prep activities that students engage in into three dichotomous variables: no preparation vs. any preparation, some preparation (2 or less college prep activities) vs. more preparation (3 or more activities) and moderate preparation (4 or less activities) vs. more preparation (5 or more activities). All student-level covariates are included in the matching algorithm.[11]

[9] *Teffects Psmatch, Psmatch2, and nnmatch* in STATA compute treatment effects (Abadie et al. 2004; Guo and Fraser 2015; STATA Corp 2019)

[10] Imposing a caliper of 0.2-0.5 and increasing the number of matches to 4 does not substantively change results, available upon request.

[11] Parent-level covariates are not included in the matching procedure because the matching algorithm achieves better balance without them. Alternative models parent data are substantively robust to those presented and available upon request.

Standardized differences compare balance on treated vs. control cases (Austin 2009), scores over 0.1-0.2 would suggest a lack of balance between the groups (Normand 2001). Significant treatment effects reduce concerns over selection bias and suggest that observational differences in college enrollment are related to differences in college preparation.

The multivariate models are weighted to account for complex sampling design and non-response bias, as well as to make the sample representative of the population from which it was drawn. This study uses sampling weights and balanced repeated replication weights provided by the HSLS (HSLS 2009). Specifically, these weights are used to reduce non-response and missing data bias for each year of the survey and for the different sub-samples (i.e. parents). As such, using both the replication and sampling weights reduces bias to reflect the target population in light on non-response in different subgroups (parents vs. children) and different waves.

All models were robust to the consideration of multicollinearity, goodness-of-fit, and influential cases. The *estat gof* command was used in STATA to assess the goodness-of-fit in each model. All models were evaluated for excessive multicollinearity and all individual VIFs fall within acceptable range. Results were robust to the exclusion of influential cases with dbeta values greater than or equal to 1.

Results

6.1. Univariate Results

Table 2 reports descriptive results for the variables in this analysis. This table shows the raw number of college prep activities students engage in, to provide an interpretable descriptive measure of the differences in college preparation. Table 2 shows that there is significant variation in students' intensity of college preparation. The mean number of college preparatory activities within this sample was 3.122, and the standard deviation was 1.818. Upon close examination of the distribution, over half (56.88%) of students participate in 3 or fewer college preparatory activities with nearly 10% participating in none. About 10% of the sample participates in 6 or more college prep activities.

Table 2 here

6.2 Multinomial Logistic Model

Table 3 presents results from a multinomial logistic model analyzing the association between the level of selectivity of the institution students enroll at and CPI.[12] The first number displayed is the relative risk ratio, followed by the standard error. Looking at the risk ratios for CPI, they are positive and statistically significant, indicating that as CPI increases, students' odds of enrolling in each of these types of institutions increases relative to not enrolling in college. Further, the size of the risk ratio increases as the selectivity of the institution increases, from 1.288 to 3.608. These results support

[12] As an alternative outcome examines CPI and the type of program students enroll in (no college, taking classes but no specific program, associate's program, and bachelor's program. Results are robust to those presented and available upon request.

hypotheses 1 and *2* showing that students' CPI positively associates with their odds of enrolling in college and in increasingly selective institutions.[13]

Table 3 here

6.3. OLS Models on College Preparation Intensity

Table 4 displays results from OLS regression models using the CPI scale as the dependent variable.[14] Four models are included in this table, each of which using a different operationalization of socioeconomic status. Models 4.1 and 4.2 use parent education and family income, while models 4.3 and 4.4 use a socioeconomic status composite. Looking first at Models 4.1 and 4.2, parent education is associated with CPI as the coefficient is positive and statistically significant. Results for family income are more ambiguous, when used as a categorical variable in model 3.1, it does not reach levels of statistical significance. Yet, in model 4.2, the model does reach levels of statistical significance, although the size of the coefficient is considerably smaller than all other indicators of SES in Table 3.[15]

Models 4.3 and 4.4 utilize the SES composite developed by HSLS. Looking at model 4.3, the continuous measure of SES is positive and statistically significant. In Table 4.4, the SES composite is broken into quintiles. Here, only the 5th quintile reaches

[13] Results using alternative measures of SES and CPI are robust and available upon request.
[14] Results are robust when using the raw number of college prep activities students participate in and available upon request.
[15] When breaking this continuous measure down into the ordinal categories described in the data section, it reveals that the only significant dummy variable is the highest income group making $235,000 dollars per year. It may be that this difference is driving the significant results for the linear measure.

levels of statistical significance. These models provide support for *hypothesis 3* and show that higher socioeconomic status is associated with more intense college preparation.[16]

Table 4 here

2.5.Average Marginal Effects

Table 5 displays the average marginal effects of CPI from the multinomial logistic model in Table 3. These results allow for an understanding of the *returns* that students receive from increased CPI in their odds of college enrollment. Looking at the full sample, CPI on average reduces students' odds of not attending college by 6.5%. Put differently, this suggests that a one unit increase in CPI results in a 6.5% increase in students' odds of college enrollment. The full sample also shows that as CPI increases students' odds of enrolling in a two-year school decrease, while their odds of enrolling in selective and highly selective 4-year schools increase by 3.8% and 5.3%, respectively. However, supplemental analyses show for highly selective schools, as CPI increases, the size of the AME increases. In other words, students with higher levels of college preparation receive *greater* returns to their preparation than students with lower levels in terms of enrolling in highly selective colleges.[17]

Table 5 here

[16] From this point, SES is operationalized according to Model 3.1. However, the analyses are robust across the different socioeconomic indicators.
[17] AMEs are limited in that they focus on the *average* for the entire group of interest (Williams 2012). Results for the average marginal effect for CPI at each value of the CPI scale are available upon request.

Table 5 also shows differences in the returns to college preparation across socioeconomic groups. CPI has a greater influence on low SES students' odds of enrolling in college compared to high SES students (8.1% versus 3.7%). Second, CPI has a statistically significant influence on low SES students' odds of enrolling in 4-year non-selective and 4-year selective colleges, but it is not significant for high SES students. Third, when examining enrollment at 4-year highly selective institutions the impact of CPI is more than three times higher for high SES students compared to low SES students (9.4% vs. 2%). Together, these results show that the returns to CPI are different across socioeconomic groups, providing mixed support for *hypothesis 4*.

2.6. Predicted Probabilities

In this section, I present predicted probabilities from the multinomial logistic regression model in Table 3. I plot high SES and low SES students' odds of enrollment based on their scores on the college preparation scale. All other covariates are held at their mean. The outcomes analyzed are any college enrollment and enrollment in a highly selective institution.

Figure 1 presents predicted probabilities of college enrollment from Table 3 for high and low SES students at each point on the CPI scale. The base category for the multinomial models was not enrolling in college. To obtain the predicted probability for college enrollment I subtracted the predicted probabilities for no college from 1. Looking at this graph, there is some convergence in the probability of college enrollment between high SES and low SES students. At the low end of the college preparation scale there is a

26% difference in the probability of enrollment between the socioeconomic groups. As the intensity of students' college preparation increases, the gaps between socioeconomic groups become smaller. However, even at the highest values of the college preparation scale, high SES students' probability of college enrollment is 8.4% higher than low SES students. Additionally, at each point on the scale the predicted probabilities are statistically different from each other

Figure 1 here

Figure 2 displays predicted probabilities of students' enrollment at a highly selective institution from Table 3. Here, a different pattern emerges; as students' intensity of college preparation increases socioeconomic differences in the probability of enrollment increase from as low as 5% to 16% at the upper end of the college preparation scale. Together, these results provide mixed support for *hypothesis 5* as socioeconomic differences increase when examining highly selective enrollment but are reduced when looking at college enrollment generally.

Figure 2 here

6.6 Propensity Score Matching

Table 6 presents treatment effects of college preparation on college enrollment.[18] An analysis of standardized differences suggests that the matching estimator balanced the

[18] An alternative outcome analyzes a sub-sample of college enrollees, generating a dichotomous variable comparing those at selective colleges vs. all other college enrollees. Treatment effects are statistically significant and available upon request.

covariates for treated versus control groups.[19] The treatment effects represent different levels of college preparation: no preparation vs. any preparation, two or less activities vs. 3 or more activities, and 4 or less activities vs. 5 or more activities. These results show across different levels of college preparation, statistically significant treatment effects exist. The effect is largest when comparing those with no preparation to any (0.192) but remains even when comparing those with moderate levels of preparation to high levels (0.081). These results reduce concerns over selection bias showing that observational differences in college enrollment can at least partially be attributed to differences in college preparation.

Table 6 here.

3. Discussion and Conclusions

This study explores the relationship between college enrollment destinations and a new measure of college preparation intensity. In doing so, this research examines if the returns to college preparation are equal across social classes and if CPI can mitigate socioeconomic differences in college enrollment (Roderick et al. 2011). This paper makes three contributions to the literature on college enrollment, college preparation, and social stratification.

First, this study utilizes IRT to generate a scale of *College Preparation Intensity.* In doing so, I generate a *single* measure that captures students' participation in a variety of actions that relate to college preparation. This CPI scale captures both formal and

[19] No covariates had standardized differences greater than 0.01 results available upon request.

informal actions and presents them in a succinct way that accounts for differences in the intensity of each item in the scale and how well each item predicts overall college preparation. This analysis adds to previous literature that focuses on the relationship between individual college preparatory activities and college enrollment (Buchman, Condron and Roscigno 2010; Liu 2011; Radcliffe and Bos 2011).

Exploratory analyses reveal that high SES students prepare more intensely for college, and CPI is positively associated with both college enrollment and enrollment in selective colleges. These results provide empirical evidence for a theory of effectively maintained inequality (Lucas 2001). They show that high SES students may use CPI as a form of social closure to ensure *access* to the best resources in higher education and adapt to increasing competition (Alon 2009; Alon and Tienda 2007).

Second, this study uses average marginal effects from a multinomial logistic model to examine the returns that students gain from increased college preparation and if these returns are equal across social classes. Results shows that increases in students' CPI result in non-trivial increases in their odds of enrolling in college and selective institutions. Marginal effects reveal differences in the returns to college preparation between high and low SES students. On average, low SES students benefit more from CPI when looking at enrollment in college, and enrollment in most 4-year colleges. In line with work on college completion (Brand and Xie 2010), this work shows that students who are less likely to enroll in college benefit the most from college preparation.

Third, this study uses both average marginal effects and predicted probabilities to examine if increased CPI can alleviate socioeconomic differences in students' odds of college enrollment and enrollment in highly selective universities. When examining college enrollment generally, socioeconomic differences in college enrollment do decrease as CPI increases. This indicates that college preparation among low SES youth may work to reduce socioeconomic gaps in college enrollment (Alon 2009; Crosnoe and Muller 2014; Roderick et al. 2011).

Turning to enrollment at highly selective schools however, a different story emerges. AMEs show that high SES students returns to college preparation are more than three times larger than low SES students. This is further illustrated through predicted probabilities, that show as CPI increases, socioeconomic differences in the odds of enrollment increase. This suggests that even when low SES students prepare intensely for college, they struggle to reduce disparities in the likelihood to enroll in highly selective colleges compared to high SES students. These results inform the literature on horizontal stratification and highlight the role of college preparation in the process (Gerber and Cheng 2008; Radford 2013).

In effort to explain these socioeconomic differences, I conduct a supplemental analysis of a high-achieving group of students. I assess the same set of predicted probabilities presented in Figures 1 and 2 but focus on students with high levels of parental involvement (score of 7 on the index), the highest possible grade point average (4), and educational expectations of attending college in 9th grade, holding all other variables at their means. Even when focusing on this high achieving group of students,

we still see statistically significant differences across all scores of the college preparation scale for college enrollment and enrollment in highly selective colleges. These supplemental analyses further reveal the power of social class in shaping educational outcomes, regardless of academic preparation and achievement (Radford 2013).

7.1. Limitations and Future Directions

The High School Longitudinal Study of 2009 provides a nationally representative sample with abundant data on students' preparation for post-secondary education. However, this study has some limitations that are worth consideration. First, while the data on college preparation in the HSLS is rich, it is also dichotomous (yes/no). This means that we have no information on the quality of the college preparation from students. Some work has identified that the AP and IB courses that low SES students participate in are often of lower *quality* than those that high SES students participate in (Hallett and Venegas 2011). Qualitative differences in the college preparation that students engage in may exist across socioeconomic lines, though there is no way to identify this with the HSLS. Second, the current data for the HSLS stops when students would be enrolled as freshman in college. There is no data for students who choose to take a year off school. Future analyses should examine this subgroup of students. Moreover, future work can examine how CPI in high school translates to completion of a college degree or achievements in college.

7.2. Implications

These analyses provide a complicated picture for educational policymakers. As educational expansion continues in the United States, policymakers have sought to reduce the socioeconomic inequalities that characterize higher education (Crosnoe and Muller 2014; Radford 2013; Roderick et al. 2011). On one hand, this paper shows that increased college preparation has a positive effect on the likelihood that a student will enroll in college net of or in addition to both academic achievement and socioeconomic status. If policymakers were to institutionalize these activities within high schools, we may see low SES students begin to enroll in colleges at a higher rate given the host of benefits they provide (Buchman, Condron and Roscigno 2010; Liu 2011; Radcliffe and Bos 2011). All told, much of this paper shows that CPI can provide tangible benefits for low SES students and help them make their increasing educational expectations a reality (Goyette 2008; Grodsky and Riegle-Crumb 2010).

On the other hand, findings show that even at the highest levels of CPI social class continues to play a significant role in students' educational outcomes. Both qualitative and quantitative evidence shows that there are significant socioeconomic disparities for enrollment in highly selective colleges, even among the most academically rigorous students (Hoxby and Avery 2013; Radford 2013). Research in this area points to differences between socioeconomic groups when students are exploring and applying to colleges, resulting in high achieving low-SES students often choosing not to apply to highly selective schools (Radford 2013). This work adds to that body of research, showing that even when analyzing high achieving students who also have high CPI scores, social class still shapes enrollment destinations.

Theoretically, increased CPI *should* lessen these disparities in highly selective enrollment (Radcliffe and Bos 2011). Yet, these results suggest the exact opposite. Perhaps these differences are driven by unmeasurable factors such as legacy status, social or cultural capital, or differences in the *quality* of college preparation (Hallett and Venegas 2011; Karen 2002). These differences could also be driven by the socioeconomic "gatekeeping" that has characterized admissions at elite universities and colleges in the past (Karabel 2006). Either way, this paper offers an overview of the socioeconomic distinctions in college enrollment destinations for students who prepare intensely for college and achieve at high levels academically.

In recent decades, low SES students have seen unprecedented increases in both their educational attainment and educational expectations (Goyette 2008). Despite these increases, these analyses reveal that even among the students who prepare intensely for college *and* have the most impressive academic resumes, major gaps exist in access to highly selective universities. Highly selective universities offer the most lucrative pay-offs to education (Brand and Halaby 2006; Gaddis 2014; Shamsuddin 2016; Thomas and Zhang 2005), and by addressing socioeconomic gaps in access to these institutions, we can begin to address larger patterns of economic inequality and intergenerational mobility in the United States.

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Tables and Figures in Paper

Table 1: Description of College Preparation Intensity Items

Variable	Description	Survey Wave	Participation Rate
College Search	Student has searched Internet or read college guides for college options.	2	81.84%
College Counselor	Student has talked about options with a counselor hired to prepare for college admission.	2	12.07%
College Exam Prep	Student has taken a course to prepare for a college admission exam.	2	41.02%
College Tour	Student has attended a program or taken a tour at a college campus.	2	51.50%
College Prep Camp	Student has participated in a college preparation camp since high school began.	2	7.01%
College Class	Student has sat in on or taken a college class.	2	26.22%
College Credit	Student has taken a class for college credit in high school.	3	54.44%
High School Counselor Meeting	Student met with high school counselor to discuss college admissions during 2012-2013 school year.	3	69.06%

Source: HSLS 2009

Table 2. Descriptive Statistics

Variable	%	Mean	SD
Dependent Measures			
Participation in College Prep Activities		3.122	1.818
0	8.51%		
1	12.67%		
2	17.18%		
3	18.52%		
4	19.15%		
5	13.91%		
6	7.34%		
7	2.34%		
8	0.37%		
College Prep Intensity Scale (IRT)		1.734	0.815
College Enrollment Selectivity			
No College	32.74%		
2 Year Inclusive	25.50%		
4 Year Inclusive	10.38%		
4 Year Selective	19.05%		
4 Year Highly Selective	12.33%		
Independent Measures			
Parent Education			
High School or Less (ref category)	46.77%		
Associates Degree	16.37%		
Bachelor's Degree or More	36.86%		
Family Income			
$35,000 or less (ref category)	31.73%		
$35,000-$75,000	32.08%		
$75,000 or more	36.18%		
Socioeconomic Status Composite		-0.072	0.757
Socioeconomic Status Composite Quintiles			
1	19.83%		
2	20.00%		
3	19.94%		
4	19.73%		
5	20.49%		
Educational Expectations			

Expects Bachelor's Degree or More	57.17%		
Does Not Expect Bachelor's Degree or Doesn't Know	42.83%		
Parental Involvement		3.539	1.883
0	5.75%		
1	9.64%		
2	15.94%		
3	17.83%		
4	18.77%		
5	15.21%		
6	10.30%		
7	6.57%		
Student's Sex			
Male (ref category)	50.46%		
Female	49.54%		
Student's Race			
White Non-Hispanic (ref category)	51.91%		
Black	13.61%		
Hispanic	21.96%		
Asian	3.52%		
Other	9.00%		
Student's GPA		2.520	0.879
Math Score		-0.028	0.954
Household Size		4.257	1.472
Household Composition			
One-Parent Household	24.48%		
Two-Parent Household	75.52%		

Source: HSLS 2009
Data are weighted

Table 3. Multinomial Logistic Regression Model on Students' College Enrollment Destinations

	2-Year	4-Year Inclusive	4-Year Selective	4-Year Highly Selective
College Prep Intensity	1.288**	2.009***	2.431***	3.608***
	(0.113)	(0.206)	(0.218)	(0.357)
Parent Education				
Associates Degree	1.535**	2.007***	2.080***	1.645
	(0.189)	(0.311)	(0.348)	(0.428)
Bachelor's or more	1.781***	1.943***	3.232***	4.468***
	(0.198)	(0.278)	(0.364)	(0.799)
Family Income				
$35,000-$75,000	1.131	1.671**	1.618**	1.657*
	(0.116)	(0.244)	(0.259)	(0.335)
More than $75,000	1.670***	2.370***	2.526***	3.629***
	(0.222)	(0.390)	(0.395)	(0.733)
Race				
Black (non-Hispanic)	1.472*	2.838***	2.199***	1.930*
	(0.269)	(0.558)	(0.425)	(0.616)
Asian	1.449	2.039	1.731	3.340**
	(0.563)	(0.929)	(0.763)	(1.453)
Hispanic	1.774**	1.743*	1.242	1.658*
	(0.288)	(0.372)	(0.272)	(0.331)
Other	0.991	1.340	0.939	0.673
	(0.175)	(0.252)	(0.183)	(0.144)
Sex	1.309*	1.212	1.172	0.924
	(0.141)	(0.147)	(0.131)	(0.127)
GPA	2.098***	4.073***	6.355***	16.727***
	(0.149)	(0.383)	(0.620)	(2.545)
Parental Involvement	1.025	1.074*	1.090**	1.115**
	(0.025)	(0.034)	(0.034)	(0.043)
Educational Expectations	1.178	1.614***	1.633***	1.584**
	(0.128)	(0.190)	(0.191)	(0.263)
Math Score	0.982	1.047	1.253**	2.082***
	(.100)	(0.084)	(0.100)	(0.162)
Household Size	0.995	0.956	0.958	0.980
	(0.038)	(0.040)	(0.035)	(0.053)
Household Composition	1.191	0.991	0.875	0.848
	(0.139)	(0.149)	(0.150)	(0.162)
Constant	0.048***	0.001***	(0.001)***	1.56e-06***
	(.012)	(0.001)	(.001)	(9.47e-07)
N	17,910			

Source: HSLS 2009. *** p < 0.001, ** p < 0.01, * p < 0.05. Reference Category = No College
The first number reported is the relative risk ratio, the second number is the standard error

Table 4. OLS Regression on College Preparation Intensity

	4.1	4.2	4.3	4.4
Parent Education				
Associates Degree	0.024	0.019		
	(0.034)	(0.034)		
Bachelor's or more	0.101***	0.090***		
	(0.024)	(0.023)		
Family Income (categorical)				
$35,000-$75,000	-0.053			
	(0.033)			
More than $75,000	0.011			
	(0.036)			
Family Income (linear)		0.010*		
		(0.004)		
SES Composite			0.091***	
			(0.015)	
SES Quintiles				
Q2				0.022
				(0.043)
Q3				0.082
				(0.043)
Q4				0.051
				(0.040)
Q5				0.204***
				(0.042)
Race				
Black (non-Hispanic)	0.311***	0.320***	0.321***	0.318***
	(0.048)	(0.048)	(0.048)	(0.049)
Asian	0.281***	0.283***	0.287***	0.282***
	(0.058)	(0.057)	(0.056)	(0.056)
Hispanic	0.165***	0.169***	0.183***	0.177***
	(0.040)	(0.040)	(0.041)	(0.042)
Other	0.146***	0.151***	0.151***	0.151***
	(0.038)	(0.038)	(0.038)	(0.039)
Sex	0.119***	0.120***	0.121***	0.121***

	(0.024)	(0.023)	(0.023)	(0.023)
GPA	0.279***	0.277***	0.274***	0.275***
	(0.018)	(0.185)	(0.019)	(0.019)
Parental Involvement	0.041***	0.040***	0.039***	0.039***
	(0.007)	(0.007)	(0.006)	(0.007)
Educational Expectations	0.265***	0.261***	0.259***	0.259***
	(0.029)	(0.029)	(0.029)	(0.029)
Math Score	0.147***	0.144***	0.143***	0.143***
	(0.015)	(0.015)	(0.015)	(0.015)
Household Size	-0.001	-0.002	-0.001	-0.001
	(0.008)	(0.008)	(0.008)	(0.008)
Household Composition	-0.012	-0.023	-0.034	-0.025
	(0.030)	(0.030)	(0.030)	(0.031)
Constant	0.574***	0.538***	0.638***	0.550***
	(0.056)	(0.053)	(0.056)	(0.056)
N	18,327	18,327	18.327	18,327

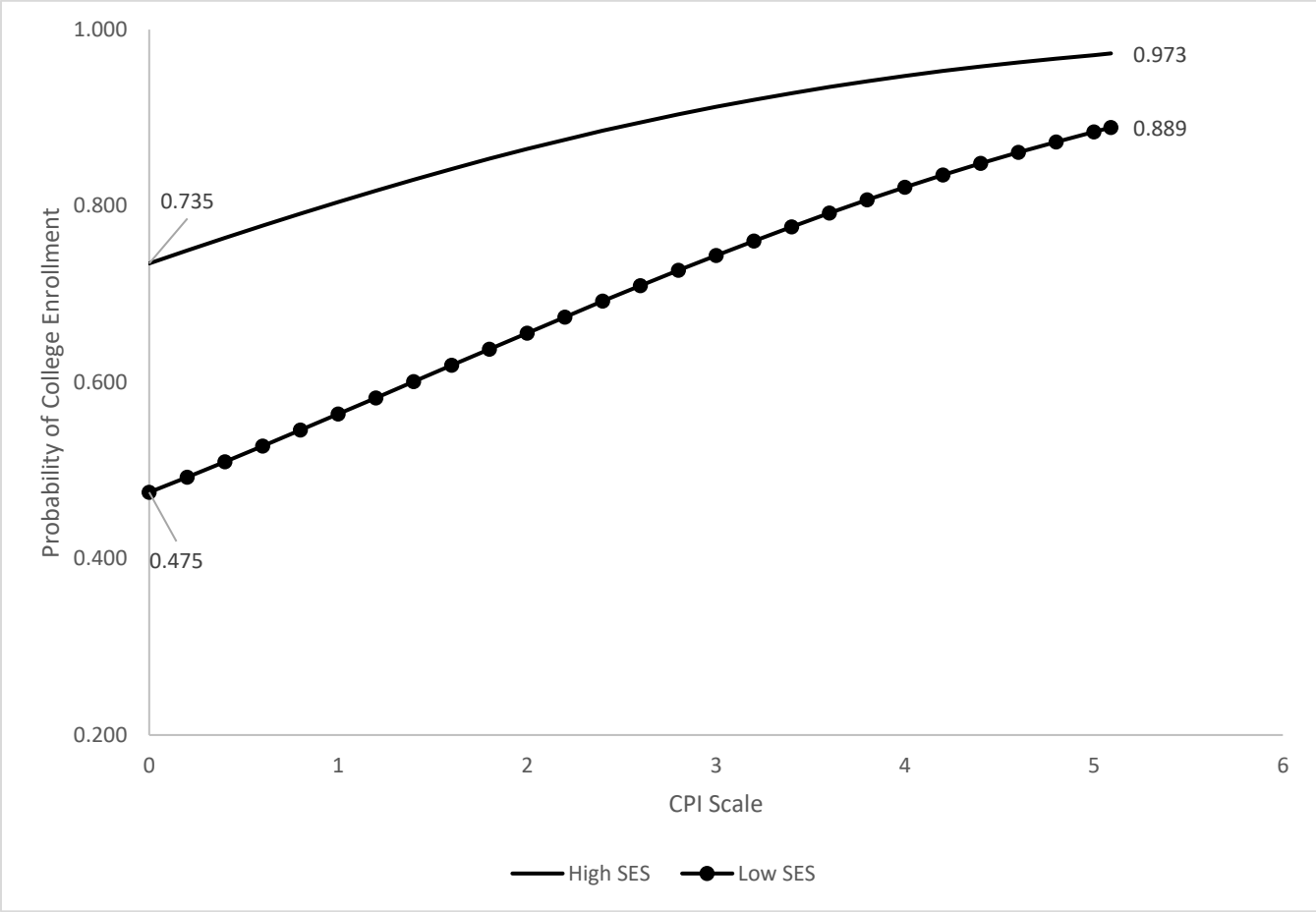
The first number reported is the regression coefficient, the second number is the standard error
*** p<0.001, ** p<0.01, * p<0.05
Source: HSLS 2009

Table 5. Average Marginal Effects of College Preparation Intensity Across Socioeconomic Groups

	Full Sample	High SES	Low SES
No College	-0.065***	-0.037***	-0.081***
2-Year	-0.039**	-0.065***	-0.002
4-Year Non-Selective	0.013^	0.003	0.023***
4-Year Selective	0.038***	0.014	0.040***
4-Year Highly Selective	0.053***	0.094***	0.020***

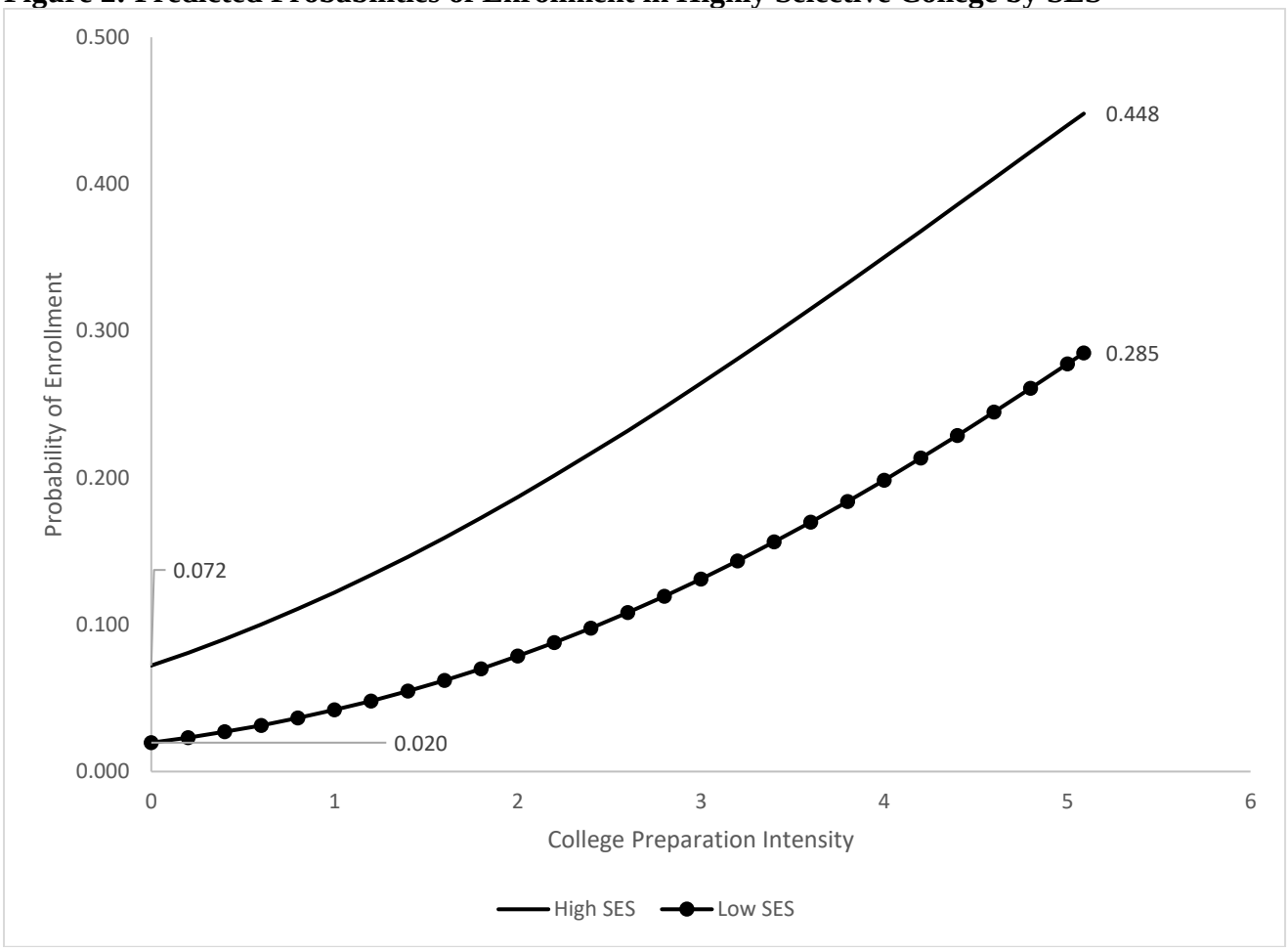
Source: HSLS 2009. *** p < 0.001, ** p < 0.01, * p < 0.05, ^ p < .10 (two-tailed tests).
Notes: 1. High SES = parent with bachelor's degree and family income >= 75k, Low SES = Parent with high school education or less and family income <= 35k. 2. All SES comparisons are statistically different from one another. Post-estimation results from Model 3.

Figure 1: Predicted Probabilities of College Enrollment by SES



Source: HSLS 2009
Predicted Probabilities from Model in Table 3
Notes: 1. High SES = parent with bachelor's degree and family income >= 75k, Low SES = parent with high school education or less and family income <= 35k. 2. All SES comparisons are statistically different from one another. 3. All other covariates held at mean.

Figure 2: Predicted Probabilities of Enrollment in Highly Selective College by SES



Source: HSLS 2009
Predicted Probabilities from Model in Table 3
Notes: 1. High SES = parent with bachelor's degree and family income >= 75k, Low SES = parent with high school education or less and family income <= 35k. 2. All SES comparisons are statistically different from one another. 3. All other covariates held at mean.

Table 6. Average Treatment Effects of College Preparation

Treatment Effects	ATE	SE	CI lower	CI upper
no preparation vs. any preparation	0.192	0.028	0.137	0.246
some preparation vs. more preparation	0.119	0.007	0.104	0.135
moderate preparation vs. extensive preparation	0.081	0.009	0.063	0.099

Source: HSLS 2009