Talking 'Bout My Generation:

Defining 'First-Generation Students' in Higher Education Research

Robert K. Toutkoushian
Professor
Institute of Higher Education
University of Georgia

Robert S. Stollberg
Graduate Assistant
Institute of Higher Education
University of Georgia

Kelly A. Slaton
Graduate Student
Institute of Higher Education
University of Georgia

DRAFT: October 14, 2015

Abstract

In this study, we used data from the Education Longitudinal Study of 2002 to determine if the way in which researchers define first-generation college students matters with regard to its connections to the postsecondary aspirations and actions of students. We considered eight alternative definitions of first-generation students, and found that depending on the definition used the set of first-generation students varied from 22% to 77% of the sample. Thus who gets counted as a first-generation student can be greatly affected by the particulars of how one defines first-generation status. Despite the large differences in the groups of first-generation students in our study, however, we found that first-generation students were consistently less likely than on-first-generation students to plan on taking a college entrance exam, apply to college, and enroll in college. Nonetheless, the average marginal effects of the first-generation variable in these models exhibited some differences in magnitude across definitions and the dependent variable considered.

Talking 'Bout My Generation:

Defining 'First-Generation Students' in Higher Education Research

Introduction

Higher education policy makers and stakeholders have long been interested in finding ways to entice more students to go to college following graduation from high school. For some, it is hoped that higher societal levels of educational attainment will lead to a wide range of financial and social benefits for all (McMahon, 2009). Others approach the topic from an equity perspective, in that education provides a mechanism for individuals to improve their standard of living, possibly reduce inequalities between selected groups of individuals and mitigate the effects of family background on a person's well-being. To help inform these policies, researchers have focused considerable attention on gaining an understanding of how students make decisions about whether or not to go to college after high school. Often these studies concentrate on factors that can be adjusted by policy makers to help more students attend college such as financial aid.

There is a general consensus among researchers that there is a strong association between the choices that students make regarding college and the educational attainment of their parents. Not surprisingly, students who come from families with highly-educated parents are themselves more likely to be predisposed to go to college and to actually enroll at a postsecondary institution. The connection between parental education and student postsecondary aspirations could be due to several factors. Because earnings and educational attainment are related, families with highly-educated parents on average have more financial resources at their disposal to pay for their children's education and to provide support services to help improve their academic performance in primary and secondary schools. It is also possible that students with college-

educated parents are more likely to hear their parents talk about college and learn about college from them, and thus in turn may consider going to college themselves. Finally, college-educated parents may possibly have more friendships with and/or reside near other adults who have gone to college, which in turn may provide information and additional role models for students forming their own educational expectations.

Even though many researchers use measures of parental education in their studies, we do not yet fully understand how parental education helps to shape the decisions and outcomes of students. The lack of understanding is due in part to differences in how researchers represent parental education in their statistical models. This problem is particularly notable when researchers try to identify "first-generation college students" in their data because it is not clear how broadly first-generation status should be defined. Is a first-generation student someone for whom neither parent has earned a college degree, or at least one parent has not earned a college degree? Does the type of degree earned or pursued by a parent – associate's or bachelor's -- matter when defining a first-generation college student? Or is someone still a first-generation college student if their parent(s) attended college but did not graduate with a degree? And does the definition depend on whether a student's parent is their biological parent, and/or parent residing with them in their home? These variations in how to define first-generation college status are subsequently reflected in the lack of consensus in the field regarding measurement of this factor.

Often the specific measure used depends on the type of data available to the researcher. With regard to parental education, a survey may ask students to identify the levels of education attempted by each parent or the degrees earned by each parent. Another survey may inquire about parental education in an aggregated form such as "Are either of your parents college

graduates?" or simply "Have your parents gone to college?" As a result, first-generation status has been defined in a number of different ways by researchers.

Determining whether and how first-generation college students fare relative to other students is important for several reasons. Despite the broad array of initiatives aimed at accomplishing the aforementioned goals, many students still do not go to college and/or earn a degree. There is substantial interest in the US in raising the postsecondary aspirations and experiences of students. The Bill and Melinda Gates Foundation (2012), Complete College America (2014), and the federal government have each called for significant increases in the proportion of citizens with some form of postsecondary credential. Likewise, a number of state governments are implementing "performance funding systems" where state funding is tied to the numbers of students earning postsecondary degrees. The connection between parental education and postsecondary decisions will be particularly relevant in the future as the demographic composition of the US population continues to shift towards racial/ethnic groups where parental education levels on average have traditionally been lower.

In this study, we focus on the associations between different ways of defining first-generation college students and the postsecondary aspirations and decisions of students. We use longitudinal data from ELS to examine a cohort of approximately 7,300 10th graders and determine in more detail whether the way in which researchers identify first-generation status is important for the conclusions reached in their studies. We estimate a series of logistic regression models where the dependent variables include whether a student plans on taking the SAT or ACT, whether a student has applied to college, and whether a student enrolls in a postsecondary institution. Our focus is then on whether the way in which first-generation status is defined matters for these models.

<center>**Literature Review**</center>

Conceptual Frameworks

       We rely on human capital theory, cultural capital theory, the college choice framework, and Tinto's interactionalist theory to guide this study. According to human capital theory, individuals invest in themselves through acquiring new knowledge and skills. As these attributes accumulate, an individual builds human capital that enables them to become more valuable in the workplace, eventually leading to higher compensation (Becker, 1975; Mincer, 1958; Schultz, 1961). Cultural capital theory asserts that those with greater cultural capital, or non-financial social assets that promote social mobility beyond economic means, receive greater success in life (Bourdieu, 1977). Because education affords people a greater amount of cultural capital than they would have otherwise had, non-first-generation students may begin college with more cultural capital than do their first-generation peers.

       Human capital theory and cultural capital theory cannot explain the entirety of student college-going behaviors, however. Much of the research on college choice has relied on the work of Don Hossler and colleagues (Hossler, Braxton, & Coopersmith, 1989; Hossler & Gallagher, 1987; Hossler, Schmit, & Vesper, 1999) and others (Paulsen, 1990; Perna, 2006) to explain the way in which students tend to make these decisions. According to their work, the college choice process involves three major phases: predisposition, search, and choice. Finally, Tinto (1993) asserts that students are more likely to persist in college when they successfully separate from their home context and become academically integrated into the college setting. Academic and student affairs professionals in colleges and universities across the United States have implemented programming strategies to enhance students' connection to their institutions and ease their transition to college (Inkelas, Daver, Vogt, & Leonard, 2007). Despite these efforts,

<center>6</center>

first-generation students enter college at lower rates than their non-first-generation peers and have lower levels of success in college.

There are several reasons why parental education could possibly influence a student's postsecondary decisions in these frameworks. First, the positive association between educational attainment and earnings means that students from highly-educated families may be better able to pay for college. Second, parents who have gone to college may have better information about the costs and benefits to college and can pass along this information to their children. This is particularly true of parents who play a large role in their children's education. When both parents have gone to college, they may also have more social and/or cultural capital that can be used to help entice their children to go to college (Dumais & Ward, 2010; Prospero & Vohra-Gupta, 2007; Wells, et al., 2011). Finally, parents who have gone to college are more likely to equip their children with the academic and social skills necessary to prepare for college and help their children navigate the college choice process.

Prior Studies

There is a long history of studies on the many different factors that are connected to the postsecondary decisions of students. Because the student college choice process involves multiple steps, there are a number of factors that can influence this process. Many studies have focused on the role of personal factors such as gender and race/ethnicity in student choice, or whether financial incentives and information about college can help entice more students to enroll in a postsecondary institution (Astin, 1964; Hearn, 1991; Hossler & Maple, 1993; Maple & Stage, 1991; Nora, 1987; Paulsen & St. John, 2002; Perna, 2000; Stage & Hossler, 1989).

Studies also analyze the pre-collegiate characteristics of students to gain a better understanding of predisposition. London (1989) found that the social histories and psychodynamics of families affect the matriculation of students and that breaking away from the culture of their families in order to integrate into the culture of college life can be challenging for first-generation students. Researchers have found that first-generation students are more likely to have a lower family income and more likely to be from racial/ethnic minority backgrounds (Terenzini, Springer, Yeager, Pascarella & Nora, 1996). They are also more likely than non-first-generation students to be women, to be older, to have children, and to have lower degree aspirations (Nuñez & Carroll, 1998). In terms of academic preparation for college, first-generation students tend to be less academically prepared and have lower reading, math, and critical thinking skills. They are also more likely to attend high schools with less rigorous curricula (Choy, 2001; Terenzini et. al., 1996).

Within this vast literature, a number of studies address how the socioeconomic status (SES) of a student's family affects their postsecondary decisions (Astin & Oseguera, 2004; Pascarella & Terenzini, 2005; Sewell & Shah, 1968). In general, these studies have concluded that there is a positive association between various measures of SES and student decisions about college. The positive association suggests that students from higher SES families can better afford to pay for college, and/or have more frequent interaction with people who have themselves gone to college and demonstrate the benefits of doing so.

An important facet of socioeconomic status is the educational attainment of a student's parents. Researchers have used many different approaches to measuring this construct. Some studies such as Card (1993) focused on a single variable for the years of parental education, while other studies including Dubow, Boxer, and Huesman (2009) utilized a single composite

variable with values for different degree levels attained by parents (such as 1=high school, 2=some college, 3=associate degree, and so on). Although these approaches are parsimonious, they restrict each increment in parental education to have the same impact on students. A more flexible approach to measuring parental education is to use multiple dichotomous variables for different levels of parental education (e.g., Paulsen & St.John, 2002).

It is common for education studies to use parental education to group students into two categories: "first-generation college student" or "not first-generation college student" (Chen & Carroll, 2005; Choy, 2001; Ishitani, 2006; Padgett, Johnson, & Pascarella, 2012; Pascarella et al., 2004; Ward, Siegel, & Davenport, 2012). The focus on first-generation college students follows from the belief that these students on average face particular hardships that constrain their educational attainment. Research studies using this approach have shown in general that first-generation college students are less likely than other students to go to college and earn a degree. However, there are a number of ways in which first-generation status could be defined. First-generation status could be based on whether neither parent graduated from college, neither parent attended college, both parents did not attend/graduate from college, or one specific parent (e.g., mother) has done so. The definition can also depend on whether "college" refers to any postsecondary institution or only 4-year institutions. Studies can likewise differ in terms of who is defined as a "parent." A parent may refer to a student's biological mother and father, or it may include stepparents, adoptive parents, guardians, foster parents, grandparents, or others.

The effects of parental education on their children may further depend on the educational attainment of each individual parent. Some studies have used variables for both the mother's and father's education (e.g., Brewer, Eide, & Ehrenberg, 1999). Due to the correlation between a mother's and father's education, however, the results for these variables could cancel each other

9

out (Kodde & Ritzen, 1988) which led some researchers to only use the mother's education level. It is not clear which parent's education should matter the most, and it may depend upon which parent is living at home. Finally, some prior studies have considered how the number of parents with postsecondary education may affect student decisions. It is possible that students coming from families where both parents went to college make different decisions than others. The connection between parental education and family structure may matter as well.

A recent analysis of the postsecondary aspirations of high school seniors in New Hampshire illustrates some of the complexities in using parental education status in statistical models (Harding, Parker, & Toutkoushian, 2015). The survey asked students to provide information on the highest level of education for their mother and father; however, no details were provided as to how these should be defined or how students living in other family situations should respond to the question. The authors found that students were more likely to take college preparatory courses and apply to college as the number of parents with a college education increased. Likewise, students who had at least one parent with a PhD were more likely to pursue a graduate education. These results support the notion that the effect of parental education on students goes beyond the simple first-generation/non-first generation dichotomy.

Data and Methodology

Data

For this study, we relied on data from the Education Longitudinal Study (ELS) of 2002. ELS is a longitudinal survey in which a nationally-representative sample of more than 16,000 10th grade students as of 2002 are surveyed again in 12th grade and twice subsequently (2006 and 2012). The high response rates to the follow-up surveys in the first and second waves (~89%)

10

ensure that there were a sufficient number of students in the sample to conduct the statistical analyses for our particular study. To focus attention on the role of parental education on students, we restricted our analysis to students who were living full-time with two parents (defined as either biological, step, adopted, or foster parents) as of grade 10 and had reported information on their educational attainment. After deleting additional cases with missing data on the dependent variables, the final weighted sample used in our study consisted of approximately 7,300 students.[1]

There are a number of reasons that ELS is an ideal dataset for the purpose of our study. First, the data are nationally representative and therefore the findings can be applied to the larger set of students in the United States. Second, the survey collected information from students at both the predisposition and choice stages of their college careers, and not just whether they enrolled in college. Thus the data enable us to determine how parental education affected the initial postsecondary aspirations of students as well as whether they subsequently enrolled in college. Third, ELS is the most current snapshot of a longitudinal sample of US students that follows those surveyed through what would be considered a typical time period for college completion. Finally, ELS is valuable for this study because it collected information about parental education from the parents and not the students, providing a more reliable measure of parental educational attainment and the opportunity to obtain a better understanding of the effects of first-generation status on student decisions about college.

Variables

Dependent Variables. In this study, we focused on three dependent variables. The first of these was whether a student in 10$^{\text{th}}$ grade indicated that he or she has taken or planned on

---

[1] All sample sizes are rounded per requirements from the National Center for Education Statistics.

taking the SAT or ACT during high school. In most states, the act of taking either standardized test in this time period was a good early indicator of a student's interest in going to college.[2] The second dependent variable was whether or not the student applied to at least one postsecondary institution. Finally, the last dependent variable that we considered was whether or not a student enrolled in a two- or four-year postsecondary institution. Note that all three dependent variables are binary in nature.

Variables for First-Generation College Status. There are eight different measures that we constructed to identify first-generation college students (P). The variations in these measures depend on two factors: the level of parental education required for a student to be counted as a first-generation college student, and the number of parents who must meet these criteria. As noted earlier, there are four different levels of educational attainment that we used to define first-generation college students: (1) parent(s) have at most a high school degree; (2) parent(s) have at most started (but not completed) an associate's degree; (3) parent(s) have at most completed an associate's degree; and (4) parent(s) have at most started (but not completed) a bachelor's degree. For each of these categories, we created two variables depending on whether both parents or at least one parent needed to meet the education criteria.

In the parental survey component of ELS, the respondent was asked to identify his/her relationship to the student as well as the relationship to the student of a spouse or partner who was living in the same household. The available options included biological parent, adoptive parent, stepparent, foster parent, grandparent, partner, other relative, or other guardian. For the purpose of this study, we defined "parents" to include biological, step, adoptive, and foster

---

[2] Several states required all students in high school to take either the ACT or SAT, and thus taking a college entrance exam in these states does not provide information about the student's interest in going to college.

parents. We also tested to see whether the key results from our analyses differed if we restricted the sample to only students who were living with both biological parents.

In addition to comparing first-generation to non-first-generation college students, we divided students into four different categories depending on which of the two parents had a specific level of education. The four categories were: both parents were not college educated, only the mother was college educated, only the father was college educated, and both parents were college educated, where the definition of "college educated" corresponded to one of the four definitions noted above. Accordingly, we used these variables to test not only whether first-generation college students differ from non-first-generation students, but also whether students with only one parent meet the criteria differed from students with two college-educated parents and if the gender of the parent with college experience mattered.

Other Explanatory Variables. The remaining explanatory variables fall into four general categories. The first group of variables (*D*) represents student-level characteristics such as their gender, race, and ethnicity. Student characteristics also include the student's grade point average in grade 9 or in grades 9-12 (depending on the dependent variable) and the student's score on standardized tests in mathematics and reading collected by ELS. The second group (*F*) denotes family measures that may affect demand for higher education such as family income (5 categories), number of dependents, and number of siblings. The third group of explanatory variables (*S*) represents high school characteristics including enrollments in grade 10, geographic location, whether located in an urban, suburban, or rural area, whether public, percent students on free lunch, and percent students taking AP courses. Finally, the last set of explanatory variables (*I*) include measures of parental involvement with their children's education. We created dummy variables for this last category from the following: whether students often or

13

sometimes had discussions with parents about (1) high school courses, (2) high school activities, (3) high school grades, (4) taking the SAT or ACT, and (5) going to college. To help retain students in the sample, we created dummy variables for students with missing data on gender, race, ethnicity, family income, number of siblings and dependents, percent students on free lunch or in AP courses, and parental involvement questions.

Statistical Models

For each of the three dependent variables, we began by estimating a series of nested regression models where we focused on how the relationship between first-generation college status and the outcome variable changed as we added selected control variables. Because each of the dependent variables is binary, we used logistic regression analysis to estimate the key parameters of the model. In all models, we converted the logistic regression coefficients to marginal effects, weighted the data to take into account the two-stage stratified sampling design used by NCES, and clustered the standard errors at the school level to account for the possible non-independence of students in the same school. In the nested models shown below, we defined first-generation college students as those for whom both parents did not attempt or complete any education beyond high school. Note that this is the most restrictive definition of first-generation students of the eight that we considered, and arguably corresponds most closely to how many define this construct. In subsequent models we relaxed this assumption.

Specifically, we first estimated the following three equations for whether the student planned on or had taken the SAT or ACT as of grade 10:

(1.1) $\quad SAT = \alpha + \theta P + D\beta + \varepsilon$

(1.2) $\quad SAT = \alpha + \theta P + D\beta + F\delta + S\gamma + \varepsilon$

(1.3) $\quad SAT = \alpha + \theta P + D\beta + F\delta + S\gamma + I\omega + \varepsilon$

where $SAT = 1$ if student has taken or planned on taking the SAT or ACT as of grade 10, and $\alpha, \beta, \gamma, \delta, \theta, and\ \omega$ are parameters to be estimated. In the first model, the likelihood of taking the SAT or ACT is modeled as a function of the student's first-generation college status and other personal characteristics such as gender, race, and academic ability. The model in Equation (1.2) adds controls for family characteristics such as family income and dependents and school-level variables. Similarly, the last model adds controls for parental involvement measures to the equation. Collectively, the three models help us see whether the association between first-generation college status and SAT-taking behavior is driven by other factors that may also be related to SAT-taking behavior and correlated with first-generation college status. For example, first-generation college students are more likely than their counterparts to reside in families with lower income and attend schools with lower college-going rates. The last equation is designed to help determine whether the lower college-going rate of first-generation college students is reduced once we controlled for parental involvement in their children's education.

Turning to college application, we used a similar structure of the nested models:

(2.1) $\quad APPLY = \alpha + \theta P + D\beta + \varepsilon$

(2.2) $\quad APPLY = \alpha + \theta P + D\beta + F\delta + S\gamma + \varepsilon$

(2.3) $\quad APPLY = \alpha + \theta P + D\beta + F\delta + S\gamma + I\omega + \varepsilon$

(2.4) $\quad APPLY = \alpha + \theta P + D\beta + F\delta + S\gamma + I\omega + \varphi SAT + \varepsilon$

where $APPLY = 1$ if applied to at least one college. The only difference in the model structure used here is that we added a control for whether the student planned on taking the SAT or ACT to determine whether being a first-generation college student has an additional association to applying to college even after taking into account its relationship to taking the SAT or ACT.

Finally, the nested model structure for the dependent variable $ENROLL = 1$ if enrolled in any postsecondary institution is as follows:

(3.1) $ENROLL = \alpha + \theta P + D\beta + \varepsilon$

(3.2) $ENROLL = \alpha + \theta P + D\beta + F\delta + S\gamma + \varepsilon$

(3.3) $ENROLL = \alpha + \theta P + D\beta + F\delta + S\gamma + I\omega + \varepsilon$

(3.4) $ENROLL = \alpha + \theta P + D\beta + F\delta + S\gamma + I\omega + \varphi SAT + \varepsilon$

(3.5) $ENROLL = \alpha + \theta P + D\beta + F\delta + S\gamma + I\omega + \varphi SAT + \tau APPLY + \varepsilon$

As before, the last equation (3.4) was added to the structure to determine if first-generation college students were less likely to enroll in college even after controlling for their likelihood of taking the SAT/ACT, and the last model adds the variable for whether the student applied to college.

In the nested models shown above, we relied on a single definition of first-generation college students. To determine whether the way in which first-generation status is defined matters, we reestimated the third model for each dependent variable (where we controlled for student, family, school, and parental involvement factors) after replacing the first-generation status measure with each of the seven alternative measures. Likewise, to determine whether the gender of the parent with college experience matters, we used the third equation specification for each dependent variable and replaced the single dummy variable for first-generation college status with three dummy variables for the educational attainment of each parent, as in:

(4.1) $SAT = \alpha + \theta_1 P_1 + \theta_2 P_2 + \theta_3 P_3 + D\beta + F\delta + S\gamma + I\omega + \varepsilon$

(4.2) $APPLY = \alpha + \theta_1 P_1 + \theta_2 P_2 + \theta_3 P_3 + D\beta + F\delta + S\gamma + I\omega + \varepsilon$

(4.3) $ENROLL = \alpha + \theta_1 P_1 + \theta_2 P_2 + \theta_3 P_3 + D\beta + F\delta + S\gamma + I\omega + \varepsilon$

where $P_1 = 1$ if neither parent is college-educated, $P_2 = 1$ if only mother is college-educated, and $P_3 = 1$ if only father is college-educated. The reference category against which these variables are compared is $P_4 = 1$ if both parents are college-educated.

Results

In Table 1 we provide descriptive statistics for the variables used in our study. Beginning with the dependent variables, we found that about three-quarters of the students in our sample indicated that they had taken or were planning to take the SAT or ACT exam at some time during high school. We observed that the vast majority of students (86%) eventually applied to at least one postsecondary institution and that 82% enrolled in a postsecondary institution. The next block of variables shows that the way in which a researcher defines "first-generation college students" can have a large impact on the size of the group. We found that the percentage of first-generation students varies from a high of 77% using the most lenient definition (where a student is labeled a first-generation college student unless both parents have earned bachelor's degrees) to a low of 22% (where a student is categorized as a first-generation college student only when both parents have not enrolled in any form of postsecondary education). As expected, the number of first-generation college students rises as the parental education level needed to be included in the first-generation category rises. The first four measures of first-generation college status have fewer students than the last four measures because they require both parents to meet the educational criteria for them to be counted as a first-generation college student.

------------------------------- Insert Table 1 Here -----------------------------------

Next, we focused on how the means for the three dependent variables differed between first-generation and non-first-generation college students using each of the eight alternative

17

definitions. The results are shown in Table 2. Each row corresponds to one of the eight

alternative ways of defining first-generation college students. There are three columns of values

for each dependent variable for first-generation students, non-first-generation students, and the

difference (gap) between them. Regardless of how first-generation status was measured,

students in the first-generation category were significantly less likely than students in the non-

first-generation category to plan on taking the SAT or ACT, apply to college, and enroll in

college. In comparison to non-first-generation college students, first-generation college students

were, on average, between 16 and 20 percentage points less likely to take the SAT or ACT,

between 13 and 19 percentage points less likely to apply to college, and 19 to 24 percentage

points less likely to enroll in college. The differences in means tended to be larger for the more

restrictive groups of first-generation students. In particular, the gaps in average outcomes

between the two groups are the largest for the most-restrictive definitions where a student is

considered a first-generation student only if neither parent has attended college at any level.

Interestingly, the gaps do not change very much as the first-generation definition becomes

broader because at the same time the non-first-generation definition becomes narrower. In part,

this is due to the fact that as the first-generation category becomes less restrictive, the other

category (non-first-generation students) becomes more restrictive.

------------------------------- Insert Table 2 Here -----------------------------------

In Table 3, we focus on how the first-generation status of students, as well as other

explanatory variables, affects a student's plans for taking the SAT or ACT at some time during

high school. We use this variable as an early indicator of a student's predisposition to go to

college. The three models were estimated using binary logistic regression analysis, and the data

were weighted by the probability of being included in the sample. All coefficients in the model

have been converted to average marginal effects for ease of interpretation. The models were chosen to help highlight how the association between first-generation status and SAT/ACT taking is affected by whether we also controlled for personal and family characteristics of students that may be related to the same dependent variable. We only present the complete findings here for the case where students are defined as first-generation when both of their parents have at most a high school diploma.

-------------------------- Insert Table 3 Here -----------------------------

Beginning with the main variable of interest for our study, first-generation college students were 6.3% less likely than non-first-generation college students to plan on taking the SAT or ACT after controlling for selected personal characteristics. After we controlled for family income and number of siblings and dependents, as well as selected characteristics of the schools they attended, first-generation students were almost 5% less likely to plan on taking the SAT or ACT. Finally, first-generation students were still 4.3% less likely than non-first-generation students to plan on taking the SAT or ACT after adding variables to the model for parental involvement in their education. The marginal effects show that the majority of the 20% gap in SAT/ACT taking behavior is accounted for by these other factors; nonetheless, the remaining marginal effects for first-generation status were still large and statistically significant.

Among the key results for the variables not related to parental education are the following: Females were 5% to 6% more likely than males to plan on taking the SAT/ACT. With regard to race/ethnicity, we found that black and Asian students were more likely than white students to plan on taking the SAT/ACT. Not surprisingly, there was a strong positive relationship between a student's intent to take the SAT or ACT and his or her grade point average in 9th grade or standardized test score in math and reading. Interestingly, family

19

characteristics had little marginal effect on the likelihood of a student taking a college entrance exam. Turning to school-level variables, we observed that there was a positive association between school size and the student's plans for taking the SAT or ACT, and that students in selected regions of the country were more likely to be inclined to take a college entrance exam. Finally, students whose parents were more heavily involved with them in their academic experiences were more likely to consider taking a college entrance exam. However, the fact that the addition of these controls did not eliminate the first-generation effect suggests that the disadvantage faced by first-generation college students is due to more than lack of parental involvement and interest in their education.

In Table 4 we summarize the findings for the first-generation status variables when we ran the same model (3) for each alternative definition of first-generation college student. The last four rows correspond to each of the four parental education levels we used to define "college-educated" and "non-college-educated" parents. The first column indicates which parents had to meet the education criteria for the student to be labeled as a first-generation college student, and the second column shows the reference group used for comparison. Each row then indicates the specific comparison that is being made between groups of students. In the second row, for example, we compared students where both parents have not gone further than high school against students where at least one parent has gone to college at some level. These models correspond to what we presented in Table 3. The first row contains the results from a model similar to that in the second row, except that the sample was restricted to students who were residing with both of their biological parents. In the third row we compared students where one or more parent has no college experience to students where both parents have college experience as defined by the last four columns. In rows 1-3, each student can only fall into one of the two

categories. The last three rows in the table are used to test whether the number of parents meeting the education criteria, and the gender of the parent, has an impact on the SAT/ACT taking behavior of students. Note that the reference category for each of these models is when both parents have college experience.

-------------------------- Insert Table 4 Here ------------------------------

The results in the first two rows show that regardless of the level of parental education used to define a first-generation student, first-generation college students were less likely than non-first-generation college students to plan on taking the SAT or ACT. The marginal effects for this variable were relatively consistent across the four levels of parental education that we used to define the variable. At the same time, when first-generation college students are defined as those with at least one parent without college experience (third row), the marginal effects are smaller and in several instances not statistically different from zero. Turning to the last three rows in the table, it can be seen that there is no consistent evidence that students with only one parent without college experience were less likely than students in the reference group to take the SAT or ACT. Likewise, the marginal effects were close to zero regardless of whether it was the student's mother or father who did not have experience in college.

In Table 5, we present the results from the nested models shown in equations (2.1) to (2.4) where the dependent variable is whether a student applied to college. We present the results from four alternative models to determine whether the association between first-generation status and likelihood of applying to college was affected by controlling for student-level characteristics, family and school characteristics, parental involvement in education, and whether the student planned on taking the SAT/ACT. As before, in the interest of parsimony we only show the

marginal effects for the models where first-generation college students are those for whom both parents have at most a high school degree.

-------------------------- Insert Table 5 Here ----------------------------

Overall, the findings in Table 5 are similar to what we observed in Table 3 for SAT/ACT taking behavior. First-generation college students were about 8.5% less likely than non-first-generation college students to apply to college following adjustments for selected personal characteristics. Adding family- and school-level characteristics to the model reduced the first-generation marginal effect to 6.9%, but it was still statistically significant. Likewise, the marginal effect for the first-generation variable did not change very much after controlling for parental involvement in their children's education and whether the student planned on taking a college entrance exam. Interestingly, a number of family- and school-related characteristics were found to have different relationships with college application behavior than they did SAT-taking behavior.

The structure of Table 6 parallels the results presented in Table 4, except that the focus in Table 6 is on whether the student applied to college. We used the third model specification (3) for each equation so that the results would more closely correspond to the prior dependent variable. It can be seen from the first two rows that regardless of how we defined first-generation status with regard to the level of parental education, these students were between 5 to 7 percent less likely than non-first-generation students to apply to college. The results in the third row show that when first-generation status is defined for students with at least one parent not having the required college experience level, these students were between 4 to 6 percent less likely to apply to college. Finally, the findings in the last three columns again show that students with only one parent without college experience in general were just as likely as non-first-generation

22

students to apply to college. The only exceptions to this rule were found when we used lower levels of educational attainment to separate first-generation and non-first-generation students (column 3). Students who came from families where only the mother did not have experience in college were 5% less likely than students with two college-educated parents to apply to college.

-------------------------- Insert Table 6 Here ------------------------------

Finally, Tables 7 and 8 parallel the analyses presented earlier except that the dependent variable is now whether the student enrolled in college. There are five models shown in Table 7: (1) controls for student-level factors, (2) family plus school-level variables, (3) parental involvement, (4) whether planned on taking the SAT or ACT, and whether applied to college.

-------------------------- Insert Table 7 Here ------------------------------

With regard to the personal characteristics, we found that black and Asian students were each more likely than comparable white students to enroll in college even after taking into account whether they applied to college. Both student GPA and math and reading test scores had strong associations with college-going behavior. Family characteristics such as income and the number of siblings had larger effects on enrollment behavior than on SAT-taking or college application behavior. First-generation college students were about 10% less likely than non-first-generation students to enroll in college after controlling for only student-level characteristics. The marginal effect for this variable fell by about four percentage points after accounting for family and school factors, and did not show much change after we added controls for parental involvement in their child's education or whether the student planned on taking the SAT or ACT. However, after we added a variable to the model for whether the student applied to college, first-generation college students were still about 2% less likely than their peers to enroll in college.

The findings in Table 8 reveal that regardless of how we defined first-generation status, students in this category were significantly less likely than non-first-generation students go enroll in college. The marginal effects for the first-generation variables in rows 1 and 2 ranged from a low of 4.7% to a high of 7.5%. Interestingly, when first-generation status was defined as having at least one parent without college experience (row 3), the marginal effects increased to 7.2% to 11.2%. A striking difference also emerged in the last three rows where we separated students into four different categories depending on how many and which parent did not have college experience. Across the various educational attainment levels considered, students with one non-college-educated parent were significantly less likely than students with two college-educated parents to enroll in college. The estimated marginal effects were negative and significant regardless of whether it was the mother or father who did not go to college.

--------------------------- Insert Table 8 Here ------------------------------

Summary and Discussion

Higher education researchers have long been interested in examining the experiences and outcomes of students who are the first in their families to go to college. And countless studies have done this by categorizing students according to whether they are first-generation college students or not. Unlike many other variables used in higher education studies, however, there is no consensus among researchers as to how broadly or narrowly first-generation status should be defined. Is someone no longer a first-generation student if his or her parent(s) simply attended college at some point in time, or do their parents have to earn a degree for the student to no longer be considered first generation? Does the level of degree pursued or earned by parents

24

matter? And is it important whether just one parent or both parents have to meet the designated educational criteria?

In this study, we used data from a nationally-representative sample of students to determine whether the way in which researchers define first-generation status affects its association with the postsecondary aspirations and actions of students. We considered eight alternative definitions of first-generation students, and found that the percentage of students identified as first-generation varied substantially across definitions. Thus who gets counted as a first-generation student can be greatly affected by the particulars of how one defines first-generation status. This result alone has important implications for postsecondary institutions and government agencies to consider as they design programs to help first-generation college students succeed in academia because the cost of implementing such programs will naturally vary with the size of the group. For example, broadening the definition of first-generation students from "less than high school education" to "less than bachelor's degree" may result in more than a doubling of the number of students who would be eligible to use such assistance programs.

Despite the large differences in the size of the groups of first-generation students in our study, we found that the signs and significance levels of the first-generation variables were for the most part consistent across definitions. From the results, we would conclude that regardless of how we defined first-generation students, they were less likely than their counterparts to take steps to go to college and then to actually enroll in a postsecondary institution. The differences in effects of first-generation status on the outcomes considered here may be smaller than first thought because at the same time that the group of first-generation students becomes broader, the reference group of non-first-generation students becomes more selective. Accordingly, while the

levels of outcomes for the groups shift up and down with the level of education used to define these groups, the differences between them remain fairly consistent.

Looking across the models, the number of parents used to define first-generation college status only seems to matter at the enrollment decision. In this instance, students with exactly one parent without college experience are at a disadvantage relative to students with two college-educated parents, and students with neither parent having college experience are at the greatest disadvantage. These results show that the way in which first-generation status is defined matters the most in studies where the researcher seeks to explain college enrollment behavior and is less important at the predisposition stage for college.

One remaining important question for researchers is: why are first-generation students -- regardless of how they are measured – less likely than their peers to want to go to college and to eventually enroll, and how does this relate to the way in which first-generation status should be measured? The act of having gone to college may help parents understand and transmit to their children what is needed to pursue a college education, and thus simply going to college may be an important defining line between students. Or perhaps it is only when parents earn a college degree that they understand the financial and non-financial benefits of college and encourage their children to do the same. In each of these instances, the effect of parental education on children is driven by the social capital and information that parents convey to their children that then translate into observed behavior.

Alternatively, it could be that parental education serves as a measure of academic aptitude or ability that is often passed down to their children. In this case, the advantage experienced by students with college-educated parents is not due to their having better information about the benefits of college or being more socialized to attend college, but rather

that due to genetics they are more likely to succeed in college and thus more likely to pursue this option.

Separating the "nature" versus "nurture" explanation of the first-generation effect on students is very difficult to do in practice. In ELS, data are only available on both biological parents when they were both currently residing in the household with the student. Our models showed that controlling for family income, which is correlated with parental education, led to a small reduction in the disadvantage faced by first-generation students but did not eliminate the connection. Likewise, the results from models where we controlled for measures of parental involvement in their children's education suggest that this alone has a relatively small impact on the connection between first-generation status and postsecondary predisposition and enrollment. For now, the best advice for researchers who are developing survey instruments to collect information on parental education is to include a larger menu of alternatives for parents. In this way, researchers can easily test the sensitivity of their findings to the specific way in which first-generation status is defined in their work. It also has the potential to allow researchers to examine how the effects of first-generation college status change when particular factors are controlled for in statistical models.

There are a number of promising future directions for research on first-generation college students that can complement the work that we presented here. First, it would be helpful to determine whether the association between first-generation status and college enrollment varies with the type of postsecondary institution. It is possible that ceteris paribus first-generation students are more likely to matriculate at institutions where their chances for success are greater, such as 2-year colleges and less-selective 4-year institutions. Second, attention should be given to other indicators of interest in postsecondary education, such as whether a student took

advanced placement (AP) classes in high school, participated in extracurricular activities, and so on. Finally, there are additional ways of measuring first-generation status that might be interesting to examine. For example, is someone a first-generation college student if their parents did not go to college but one or more of their grandparents did? Typically we only look at the student's immediate family (parents) to make this determination, and perhaps it is the right way to do it if the benefits/costs are mainly imposed by parents and not grandparents.

References

Aspelmeier, J., Love, M., McGill, L., Elliott, A., & Pierce, T. (2012). Self-esteem, locus of control, college adjustment, and GPA among first-and continuing-generation students: A moderator model of generational status. *Research in Higher Education, 53*, 755-781.

Astin, A. (1964). Personal and environmental factors associated with college dropouts among high aptitude students. *Journal of Educational Psychology, 55*, 219-227.

Astin, A., & Oseguera, L. (2004). The declining" equity" of American higher education. *The Review of Higher Education, 27*, 321-341.

Becker, G. (1975). *Human capital: A theoretical and empirical analysis, with special reference to education*. Chicago: University of Chicago Press.

Bill and Melinda Gates Foundation (2012). *New grants to reimagine financial aid & help increase postsecondary access, success and completion (http://www.gatesfoundation.org/media-center/press-releases/2012/09/postsecondary-financial-aid-grants-announcement).*

Billson, J., & Terry, M. (1982). In search of the silken purse: Factors in attrition among first-generation students. *College and University, 58*, 57-75.

Bourdieu, P. (1977). Cultural reproduction and social reproduction. In J. Karabel and A. H. Halsey (eds.), *Power and ideology in education*. Oxford: Oxford University Press.

Brewer, D., Eide, E., & Ehrenberg, R. (1999). Does it pay to attend an elite private college? Cross-cohort evidence on the effects of college type on earnings. *Journal of Human Resources*, 104-123.

Card, D. (1993). Using geographic variation in college proximity to estimate the return to schooling. NBER Working Paper No. 4483. Cambridge, MA: National Bureau of Economic Research.

Chen, X., & Carroll, C. (2005). First-generation students in postsecondary education: A look at their college transcripts. Postsecondary education descriptive analysis report. NCES 2005-171. *National Center for Education Statistics*.

Choy, S. (2001). Students whose parents did not go to college: Postsecondary access, persistence, and attainment. Findings from the condition of education, 2001.

Collier, P., & Morgan, D. (2008). "Is that paper really due today?": Differences in first-generation and traditional college students' understandings of faculty expectations. *Higher Education, 55*, 425-446.

Complete College America (2014). Alliance of the states: leading the college completion movement. (http://completecollege.org/the-alliance-of-states/)

Dennis, J., Phinney, J., & Chuateco, L. (2005). The role of motivation, parental support, and peer support in the academic success of ethnic minority first-generation college students. *Journal of College Student Development, 46*, 223-236.

Dougherty, P., Gernand, R., Pollock, C., & Wiley, A. (2007). *First-generation students in the 2006 cohort.* Paper presented at the annual meeting of the Association for Institutional Research, Kansas City, MO.

Dubow, E., Boxer, P., & Huesmann, L. (2009). Long-term effects of parents' education on children's educational and occupational success: Mediation by family interactions, child aggression, and teenage aspirations. *Merrill-Palmer Quarterly, 55*, 224-249.

Dumais, S., & Ward, A. (2010). Cultural capital and first-generation college success. *Poetics, 38*, 245-265.

Grayson, J. (1997). Academic achievement of first-generation students in a Canadian university. *Research in Higher Education, 38*, 659-676.

Hahs-Vaughn, D. (2004). The impact of parents' education level on college students: An analysis using the beginning postsecondary students longitudinal study 1990-92/94. *Journal of College Student Development, 45*, 483-500.

Harding, J., Parker, M., & Toutkoushian, R. (2014). Deciding about college: How soon is soon enough? Paper presented at the annual meeting of the Association for Education Finance & Policy, San Antonio, TX, March 13.

Hearn, J. (1991). Academic and nonacademic influences on the college destinations of 1980 high school graduates. *Sociology of Education*, 64, 158-171.

Hossler, D., Braxton, J., & Coopersmith, G. (1989). Understanding student college choice. In J. Smart (Ed.), *Higher education: Handbook of theory and research,* Vol. 5 (pp.231-288). New York: Agathon Press.

Hossler, D., & Gallagher, K. (1987). Studying student college choice: A three-phase model and the implications for policymakers. *College and University*, *62*, 207-21.

Hossler, D., & Maple, S. (1993). An investigation of the factors which differentiate among high school students' plans to attend a postsecondary educational institution and those who are undecided. *Review of Higher Education, 16,* 285-307.

Hossler, D., Schmit, J., & Vesper, N. (1999). *Going to college: How social, economic, and educational factors influence the decisions students make.* Baltimore: Johns Hopkins University Press.

Inkelas, K., Daver, Z., Vogt, K., & Leonard, J. (2007). Living–learning programs and first-generation college students' academic and social transition to college. *Research in Higher Education, 48*, 403-434.

Ishitani, T. (2003). A longitudinal approach to assessing attrition behavior among first-generation students: Time-varying effects of pre-college characteristics. *Research in Higher Education, 44*, 433-449.

Ishitani, T. (2006). Studying attrition and degree completion behavior among first-generation college students in the United States. *The Journal of Higher Education*, 77, 861-885.

Kim, Y., & Sax, L. (2009). Student–faculty interaction in research universities: Differences by student gender, race, social class, and first-generation status. *Research in Higher Education, 50*, 437-459.

Kodde, D., & Ritzen, J. (1988). Direct and indirect effects of parental education level on the demand for higher education. *Journal of Human Resources*, 356-371.

Lohfink, M., & Paulsen, M. (2005). Comparing the determinants of persistence for first-generation and continuing-generation students. *Journal of College Student Development, 46*, 409-428.

London, H. (1989). Breaking away: A study of first-generation college students and their families. *American Journal of Education*, 144-170.

Maple, S., & Stage, F. (1991). Influences on the choice of math/science major by gender and ethnicity. *American Educational Research Journal, 28*, 37-60.

McCarron, G., & Inkelas, K. (2006). The gap between educational aspirations and attainment for first-generation college students and the role of parental involvement. *Journal of College Student Development, 47*, 534-549.

McMahon, W. (2009). *Higher learning, greater good: The private and social benefits of higher education.* Baltimore, MD: The Johns Hopkins University Press.

Mincer, J. (1958). Investment in human capital and personal income distribution. *The Journal of Political Economy*, *66*, 281-302.

Nora, A. (1987). Determinants of retention among chicano college students: A structural model. *Research in Higher Education, 26*, 31-59.

Nunez, A., & Carroll, D. (1998). *First-generation students: Undergraduates whose parents never enrolled in postsecondary education* (NCES 98-082). Washington, DC: National Center for Education Statistics, U.S. Government Printing Office.

Padgett, R., Johnson, M., & Pascarella, E. (2012). First-generation undergraduate students and the impacts of the first year of college: Additional evidence. *Journal of College Student Development*, *53*, 243-266.

Pascarella, E., Pierson, C., Wolniak, G., & Terenzini, P. (2004). First generation college students: Additional evidence on college experience and outcomes. *Journal of Higher Education*, 75, 249-284.

Pascarella, E., & Terenzini, P. (2005). *How college affects students* (Vol. 2). K. Feldman (Ed.). San Francisco: Jossey-Bass.

Paulsen, M. (1990). *College choice: Understanding student enrollment behavior.* ASHE-ERIC Higher Education Report, No. 6. Washington, DC: School of Education and Human Development, The George Washington University.

Paulsen, M., & St John, E. (2002). Social class and college costs: Examining the financial nexus between college choice and persistence. *The Journal of Higher Education, 73*, 189-236.

Perna, L. (2000). Differences in the decisions to enroll in college among African Americans, Hispanics, and Whites. *Journal of Higher Education, 71*, 117-141.

Perna, L. (2006). Studying college access and choice: A proposed conceptual model. In J. Smart (Ed.), *Higher Education: Handbook of Theory and Research, Vol. XXI* (pp. 99-157). The Netherlands: Springer.

Pike, G., & Kuh, G. (2005). First-and second-generation college students: A comparison of their engagement and intellectual development. *Journal of Higher Education*, 276-300.

Prospero, M., & Vohra-Gupta, S. (2007). First generation college students: Motivation, integration, and academic achievement. *Community College Journal of Research and Practice*, *31*, 963-975.

Saenz, V. (2007). *First in my family: A profile of first-generation college students at four-year institutions since 1971.* Los Angeles, CA: Higher Education Research Institute.

Schultz, T. (1961). Investment in human capital. *American Economic Review*, *51*, 1-17.

Sewell, W., & Shah, V. (1968). Social class, parental encouragement, and educational aspirations. *American Journal of Sociology*, 73, 559-572.

Stage, F., & Hossler, D. (1989). Differences in family influence on the college plans of high school males and females. *Research in Higher Education, 30,* 301-315.

Terenzini, P., Springer, L., Yeager, P., Pascarella, E., & Nora, A. (1996). First generation college students: Characteristics, experiences, and cognitive development. *Research in Higher Education*, 1-22.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition research.* (2nd ed.) Chicago: University of Chicago.

Warburton, E., Bugarin, R., & Nunez, A. (2001). Bridging the gap: Academic preparation and postsecondary success of first-generation students. Statistical analysis report. Postsecondary education descriptive analysis reports.

Ward, L., Siegel, M., & Davenport, Z. (2012). *First-generation college students: Understanding and improving the experience from recruitment to commencement.* San Francisco: John Wiley & Sons.

Wells, R., Seifert, T., Padgett, R., Park, S., & Umbach, P. (2011). Why do more women than men want to earn a four-year degree?: Exploring the effects of gender, social origin, and social capital on educational expectations. *The Journal of Higher Education, 82*, 1-32.

Table 1: Means for Variables Used in the Study

Variable	Mean
Dependent Variables:	
Take SAT or ACT	76.6%
Apply to College	86.2%
Enroll in College	82.3%
First-Generation Status Variables:	
Both Parents: HS Degree or Less	21.9%
Both Parents: Some AA or Less	32.0%
Both Parents: AA Degree or Less	42.8%
Both Parents: Some BA or Less	53.8%
At Least One Parent: HS Degree or Less	46.7%
At Least One Parent: Some AA or Less	58.3%
At Least One Parent: AA Degree or Less	67.9%
At Least One Parent: Some BA or Less	77.1%
Student-Level Variables:	
Female	51.6%
Male	48.0%
Missing: Gender	0.4%
White	74.6%
Black	8.9%
Asian	11.5%
Other Race	4.8%
Missing: Race	6.2%
Hispanic	12.4%
Missing: Ethnicity	1.0%
GPA Grade 9	2.93
GPA Grades 9-12	2.92
Score: Mathematics	5.19
Score: Reading	5.51
Family-Level Variables:	
Income Below $20,000	5.9%
Income $20K to $50K	27.7%
Income $50K to $100K	37.4%
Income Above $100K	18.1%
Missing: Income	10.9%
Number Siblings	2.06
Missing: Number of Siblings	5.7%
Number of Family Dependents	2.58
Missing: Number of Dependents	5.0%

(Table continues)

Variable	Mean
School-Level Variables:	
Enrollments: Grade 10	299
Public	74.1%
Urban	30.0%
Suburban	50.7%
Free Lunch Students	20.0%
AP Students	15.2%
Missing: Free Lunch Students	7.5%
Missing: AP Students	6.4%
New England	4.4%
Mid Atlantic	13.8%
E North Central	19.4%
W North Central	7.6%
South Atlantic	17.6%
E South Central	7.9%
W South Central	9.9%
Mountain	5.3%
Parental Involvement Variables:	
Discuss HS Courses w/Parents	27.9%
Discuss HS Activities w/Parents	35.5%
Discuss HS Grades w/Parents	45.4%
Discuss SAT or ACT w/Parents	16.2%
Discuss College w/Parents	41.0%
Missing: Discuss HS Courses w/Parents	12.5%
Missing: Discuss HS Activities w/Parents	12.7%
Missing: Discuss HS Grades w/Parents	12.9%
Missing: Discuss SAT or ACT w/Parents	13.2%
Missing: Discuss College w/Parents	13.3%

Notes: Sample size is approximately 7,300 (rounded per NCES requirements).

Table 2: Breakdown of Dependent Variables by First-Generation Status

Definition of First-Generation College Student	Y = Planned in Grade 10 on Taking the SAT or ACT			Y = Applied to College			Y = Enrolled in College		
	1st Gen	Non-1st Gen	Gap	1st Gen	Non-1st Gen	Gap	1st Gen	Non-1st Gen	Gap
Both Parents: HS or Less	60.6%	81.1%	-20.5%	71.2%	90.4%	-19.2%	63.4%	87.6%	-24.2%
Both Parents: Some AA or Less	64.2%	82.5%	-18.3%	74.8%	91.5%	-16.7%	67.2%	89.4%	-22.2%
Both Parents: AA or Less	66.0%	84.6%	-18.6%	77.2%	92.9%	-15.7%	70.0%	91.4%	-21.4%
Both Parents: Some BA or Less	68.3%	86.3%	-18.0%	79.5%	93.9%	-14.4%	72.3%	93.8%	-21.5%
At Least One Parent: HS or Less	67.6%	84.6%	-17.0%	78.0%	93.3%	-15.3%	71.0%	92.1%	-21.1%
At Least One Parent: Some AA or Less	69.8%	86.2%	-16.4%	80.2%	94.5%	-14.3%	73.9%	94.0%	-20.1%
At Least One Parent: AA or Less	71.4%	87.6%	-16.2%	81.8%	95.4%	-13.6%	76.0%	95.4%	-19.4%
At Least One Parent: Some BA or Less	72.6%	90.3%	-17.7%	83.2%	96.2%	-13.0%	77.8%	97.4%	-19.6%

Notes: Sample size is approximately 7,300 (rounded per NCES requirements). All differences in means were statistically significant at the 0.1% significance level.

Table 3: Average Marginal Effects for Taking the SAT/ACT – Nested Models

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement
Both Parents: HS	-0.063***	-0.049***	-0.043**
	(0.013)	(0.015)	(0.014)
Female	0.067***	0.066***	0.051***
	(0.012)	(0.012)	(0.012)
Black	0.127***	0.114***	0.099***
	(0.020)	(0.021)	(0.020)
Asian	0.109***	0.112***	0.108***
	(0.024)	(0.027)	(0.027)
All Other Races	0.001	0.016	0.016
	(0.029)	(0.029)	(0.028)
Hispanic	-0.032	-0.038+	-0.036+
	(0.021)	(0.022)	(0.021)
GPA Grade 9	0.088***	0.089***	0.073***
	(0.009)	(0.009)	(0.009)
Score: Math	0.087***	0.080***	0.080***
	(0.011)	(0.011)	(0.010)
Score: Reading	0.045***	0.042***	0.036***
	(0.010)	(0.010)	(0.010)
Number of Siblings	-----	-0.010*	-0.008+
		(0.005)	(0.004)
Number of Dependents	-----	0.007	0.006
		(0.006)	(0.005)
Income Below $20K	-----	-0.008	0.000
		(0.025)	(0.025)
Income $20K to $50K	-----	-0.020	-0.010
		(0.015)	(0.014)
Income Above $100K	-----	0.042+	0.034
		(0.024)	(0.023)

(Table continues)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement
Enrollments: Grade 10	-----	0.009** (0.003)	0.008** (0.003)
School: Urban	-----	0.001 (0.023)	-0.007 (0.021)
School: Suburban	-----	-0.021 (0.017)	-0.023 (0.016)
School: Pct Free Lunch	-----	-0.000 (0.000)	-0.000 (0.000)
School: Pct AP	-----	0.001 (0.001)	0.001 (0.001)
School: Public	-----	-0.046+ (0.024)	-0.043+ (0.024)
School: New England	-----	0.046 (0.034)	0.047 (0.032)
School: Mid Atlantic	-----	0.028 (0.028)	0.021 (0.026)
School: E North Central	-----	0.037 (0.025)	0.039 (0.024)
School: W North Central	-----	0.012 (0.028)	0.019 (0.027)
School: South Atlantic	-----	0.075** (0.025)	0.064** (0.024)
School: E South Central	-----	0.102*** (0.029)	0.093*** (0.028)
School: W South Central	-----	0.092*** (0.025)	0.080*** (0.024)
School: Mountain	-----	0.010 (0.031)	0.018 (0.028)

(Table continues)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement
Discuss Courses w/Parents	-----	-----	0.014 (0.017)
Discuss Activities w/Parents	-----	-----	0.051** (0.016)
Discuss Grades w/Parents	-----	-----	0.007 (0.015)
Discuss SAT/ACT w/Parents	-----	-----	0.124*** (0.025)
Discuss College w/Parents	-----	-----	0.090*** (0.017)
Log Likelihood: Model	-742,785	-730,302	-699,304
Chi-Square	633.17***	725.99***	835.51***
Pseudo R2	0.16	0.17	0.21

Sample size ~ 7,300. Log likelihood (null) = -884,514. Standard errors are shown in parentheses and were clustered at the school level. Dependent variable is whether student has taken or planned on taking the SAT or ACT during high school. Data are weighted using survey weights for participation in 10th grade. Reference category for race is white. Reference category for income is $50K to $100K. Reference category for parental education is at least one parent has attended college at some level. Model includes variables for missing income, ethnicity, siblings, dependents, race, and parental involvement variables. + $p<.10$, * $p<.05$, ** $p<.01$, *** $p<.001$.

Table 4: Average Marginal Effects of First-Generation Status on SAT/ACT Taking

Model	First-Generation Group: Parents w/o College	Reference Group: Parents w/College	Education Level for Defining "College"			
			High School Degree or Less	Some Associate-Level Education or Less	Associate's Degree or Less	Some Bachelor-Level Education or Less
1	Both Biological Parents[1]	At Least One Biological Parent[1]	-0.049** (0.016)	-0.048** (0.015)	-0.053*** (0.014)	-0.058*** (0.015)
2	Both Parents[2]	At Least One Parent[2]	-0.049*** (0.015)	-0.043** (0.014)	-0.050*** (0.013)	-0.053*** (0.014)
3	One or More Parent[2]	Both Parents[2]	-0.030* (0.014)	-0.024 (0.015)	-0.032+ (0.017)	-0.059** (0.020)
4	Both Parents[2]	Both Parents[2]	-0.055*** (0.017)	-0.044** (0.017)	-0.052** (0.018)	-0.075*** (0.021)
	Only Male Parent[2]	Both Parents[2]	-0.015 (0.018)	-0.003 (0.019)	-0.015 (0.023)	-0.054+ (0.028)
	Only Female Parent[2]	Both Parents[2]	-0.008 (0.019)	-0.003 (0.019)	0.006 (0.021)	-0.016 (0.024)

Notes: [1]Sample only includes students who live with both biological parents (n ~ 6,000). [2]Sample includes students who reside with two parents: biological, step, adopted, or foster (n ~ 7,300). Numbers represent average marginal effects. Standard errors are shown in parentheses and were clustered at the school level. Dependent variable is whether student had taken or planned on taking the SAT or ACT during high school. Data are weighted using survey weights for participation in 10th grade. Each logistic regression model also controlled for gender, race, student academic performance, number of siblings, number of dependents, family income, school characteristics, and parental involvement measures (model (3) from Table 3). + p<.10, * p<.05, ** p<.01, *** p<.001.

Table 5: Average Marginal Effects for Applying to College – Nested Models

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT
Both Parents: HS	-0.085***	-0.069***	-0.067***	-0.063***
	(0.010)	(0.011)	(0.011)	(0.011)
Female	0.024*	0.025*	0.020*	0.016+
	(0.010)	(0.010)	(0.010)	(0.009)
Black	0.098***	0.099***	0.094***	0.083***
	(0.017)	(0.017)	(0.017)	(0.017)
Asian	0.059**	0.068***	0.070***	0.058**
	(0.019)	(0.020)	(0.020)	(0.020)
All Other Races	-0.020	-0.002	0.001	-0.004
	(0.019)	(0.019)	(0.019)	(0.019)
Hispanic	0.025	0.035*	0.033+	0.038*
	(0.016)	(0.017)	(0.017)	(0.017)
GPA Grades 9-12	0.135***	0.138***	0.133***	0.125***
	(0.008)	(0.008)	(0.008)	(0.008)
Score: Math	0.024**	0.014	0.015+	0.008
	(0.009)	(0.009)	(0.009)	(0.009)
Score: Reading	0.029***	0.024**	0.022**	0.018*
	(0.008)	(0.008)	(0.008)	(0.008)
Number of Siblings	-----	-0.010**	-0.010**	-0.009**
		(0.004)	(0.004)	(0.004)
Number of Dependents	-----	0.006	0.006	0.005
		(0.004)	(0.004)	(0.004)
Income Below $20K	-----	-0.034+	-0.032+	-0.031
		(0.019)	(0.019)	(0.019)
Income $20K to $50K	-----	-0.008	-0.006	-0.005
		(0.012)	(0.012)	(0.012)
Income Above $100K	-----	0.075***	0.073***	0.071***
		(0.021)	(0.021)	(0.021)

(Table continues)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT
Enrollments: Grade 10	-----	0.004+ (0.002)	0.003 (0.002)	0.002 (0.002)
School: Urban	-----	-0.003 (0.015)	-0.005 (0.015)	-0.005 (0.015)
School: Suburban	-----	-0.013 (0.013)	-0.013 (0.013)	-0.012 (0.012)
School: Pct Free Lunch	-----	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
School: Pct AP Courses	-----	0.001* (0.000)	0.001** (0.000)	0.001* (0.000)
School: Public		-0.089*** (0.019)	-0.086*** (0.018)	-0.082*** (0.018)
School: New England		0.047+ (0.025)	0.047+ (0.025)	0.043+ (0.024)
School: Mid Atlantic		0.086*** (0.022)	0.084*** (0.022)	0.083*** (0.021)
School: E North Central		0.069*** (0.018)	0.071*** (0.018)	0.066*** (0.018)
School: W North Central		0.029 (0.023)	0.032 (0.023)	0.030 (0.022)
School: South Atlantic		0.045* (0.018)	0.043* (0.018)	0.037* (0.018)
School: E South Central		0.032 (0.021)	0.032 (0.021)	0.024 (0.020)
School: W South Central		0.026 (0.019)	0.022 (0.019)	0.015 (0.018)
School: Mountain		-0.014 (0.019)	-0.012 (0.019)	-0.014 (0.018)

(Table continues)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT
Discuss Courses w/Parents	-----	-----	-0.025+ (0.015)	-0.024+ (0.015)
Discuss Activities w/Parents	-----	-----	0.015 (0.014)	0.008 (0.013)
Discuss Grades w/Parents	-----	-----	0.008 (0.012)	0.007 (0.012)
Discuss SAT/ACT w/Parents	-----	-----	0.009 (0.019)	0.003 (0.019)
Discuss College w/Parents	-----	-----	0.051*** (0.013)	0.040** (0.013)
Planned on Taking SAT or ACT	-----	-----	-----	0.068*** (0.009)
Log Likelihood: Model	-530721	-512368	-506837	-499310
Chi-Square	769.08	985.04	999.42	1065.35
Pseudo R2	0.22	0.24	0.25	0.26

Sample size ~ 7,300. Log likelihood (null) = -676,204. Standard errors are shown in parentheses and were clustered at the school level. Dependent variable is whether student applied to college. Data are weighted using survey weights for participation in 10th grade. Reference category for race is white. Reference category for income is $50K to $100K. Reference category for parental education is at least one parent has attended college at some level. Model includes variables for missing income, ethnicity, siblings, dependents, race, and parental involvement variables.
+ p<.10, * p<.05, ** p<.01, *** p<.001

Table 6: Average Marginal Effects of First-Generation Status on Applying to College

Model	First-Generation Group: Parents w/o College	Reference Group: Parents w/College	Education Level Defining "College"			
			High School Degree or Less	Some Associate-Level Education or Less	Associate's Degree or Less	Some Bachelor-Level Education or Less
1	Both Biological Parents[1]	At Least One Biological Parent[1]	-0.073*** (0.012)	-0.069*** (0.012)	-0.065*** (0.013)	-0.058*** (0.013)
2	Both Parents[2]	At Least One Parent[2]	-0.069*** (0.011)	-0.056*** (0.011)	-0.053*** (0.011)	-0.046*** (0.012)
3	One or More Parent[2]	Both Parents[2]	-0.059*** (0.012)	-0.051*** (0.013)	-0.047** (0.015)	-0.039* (0.019)
4	Both Parents[2]	Both Parents[2]	-0.087*** (0.014)	-0.072*** (0.014)	-0.064*** (0.016)	-0.053** (0.020)
	Only Male Parent[2]	Both Parents[2]	-0.020 (0.016)	-0.029+ (0.017)	-0.024 (0.020)	-0.010 (0.025)
	Only Female Parent[2]	Both Parents[2]	-0.051*** (0.014)	-0.022 (0.016)	-0.011 (0.018)	-0.009 (0.023)

Notes: [1]Sample only includes students who live with both biological parents (n ~ 6,000). [2]Sample includes students who reside with two parents: biological, step, adopted, or foster (n ~ 7,300). Numbers represent average marginal effects. Standard errors are shown in parentheses and were clustered at the school level. Dependent variable is whether student enrolled in any college. Data are weighted using survey weights for participation in 10th grade. Each logistic regression model also controlled for gender, race, number of siblings, number of dependents, family income, school characteristics, and parental involvement measures (model (3) from Table 5). + p<.10, * p<.05, ** p<.01, *** p<.001.

Table 7: Average Marginal Effects for Enrolling in College – Nested Models

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT	(5) Plus Apply
Both Parents: HS	-0.098***	-0.058***	-0.057***	-0.053***	-0.021*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)
Female	0.031**	0.031**	0.026*	0.022*	0.015+
	(0.011)	(0.011)	(0.010)	(0.010)	(0.008)
Black	0.088***	0.100***	0.089***	0.079***	0.034*
	(0.019)	(0.018)	(0.018)	(0.018)	(0.015)
Asian	0.074***	0.074***	0.072***	0.061**	0.030*
	(0.019)	(0.019)	(0.019)	(0.019)	(0.014)
All Other Races	-0.062**	-0.045*	-0.044*	-0.046*	-0.045**
	(0.021)	(0.020)	(0.020)	(0.019)	(0.015)
Hispanic	0.010	0.017	0.016	0.021	0.001
	(0.019)	(0.019)	(0.019)	(0.019)	(0.015)
GPA Grades 9-12	0.162***	0.165***	0.158***	0.150***	0.081***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Score: Math	0.046***	0.029**	0.029**	0.024*	0.019*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Score: Reading	0.030***	0.022**	0.020*	0.016*	0.008
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Number of Siblings	-----	-0.017***	-0.016***	-0.015***	-0.010**
		(0.004)	(0.004)	(0.004)	(0.003)
Number of Dependents	-----	0.008+	0.007	0.006	0.004
		(0.005)	(0.005)	(0.005)	(0.004)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT	(5) Plus Apply
Income Below $20K	-----	-0.106*** (0.019)	-0.103*** (0.019)	-0.103*** (0.019)	-0.085*** (0.016)
Income $20K to $50K	-----	-0.053*** (0.012)	-0.049*** (0.012)	-0.048*** (0.011)	-0.046*** (0.010)
Income Above $100K	-----	0.078*** (0.021)	0.076*** (0.021)	0.074*** (0.022)	0.037* (0.018)
Enrollments Grade 10	-----	0.007** (0.002)	0.007** (0.002)	0.006* (0.002)	0.004* (0.002)
School: Urban	-----	0.021 (0.017)	0.017 (0.017)	0.017 (0.017)	0.022 (0.014)
School: Suburban	-----	0.001 (0.013)	-0.001 (0.013)	0.001 (0.013)	0.005 (0.011)
School: Pct Free Lunch	-----	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000* (0.000)
School: Pct AP Courses	-----	0.001* (0.001)	0.001* (0.000)	0.001* (0.000)	0.000 (0.000)
School: Public	-----	-0.111*** (0.021)	-0.111*** (0.020)	-0.107*** (0.020)	-0.056*** (0.015)
School: New England	-----	0.044+ (0.027)	0.045+ (0.026)	0.041 (0.025)	0.020 (0.020)
School: Mid Atlantic	-----	0.057** (0.021)	0.057** (0.021)	0.055** (0.020)	0.013 (0.016)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT	(5) Plus Apply
School: E North Central	-----	0.042* (0.020)	0.044* (0.020)	0.040* (0.020)	0.004 (0.017)
School: W North Central	-----	0.019 (0.023)	0.023 (0.022)	0.021 (0.022)	0.000 (0.018)
School: South Atlantic	-----	0.020 (0.018)	0.016 (0.017)	0.010 (0.017)	-0.010 (0.015)
School: E South Central	-----	0.032 (0.023)	0.031 (0.022)	0.023 (0.022)	0.011 (0.019)
School: W South Central	-----	0.004 (0.018)	-0.002 (0.018)	-0.009 (0.018)	-0.015 (0.016)
School: Mountain	-----	0.001 (0.021)	0.007 (0.021)	0.006 (0.021)	0.015 (0.019)
Discuss HS Courses w/Parents	-----	-----	0.016 (0.015)	0.016 (0.015)	0.032* (0.013)
Discuss HS Activities w/Parents	-----	-----	-0.001 (0.014)	-0.007 (0.014)	-0.013 (0.012)
Discuss HS Grades w/Parents	-----	-----	0.009 (0.013)	0.009 (0.012)	0.002 (0.010)
Discuss SAT/ACT w/Parents	-----	-----	0.038* (0.019)	0.033+ (0.019)	0.026+ (0.016)
Discuss College w/Parents	-----	-----	0.048*** (0.013)	0.037** (0.013)	0.017 (0.011)

	(1) Student Measures	(2) Plus Family & School	(3) Plus Parental Involvement	(4) Plus SAT/ACT	(5) Plus Apply
Planned on Taking SAT or ACT	-----	-----	-----	0.065***	0.026**
				(0.011)	(0.009)
Applied to College	-----	-----	-----	-----	0.240***
					(0.006)
Log Likelihood: Model	-579,671	-546,014	-538,320	-531,983	-406,781
Chi-Square	847.31***	1027.09***	1111.59***	1176.67***	1272.93***
Pseudo R2	0.25	0.30	0.31	0.32	0.48

Sample size ~ 7,300. Log likelihood (null) = -777,267. Standard errors are shown in parentheses and were clustered at the school level. Dependent variable is whether student enrolled in college. Data are weighted using survey weights for participation in 10th grade. Reference category for race is white. Reference category for income is $50K to $100K. Reference category for parental education is at least one parent attended college at some level. Model includes variables for number of dependents, missing income, ethnicity, siblings, dependents, race, and family involvement measures. + p<.10, * p<.05, ** p<.01, *** p<.001

Table 8: Average Marginal Effects of First-Generation Status on Enrolling in College

Model	First-Generation Group: Parents w/o College	Reference Group: Parents w/College	Education Level for Defining "College"			
			High School Degree or Less	Some Associate-Level Education or Less	Associate's Degree or Less	Some Bachelor-Level Education or Less
1	Both Biological Parents[1]	At Least One Biological Parent[1]	-0.064*** (0.012)	-0.059*** (0.012)	-0.052*** (0.013)	-0.075*** (0.014)
2	Both Parents[2]	At Least One Parent[2]	-0.057*** (0.011)	-0.050*** (0.011)	-0.047*** (0.011)	-0.069*** (0.012)
3	One or More Parent[2]	Both Parents[2]	-0.072*** (0.011)	-0.080*** (0.013)	-0.077*** (0.016)	-0.112*** (0.025)
4	Both Parents[2]	Both Parents[2]	-0.089*** (0.013)	-0.091*** (0.014)	-0.088*** (0.017)	-0.127*** (0.025)
	Only Male Parent[2]	Both Parents[2]	-0.051*** (0.016)	-0.078*** (0.018)	-0.076*** (0.022)	-0.083** (0.029)
	Only Female Parent[2]	Both Parents[2]	-0.068*** (0.014)	-0.055** (0.017)	-0.045* (0.020)	-0.071* (0.028)

Notes: [1]Sample only includes students who live with both biological parents (n ~ 6,000). [2]Sample includes students who reside with two parents: biological, step, adopted, or foster (n ~ 7,300). Numbers represent average marginal effects. Standard errors are shown in parentheses. Dependent variable is whether student enrolled in any college. Data are weighted using survey weights for participation in 10th grade. Each logistic regression model also controlled for gender, race, number of siblings, number of dependents, family income, school characteristics, and parental involvement measures (model (3) from Table 7). + $p<.10$, * $p<.05$, ** $p<.01$, *** $p<.001$.