AN INTEGRATED APPROACH TO CAPITAL EFFECTS:

ANALYSIS OF COLLEGE GOING

FOR THE CLASS OF 2004

By

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A dissertation submitted in partial fulfillment of
the requirements for the degree of

DOCTOR OF PHILOSOPHY

WASHINGTON STATE UNIVERSITY
Department of Sociology

MAY 2010

To the Faculty of Washington State University:

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ACKNOWLEDGEMENTS

As I finally stand on the brink of finishing my graduate career, I am humbled by the many acts of kindness that have led to this moment. I am grateful (and still a bit puzzled) that Louis Grey and Tom Rotolo (as graduate committee chairs) accepted my application for admission in the first place. Over the course of my first year, Greg Hooks valiantly attempted to help me learn the art of theory writing by suggesting I eliminate bullet points from my essays. Monica Johnson and Scott Myers helped me write my first successful grant proposal. Tom and Louis both scared me, but inspired me to ask good questions and use good methods.

Monica, Irenee Beattie, Kim Lloyd and Annabel Kirschner all allowed me to work on projects with them over the next several years. Monica, Irenee, Annabel and Tom were gracious enough to co-author published work with me. Greg helped me continue to bridge the gap between the academic and administrative worlds of the university. While not my major professors, Don Dillman and Ray Jussaume always made sure there was an extra seat and good conversation at the rural sociology gatherings. And, thankfully, Cecil Williams always found a way to help me with software issues.

Perhaps most importantly, I am indebted to Monica, Irenee and Kim, who as members of my dissertation committee must be among the most patient and persistent people I know. I am sure that others would have written me off long ago. Instead, they have reviewed draft after draft of my writing, often under ridiculously tight deadlines in an effort to help me finish this project. They have provided words of encouragement when necessary, and occasionally a few words of admonishment that were admittedly probably deserved – but all with the goal of helping me to succeed. (In truth, if Monica had not helped me to petition the graduate school for just a bit more time, this dissertation would never have seen the light of day.)

Along the way, I am sure my sanity would have been much more severely compromised if it had not been for the support and cheerleading of those around me. Classmates and friends

Jolene Smyth and Kristi Chambers, Mike and Kendra Stern, Shel Llee Evans and Erik Flexman, Bryan Rookey, Nick Parsons, Leah Christian and Michelle Robertson all provided both academic insight and many enjoyable meals. Piper Peterson, Ellen Kraus-Schaeffer and Sarah McLaughlin (along with many other Team in Training friends) provided a much needed running, conversation and social-mission outlet. My financial aid colleagues and friends all helped me stay connected to the importance of student access in the real world. My Spokane writing partner, Grace Leaf, kept the spirit of academic work alive away from home base. My brother Josh once helped me search the library for hours looking for references. My sister Hanna read early drafts of my work and never failed to call or email with an encouraging word. My cats, Gravity, Emmie and the late Haley all provided amusement during the occasional dark hour. Fortunately, my mom and dad never stopped believing in me. And, even better for me, despite the odds, they are both still living to see this day!

Finally, I owe a debt of gratitude to my husband, Josh Hayes. He read drafts of my work, tried to help me understand again the academic process, and suggested that maybe outlines really would improve my writing. He put up with my laptop going with us on what was supposed to be vacation and set aside many other more enjoyable opportunities to help see me through this degree. On nights I was home, he often made dinner when I was too involved to take a break. He woke me up with morning lattes and kittens when I thought I was too tired to get out of bed at that hour yet again. In short, he went the distance with me down the stretch when it really mattered. Thank you for being with me at the finish line.

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FOR THE CLASS OF 2004

Abstract

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May 2010

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Using data from the Educational Longitudinal Study of 2002 (ELS:2002), this dissertation focuses on the forms of capital (resources) at the individual, school and state levels that influence the probability of college enrollment. Chapter 1 provides an introduction to three interrelated articles that comprise Chapters 2 through 4. Chapter 2 examines whether students' background characteristics (gender, race, parental income, parent education) systematically alter the effects of different forms of capital (human, social and financial) on the probability of college enrollment. The results indicate that forms of human and financial capital that assist in the college planning process have the greatest impact – across students groups – in the likelihood of enrollment in to both two and four-year institutions. While differences in the impact of capital by each student group were found, students in the class of 2004 do utilize capital in ways more similar than distinct. Chapter 3 tests whether parallel forms of human, social and financial capital that exist at both the individual and school levels improve the likelihood of college enrollment in to two and four-year institutions. The results indicate that while individual-level factors continue to have the greatest impact on the probability of college enrollment, school-level human, social

and financial capital measures also influence enrollment. Chapter 4 focuses on the financial capital deficit of low-income students, and seeks to determine if there are substitutable or complementary forms of capital at the individual or state level that might help to alleviate some of this deficit. The findings indicate that individual-level capital has a stronger influence on college enrollment than state-level capital. Individual-level actions, such as filing a Free Application for Federal Student Aid (FAFSA) and completing additional financial aid forms, both help reduce the financial capital deficit of low and middle-income families. The lack of statistically significant results of state need-grant programs and in-state tuition rates for either low or middle-income students suggest that these students are becoming "priced-out" of higher education.

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Dedication

This dissertation is dedicated to the many students who have dreamed of attending college – but lacked the resources or advocates to help them fulfill those wishes.

May the next generation's dreams come true.

CHAPTER ONE

INTRODUCTION

The 1960s were a time of social awakening. On the political front, in an effort to help reform society and help alleviate social injustice, the United States Congress passed The Civil Rights Act of 1964, banning discrimination in schools and other public places. What followed was a series of legislative actions, including the Higher Education Act of 1965. This landmark piece of legislation was created in response to the emerging issues of access to and affordability of higher education. Providing grants and subsidized loans for students interested in pursuing college, this Act changed the landscape for many students who would not have had the financial ability to attend college in the past.

While over forty years have passed since these important pieces of legislation were passed, we do not yet find equality in education. While college-going and graduation rates have increased across the board, disparities remain between whites and their non-white counterparts, and between rich and poor. In 2003, the percent of those aged 25 to 29 who had received a bachelor's degree was 34.2 for non-Hispanic whites, 17.2 for non-Hispanic blacks, 61.6 for non-Hispanic Asians and 10.0 for Hispanics (Stoops 2004). Similarly, among students enrolled in college in the 1995-1996 school year, only 15 percent of those in the bottom quarter of the income bracket had achieved a bachelor's degree within five years, compared to 23.7 percent of the middle-income quartiles and 41 percent of those in the top quarter (NCES 2004b).

Why are these differences in educational attainment important? The role of education has long been purported to be that of the great equalizer – providing opportunity for students at all socio-economic levels, and of any race or gender, to achieve minimum competency levels in elementary and high schools. Whether social mobility in the United States is based on ability and

achievement (contest mobility) or whether the elite simply remain the elite (social reproduction) has been debated (Turner 1960; Blau and Duncan 1967). Regardless, empirical research has consistently documented the association between educational attainment and both occupational attainment and economic returns (Bills 1998, Kerckhoff 1995). This return on skill-building and credentialing has in fact increased over the past four decades (Juhn, Murphy and Pierce 1993).

In order to move toward economic equality in this country, we must more fully understand the process of educational attainment. Research on educational attainment has focused attention on why some students make the transition from high school to college while others do not, including theories of social and cultural reproduction (e.g. Blau and Duncan 1967; Kerckhoff and Cambell 1977; Portes and Wilson 1976; Sewell, Haller and Portes 1969), academic preparation (e.g. Coleman et al 1966; Gamoran and Mare 1989; Hallinan 1994; Rosenbaum 1980), human, social and cultural capital (e.g. Beattie 2002; Becker 1975; Bourdieu 1977; DiMaggio 1982; Manski 1990; Schultz 1961; Stanton-Salazar 1997) and financial policy (e.g. Advisory Committee on Student Financial Assistance 2005; Dynarski 2003; Flint 1993; Heller 2006; King 2004; Perna 2006; Plank and Jordan 2001).

The research presented in this dissertation adds to this literature in two important ways. First, it recognizes the common theme among the above theoretical traditions – that of variability in resources (different forms of "capital") available to students which helps them to navigate the academic journey. This *integrated* approach to understanding how these resources – at the individual, family, school and state levels – assist students in the college-going process more accurately reflects the complicated interaction of many forms of capital that ultimately lead to the possibility of college enrollment. While researchers have pointed to the theoretical importance of directing attention more broadly across both forms and levels of capital (Beattie

2002; Dumais 2007; Parcel and Dufur 2001b; Zeidner 2006), to date there is limited published research that actually tests hypotheses concerning combined effects of capital either across form or across level on the question of college-going, much less both across form and level.[1]

Secondly, this research provides an understanding of contemporary society and the impact of current educational policies. The data utilized in this project come from the Educational Longitudinal Study of 2002 (ELS:2002). This nationally representative dataset follows in the tradition of three prior national surveys that cover the transition from high school to later life – the National Longitudinal Study of the High School Class of 1972 (NLS-72), the High School & Beyond Longitudinal Study of 1980 (HSB), and the National Education Longitudinal Study of 1988 (NELS:88). While these other datasets have been used extensively in researching educational attainment questions, state and national policies related to education have changed substantially over the past four decades, as have educational attainment levels themselves. This project helps to fill the gap of understanding educational attainment in today's environment.

Additionally, this project returns to the intention of the original Higher Education Act of 1965 by emphasizing the importance of both access to education *and* affordability. While sociological research on educational attainment often emphasizes the importance of academic preparation and research in the financial aid realm investigates the effects of funding on college enrollment and persistence, it is rare for research to include variables that tap both students' academic preparation and financial ability to pay for school (beyond parental income level) .

[1] See Dumais (2007) for an examination of the combined impact of different types of individual-level capital on college enrollment for students whose parents did not attend college; Parcel and Dufur (2001) investigate different forms of capital at home and school on academic achievement; Beattie (2002) frames variables in a decision-making model, but ultimately tests individual, school and state-level factors on college-going.

This study introduces the idea that understanding the importance of and taking steps to prepare for both parts of this equation are relevant pieces of the educational attainment model.

To those ends, this dissertation is arranged around three interrelated research questions each addressed in a separate chapter. Chapter 2 focuses on the combined effects of different *forms* of individual-level capital on college enrollment and the impact on different student groups. Specifically, I investigate whether students' background characteristics (gender, race, parental income level, parent education) systematically alter the effects of different forms of capital (human, social and financial) on the probability of college enrollment. To do so, I first examine the effects of each form of capital on the probability of two-year or four-year college enrollment for all students. I then test interaction effects of student group membership on different forms of capital to investigate whether capital is utilized in the same way across student groups.

Chapter 3 focuses on the combined effects of capital across both *forms* and *levels* of influence. I identify parallel forms of human, sociala and financial capital at the individual and school level. I examine the effects of these variables at each level and in combination with each other on the probability of two-year or four-year college enrollment. I also investigate whether school effects work primarily in a direct fashion, or through more indirect means, in influencing college enrollment.

Chapter 4 focuses directly on the disparity of enrollment rates between low, middle and upper-income students and the potential of other forms of capital to act as substitutes for the lack of financial capital for low-income students – and to a lesser extent for middle-income students. This explores the effectiveness of current federal and state policies, programs and tools (as forms

of capital) that have been specifically designed to address the inequality of enrollment rates between income groups.

METHODOLOGICAL APPROACH

The primary data for this study come from the Educational Longitudinal Study of 2002 (ELS:2002). ELS:2002 is a nationally representative survey of students who were in 10th grade in 2002, during which the base-year survey was conducted. This round of data included information collected from students, their parents and their teachers, along with information about the school itself. The original sample of 17,591 students was drawn from approximate 750 schools. Students were randomly selected from participating schools, with a sample design that intentionally over-sampled Asian and Hispanic students.

The first follow-up of these participants occurred in 2004, two years after the initial survey. At this point, many of the students were seniors, although information on those who dropped out of school and/or who were in other grades was also included. Additionally, this wave of data also included full high school transcript data from grades 9-12, and a special math assessment was completed. The second follow-up was conducted in 2006, two years after most of the participants graduated from high school. This wave provides information on the educational and vocational outcomes of the respondents in their first years following high school.

While the ELS:2002 survey provides the individual, family and school-level data for this project, the state-level data were obtained from four additional sources. Information on state financial aid programs was obtained from the National Association of State Student Grant and Aid Programs (NASSGAP 2004). Information on the average costs of public four-year institutions was obtained from figures reported by schools to the Integrated Postsecondary Data System (U.S. Department of Education 2003). Information on the average per-pupil expenditure

by state comes from the National Public Education Financial Survey (NPEFS) as part of the Common Core of Data collected annually by the National Center for Educational Statistics (U.S. Department of Education 2007). Information on state-level demographics including per capita income, unemployment rates, and educational attainment levels was obtained from the United States Census Bureau (U.S. Census Bureau 2002a, 2002b, 2002c).

Throughout the analysis, I utilize a multinomial logistic regression approach to differentiate between students that do not enroll in college, students who enroll in a two-year institution and students that enroll in a four-year institution. I make this distinction between types of enrollment as the criteria for admission to four-year institutions is generally more rigorous, and the costs are often higher. However, this distinction is also important as two-year institutions have played a significant role in increased access to and enrollment in post-secondary education overall. At the same time, enrollment in community colleges has historically included disproportionate numbers of non-white, female, lower-income and first-generation college students (Provasnik and Planty, 2008).

Due to the utilization of data in Chapters 3 and 4 that cross different levels of analysis (a hierarchical data structure), a multi-level statistical approach is warranted. The primary benefit of utilizing a multilevel statistical model is to account for variation that occurs both at the individual level, and across levels – in this case across schools and/or states. This approach is slightly more conservative than standard regression models, yielding more appropriate standard errors across units of analysis (Bryk and Raudenbush 1992).

Because ELS:2002 oversampled Asians and Hispanics in the ELS:2002 survey, weighting is also recommended to correct for any potential bias the over-sampled groups may exert on the results. To accomplish both multilevel modeling and appropriate weighting, I use the

HLM computer program designed by Raudenbush, Bryk and Congdon (2004) for the analyses presented in Chapters 3 and 4. Stata (StataCorp 2007) is utilized for both the initial creation of data for all three chapters and the analyses presented in Chapter 2.

CHAPTER TWO

DIFFERENCES IN CAPITAL UTILIZATION BETWEEN THE ADVANTAGED AND DISADVANTAGED IN THE COLLEGE ENROLLMENT PROCESS

Over the past fifty years there have been great strides made in improving both the high school completion and college enrollment rates of students in the United States. This has been seen across gender, race, parental income and parent education levels. Today, college enrollment disparities have been all but eliminated in the case of gender (and in fact now benefit women), but substantial gaps remain between these other student groups (Livingston 2008).

Research on education attainment has uncovered a variety of important contextual factors that may impact a student's ability and desire to attend college. Theoretical foundations include those of social and cultural reproduction (e.g. Blau and Duncan 1967; Kerckhoff and Cambell 1977; Portes and Wilson 1976; Sewell, Haller and Portes 1969), academic preparation (e.g. Coleman et al.1966; Gamoran and Mare 1989; Hallinan 1994; Rosenbaum 1980), social and cultural capital (Bourdieu 1977; DiMaggio 1982; Stanton-Salazar 1997), econometrics (e.g. Manski 1990, Beattie 2002) and financial policy (e.g. Advisory Committee on Student Financial Assistance 2005; Dynarski 2004; Flint 1993; Heller 2006; King 2004; Perna 2006; Plank and Jordan 2001). While not explicit in all cases, each of these theories brings to light the concept of variability in resources (different forms of "capital") that are available to students.

However, few studies seek to understand the interplay between these sources of capital. For example, much of the sociological research on educational attainment emphasizes the importance of academic preparation, while research in the financial aid realm investigates the effects of funding on college enrollment and persistence. It is rare for research to include variables that tap both a students' academic preparation and financial ability to pay for school

(beyond parental income level). This study introduces the idea that it may actually be the combination of these various forms of capital that better explain the educational attainment model.

And, for specific student groups, understanding how the combination of these various resources are utilized may be particularly important in modeling the college-going process. Prior research has indicated that different groups of students have both varying access to resources and may utilize resources differentially in decision-making (Beattie 2002; Manski 1990). For example, low-income students by definition lack financial capital. It is possible that they utilize other forms of capital to make up for this deficit. Similarly, students whose parents did not attend college lack this form of social capital, and they may rely more heavily on other resources to alleviate the impact of this missing piece of capital. If we can identify these factors, we may be able to focus resources and policies to improve equity in college access.

In addition, educational policy has changed over the last decade, as have economic and social climates. Prior research on educational attainment has had to rely on data sets such as the National Longitudinal Study of the High School Class of 1972 (NLS-72), the High School & Beyond Longitudinal Study of 1980 (HSB), and the National Education Longitudinal Study of 1988 (NELS:88). While all three of these prior national surveys cover the transition from high school to later life, the most recent covers students who entered college in the early 1990s. College-going rates of various student groups have changed over time and it is important to understand if the college-going process has as well.

To that end, this study explores the question: Do students' background characteristics (gender, race, parental income level, parent education) systematically alter the effects of different

forms of capital (human, social, and financial[2]) on the probability of college enrollment? And, does this vary for two-year versus four-year institutions? To examine this question, I use data from the Educational Longitudinal Study of 2002 (ELS). This nationally representative data set is the most current data available on a recent graduating high school class which allows the question of college enrollment to be studied within contemporary social and economic conditions.

Conceptually, I frame resources available to students in terms of various forms of capital. I address forms of human, social and financial capital within the student's personal realm, and within the student's family. I also move beyond a single model that assumes that all students utilize capital in the same way, and instead seek to understand how different student groups utilize capital in the college enrollment decision process. Due to the continued disparity in the college enrollment rates of black and Hispanic students, low-income students, and students whose parents have not achieved a bachelor's degree (referenced as potential first-generation college students throughout the rest of this paper), along with the relatively recent shift to a female advantage in college enrollment, I focus on the conditional effects of each form of capital by gender, race, parental income level, and parent education.

STUDENT CAPITAL AND COLLEGE ENROLLMENT

Human capital consists of the various skills and knowledge that individuals possess which help facilitate new action (Becker 1975; Schultz 1961). In educational attainment literature, this is often conceptualized through measures such as course-taking patterns and grade point averages. Research confirms that enrolling in the academic track or similar course-taking

[2] Cultural capital has also been well conceptualized by Bourdieu (1977), DiMaggio (1982) and others. While important, the measures of cultural capital available in this data set are limited and are therefore not included in this study.

patterns (Lucas 1999; Rosenbaum 1980), and enrollment in high-level math classes (Horn and Nunez 2000; Beattie and Thaden 2007) are positively and significantly related to college enrollment. Similarly, increased grade point average and test scores also improve the likelihood of enrollment (Roscigno and Ainsworth-Darnell 1999). However, these forms of human capital have also been shown to be differentially distributed by student group. Previous research indicates that whites and Asians are more likely to be enrolled in academic-level coursework in comparison to their black or Hispanic counterparts (Oakes 1985), although Gamoran and Mare (1989) found that controlling for prior coursework eliminates this race effect. Students from higher socioeconomic levels are also more likely to be enrolled in academic-level coursework compared to their lower socioeconomic counterparts, even after controlling for prior academic achievement (Lucas and Gamoran 1991). This trend also exists by gender with women enrolling in academic coursework at higher rates than men (Gamoran and Mare 1989). Similarly, there are persistent and significant racial differences in both test scores and grades between white students and their non-white counterparts, and between high and low socio-economic status (SES) students (Fischer et al. 1996; Jencks and Phillips 1998; Roscigno and Ainsworth-Darnell 1999).

Recent research also provides evidence that it is not only academic knowledge and preparation, but also knowledge of the college process itself that influences college enrollment. While taking college entrance exams or filing a Free Application for Federal Student Aid (FAFSA) have not been generally framed as human capital in prior research, I argue that these should be recognized as clear proxies of human capital as they represent knowledge of the steps necessary to be able to apply for college admission and financial aid. Studies point to the importance of this information and action. For example, planning for and taking college entrance exams such as the ACT and SAT and understanding the financial aid process and completing

financial aid steps have been found to significantly increase college expectations and the probability of college enrollment (Flint 1993; Hossler, Schmit and Vesper, 1999; Plank and Jordan 2001).

Just like more traditional measures of student human capital, obtaining information about and understanding the college process is also differentiated by group. McDonough (1997) found that students from privileged backgrounds have greater access to college process information and are more likely to ask for assistance if they need it. Plank and Jordan (2001) found that the college-going difference between whites, blacks, Hispanics and Native Americans is eliminated once variables about information and guidance for college are introduced. And, while the direct effect of socioeconomic status remained in their research, information on early college planning and receiving information about academic and financial aid matters also helped reduce the difference in college enrollment rates between high and low socioeconomic level students.

Students' expectations about educational attainment are also often used in human capital models to emphasize that individuals make decisions about whether or not to pursue (or continue to pursue) education based on both potential future income as well as current opportunity costs and individual ability. While early research indicated that higher educational expectations are related to higher levels of educational attainment (Sewell, Haller and Portes 1969; Sewell , Haller and Ohlendorf 1970), more recent research finds that expectations vary by income level, gender and race/ethnicity in both simple magnitude, realism and effect (Bohon, Johnson, and Gorman 2006; Hanson 1994; Lloyd, Leicht and Sullivan 2008; Mickelson 1990).

Social capital for students, in terms of relationships that strengthen college-going norms or provide access to information, have also been positively related to college enrollment. For example, students who have friends that are high academic achievers and/or who have high

expectations in terms of college enrollment are more likely to attend college (Furstenberg and Hughes 1995; Henderson, Mieszkowski and Sauvageau 1978). Additionally, information sharing about the college process and encouragement to engage in college preparation activities by teachers and other important adults has been shown to positively impact college enrollment (Plank and Jordon 2001).

While some students do work during high school, the financial well-being of the student and family typically relies on parental earnings. Therefore, I focus on financial capital in the following section.

FAMILY CAPITAL AND COLLEGE ENROLLMENT

Students also have access to capital through their families. Status attainment research consistently finds that parental *human capital*, in terms of parents' educational levels, is positively related to both educational and occupational attainment (e.g. Blau and Duncan 1967; Sewell, Haller and Portes 1969), as well as to gains in both math and reading achievement (Parcel and Dufur 2001b). Similarly, students whose parents did not attend college are also less likely to be enrolled in academic track courses compared to their counterparts whose parents did attend college (Horn and Nunez 2000; Vargas 2004).

Additionally, students whose parents did not attend college are disadvantaged in terms of understanding what it takes to be admitted to and pay for college. These students are significantly less likely to be academically qualified to be admitted to a four-year institution (Choy 2001). And, for all students, when their parents do not understand or have correct information about financial aid, their odds of enrolling in college decrease (Flint 1993).

Social capital, in terms of communication and interaction between students and parents, has also been shown to have positive effects for students. Parental values about education,

measured in terms of educational aspirations and expectations for children, have been linked to lower dropout rates, higher test scores, and an increased likelihood of graduating from high school and continuing on to college (Carbonaro 1998; Teachman et al. 1996; White and Glick 2000; Yan 1999).

Family structure has the potential to impact the frequency and quality of parent-child interaction. Children who are part of a two-parent family have been shown to have higher grades (Valenzuela and Dornbusch 1994; Israel, Beaulieu and Hartless 2001), higher test scores (Sun 1999), and achieve higher levels of education (McLanahan and Sandefur 1994). Among children of single teenage mothers, even the presence of the father in the home increased the probability of high school graduation and college enrollment (Furstenberg and Hughes 1995). However, the presence of a step-parent has been linked to higher dropout rates (Teachman, Paasch and Carver 1996).

In contrast to a two-parent family, additional siblings may reduce the number of parent-child interactions that are likely to occur per child, producing a dilution of family social capital for the student. Research has shown that an increased number of siblings is associated with behavior problems (Parcel and Dufur 2001a) and higher dropout rates (Smith, Beaulieu and Isreal 1992). Similarly, fewer siblings are associated with higher educational aspirations (Qian & Blair 1999), higher test scores (Sun 1999; Israel, Beaulieu and Hartless 2001), higher grades (Valenzuela and Dornbusch 1994), a significantly higher probability of attending college (Adams and Meidam 1968) and ultimately higher educational attainment levels (Lloyd 1993; Powell and Steelman 1993).

As with student interaction, social interaction by parents with school personnel may also act as a resource for students. Prior research indicates that this may vary by group, with middle

class parents able to tap in to a network that has more positive influence than lower-income parents (Lareau 1987; Horvat at al. 2003). Racial disparities may also exist, as Lareau and Horvat (1999) find that white parents engage and respond to school personnel creating positive effects for children in a way that black parents do not, although they find that this is mediated somewhat by income level. However, Horvat et al. (2003) find no difference by race, only by income level, and McNeal (1999) finds no effect for parent-teacher interaction on student achievement for any group.

The *financial capital* of the family – and the additional resources that come with discretionary income – also impacts college enrollment. Students from low-SES families are significantly more likely to delay enrollment in post-secondary education or to simply not seek additional education (Bozick and DeLuca 2005; Perna 2000). At the same time, educational resources in the home such as books and reference materials have been positively linked to higher educational attainment levels (Teachman 1987). Additionally, recent research on the admission and financial aid processes recognizes that the application process for both has become primarily electronic. This may be particularly detrimental to low-income students who have little or no electronic access, especially at home (Jackson 2003; Wright, Stewart and Burrell 1999). Certainly, current research has shown that computer access is associated with school achievement in terms of math and reading test scores (Attewell and Battle 1999).

Family structure may also impact college going by diluting the economic pool of resources. Similar to the idea that additional children in a family reduce the amount of time an individual parent may have available to interact with each child, the number of children may also reduce the amount of financial capital available to support college-going. Research has shown

that additional siblings decreases the probability that parents will provide financial support for college and increases the use of student loans (Steelman and Powell 1989).

HYPOTHESES

Regardless of student group, the presence of any form of capital that could be considered a part of college preparation and planning on the student's part, or that would assist in the understanding of the college-going process, should be beneficial to the student's likelihood of college enrollment. Therefore, one would expect that all student groups should receive some positive benefit from expecting to go to college, enrolling in academic coursework, taking a high-level math course, taking college entrance exams, getting information about the college process, and having friends that want to go to college. In addition, filing the Free Application for Federal Student Aid (FAFSA) – the form that is the gateway to federal, state and often institutional financial aid – should also be positively related to college enrollment as this reflects both a student's knowledge of the financial aid process and potential financial resources.

Capital, in terms of parental resources, should also provide a general benefit across student groups. Having parents who expect their child to go college, save money for college, provide a computer in the home, establish household rules about homework and grades, and interact with their child and their child's school should positively influence the likelihood of college enrollment. Students who have two parents in the home should benefit from additional parent-student interaction time, and students with fewer (or any) siblings should also benefit from not having to share time with parents or financial resources with other children in the household.

However, there are some reasons to expect to see differences by student group. For example, I expect that low-income students will benefit more than their middle and upper-

income counterparts from filing the FAFSA. These students are more likely to need financial assistance to afford to attend school, and the FAFSA is the universal application that must be completed to access most forms of financial aid. At the same time, based on the FAFSA calculation currently in use, low-income students may actually be negatively impacted if their parents save for college. And, from a cost-benefit analysis standpoint, students from low-income families may have such limited expendable resources available that there is no additional cost to be had in sharing financial resources with siblings. Thus, these students would not see a benefit from having few if any siblings, while their middle and upper-income counterparts may.

For potential first-generation college students, I expect they might also receive an extra benefit from both filing the FAFSA and reaching out to other sources to get college information (including talking to a teacher/coach/counselor/friend/college representative or reading a college publication or search guide), as they do not have the benefit of their parents' personal knowledge and experience of the college process.

How various forms of capital might be differentially utilized by gender and varying race/ethnicity groups is less clear. While previous research confirms differences between males and females on course-taking behavior and between white and non-white students in terms of rates of academic course-taking, test-taking, and access to general college information, there is no surface reason to believe that any of these forms of capital should benefit one student over another if the student possesses that form of capital (discrimination aside). Previous admission and financial aid practices that provided preference by race and gender have all but been eliminated (at least on paper) and should not be in evidence here. However, prior research has shown that college expectations are not as closely aligned with actual attainment for many non-

white students. And, while contrary findings exist, parent-school interaction has been found to be more beneficial for white students than their non-white counterparts.

DATA AND METHODS

The analyses are based on the Educational Longitudinal Study of 2002 (ELS:2002). Sponsored by the National Center for Educational Statistics of the U.S. Department of Education, ELS:2002 follows the National Longitudinal Study of the High School Class of 1972 (NLS-72), the High School & Beyond longitudinal study of 1980 (HSB), and the National Education Longitudinal Study of 1988 (NELS:88), covering the transition from high school to later life. This data is highly appropriate for this analysis as the recent nature of ELS:2002 allows study of what most closely approximates today's students and current educational environment. Additionally, this study provides information on students who both go on to college *and* those who do not. Other nationally representative studies that cover this more recent timeframe, such as the Beginning Postsecondary Students Longitudinal Study of 2004 (BPS:04/09) and the National Postsecondary Student Aid Study of 2004 (NPSAS:04) which both follow students first entering college in 2004, provide information on post-high school enrollment but are limited to those students who enroll in a post-secondary institution. The availability of information on both students who do *and* do not enroll in college allows a better vantage in to the important differences between these student groups.

ELS:2002 began with a nationally representative sample of 10^{th} grade students in public and private schools in 2002. The base year data includes demographic information for these 10^{th} grade students, along with parent, teacher and school information. Follow-up data was collected in 2004 and 2006. The first follow-up provides data from the 12^{th} grade year. The second follow-

up contains information on the educational and vocational outcomes of the respondents in their first years out of high school.

The base year sample of ELS: 2002 originally included 17,591 students drawn from approximately 750 schools. While students were randomly selected from these schools, the sample design also allowed for oversampling of Asians and Hispanics. For this analysis, I first restrict the sample to the 16,197 students who initially responded in the first wave of data collection. I then restrict the sample to students who did not drop out of high school, and who completed their high school program or received a GED, as students without this credential cannot enroll in a post-secondary institution. This resulted in a loss of 1,056 cases (6.5 percent). I further limited the sample to students who completed the second follow-up which provides information for the dependent variable, two-year or four-year college enrollment. I also restrict the sample to students who have complete information on each of the independent variables related to student group (gender, race, low-income, first-generation) as group differences are the focus of this study. This resulted in a loss of 2,967 cases (18.3 percent).

I utilized Stata's multiple imputation command "ice" to impute data for the missing data elements on the remaining independent variables (StataCorp 2007).[3] While the use of multiple imputation relies on the assumption that missing data be "missing at random" – a condition that is often violated in practice – listwise deletion also presents obstacles. Data eliminated through listwise deletion are also subject to selection bias. In addition, the loss of these additional cases reduces the precision of the model. Multiple imputation (as opposed to mean substitution or other single replacement techniques) introduces random error in to each imputed data set which

[3] Academic track and parent aspirations were previously imputed by NCES. The full ELS sample missing rate was 4.01 and 4.23 percent on these two items (Ingels et al. 2005). ACT/SAT scores and FAFSA completion were obtained directly from secondary sources by NCES, and thus have no missing cases.

helps to approximate unbiased estimates over the sets. (See Allison 2000 and Rubin 1987 for further discussion of this method.)

For multiple imputation to be effective, an appropriate statistical technique must also be used. Stata's "ice" program relies on "multiple imputation using chained equations" (van Buuren et. al 1999) which is a switching regression technique that creates values for each missing variable in to each of a user-determined number of imputed data sets. (See Royston 2007 for the most recent programming update.) Three to ten imputed data sets have been shown to be sufficient to produce reliable estimates of missing data (Rubin 1987). I utilize five imputations, which results in a final weighted sample of 12,175 cases.

Measures

During the second follow-up of ELS:2002, participants were asked if they had ever attended a post-secondary institution. This allows a time-period of up to two years from when these students graduated from high school (assuming on-time graduation) to enter some form of post-secondary schooling. I utilize a categorical measure of enrollment that distinguishes between those students who did not attend college, those that first attend a two-year institution, and those that first attend a four-year institution. I make this distinction between two-year and four-year institutions primarily because the criteria to enter four-year institutions are generally more rigorous and the costs are often higher. However, this is also important because two-year institutions have played a significant role in increased access to and enrollment in post-secondary education overall. At the same time, community college enrollment has historically included disproportionate numbers of non-white, female, lower-income and first-generation college students (Provasnik & Planty, 2008).

Student human capital is measured by a set of dummy variables (1 = yes). These include enrolling in their high school's academic track (or similar course-taking), taking a high level math course (i.e. trigonometry, pre-calculus or calculus), and expecting a bachelor's degree or higher in the 10th grade. Additionally, a continuous variable that measures each student's grade point average (0 to 4.0) is included. All of these variables are traditional measures of human capital. I also include taking the ACT or SAT, filing the FAFSA, and seeking college entrance information from any source (1 = yes) as more specific measures of understanding the college process. Student social capital is measured by two additional dichotomous variables (1 = yes); a variable that indicates whether the student's friends expect him or her to go to college and a variable that that indicates whether the student thinks their friends believe it is very important to go to college.

College expectations, academic track and college entrance information were obtained from the base year survey. The math, grade point average and college entrance exam variables were obtained from the transcript data that was collected as part of the first follow-up survey. The FAFSA information was collected as part of the financial aid questions in the second follow-up survey.

Parent human capital is measured with a series of dichotomous variables: a first-generation college status indicator which is measured by whether or not either parent has achieved a four-year degree (1 = yes); two measures for family structure - a measure for whether this is a single parent family and a measure for whether this is a stepparent family (two parent family as the reference category) and a continuous variable ranging from 0 to 6 that measures number of siblings is also included[4]. Parent social capital is measured with four dummy variables

[4] While families may have more than six children, the ELS dataset categorized responses from 0 to "6 or more" siblings.

(1 = yes): whether the parent(s) expect their child to achieve a bachelor's degree or higher, whether there are rules about homework, whether there are rules about grades, and whether the parent has initiated any contact with their child's school.[5] Parent-student contact is measured with an dichotomous variable that indicates whether parents talk often with their child about course selection (1 = yes).[6] Parent financial capital is measured with another series of dichotomous variables (1 = yes): an indicator of whether they are low-income (family income of less than $25,000 year)[7], whether the parent saved any money for their child's education; and whether there is a computer in the home. All of these variables were obtained from the parent survey conducted in the base year.

Based on previous research, I also include the following school-level characteristics as control variables: high school sector (public or private, private = 1) and school location (urban, rural, or suburban – suburban as reference). In addition, I include dichotomous variables for gender (male = 1) and race/ethnicity[8] (Hispanic, black, Asian or white – white as reference), along with the previously described low-income and first-generation variables to assess differences by student group.

The Appendix provides specific coding information and descriptions of each variable. Table 2.1 provides the descriptive statistics for each variable (weighted percents, means and standard deviations), along with the percent of imputed cases for each variable. Table 2.2 shows

[5] I tested different measures of parent-school interaction including a count variable of the types of school-parent interaction possible to specific types of contact. All forms yielded similar results. This dummy variable is used for simplicity.

[6] I also tested different measures of parent-student interaction including a count of the types of parent-student interaction, the frequency of discussion about college entrance exams and the frequency of discussion about college applications. None of those measures produced significant results and are omitted from these models.

[7] Parent income is a categorical variable in this data set. The low income variable as constructed here represents just under 20 percent of the sample. This is consistent with the National Center for Educational Statistic's measurement of low-income students.

[8] For students that indicated both Hispanic background and either black, Asian or white, these students have been coded as Hispanic. Thus, black, Asian and white refer to non-Hispanic black, non-Hispanic Asian and non-Hispanic whites throughout this analysis.

the descriptive statistics by student group. (Correlation coefficients among all variables are less than 0.6 and the variance inflation factor is less than 2.0 for all variables.)

Analysis

Multinomial logistic regression is used to ascertain the probability of college enrollment in to two-year and four-year institutions. This is an appropriate method when the dependent variable is a nominal outcome variable. Multinomial logistic regression simultaneously estimates a set of binary logits for each outcome category. In this case, there are three possible enrollment outcome comparisons: four-year enrollment versus not being enrolled; two-year enrollment versus not being enrolled; and four-year enrollment versus two-year enrollment.

$$\ln \{\Pr(\text{4-year}|x)/\Pr(\text{not enrolled}|x)\} = \beta_{0,\text{4-year/not enrolled}} + \beta_{1,\text{4-year/not enrolled}}\ \text{var1} + \ldots$$

$$\ln \{\Pr(\text{2-year}|x)/\Pr(\text{not enrolled}|x)\} = \beta_{0,\text{2-year/not enrolled}} + \beta_{1,\text{2-year/not enrolled}}\ \text{var1} + \ldots$$

$$\ln \{\Pr(\text{4-year}|x)/\Pr(\text{2-year}|x)\} = \beta_{0,\text{4-year/2-year}} + \beta_{1,\text{4-year/2-year}}\ \text{var1} + \ldots$$

As $\ln(a/b)$ equals $\ln a - \ln b$, these equations do include redundant information. Therefore, I present the results for each of the three outcomes in the first model shown, and present only the comparisons for four-year versus not enrolled and two-year versus not enrolled throughout the rest of the models.

The models themselves are fitted by maximum likelihood estimates. These estimates are produced with a likelihood function which calculates how likely the observed data would be if the parameter estimates provided were the true parameters. Maximum likelihood methods are most consistent and stable with larger sample sizes (those above 500), and with independent variables that are constructed to have similar scaling – producing a more consistent magnitude of

standard errors (Long and Freese 2003). The data used here conform to these generally accepted standards.

The disadvantage of multinomial logistic regression is that the estimation for each equation is based on a different sample. Therefore, data must be present for each independent variable as well as the dependent variable to produce equivalent results across models. As explained above, I utilized multiple imputation techniques to retain cases that would have otherwise been necessarily eliminated by the necessity of list-wise deletion for this method to be appropriate. An additional disadvantage of multinomial logistic regression is that goodness-of-fit methods that are traditionally used for binary or count outcomes, such as the chi-squared statistic, do not appropriately reflect similar measures for ordinal or nominal data. They are therefore not reported in the analyses below.

I begin with a brief descriptive analysis of the students in this sample. I then move on to the multinomial logistic regression models, where I first estimate a baseline model that includes all of the student and family capital variables, along with the school control variables. I then shift the focus to each of the different student groups to examine the interaction effect of specific student characteristics with different forms of capital. To do so, interaction terms for each student group (gender, low-income, first-generation and race/ethnicity) are added one at a time to the base model. I display the statistically significant interaction models in the tables that follow.

RESULTS

Descriptive Analysis

Table 2.1 indicates that the high school class of 2004 is interested in pursuing post-secondary education. Over 75 percent of this class went to college with 29.2 percent attending a two-year institution and 46.4 percent attending a four-year institution within two years of

graduation. However, as Table 2.2 shows, these enrollment rates vary by gender, race/ethnicity, parental income level and parent education. Female students continue to outpace their male counterparts at both the two-year and four-year level. While white, black and Asian students enroll at similar levels at two-year institutions (28.4, 28.7 and 26.5 percent, respectively), Hispanics enroll at two-year institutions at a significantly higher rate (36.6 percent). Correspondingly, Hispanics have the lowest level of four-year enrollment (27.7 percent), followed by blacks (40.6 percent), whites (50.7 percent) and Asians (59.2 percent). Low-income students outpace their middle and upper-income counterparts in two-year enrollment (32.3 vs. 38.8 percent), while lagging significantly behind in four-year enrollment (26.8 vs. 50.5 percent). The same is true for students whose parents do not have a bachelor's degree. These first-generation college students outpace their peers in enrollment rates in the two-year segment (33.5 vs. 23.6 percent) while falling far short in four-year enrollment (33.2 vs. 64.4 percent).

Consistent with previous cohorts of students, this class also shows differences by group across many of the forms of capital investigated here. The differences are least pronounced between male and female students. For example, all student groups show significant differences on the rates of enrollment in the academic track, grade point average and rates of FAFSA filing. Males and females are nearly equal in enrolling in high-level math, but rates vary significantly across the other three groups. White and Asian students are close across many measures, but black and Hispanic students lag in terms of the percentage of students who take college entrance exams and are also less likely to have parents who save for college or provide a computer in the home. The same is true for both low-income and potential first-generation college students.

Main Effects

Turning to the multinomial logistic regression models, Table 2.3 shows the effects of the different forms of student and family capital on the probability of enrolling in to a two-year or four-year institution. The coefficients reported in the first column show the effects of the independent variables on enrolling in a two-year institution versus not being in school. The second column shows the effects of the independent variables on enrolling in a four-year institution versus not being in school. The third column indicates whether significant effects exist between enrolling in a two-year versus four-year institution.

On the student capital side, student's own human capital has the greatest impact on the increased probability of college enrollment. For both two-year and four-year institutions, having a higher grade point average, expecting to obtain at least a bachelor's degree, taking the ACT or SAT, and filing the FAFSA all result in higher odds of enrollment. Being in an academic track, taking high-level math classes, and getting information on the college process also significantly and positively impact the probability of being enrolled in a four-year institution versus not be enrolled in college. Additionally, each of the student human capital variables is a positive predictor of enrolling in a four-year versus a two-year institution. Having friends who think it is very important to attend college – a measure of social capital – does have a significant effect on the probability of enrolling in a four-year school versus not being enrolled, but has no effect on the probability of enrollment in to a two-year institution or between two and four-year enrollment. Whether a student's friends expect him or her to attend college has no statistical significance in this model.

Similar to student social capital, social capital at the parent level produces mixed findings. Parents' educational aspirations for their child are positively and significantly related to the probability of enrolling in to both two-year and four-year institutions, and between four-year

and two-year enrollment. Parent-school interaction actually produces a statistically significant negative effect on the probability of enrolling in to a two-year school, has no effect on the probability of enrolling in a four-year school, and has a positive effect on the difference between enrolling in a two-year versus four-year institution. At the same time, parent-student interaction has a significant positive effect on the likelihood of four-year enrollment. Having rules about grades or homework has no statistical effect on enrollment.

Family capital in terms of family structure – which may amplify or dilute both social and financial capital – also impacts the probability of enrollment. While residing in a single-parent home has no statistically significant effect on enrollment, living in a step-parent family reduces the probability of enrolling in either a two-year or four-year institution. The presence of siblings also has a small negative effect on the probability of enrolling in either a two-year or four-year institution. The two measures of parent financial capital – saving for college and having a computer in the home – increase the probability of enrolling in both two-year and four-year institutions. Saving for college also has a positive effect on enrollment between four-year and two-year institutions.

Males have a slightly lower probability of being enrolled in a two-year institution vs. not being in school. However, this effect does not translate to four-year enrollment versus not being in school. And, controlling for the effects of student and family capital, males actually have a higher likelihood of enrolling in a four-year versus a two-year institution. Differences by race/ethnicity are absent with the exception of a significant positive advantage for black students enrolling in a four-year institution versus not being in school and versus two-year institution enrollment compared to their white counterparts. Consistent with prior research, being from a low-income or potential first-generation college family significantly reduces the likelihood of

enrollment in to either a two-year or four-year institution. And, both low-income and first-generation status also has a negative impact on the probability of enrolling in a four-year versus two-year institution.

Group Differences

While Table 2.3 shows the effects of different types of student and parent capital on enrollment in to two-year and four-year institutions, and the likelihood of enrollment for each student group, this model does not answer the question of whether different forms of capital have varying effects for different student groups. To explore this, I test separate models that interact each form of capital with each student group. Tables 2.4 through 2.7 show the significant interaction terms for each student group with the various forms of student and parent capital. (The coefficients for the difference between two-year and four-year institution are not reported in the subsequent tables as they are the difference between the first and second columns for each model.)

Table 2.4 shows three significant interaction terms for gender. As Model 2 indicates, there is a significant negative effect of the interaction between gender and grade point average in the enrollment in to four-year institutions and in four-year versus two-year enrollment. The gender variable also changes direction, and becomes significant in enrollment in to four-year institutions. Overall, this suggests that female students benefit more from higher grade point averages. At the same time, as Model 3 shows, the interaction between males and having friends that expect you to go to college is positive for four-year enrollment. Similarly, Model 4 shows the positive effect on the probability of two-year enrollment on the interaction between male students and parent-student interaction. Both of these findings suggest that males benefit more from these forms of social capital.

Significant interactions for low-income and first-generation students are shown in Table 2.5. Model 5 shows low-income students whose parents saved for college significantly reduced their likelihood of enrollment in to four-year schools. At the same time, students from middle and upper-income families were actually more likely to attend a four-year institution if their parents saved for college. This finding supports the hypothesis that low-income families are negatively impacted by saving, and suggests that this action may have reduced or eliminated their eligibility for federal and state financial aid, based on FAFSA formulas that were in effect in 2004-2006.

While it had been predicted there might be differences between low-income students and their upper and middle-income counterparts where siblings were concerned, there was no significant interaction found between low-income students and siblings. Consistent with McNeal (1999), I find no significant difference by income group on parent-school interaction either.

First-generation college students benefit from both student and family capital in the same ways as their counterparts whose parents completed college – with one exception. As Model 6 shows, there is a significant and positive effect of the interaction between first-generation status and having filed a FAFSA. This is true for enrollment in to either a two-year or a four-year institution. This indicates an understanding of the importance of having financial resources available to attend college, along with the knowledge of how to tap financial resources beyond family assets.

Table 2.7 shows the statistically significant interactions of capital with race/ethnicity. Conditional effects were evident for both student and parent capital, and for each racial/ethnic group. Consistent with previous research, Model 7 indicates that both black and Hispanic students do not benefit from higher college expectations, at least in terms of the probability of

enrolling in a four-year institution. Model 8 shows that black students also do not benefit in the same way as their white counterparts when it comes to having a computer in the home. Unless there is something significantly different about the computers in white and black students' homes, this is an unusual finding. This may reflect different types of computer use or parental monitoring of use, or may indicate a difference in internet access more than computer access itself.

Model 9 also produced an unexpected finding, that of the negative effect on the probability of four-year enrollment for the interaction between Asian students and filing the FAFSA. These results are perplexing particularly since the FAFSA does not even ask a question about a student's race/ethnicity, and federal and state financial aid programs are required to remain race-blind. It is possible this is due to a selection effect, with some unmeasured difference being captured between Asian students who do or do not file the FAFSA.

The significant effects of interaction terms with Hispanic students are equally unexpected, but in a more positive direction (see Table 2.7 continued). As Model 10 shows, the direct effect of being in a step-parent family has remained consistently significant and negative across models for enrollment in to a two-year or four-year school. However, unlike previous models that showed no effect for single-parent status on the likelihood of enrollment at either two-year or four-year schools, Model 10 shows a positive and significant interaction between Hispanic and single-parent family status on the enrollment in to both two-year and four-year institutions. While prior research has shown that single-parent families are negatively related to educational outcomes, Hispanic students are less negatively impacted from residing in a single-parent home – at least in comparison to their white counterparts.

Similar to the response of single-parent family, Model 11 shows a significant positive effect for the interaction between Hispanic and first-generation status on the probability on enrolling in a four-year institution versus not being enrolled. And, Model 12 shows a positive effect on the interaction between Hispanic and low-income status on both two and four-year enrollment. These results again suggest a somewhat counterintuitive finding: compared to their white counterparts, Hispanic students who live in low-income families or who are potential first-generation college students are harmed less in terms of the probability of college enrollment.

DISCUSSION

The class of 2004 is attending college at unprecedented rates. Over 75 percent of the students in this sample enrolled in college within the first two years of high school graduation. That is up from a rate of 70 percent from the students who were part of the class of 1992 and participated in the National Education Longitudinal Survey (U.S. Department of Education 2000).

Consistent with previous research and previous cohorts of students, the various forms of both student and parent human capital continue to have a significant effect on college enrollment in to both two and four-year institutions. Traditional mechanisms of influence, such as grade point average and college expectations for students – along with parents aspirations for their child – all continue to be positively and significantly related to two-year and four-year college enrollment. And, being in the academic track and taking high level math courses are also positively related to enrollment in to a four-year institution vs. not be enrolled.

Of particular importance, however, is the recognition that college planning activities, such as taking the ACT or SAT and filing a FAFSA have the strongest effects of all variables in the model on both two-year and four-year college going. This is true even while taking grade

point average, college expectations and family background in to account. Similarly, seeking college information also boosts the probability of four-year enrollment. This finding suggests that both parents and schools can have a significant impact on the probability of college enrollment by either encouraging their student to complete these activities, or by passing policy that facilitates or requires student engagement in these activities – including dissemination of information about fee waivers for college entrance exams and admission applications for income qualified students.

This research also highlights the importance of parent financial capital variables – beyond that of family income. Similar to student college planning activities, parents who plan for their child to attend college by saving for college increase the likelihood of both two and four-year enrollment (except among low-income students). And, those parents who provide resources in the home to assist with both academic activities and the college application process – in this case, measured by having a computer in the home – also increase the probability of college enrollment (except for black students).

These results indicate that student groups do vary in the effects of different kinds of capital on college-going in some ways. However, taken as a whole, most of the interactions between capital and student group indictor are not significant. Overall, the effects of capital are generally similar across all groups of students. And, in a few of the instances that they differ, the results are encouraging, as they suggest avenues to close the gaps between groups. For example, filing the FAFSA is especially beneficial for potential first-generation college students. Policies and practices that assist in increasing the percentage of students who complete the FAFSA have the potential benefit all students. Current Congressional discussion on FAFSA simplification

may assist in this regard – and may be especially beneficial to these otherwise underrepresented students.

On the other hand, these results require further social reflection. The fact that students from low-income families are actually negatively impacted by their family saving for college, while their middle and upper-income counterparts benefit, is disappointing. Current efforts to revamp the FAFSA formula, negating asset information from the equation for low-income families, may in fact be one policy avenue that could provide a positive impact for low-income students.

In terms of differences by race/ethnicity, the interesting story is the findings surrounding Hispanic students. Contrary to their white counterparts, Hispanic students' college enrollment chances are much less negatively impacted when they come from a single-parent home, a low-income family, or when neither parent has completed a college degree. These results may simply be a reflection on the lower likelihood of college enrollment as a whole. It may also be that this is a reflection of selection effects, as greater numbers of Hispanic students are more likely to have dropped out of school before completing high school.[9] In conjunction, it may also be that the many public and private programs that have been implemented to specifically help increase the college enrollment of these student groups are actually providing some benefit to these students.

Or, it may be that Stanton-Salazar's (1997) theoretical ideas may yield some fruitful avenues of exploration. He suggests that disadvantaged students who connect with institutional agents that help them understand the educational system may be more successful in this realm.

[9] The Hispanic and Asian umbrellas encompass many distinct subgoups. It may be that an extrication of these subgroups and/or accounting for immigrant generation status may also help to explain some of this finding.

While the social capital variables used in this study yielded mixed results, more careful analysis of these kinds of social connections may be valuable.

Future research should therefore consider both additional measures of social capital – in terms of student connections with institutional agents, along with additional measures of human capital that capture college process information. If positive connections are found, this would match the findings above that measures of student and family capital that support college planning activities have a positive impact on the probability of college enrollment. And, this may help to inform students, parents, schools, and policy-makers as decisions are made on where to place efforts and limited resources.

Table 2.1. Descriptive Statistics for Variables Used in the Analyses of Capital Utilization in the College Enrollment Process

	Percent or Mean (s.d.)	% Missing
Dependent Variable		
Two-year school enrollment	29.47	na
Four-year school enrollment	45.85	na
Student Group		
Male	48.17	na
Female (reference)	51.83	na
White (reference)	65.92	na
Black	14.95	na
Asian	4.64	na
Hispanic	14.49	na
Low-income	19.52	na
First-generation	59.36	na
Student Capital		
Academic track	53.95	0.00
High math	45.67	6.48
GPA	2.78 (0.73)	7.48
College expectations	82.69	8.71
ACT/SAT taken	63.23	0.00
FAFSA filed	46.55	0.00
College information	86.97	15.57
College expectations – friends	58.76	31.45
College importance – friends	57.23	28.87
Family Capital		
Single-parent family	22.55	0.82
Step-parent family	15.48	0.82
Siblings	2.28 (1.38)	15.61
College aspirations for child	88.58	0.00
Parent saved for college	52.84	21.09
Computer in home	90.02	10.72
Rules about grades	84.47	15.83
Rules about homework	93.84	15.88
Parent-school interaction	78.39	15.94
Parent-child interaction	48.52	15.33
School Controls		
Urban	29.30	0.00
Rural	19.95	0.00
Suburban (reference)	50.75	0.00
Private School	8.47	0.00
Public School (reference)	91.53	0.00
Number of Respondents (weighted)	12175	

SOURCE: Educational Longitudinal Study of 2002 (ELS)

Table 2.2. Descriptive Statistics for Variables Used in Analyses of Capital Utilization in the College Enrollment Process by Student Group (with means tests)[10]

Percent or Mean (s.d.)	*Male*	Female	*White*	Black	Asian	Hispanic	*Low Income*	Mid/Upper Income	*First Gen*	Parents with BA
Dependent Variable										
Two-year school enrollment	28.39	30.47 *	28.39	28.73	26.53	36.56 ***	32.34	28.77 **	33.50	23.59 ***
Four-year school enrollment	42.65	48.83 ***	50.69	40.64 ***	59.17 ***	27.70 ***	26.75	50.49 ***	33.16	64.39 ***
Student Capital										
Academic track	51.30	56.41 ***	55.80	51.51 **	63.89 ***	45.39 ***	46.37	55.79 ***	48.63	61.72 ***
High math	44.72	46.54	49.92	36.65 ***	63.35 ***	31.80 ***	29.56	49.57 ***	36.14	59.58 ***
GPA	2.65	2.90 ***	2.93	2.38 ***	3.04 ***	2.49 ***	2.50	2.85 ***	2.63	3.00 ***
	(0.74)	(0.72)	(0.70)	(0.73)	(0.74)	(0.75)	(0.73)	(0.72)	(0.73)	(0.70)
College expectations	78.36	86.73 ***	83.72	81.81	90.08 ***	76.74 ***	73.30	84.97 ***	76.83	91.26 ***
ACT/SAT taken	59.26	66.92 ***	69.86	56.93 ***	70.08	41.13 ***	43.54	68.00 ***	54.07	76.60 ***
FAFSA filed	41.99	50.79 ***	47.08	52.00 **	50.95 *	39.25 ***	43.18	47.37 **	43.50	51.00 ***
College information	83.39	90.29 ***	86.05	90.35 ***	92.65 ***	86.16	85.20	87.40 *	85.54	89.05 ***
College expectations – friends	57.33	60.10 **	56.68	68.19 ***	62.96 **	57.55	57.02	59.19	55.64	63.32 ***
College importance – friends	1.95	1.97	1.96	1.97	1.97	1.95	1.95	1.96	1.95	1.97
	(0.21)	(0.17)	(0.19)	(0.18)	(0.16)	(0.21)	(0.21)	(0.18)	(0.21)	(0.16)
Family Capital										
Single parent family	22.18	22.90	17.49	44.37 ***	13.38 ***	24.08 ***	52.31	15.33 ***	23.97	20.47 ***
Stepparent family	15.36	15.59	14.98	17.25	10.32 ***	16.69	12.66	16.16 ***	18.48	11.10 ***
Siblings	2.26	2.30	2.09	2.72 ***	2.20	2.65 ***	2.64	2.19 ***	2.43	2.07 ***
	(1.49)	(1.54)	(1.41)	(1.65)	(1.59)	(1.58)	(1.68)	(1.46)	(1.58)	(1.41)
College aspirations for child	86.07	90.92 ***	87.80	91.07 ***	93.67 ***	88.34	82.12	90.15 ***	84.23	94.94 ***
Parent saved for college	52.86	52.82	57.09	49.14 ***	58.88	36.57 ***	31.55	58.00 ***	43.04	67.15 ***
Computer in home	90.53	89.55	94.21	80.01 ***	95.18	81.27 ***	76.10	93.40 ***	86.11	95.74 ***
Rules about grades	85.13	83.85	82.31	90.32 ***	85.33	87.70 ***	84.61	84.43	86.02	82.20 **
Rules about homework	93.92	93.77	93.14	96.78 ***	92.89	94.19	92.98	94.05	94.15	93.40
Parent-school interaction	80.66	76.28 ***	78.54	80.61	67.61 ***	77.93	73.56	79.56 ***	76.38	81.32 ***
Parent-child interaction	1.93	1.93	1.94	1.92	1.88 ***	1.91 **	1.88	1.94 ***	1.92	1.94 **
	(0.26)	(0.27)	(0.25)	(0.27)	(0.33)	(0.29)	(0.33)	(0.24)	(0.29)	(0.25)
Low-income	18.49	20.47 *	11.75	34.55 ***	24.46 ***	35.06 ***	--	--	26.84	8.83 ***
First-generation	59.10	59.59	54.60	66.27 ***	43.16 ***	76.83 ***	81.62	53.96 ***	--	--

*p<.05, **p<.01, ***p<.001 (two-tailed test).

[10] Means tests for race/ethnicity groups show significance of difference in relationship to whites (reference category). Reference categories for each group are italicized above.

Table 2.3. Multinomial Logistic Regression of Student and Family Capital on Postsecondary Enrollment (Two-Year and Four-Year)

Independent Variable	Model 1		
	2-Year vs. Not in school	4-Year vs. Not in school	4-Year vs. 2-Year
Student Capital			
Academic track	-0.018	0.216 **	0.234 ***
	(0.074)	(0.083)	(0.064)
High math	0.017	0.823 ***	0.805 ***
	(0.089)	(0.093)	(0.067)
GPA	0.464 ***	1.336 ***	0.872 ***
	(0.062)	(0.076)	(0.062)
College expectations	0.292 **	0.798 ***	0.507 ***
	(0.086)	(0.123)	(0.115)
ACT/SAT taken	0.678 ***	1.567 ***	0.890 ***
	(0.079)	(0.093)	(0.081)
FAFSA filed	1.382 ***	1.729 ***	0.347 ***
	(0.085)	(0.094)	(0.065)
College information	0.086	0.325 **	0.239 *
	(0.095)	(0.112)	(0.094)
College expectations – friends	0.146	0.147	0.002
	(0.075)	(0.085)	(0.066)
College importance – friends	0.141	0.171 *	-0.030
	(0.075)	(0.086)	(0.066)
Family Capital			
Single-parent family	-0.071	-0.024	0.046
	(0.089)	(0.107)	(0.088)
Step-parent family	-0.243 *	-0.294 *	-0.051
	(0.096)	(0.114)	(0.093)
Siblings	-0.087 **	-0.085 **	0.002
	(0.025)	(0.030)	(0.024)
College aspirations for child	0.380 ***	0.662 ***	0.281 *
	(0.094)	(0.146)	(0.136)
Parent saved for college	0.200 **	0.364 ***	0.163 *
	(0.074)	(0.085)	(0.065)
Computer in home	0.460 ***	0.684 ***	0.224
	(0.104)	(0.144)	(0.129)
Rules about grades	-0.072	-0.199	-0.127
	(0.109)	(0.122)	(0.098)
Rules about homework	0.197	0.093	-0.104
	(0.164)	(0.185)	(0.141)
Parent-school interaction	-0.185 *	-0.031	0.155 *
	(0.087)	(0.099)	(0.074)
Parent-student interaction	0.111	0.160 *	0.049
	(0.070)	(0.081)	(0.062)

Independent Variable	Model 1		
	2-Year vs. Not in school	4-Year vs. Not in school	4-Year vs. 2-Year
Student Group			
Male	-0.167 *	-0.032	0.135 *
	(0.071)	(0.082)	(0.064)
Black	-0.116	0.274 *	0.390 ***
	(0.108)	(0.127)	(0.099)
Asian	0.264	0.228	-0.035
	(0.156)	(0.162)	(0.105)
Hispanic	0.191	-0.007	-0.198
	(0.100)	(0.130)	(0.104)
Low-income	-0.307 ***	-0.505 ***	-0.198 *
	(0.086)	(0.109)	(0.094)
First-generation	-0.349 ***	-0.923 ***	-0.573 ***
	(0.084)	(0.091)	(0.066)
School Controls			
Urban	-0.036	0.399 ***	0.434 ***
	(0.083)	(0.101)	(0.078)
Rural	-0.110	-0.145	-0.035
	(0.088)	(0.100)	(0.078)
Private school	0.498 ***	0.863 ***	0.365 ***
	(0.124)	(0.126)	(0.077)
Constant	-2.146	-6.754	-4.608

Note: Numbers in parentheses are standard errors; N= 12175 (weighted).
*p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 2.4. Multinomial Logistic Regression of Student and Family Capital on Postsecondary Enrollment (Two-Year and Four-Year) – Significant Gender Interactions

Independent Variable	Model 2		Model 3		Model 4	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Student Group Interactions						
Male * GPA	-0.093	-0.343 *				
	(0.108)	(0.135)				
Male * College expectations – friends			0.137	0.354 *		
			(0.138)	(0.161)		
Male * Parent – student interaction					0.271 *	0.276
					(0.137)	(0.159)
Student Capital						
Academic track	-0.018	0.216 **	-0.019	0.215 *	-0.018	0.216 **
	(0.074)	(0.083)	(0.074)	(0.083)	(0.074)	(0.083)
High math	0.017	0.820 ***	0.016	0.822 ***	0.013	0.818 ***
	(0.089)	(0.093)	(0.089)	(0.093)	(0.089)	(0.093)
GPA	0.516 ***	1.508 ***	0.464 ***	1.338 ***	0.465 ***	1.337 ***
	(0.081)	(0.102)	(0.062)	(0.076)	(0.062)	(0.076)
College expectations	0.291 **	0.803 ***	0.290 **	0.791 ***	0.296 **	0.801 ***
	(0.086)	(0.123)	(0.086)	(0.124)	(0.086)	(0.124)
ACT/SAT taken	0.676 ***	1.570 ***	0.678 ***	1.567 ***	0.681 ***	1.570 ***
	(0.079)	(0.093)	(0.079)	(0.093)	(0.079)	(0.093)
FAFSA filed	1.382 ***	1.733 ***	1.381 ***	1.729 ***	1.380 ***	1.728 ***
	(0.085)	(0.094)	(0.085)	(0.094)	(0.085)	(0.094)
College information	0.084	0.321 **	0.085	0.322 **	0.084	0.323 **
	(0.095)	(0.112)	(0.095)	(0.112)	(0.095)	(0.112)
College expectations – friends	0.146	0.147	0.070	-0.024	0.142	0.144
	(0.075)	(0.085)	(0.101)	(0.113)	(0.075)	(0.085)
College importance – friends	0.142	0.173 *	0.142	0.169 *	0.146	0.175 *
	(0.075)	(0.085)	(0.075)	(0.086)	(0.075)	(0.086)
Family Capital						
Single-parent family	-0.071	-0.022	-0.072	-0.025	-0.068	-0.022
	(0.089)	(0.106)	(0.089)	(0.107)	(0.089)	(0.107)
Step-parent family	-0.244 *	-0.297 **	-0.242 *	-0.292 *	-0.245 *	-0.296 **
	(0.096)	(0.114)	(0.096)	(0.114)	(0.096)	(0.114)

Independent Variable	Model 2		Model 3		Model 4	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Siblings	-0.087 **	-0.085 **	-0.087 **	-0.086 **	-0.087 **	-0.085 **
	(0.025)	(0.030)	(0.025)	(0.030)	(0.025)	(0.030)
College aspirations for child	0.380 ***	0.657 ***	0.380 ***	0.656 ***	0.381 ***	0.663 ***
	(0.094)	(0.145)	(0.094)	(0.146)	(0.094)	(0.146)
Parent saved for college	0.206 **	0.367 ***	0.200 **	0.361 ***	0.200 **	0.363 ***
	(0.074)	(0.085)	(0.074)	(0.085)	(0.074)	(0.085)
Computer in home	0.461 ***	0.683 ***	0.458 ***	0.682 ***	0.465 ***	0.688 ***
	(0.104)	(0.144)	(0.104)	(0.144)	(0.104)	(0.144)
Rules about grades	-0.069	-0.193	-0.073	-0.199	-0.071	-0.198
	(0.109)	(0.122)	(0.109)	(0.122)	(0.109)	(0.122)
Rules about homework	0.195	0.088	0.196	0.086	0.204	0.099
	(0.165)	(0.185)	(0.164)	(0.185)	(0.165)	(0.185)
Parent-school interaction	-0.187 *	-0.035	-0.188 *	-0.036	-0.181 *	-0.026
	(0.087)	(0.099)	(0.087)	(0.099)	(0.087)	(0.099)
Parent-student interaction	0.112	0.161 *	0.110	0.160 *	-0.031	0.016
	(0.070)	(0.081)	(0.070)	(0.081)	(0.097)	(0.109)
Student Group						
Male	0.041	0.909 *	-0.236 *	-0.239 *	-0.291 **	-0.159
	(0.271)	(0.371)	(0.100)	(0.122)	(0.097)	(0.111)
Black	-0.114	0.285 *	-0.111	0.284 *	-0.114	0.275 *
	(0.108)	(0.127)	(0.108)	(0.127)	(0.108)	(0.127)
Asian	0.261	0.225	0.260	0.224	0.265	0.230
	(0.156)	(0.162)	(0.156)	(0.163)	(0.155)	(0.162)
Hispanic	0.190	-0.007	0.193	0.002	0.192	-0.005
	(0.100)	(0.130)	(0.100)	(0.129)	(0.100)	(0.130)
Low-income	-0.307 ***	-0.509 ***	-0.305 ***	-0.507 ***	-0.313 ***	-0.511 ***
	(0.086)	(0.110)	(0.086)	(0.110)	(0.086)	(0.109)
First-generation	-0.346 ***	-0.917 ***	-0.349 ***	-0.922 ***	-0.344 ***	-0.918 ***
	(0.084)	(0.091)	(0.084)	(0.091)	(0.084)	(0.091)
School Controls						
Urban	-0.037	0.396 ***	-0.037	0.395 ***	-0.034	0.400 ***
	(0.088)	(0.101)	(0.088)	(0.101)	(0.088)	(0.101)
Rural	-0.110	-0.142	-0.110	-0.144	-0.115	-0.149
	(0.088)	(0.100)	(0.088)	(0.100)	(0.088)	(0.100)
Private school	0.498 ***	0.865 ***	0.501 ***	0.867 ***	0.498 ***	0.863 ***
	(0.124)	(0.126)	(0.125)	(0.126)	(0.124)	(0.126)

Independent Variable	Model 2		Model 3		Model 4	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Constant	-2.267	-7.246	-2.100	-6.632	-2.101	-6.707

Note: Numbers in parentheses are standard errors; N= 12175 (weighted).
*p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 2.5. Multinomial Logistic Regression of Student and Family Capital on Postsecondary Enrollment (Two-Year and Four-Year) – Significant Low-Income and First-Generation Interactions

Independent Variable	Model 5		Model 6	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Student Group Interactions				
Low-income * Parent saved	-0.261	-0.632 **		
	(0.165)	(0.209)		
First-generation * FAFSA filed			0.586 **	0.579 **
			(0.188)	(0.198)
Student Capital				
Academic track	-0.017	0.215 *	-0.019	0.215 *
	(0.074)	(0.083)	(0.074)	(0.083)
High math	0.015	0.821 ***	0.021	0.826 ***
	(0.089)	(0.093)	(0.089)	(0.093)
GPA	0.464 ***	1.334 ***	0.469 ***	1.341 ***
	(0.062)	(0.076)	(0.062)	(0.076)
College expectations	0.290 ***	0.796 ***	0.293 ***	0.800 ***
	(0.086)	(0.123)	(0.086)	(0.123)
ACT/SAT taken	0.675 ***	1.564 ***	0.675 ***	1.564 ***
	(0.079)	(0.093)	(0.079)	(0.094)
FAFSA filed	1.382 ***	1.730 ***	0.935 ***	1.299 ***
	(0.085)	(0.094)	(0.165)	(0.166)
College information	0.086	0.328 **	0.084	0.323 **
	(0.095)	(0.113)	(0.095)	(0.112)
College expectations – friends	0.145	0.149	0.143	0.145
	(0.075)	(0.085)	(0.075)	(0.085)
College importance – friends	0.141	0.168 *	0.144	0.174 *
	(0.075)	(0.086)	(0.075)	(0.086)
Family Capital				
Single-parent family	-0.069	-0.019	-0.069	-0.022
	(0.089)	(0.106)	(0.090)	(0.107)

Independent Variable	Model 5		Model 6	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Step-parent family	-0.242 *	-0.290 *	-0.246 *	-0.296 *
	(0.096)	(0.114)	(0.096)	(0.114)
Siblings	-0.088 ***	-0.087 **	-0.085 **	-0.083 **
	(0.025)	(0.030)	(0.025)	(0.030)
College aspirations for child	0.385 ***	0.676 ***	0.380 ***	0.660 ***
	(0.094)	(0.146)	(0.094)	(0.146)
Parent saved for college	0.268 **	0.486 ***	0.197 **	0.360 ***
	(0.084)	(0.094)	(0.074)	(0.085)
Computer in home	0.467 ***	0.706 ***	0.456 ***	0.681 ***
	(0.104)	(0.144)	(0.104)	(0.145)
Rules about grades	-0.069	-0.197	-0.078	-0.205
	(0.109)	(0.122)	(0.109)	(0.122)
Rules about homework	0.194	0.091	0.205	0.101
	(0.164)	(0.185)	(0.165)	(0.186)
Parent-school interaction	-0.184 *	-0.028	-0.183 *	-0.028
	(0.087)	(0.099)	(0.088)	(0.099)
Parent-student interaction	0.111	0.158 *	0.115	0.164 *
	(0.070)	(0.081)	(0.070)	(0.081)
Student Group				
Male	-0.169 *	-0.035	-0.165 *	-0.029
	(0.071)	(0.082)	(0.072)	(0.082)
Black	-0.113	0.278 *	-0.113	0.277 *
	(0.108)	(0.127)	(0.108)	(0.126)
Asian	0.274	0.248	0.262	0.226
	(0.156)	(0.163)	(0.154)	(0.161)
Hispanic	0.190	-0.012	0.191	-0.007
	(0.100)	(0.129)	(0.100)	(0.130)
Low-income	-0.218 *	-0.269 *	-0.311 ***	-0.509 ***
	(0.102)	(0.133)	(0.087)	(0.110)
First-generation	-0.342 ***	-0.908 ***	-0.476 ***	-1.056 ***
	(0.084)	(0.091)	(0.095)	(0.109)

Independent Variable	Model 5		Model 6	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
School Controls				
Urban	-0.037	0.396 ***	-0.035	0.400 ***
	(0.088)	(0.101)	(0.088)	(0.101)
Rural	-0.113	-0.148	-0.112	-0.148
	(0.088)	(0.100)	(0.088)	(0.101)
Private school	0.498 ***	0.886 ***	0.496 ***	0.860 ***
	(0.125)	(0.126)	(0.125)	(0.126)
Constant	-2.189	-6.853	-2.069	-6.677

Note: Numbers in parentheses are standard errors; N= 12175 (weighted).
*p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 2.6. Multinomial Logistic Regression of Student and Family Capital on Postsecondary Enrollment (Two-Year and Four-Year) – Significant Race/Ethnicity Interactions

Independent Variable	Model 7		Model 8		Model 9	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Student Group Interactions						
Black * College expectations	-0.357	-0.810 **				
	(0.207)	(0.293)				
Asian * College expectations	-0.402	-0.235				
	(0.314)	(0.410)				
Hispanic * College expectations	-0.064	-0.682 *				
	(0.199)	(0.337)				
Black * Computer in home			-0.098	-0.815 *		
			(0.244)	(0.326)		
Asian * Computer in home			-0.087	0.082		
			(0.475)	(0.512)		
Hispanic * Computer in home			0.134	-0.412		
			(0.251)	(0.384)		
Black * FAFSA filed					0.126	-0.247
					(0.214)	(0.240)
Asian * FAFSA filed					-0.370	-0.724 *
					(0.355)	(0.363)
Hispanic * FAFSA filed					0.069	0.005
					(0.219)	(0.269)
Student Capital						
Academic track	-0.023	0.205 *	-0.018	0.217 **	-0.017	0.218 **
	(0.074)	(0.083)	(0.074)	(0.083)	(0.074)	(0.083)
High math	0.015	0.816 ***	0.016	0.818 ***	0.019	0.824 ***
	(0.089)	(0.093)	(0.089)	(0.093)	(0.089)	(0.093)
GPA	0.464 ***	1.337 ***	0.466 ***	1.339 ***	0.463 ***	1.332 ***
	(0.062)	(0.076)	(0.062)	(0.076)	(0.062)	(0.076)
College expectations	0.382 ***	1.080 ***	0.291 **	0.796 ***	0.290 **	0.798 ***
	(0.107)	(0.153)	(0.086)	(0.124)	(0.086)	(0.123)
ACT/SAT taken	0.677 ***	1.567 ***	0.677 ***	1.565 ***	0.677 ***	1.577 ***
	(0.079)	(0.093)	(0.079)	(0.093)	(0.079)	(0.094)
FAFSA filed	1.384 ***	1.736 ***	1.378 ***	1.726 ***	1.364 ***	1.789 ***
	(0.085)	(0.094)	(0.085)	(0.094)	(0.112)	(0.120)

Independent Variable	Model 7		Model 8		Model 9	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
College information	0.086	0.325 **	0.087	0.327 **	0.085	0.329 **
	(0.095)	(0.112)	(0.095)	(0.113)	(0.095)	(0.111)
College expectations – Friends	0.147	0.146	0.147	0.148	0.146	0.152
	(0.075)	(0.085)	(0.075)	(0.085)	(0.075)	(0.085)
College importance – Friends	0.141	0.170 *	0.140	0.167	0.140	0.169 *
	(0.075)	(0.085)	(0.075)	(0.086)	(0.075)	(0.086)
Family Capital						
Single-parent family	-0.066	-0.017	-0.071	-0.025	-0.071	-0.028
	(0.089)	(0.107)	(0.089)	(0.107)	(0.090)	(0.107)
Step-parent family	-0.242 *	-0.291 *	-0.244 *	-0.293 *	-0.243 *	-0.256 *
	(0.096)	(0.114)	(0.096)	(0.114)	(0.096)	(0.114)
Siblings	-0.088 ***	-0.086 **	-0.087 **	-0.088 **	-0.086 **	-0.083 **
	(0.025)	(0.030)	(0.025)	(0.030)	(0.025)	(0.030)
College aspirations for Child	0.367 ***	0.631 ***	0.382 ***	0.667 ***	0.384 ***	0.664 ***
	(0.094)	(0.146)	(0.094)	(0.147)	(0.094)	(0.146)
Parent saved for college	0.202 **	0.368 ***	0.202 **	0.365 ***	0.201 **	0.365 ***
	(0.074)	(0.085)	(0.074)	(0.085)	(0.074)	(0.085)
Computer in home	0.463 ***	0.690 ***	0.454 **	1.036 ***	0.461 ***	0.678 ***
	(0.104)	(0.144)	(0.150)	(0.215)	(0.104)	(0.145)
Rules about grades	-0.067	-0.194	-0.069	-0.201	-0.073	-0.202
	(0.109)	(0.122)	(0.109)	(0.122)	(0.109)	(0.122)
Rules about homework	0.190	0.079	0.197	0.097	0.195	0.097
	(0.164)	(0.186)	(0.164)	(0.186)	(0.164)	(0.186)
Parent-school interaction	-0.185 *	-0.031	-0.184 *	-0.023	-0.185 *	-0.033
	(0.088)	(0.099)	(0.088)	(0.099)	(0.088)	(0.098)
Parent-student interaction	0.112	0.160 *	0.111	0.163 *	0.111	0.158
	(0.070)	(0.081)	(0.070)	(0.181)	(0.070)	(0.081)
Student Group						
Male	-0.167 *	-0.032	-0.168 *	-0.034	-0.168 *	-0.030
	(0.071)	(0.082)	(0.071)	(0.082)	(0.071)	(0.082)
Black	0.138	0.951 **	-0.050	0.991 **	-0.191	0.428 **
	(0.180)	(0.275)	(0.224)	(0.308)	(0.130)	(0.161)
Asian	0.573 *	0.389	0.344	0.151	0.322	0.474 **
	(0.263)	(0.374)	(0.448)	(0.487)	(0.176)	(0.178)
Hispanic	0.227	0.584	0.080	0.393	0.169	0.002
	(0.170)	(0.314)	(0.234)	(0.366)	(0.111)	(0.169)

Independent Variable	Model 7		Model 8		Model 9	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Low-income	-0.308 ***	-0.503 ***	-0.309 ***	-0.510 ***	-0.304 ***	-0.494 ***
	(0.086)	(0.109)	(0.086)	(0.109)	(0.086)	(0.109)
First-generation	-0.341 ***	-0.910 ***	-0.348 ***	-0.914 ***	-0.349 ***	-0.926 ***
	(0.085)	(0.091)	(0.084)	(0.091)	(0.084)	(0.091)
School Controls						
Urban	-0.034	0.404 ***	-0.032	0.400 ***	-0.034	0.397 ***
	(0.088)	(0.101)	(0.088)	(0.101)	(0.088)	(0.101)
Rural	-0.111	-0.143	-0.111	-0.135	-0.109	-0.149
	(0.088)	(0.101)	(0.088)	(0.100)	(0.087)	(0.100)
Private school	0.500 ***	0.868 ***	0.497 ***	0.866 ***	0.499 ***	0.865 ***
	(0.125)	(0.127)	(0.125)	(0.126)	(0.124)	(0.126)
Constant	-2.200	-6.974	-2.147	-7.108	-2.135	-6.786

Note: Numbers in parentheses are standard errors; N= 12175 (weighted).

*p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 2.6 (continued). Multinomial Logistic Regression of Student and Family Capital on Postsecondary Enrollment (Two-Year and Four-Year) – Significant Race/Ethnicity Interactions

Independent Variable	Model 10		Model 11		Model 12	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Student Group Interactions						
Black * Single-parent	-0.343	-0.316				
	(0.220)	(0.258)				
Black * Step-parent	0.176	0.318				
	(0.288)	(0.329)				
Asian * Single-parent	-0.533	-0.827				
	(0.427)	(0.494)				
Asian * Step-parent	0.420	-0.317				
	(0.405)	(0.460)				
Hispanic * Single-parent	0.510 *	0.691 *				
	(0.223)	(0.301)				
Hispanic * Step-parent	0.144	0.332				
	(0.247)	(0.321)				
Black * First-generation			0.046	0.297		
			(0.222)	(0.247)		
Asian * First-generation			-0.076	-0.026		
			(0.352)	(0.356)		
Hispanic * First-generation			0.348	0.754 **		
			(0.237)	(0.288)		
Black * Low-income					0.079	-0.233
					(0.206)	(0.258)
Asian * Low-income					0.189	-0.072
					(0.337)	(0.378)
Hispanic * Low-income					0.648 **	0.670 *
					(0.199)	(0.270)
Student Capital						
Academic track	-0.013	0.223 **	-0.020	0.211 *	-0.012	0.225 **
	(0.074)	(0.083)	(0.074)	(0.083)	(0.074)	(0.083)
High math	0.017	0.821 ***	0.016	0.826 ***	0.006	0.813 ***
	(0.089)	(0.093)	(0.089)	(0.093)	(0.089)	(0.093)
GPA	0.465 ***	1.337 ***	0.464 ***	1.336 ***	0.462 ***	1.334 ***
	(0.062)	(0.076)	(0.062)	(0.076)	(0.062)	(0.076)

Independent Variable	Model 10		Model 11		Model 12	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
College expectations	0.286 **	0.789 ***	0.290 **	0.791 ***	0.279 **	0.785 ***
	(0.086)	(0.123)	(0.086)	(0.123)	(0.086)	(0.124)
ACT/SAT taken	0.683 ***	1.574 ***	0.675 ***	1.564 ***	0.682 ***	1.577 ***
	(0.079)	(0.094)	(0.079)	(0.094)	(0.079)	(0.094)
FAFSA filed	1.384 ***	1.732 ***	1.383 ***	1.734 ***	1.387 ***	1.736 ***
	(0.085)	(0.094)	(0.085)	(0.094)	(0.085)	(0.094)
College information	0.081	0.318 **	0.089	0.326 **	0.078	0.318 **
	(0.095)	(0.112)	(0.095)	(0.112)	(0.095)	(0.112)
College expectations – friends	0.144	0.147	0.148 *	0.151	0.141	0.143
	(0.075)	(0.083)	(0.075)	(0.085)	(0.075)	(0.085)
College importance – friends	0.141	0.169 *	0.141	0.170 *	0.148 *	0.178 *
	(0.075)	(0.086)	(0.075)	(0.086)	(0.075)	(0.086)
Family Capital						
Single-parent family	-0.087	-0.038	-0.064	-0.010	-0.050	-0.003
	(0.120)	(0.138)	(0.090)	(0.107)	(0.090)	(0.107)
Step-parent family	-0.325 **	-0.399 **	-0.238 *	-0.287 *	-0.230 *	-0.285 *
	(0.119)	(0.138)	(0.096)	(0.114)	(0.096)	(0.114)
Siblings	-0.083 **	-0.080 **	-0.088 ***	-0.086 **	-0.089 ***	-0.085 **
	(0.025)	(0.030)	(0.025)	(0.030)	(0.025)	(0.030)
College aspirations for child	0.388 ***	0.668 ***	0.378 ***	0.657 ***	0.380 ***	0.664 ***
	(0.094)	(0.146)	(0.094)	(0.146)	(0.095)	(0.146)
Parent saved for college	0.197 **	0.359 ***	0.200 **	0.359 ***	0.197 **	0.363 ***
	(0.074)	(0.085)	(0.074)	(0.085)	(0.074)	(0.085)
Computer in home	0.463 ***	0.687 ***	0.467 ***	0.695 ***	0.461 ***	0.684 ***
	(0.104)	(0.144)	(0.104)	(0.144)	(0.104)	(0.144)
Rules about grades	-0.072	-0.198	-0.069	-0.192	-0.072	-0.200
	(0.110)	(0.123)	(0.109)	(0.122)	(0.109)	(0.122)
Rules about homework	0.198	0.097	0.203	0.104	0.196	0.093
	(0.164)	(0.185)	(0.164)	(0.186)	(0.165)	(0.185)
Parent-school interaction	-0.183 *	-0.027	-0.184 *	-0.030	-0.186 *	-0.032
	(0.088)	(0.099)	(0.087)	(0.099)	(0.087)	(0.098)
Parent-student interaction	0.111	0.161 *	0.108	0.159 *	0.121	0.169 *
	(0.070)	(0.081)	(0.070)	(0.081)	(0.070)	(0.081)
Student Group						
Male	-0.177 *	-0.043	-0.168 *	-0.030	-0.171 *	-0.036
	(0.071)	(0.082)	(0.071)	(0.082)	(0.071)	(0.082)

Independent Variable	Model 10		Model 11		Model 12	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Black	0.013	0.365	-0.152	0.090	-0.101	0.361 *
	(0.162)	(0.186)	(0.199)	(0.218)	(0.130)	(0.147)
Asian	0.273	0.349	0.313	0.251	0.244	0.262
	(0.187)	(0.185)	(0.309)	(0.307)	(0.178)	(0.178)
Hispanic	0.029	-0.242	-0.090	-0.557 *	-0.022	-0.248
	(0.127)	(0.162)	(0.216)	(0.254)	(0.118)	(0.151)
Low-income	-0.299 **	-0.500 ***	-0.312 ***	-0.517 ***	-0.508 ***	-0.608 ***
	(0.086)	(0.110)	(0.086)	(0.109)	(0.123)	(0.158)
First-generation	-0.347 ***	-0.917 ***	-0.414 ***	-1.066 ***	-0.348 ***	-0.923 ***
	(0.085)	(0.091)	(0.105)	(0.111)	(0.085)	(0.091)
School Controls						
Urban	-0.027	0.411 ***	-0.039	0.391	-0.040	0.393 ***
	(0.088)	(0.101)	(0.088)	(0.101)	(0.088)	(0.101)
Rural	-0.104	-0.140	-0.104	-0.130	-0.106	-0.144
	(0.088)	(0.101)	(0.088)	(0.101)	(0.088)	(0.101)
Private school	0.495 ***	0.861 ***	0.499 ***	0.867 ***	0.501 ***	0.869 ***
	(0.125)	(0.126)	(0.125)	(0.126)	(0.124)	(0.126)
Constant	-2.145	-6.758	-2.110	-6.685	-2.098	-6.728

Note: Numbers in parentheses are standard errors; N= 12175 (weighted).

*p<.05, **p<.01, ***p<.001 (two-tailed test).

APPENDIX

Description of Variables Included in the Analysis of Capital Utilization in the College Enrollment Process, Educational Longitudinal Study of 2002 (ELS)

Variable	Coding	Wave
Dependent Variable		
Postsecondary school attendance	Categorical variable: 0 = no postsecondary attendance, 1 = two-year institution, 2 = four-year institution.	2nd Follow-Up (2006)
Student Group		
Male	Dummy variable coded 1 for male.	Base (2002)
Race/ethnicity	Set of four dummy variables: white, black, Asian, Hispanic. For students that indicated both Hispanic background and identified as white, black or Asian, these students have been coded as Hispanic. (White as reference group.)	Base (2002)
Low-income	Dummy variable coded 1 for family income less than or equal to $25,000/yr.	Base (2002)
First-generation	Dummy variable coded 1 if neither parent achieved a 4-year degree.	Base (2002)
Student Capital		
Academic track	Dummy variable coded 1 for self-reported college prep track.	Base (2002)
High math	Dummy variable coded 1 for students whose highest math was trigonometry, pre-calculus or calculus.	1st Follow-Up (2004)
GPA	Continuous variable ranging from 0 to 4.0.	1st Follow-Up (2004)
College expectations	Dummy variable coded 1 for students who expect to achieve a bachelor's degree or higher in 10th grade.	Base (2002)
ACT/SAT taken	Dummy variable coded 1 for students who took either the ACT or SAT.	1st Follow-Up (2004)
FAFSA filed	Dummy variable coded 1 for students who filed the Free Application for Federal Student Aid (FAFSA).	2nd Follow-Up (2006)
College information	Dummy variable coded 1 for students who went to any source to find college information.	Base (2002)
College expectations – friends	Dummy variable coded 1 if student's friends think the student should go to college after high school.	Base (2002)
College importance – friends	Dummy variable coded 1 if a student's friends think it is very important to go to college.	Base (2002)

Family Capital		
Single-parent family	Dummy variable coded 1 if the student lives with only one parent or guardian in the 10th grade.	Base (2002)
Step-parent family	Dummy variable coded 1 if the student lives with one parent and another guardian in the 10th grade.	Base(2002)
Siblings	Continuous variable coded 0-6 for 0, 1, 2, 3, 4, 5 or 6 or more siblings.	Base (2002)
College aspirations for child	Dummy variable coded 1 if the student's parent wants the student to achieve a bachelor's degree or higher.	Base(2002)
Parent saved for college	Dummy variable coded 1 if the parent saved for college.	Base (2002)
Computer in home	Dummy variable coded 1 if there is a computer in the home.	Base (2002)
Rules about grades	Dummy variable coded 1 if there are family rules about grades.	Base (2002)
Rules about homework	Dummy variable coded 1 if there are family rules about homework.	Base (2002)
Parent-school interaction	Dummy variable coded 1 if the parent initiated contact with the school for any reason.	Base (2002)
Parent-student interaction	Dummy variable coded 1 if the parents often provide advice to their student on course selection.	Base (2002)
School Controls		
School location	Set of dummy variables that indicate urban, rural and suburban.	Base (2002)
Private school	Dummy variable coded 1 indicating enrollment in a private school.	Base (2002)

CHAPTER 3

BEYOND INDIVIDUAL LEVEL CAPITAL: THE PARALLEL EFFECTS OF SCHOOL LEVEL CAPITAL ON COLLEGE ENROLLMENT

There is a fairly extensive body of research that has examined the impact of school resources on student outcomes. While Coleman's (1966) classic report was generally interpreted to indicate that school resources did not have a significant impact on student achievement, more recent work has put this in question (Fowler and Walberg 1991, Greenwald et. al 1996; Hallinan 1988; Rivkin et. al 2005)

There is also a separate line of inquiry that focuses on the impact of individual and family characteristics and resources on student outcomes (Conley 2001; Dumais 2007; Hearn 1984; Kim and Schneider 2005). The widely accepted conclusion of this research is that individual and family resources significantly impact many measures of student achievement, from test scores to high school graduation rates to college enrollment.

While families and schools are often conceived of as separate spheres of influence, there is considerable overlap between these institutions. While I do not dispute resources in each realm impact student outcomes, bringing the focus to the parallel resources that operate at both the individual and school level may help to refine our understanding of how resources at each level together affect student outcomes.

And, although literature in the school domain often refers simply to "school resources," there is also a significant body of research that conceptualizes resources as different forms of capital. These are usually couched under the broad of umbrellas of human, social, cultural or financial capital. In this analysis I focus on three types – human, social and financial – that are

most closely aligned with the types of resources that are invested in schools and also exist for individuals and families.

While current research on parallel forms of capital focuses on in-school student achievement, such as test scores or graduation (Parcel and Dufur 2001b; Pong 1997), I extend the investigation of these potentially complementary levels of capital to the question of college enrollment. Test scores and graduation rates are certainly important student outcomes. However, understanding how investments in schools ultimately impact longer-term outcomes such as college enrollment may yield beneficial insights in to how investments might be used to obtain multiple positive student outcomes. And, as educational attainment is important to success in many other realms of life, such as health (Lynch 2003) and income (Kerckhoff 1995), which ultimately impacts society at large, this is an important extension of current work.

Therefore, I seek to answer the following question: Do human, social and financial resources invested in schools improve the likelihood of college enrollment above and beyond individual-level human, social and financial capital? To examine this question, I use data from the Educational Longitudinal Study of 2002 (ELS:2002). This nationally representative data set is the most current data available on a recent graduating high school class allowing the question of college enrollment to be studied within contemporary social and economic conditions.

HUMAN CAPITAL AND COLLEGE ENROLLMENT

There is strong and persistent evidence that human capital – knowledge, skills, and ability – of both the student and family strongly influences both high school graduation and college enrollment. These findings have their roots in status attainment literature which showed that parental educational and occupational level are strongly related to student educational and

occupational attainment (Blau and Duncan 1967; Jencks et al. 1979; Sewell Haller and Portes 1969).

Subsequent research has shown that several measures of student human capital affect academic outcomes. Enrollment in the academic track, or similar curriculum, has been shown to increase the likelihood of both college enrollment and graduation (Lucas 1999; Rosenbaum 1980). Using counterfactual models to better isolate a causal effect than previous studies, Beattie and Thaden (2007) find students enrolled in academic math coursework in high school are about 2.5 times as likely as those who are not to complete a bachelor's degree. Similarly, higher grade point averages and test scores also improve the likelihood of college enrollment (Roscigno and Ainsworth-Darnell 1999).

Human capital that is specific to the college process also matters. For example, student access to information about financial aid has been linked to positive associations of both college awareness and expectations (Flint 1993) and college enrollment (Plank and Jordan 2001). Plank and Jordan (2001) also found students who plan early to take the ACT or SAT, and then did eventually take these exams, increased their likelihood of enrolling in a four-year college. And, Thaden (2010) showed that filing the Free Application for Federal Student Aid (FAFSA) is also associated with an increased probability of college enrollment.

Research on school resources has generally not framed school variables in terms of capital, but these can easily be reframed in terms of capital. For example, just as students can use their parents' knowledge to their advantage – a form of human capital – students may also benefit from having teachers with higher levels of knowledge. Subject specific research has shown that 12th grade students' math scores are positively related to their teacher's math background and whether their teacher was certified to teach (Goldhaber and Brewer 2000).

Similarly, Hawk, Coble and Swanson (1985) found that students' math scores were higher when their teacher was certified in math. While not explicitly linked to college enrollment, this research suggests that both teacher certification itself, as well as teaching within one's subject area, improves learning and may positively influence college enrollment.

Therefore, consistent with prior research, I expect that higher levels of all forms of human capital will be positively related to student enrollment. That is, academic course-taking, high-level math, grade point average, college expectations, taking college entrance exams, filing the FAFSA, and gathering college information on the student side should all be positive influences on the likelihood of college enrollment. Similarly, students who have at least one parent with a college degree should be more likely to attend college themselves. And, on the school level, having teachers certified to teach and teaching in their field of expertise should positively impact college enrollment.

FINANCIAL CAPITAL AND STUDENT OUTCOMES

Financial resources, or capital, are also important predictors of academic achievement and college enrollment. At the individual level, parental income has been shown to have an effect on college educational attainment (Duncan et al. 1998; Mayer 1997). Not surprisingly, students from low-SES families are significantly more likely to delay enrollment in post-secondary education or to simply not seek additional education (Bozick and DeLuca 2005; Perna 2000). On the other side, wealth has shown to produce a positive effect on educational attainment levels (Conley 2001).

Educational resources in the home have also been found to have a positive effective on many student outcomes. Most relevant, resources such as books and reference material in the home, along with a specific space to study, have been positively linked to higher educational

attainment levels for both men and women (Teachman 1987). Additionally, recent research has shown that home computers have a positive impact on both reading and math test scores (Attewell and Battle 1999) as well on the admission and financial aid processes (Jackson 2003; Wright, Stewart & Burrell 1999).

While initial research regarding school resources – forms of financial capital – and academic achievement found relatively weak effects (Coleman et al. 1966; Jencks et al. 1972), continuing research has put these results in to question. For example, Parcel and Dufur (2001a) find that financial capital, measured by learning resources and per-pupil expenses, is linked to positive social adjustment for students. Similarly, Parcel and Dufur (2001b) also find that per-pupil expenditures are positively related to both math and English test scores. Elliott (1998) also finds that classroom resources have a direct effect on science achievement. Higher relative teacher pay has been associated with increased years of schooling for students (Card and Krueger 1992), while total educational expenditures per student are related to a decrease in high school dropout rate (Fitzpatrick and Yoels 1992).

Therefore, consistent with prior research, I expect that increased levels of financial resources at both the individual and school levels should positively impact student post-secondary enrollment. Students whose parents saved for their college education and who have access to a computer in their home should have a higher probability of college enrollment. Students who come from a low-income family are expected to have lower odds of enrollment. While school resources have previously been linked to achievement and persistence at the secondary level, it seems consistent that since achievement and persistence are related to educational attainment that similar effects would be present here. Therefore, on the school front, I expect that schools' learning resources, such as texts and supplies, will improve the probability

of student post-secondary enrollment. Higher average teacher salary (a financial investment) should serve to attract the "best" teachers (a proxy for higher human capital) and should therefore translate into a positive effect on student enrollment as well.

SOCIAL CAPITAL, RESOURCE DILUTION AND STUDENT OUTCOMES

Social capital captures the resources that come from the network of relationship that a person has which facilitates both information exchange and helps to support (or sanction) values within those relationships (Bourdieu 1986; Coleman 1988). In terms of student and parents, conversations about academics and expectations for educational attainment are both forms of social capital that influence student outcomes. For example, when parents and children discuss school together there is a significant reduction in the likelihood of dropping out of school (McNeal 1999) and an increased probability both high school graduation and college enrollment (Furstenberg and Hughes 1995, Yan 1999) The same outcomes are found with increased levels of both parental educational aspirations and expectations (Carbonaro 1998; Teachman et al. 1996; White and Glick 2000; Yan 1999).

Similarly, empirical studies show that relationship and information sharing – especially about the college process – between teachers and students significantly impacts college enrollment. Plank and Jordon (2001) find that encouragement to take the SAT or ACT and conversations about college planning significantly increased the probability that a student would enroll in college. And, just as parental expectations matter, attending a school that places emphasis on academic achievement, and in particular having a combination of strong school norms supporting student learning and trusting relationships between students and teachers, results in higher levels of student achievement (Goddard 2003; Hoy et al. 1990; Lee and Bryk 1989).

While these relationships within both the family and school are important, these resources are also at risk of being diluted. At the family level, additional siblings may impact both the amount of time that a parent has to spend with each child (thus limiting the amount of human capital transference), as well as the amount of financial resources that may be allocated to each child for educational expenses. In fact, research shows that fewer siblings is associated with higher educational aspirations (Qian and Blair 1999), higher test scores (Sun 1999; Israel, Beaulieu and Hartless 2001), higher grades (Valenzuela and Dornbusch 1994), a significantly higher probability of attending college (Adams and Meidam 1968) and ultimately higher educational attainment levels (Lloyd 1993; Powell and Steelman 1993). Similarly, research has also shown that additional siblings decrease the probability that parents will provide financial support for college, and increases the use of student loans (Steelman and Powell 1989).

At the same time, family structure also has the potential to facilitate or hinder interaction. Having a two-parent home provides more opportunity for parent-child interactions on a daily basis. Children who are part of a two-parent family have been shown to have higher grades (Valenzuela and Dornbusch 1994; Israel, Beaulieu and Hartless 2001), higher test scores (Sun 1999), and achieve higher levels of education (McLanahan and Sandefur 1994).

Larger schools and classrooms may also dilute the interactions between students and teachers, and lessen adherence to school norms. Research indicates that smaller school size is associated with higher test scores (Fowler and Wahlberg 1991), higher school attendance rates (Lindsay 1982) and lower dropout rates (Pittman and Haughwout 1987; Lee and Burkham 2003). While Rivkin et al. (2005) find that class size itself matters, they also find that this effect is less than that of teacher quality (more a measure of access to human capital within the school). But,

even at an aggregate state level, lower teacher-student ratios have been associated with an increase in years of educational attainment (Card and Krueger 1992).

Therefore, it is expected that students whose parents expect their child to attend college, and who talk with their child about school matters will have an increased likelihood of college enrollment, as will students who attend schools that support academic achievement norms and where students and teachers interact. At the same time, students who have fewer (if any) siblings are expected to have an increased likelihood of college enrollment, as are students who are part of a two-parent home. Similarly, lower student-teacher ratios at the school-level (a measure of both the financial investment of the school to decrease class size and a social capital measure of potential increased student-teacher interactions) should also positively impact college enrollment.

DATA AND METHODS

The analyses are based on the Educational Longitudinal Study of 2002 (ELS:2002). Sponsored by the National Center for Educational Statistics of the U.S. Department of Education, ELS:2002 covers the transition from high school to later life. ELS:2002 began with a nationally representative sample of 10th grade students in public and private school in 2002. Follow up data was collected in 2004 and 2006. The base year sample included over 17,000 students drawn from approximately 750 schools.

The base year data includes demographic information for these 10th grade students, along with parent, teacher and school information. The first follow up provides data from the 12th grade year. The second follow up occurs two years after high school graduation for most students. Importantly, this dataset provides information on students who both go on to college *and* those who do not. Often, studies that provide information on post-high school enrollment are limited to

those students who enroll in a post-secondary institution. Additionally, ELS:2002 surveyed teachers and school administrators, and gathered information about school finances and school conditions.

For this analysis, I first restrict the sample to the 14,006 students who completed all three rounds of the survey. I further restrict the sample to students who did not drop out of high school, and who completed their high school program or received a GED, as students without this credential cannot enroll in a post-secondary institution (777 cases, 5.5 percent). I further limited the sample to students with complete information on the dependent variable, two-year or four-year college enrollment (1296 cases, 9.25 percent). American Indians, Hawaiian/Pacific Islanders and "other" were dropped due to small sample sizes (293, 146 and 328 cases, 5.5 percent). Finally, I restrict the sample to students who have a valid school identification number (346 cases, 2.5 percent).

I utilized Stata's multiple imputation command "ice" to impute data for the missing data elements on the remaining independent variables (StataCorp 2007).[1] While the use of multiple imputation relies on the assumption that missing data be "missing at random" – a condition that is often violated in practice – listwise deletion also presents obstacles. Data eliminated through listwise deletion are also subject to selection bias. In addition, the loss of these additional cases reduces the precision of the model. Multiple imputation (as opposed to mean substitution or other single replacement techniques) introduces random error in to each imputed data set which helps to approximate unbiased estimates over the sets. (See Allison 2000 and Rubin 1987 for further discussion of this method.)

[1] Academic track and parent aspirations were previously imputed by NCES. The full ELS sample missing rate was 4.01 and 4.23 percent on these two items (Ingels et al. 2005). ACT/SAT scores and FAFSA completion were obtained directly from secondary sources by NCES, and thus have no missing cases.

For multiple imputation to be effective, an appropriate statistical technique must also be used. Stata's "ice" program relies on "multiple imputation using chained equations" (van Buuren et. al 1999) which is a switching regression technique that creates values for each missing variable in to each of a user-determined number of imputed data sets. (See Royston 2007 for the most recent programming update.) Three to ten imputed data sets have been shown to be sufficient to produce reliable estimates of missing data (Rubin 1987). I utilize five imputations, which results in a final unweighted sample of 10,820 students within 761 schools.

Measures

The dependent variable, college enrollment, is measured in the second follow-up of the ELS:2002 survey – two years after most of these students have graduated from high school. I utilize a categorical measure of enrollment which distinguishes the difference between not being enrolled, first enrollment in a two-year institution, or first enrollment in a four-year institution. I make this distinction between two-year and four-year institutions primarily because the criteria to enter four-year institutions are generally more rigorous, and the costs are often higher. However, this is also important as two-year institutions have played a significant role in increased access to and enrollment in post-secondary education overall. At the same time, enrollment in community colleges has historically included disproportionate numbers of non-white, female, lower-income and first-generation college students (Provasnik and Planty, 2008).

At the individual level, I include measures of student and family human, financial and social capital. Student human capital is measured by a set of dummy variables (1 = yes): enrolling in their high school's academic track (or similar course-taking), taking a high-level math (trigonometry, pre-calculus or calculus), taking the ACT or SAT, filing the FAFSA, and seeking college entrance information from any source. Additionally, a continuous variable

ranging from 0 to 4.0 that measures their grade point average is included. Student social capital is measured with two dichotomous variable (1 = yes): one that indicates whether the student expects a bachelor's degree or higher in the 10th grade and another that indicates whether the student's friends think it is very important to attend college. College expectations, academic track enrollment and seeking college entrance information were obtained from the base-year survey. The math, grade point average and college entrance exam variables were obtained from the transcript data that was collected as part of the first follow-up survey. The FAFSA information was collected as part of the financial aid questions in the second follow-up survey.

Parent human capital is measured with a dichotomous variable (1 = yes) which indicates whether or not either parent has achieved a four-year degree. Parent financial capital is measured with a series of dichotomous variables (1 = yes): an indicator of whether they are low-income (family income of less than $25,000 year – making up 21% of this sample), whether the parent saved any money for their child's education; and whether there is a computer in the home. Parent social capital is captured with two dichotomous variables (1 = yes): one that indicates whether the parent(s) expect their child to achieve a bachelor's degree or higher and a second that indicates whether the parent often provided advice about course selection to their student. All of these variables were obtained from the parent survey conducted in the base year.

Resource dispersion variables are captured with two measures for family structure - a measure for whether this is a single parent family and a measure for whether this is a stepparent family (two-parent family as reference); a continuous variable ranging from 0 to 6 that measures number of siblings is also included[2].

[2] While students could have more than six siblings, ELS answer choices restrict respondents to answer from "0" to "6 or more" siblings.

School human capital is measured with a series of continuous variables. These include the percentage of full-time teachers in the school that are certified and the percentage of full-time teachers that teach outside of their field. School financial capital is measured by a continuous variable that captures teacher salary (highest) along with a categorical measure ranging from 1 (not at all) to 4 (a lot) of whether learning is hindered by a lack of texts or supplies. Social capital is measured with two variables. The first is a continuous variable ranging from 0 (0 percent) to 6 (75-100 percent) that measures the percentage of the prior year's graduating class that went on to attend a four-year institution. The second is a categorical variable that ranges from 1 (not at all accurate) to 5 (completely accurate) that indicates the school administrator's feeling about whether students feel learning is a priority in their school. Resource dispersion is measured through a continuous variable that captures the student-teacher ratio. (This can also be construed as a form of financial capital as seen as a school investment to increase student-teacher contact or as a form of social capital capturing student-teacher contact.) All of these variables were obtained from the administrator survey conducted in the base-year.

I also include the following school-level characteristics as control variables: high school sector (public or private; public as reference); and school location (urban, rural or suburban – suburban as reference). In addition, I include dichotomous variables for gender (male = 1) and race/ethnicity[3] (Hispanic, black, Asian and white – white as reference).

The Appendix provides specific coding information and descriptions of each variable. Table 3.1 provides the descriptive statistics for each variable, along with the percent of imputed cases for each variable.

Analyses

[3] For students that indicated both Hispanic background and also indicated black, Asian or white, these students have been coded as Hispanic. Thus, black, Asian and white refer to non-Hispanic black, non-Hispanic Asian and non-Hispanic white throughout this analysis.

Because the interest of this study is to determine if both individual and school-level variables impact college enrollment – an individual-level variable – it is important to statistically account for the levels of analysis. The primary benefit of utilizing a multilevel statistical model is to account for variation that occurs both at the individual-level itself, and across levels. On a basic level, this helps to effectively determine if school context impacts individual students. At the same time, estimates for the direct effects of individual-level variables are also modeled – while accounting for the clustering (non-independent) effects of students within schools that are likely present. On a statistical level, this approach is slightly more conservative and yields more appropriate standard errors by keeping error terms at each level instead of pooling to the individual level.

The models presented here use Bryk, Raudenbush and Congdon's (2004) HLM program to account for the multilevel effects. In addition, I utilize a multinomial logistic regression within this multilevel model to access different patterns that may exist between those students who do not enroll, students who enroll in a two-year institution and those students who enroll in a four-year institution. This produces separate equations for the probability of enrollment for each of the possible enrollment outcomes in relationship to not being enrolled. The full first-level equation for two-year enrollment takes the form of:

$$\begin{aligned}
&Log(\text{probability of enrolling in a 2 year institution/probability of not enrolling}) = \\
&\beta_{0j(1)} + \beta_{1j(1)}(\text{academic track}) + \beta_{2j(1)}(\text{high-level math}) + \beta_{3j(1)}(\text{grade point average}) \\
&+ \beta_{4j(1)}(\text{college expectations - student}) + \beta_{5j(1)}(\text{college is important - friend}) \\
&+ \beta_{6j(1)}(\text{ACT/SAT taken}) + \beta_{7j(1)}(\text{FAFSA filed}) + \beta_{8j(1)}(\text{college information}) \\
&+ \beta_{9j(1)}(\text{parent-student conversation}) + \beta_{10j(1)}(\text{parent education level – no BA}) \\
&+ \beta_{11j(1)}(\text{college aspirations - parent}) + \beta_{12j(1)}(\text{single-parent})
\end{aligned}$$

$+ \beta_{13j(1)}\,(step\text{-}parent) + \beta_{14j(1)}\,(siblings) + \beta_{15j(1)}\,(low\ income)$

$+ \beta_{16j(1)}\,(parent\ saved\ for\ college) + \beta_{17j(1)}\,(computer\ in\ home) + \beta_{18j(1)}\,(male)$

$+ \beta_{19j(1)}\,(black) + \beta_{20j(1)}\,(Hispanic) + \beta_{21j(1)}\,(Asian) + r_{ij}$

and a matching equation is executed for four-year enrollment. Each first-level record corresponds to student j, with β_{qj} representing the level-one coefficients and r_{ij} representing the random effect at level one.

The full second-level equation takes the form of:

$\beta_{0j(1)} = \gamma_{00(1)} + \gamma_{01(1)}\,(\%\ teachers\ certified) + \gamma_{02(1)}\,(\%\ teachers\ teach\ out\ of\ field) +$

$+ \gamma_{03(1)}\,(school\ lacks\ texts/supplies) + \gamma_{04(1)}\,(teacher\ salary) + \gamma_{05(1)}\,(prior\ class\ four\text{-}year\ bound) + \gamma_{06(1)}\,(learning\ high\ priority) + \gamma_{07(1)}\,(student\text{-}teacher\ ratio) + \gamma_{08(1)}\,(urban)$

$+ \gamma_{09(1)}\,(rural) + \gamma_{010(1)}\,(private) + u_{qj}$

$\beta_{1j(1)} = \gamma_{10(1)}$

$\beta_{2j(1)} = \gamma_{20(1)}$

.

.

.

$\beta_{21j(1)} = \gamma_{210(1)}$

for each of the dependent variable outcomes. Similar to the level-one model, here the level-two coefficients correspond to the school, while u_{qj} represents the level-two random effect associated with a specific school. Each of the additional $\gamma_{10} - \gamma_{190}$ represent the non-random level-one coefficients and are also included as dependent variables in the regression equation at level two.

The models themselves are fitted by maximum likelihood estimates. These estimates are produced with a likelihood function which calculates how likely the observed data would be if the parameter estimates provided were the true parameters. Maximum likelihood methods are most consistent and stable with larger sample sizes (those above 500), and with independent

variables that are constructed to have similar scaling – producing a more consistent magnitude of standard errors (Long and Freese 2003). The data used here conform to these generally accepted standards.

The disadvantage of multinomial logistic regression is that the estimation for each equation is based on a different sample. Therefore, data must be present for each independent variable as well as the dependent variable to produce equivalent results across models. As explained above, I utilized multiple imputation techniques to retain cases that would have otherwise been necessarily eliminated by the necessity of list-wise deletion for this method to be appropriate. An additional disadvantage of multinomial logistic regression is that goodness-of-fit methods that are traditionally used for binary or count outcomes, such as the chi-squared statistic, do not appropriately reflect similar measures for ordinal or nominal data. However, these measures of fit can provide some context about fit from one model relative to another and are therefore reported in the analyses below.

I begin the analyses with a presentation of the base individual-level model which includes human, financial and social capital variables on the individual level. I then present the base school-level model that includes human, financial and social capital variables at the school level. I follow this with a full model of all measures of individual and school-level capital to determine the effects the remain in the presence of both levels. Finally, I introduce individual-level data into the school-level variables to ascertain whether all effects are direct effects, or if they work through other mechanisms.

RESULTS

The initial analyses in Table 3.2 show that consistent with prior research, and with prior cohorts of students, individual-level human, financial and social capital of both the student and

his or her parents are significantly related to college enrollment. As Model 1 indicates, traditional student human and social capital measures of having a higher grade point average and expecting to receive a bachelor's degree are positive and significant for both two and four-year institution enrollment. Being in the academic track and enrolling in a high-level math course are also significant, but only for being enrolled in a four-year institution versus not being enrolled. Taking the ACT or SAT and filing the FAFSA – measures of human capital that indicate knowledge of the college process – also increase the likelihood of both two and four-year college enrollment, as does seeking college information – although only for four-year enrollment. Additionally, parent human capital matters, as having parents who have not achieved at least a bachelor's degree themselves reduces the probability of enrollment at both two and four-year institutions.

Financial capital indicators also affect the probability of enrollment in expected ways. Coming from a low-income family reduces the likelihood of enrollment, while having parents who saved money for college and who provide a computer in the home significantly and positively increases the likelihood of enrollment. Parent social capital in terms of parental expectations for completing a bachelor's degree also positively increases the likelihood of college enrollment. Consistent with resource dispersion theory, having siblings reduces the probability of college enrollment into either a two-year or four-year school.

Model 2 shows the base model of the effects of school-level forms of capital on college enrollment. Partially consistent with expectations for human capital at schools, an increased percentage of full-time teachers certified in the student's school is positively and significantly related college enrollment, but only for four-year enrollment. On the financial capital side, attending a school that lacks adequate texts and supplies is significant for two-year enrollment

versus not enrolling in school, although not in the expected direction. Teacher salary is positive and significant for both two-year and four-year enrollment.

The school social capital variables also have a significant impact on college enrollment. An increased percent of the prior year's graduating class that attends a four-year institution is related to an increased likelihood of both two and four-year enrollment. Attending a school that places a high priority on learning also has a positive effect on the probability of enrolling in a four-year institution. In this model, the student-teacher ratio has no significant effect on enrollment.

I next introduced the individual-level forms of capital back in to the school-level model to determine how whether the effects of each remain in a bi-level model. As Model 3 shows, the individual-level variables remain similar in both magnitude and significance. The only exception to this is the loss of significance for academic track in the probability of four-year enrollment. On the school level, greater changes are present. The percent of teachers certified is now insignificant for four-year enrollment, as is attending a school that places a high priority on learning. The percent of the prior year's class attending a four-year institution is no longer significant for two-year enrollment.

In an effort to identify how the school-level effects might be operating with individual-level capital, I next introduced separate related forms of individual capital in to the school-level model, and also stepped in separate forms of school capital. I first added student control variables (gender/race ethnicity), followed by family structure (resource-dilution) variables, student, parent and friend college expectations, student achievement variables and family financial indicators in to models with school human capital, then financial capital, then social capital (separate step models not shown for simplicity). As Model 4 shows, when I have a model

that includes all of the individual-level variables with the exception of the set of variables that indicate whether students understand and are engaged in the college planning process – taking their ACT or SAT, filing their FAFSA and seeking information on college from any source and talking with their parents about course selection – along with all school-level variables with the exception of the percent of the prior year attending a four-year school, change occurs. All student-level variables remain consistent with the original student only model (Model 1) in direction and significance. However, the school-level variable that indicates whether learning is a high priority and the student-teacher ratio both become highly significant, especially for four-year enrollment. Comparing this model to Model 3 suggests that the benefits of schools with a culture of learning and lower student-teacher ratios operate primarily through helping students understand and engage in the college planning process.

At the same time, as both Model 4 and Model 5 (which includes the addition of the variable that measures the percent of the prior year class attending college) show, there is also a significant negative effect of the learning priority variable on two-year enrollment. This effect is not present in the full model (Model 3), suggesting that engaging in the college planning process helps to mediate the potential pressure that this environment has on students – especially those who may be among those otherwise more likely to attend a two-year or vocational school. The addition of the variable measuring the percent of the prior year class attending a four-year school in Model 5 also negates the significant effect of the student-teacher ratio and learning priority variable for four-year enrollment. This suggests that these variables are correlated, with a lower

student-teacher ratio and a culture of learning related to a positive increase in four-year college enrollment as a whole.[4]

DISCUSSION

The results presented here suggest that individual-level capital produces the greatest effects on college enrollment. In particular, student actions which reflect understanding the college process such as taking the ACT or SAT and filing the FAFSA have a significant and positive effect across models. Engaging in academic pursuits is also effective with grade point average positively and significantly impacting the probability of enrollment at both two and four year institutions, and taking courses in the academic track and enrolling in high level math classes also increasing the odds of four-year enrollment. Supportive actions by parents are also important, such as providing a computer in the home, saving for college, and having college aspirations for their child.

Consistent with previous research, the effects of school-level capital are much smaller than individual-level effects. On their own, higher teacher salary[5], an increased percentage of the prior-year class attending college and having a school norm that makes learning a high priority all increase the probability of enrolling in both two-year and four-year institutions. An increased percentage of teachers certified also boosts the likelihood of four-year enrollment.

More interesting is the appearance of the significant effect of the student-teacher ratio and the increased effect of the norm of learning as a high priority when college planning variables are omitted from the model. This suggests that the benefits of lower student-teacher

[4] All correlations among variables in the full model were less than 0.6, indicating that the inclusion of each of these variables in this model does not cause a problem of multi-collinearity.

[5] Teacher salary should be viewed with caution. The measure used here is that of highest salary at the school – not median (that measure not available). High teacher salary is likely correlated with years of experience and/or affluence of the school district.

ratios operate through helping students take concrete college preparation steps, such as taking their college entrance exams, filing their financial aid paperwork and seeking college information in general. Having an environment that supports these ideas also yields positive effects. I theorized the student-teacher ratio as a measure of resource dispersion or possibly as a financial measure – one whereby schools increase their budgets to add additional teachers to lower the student-teacher ratio. However, it appears likely that this is primarily a measure of social capital, tapping in to the connection between teachers and students and the time they have to spend with each other.

It may well be that human, social and financial capital variables at the student-level are better predictors of college enrollment than school-level variables. However, the research here indicates that social capital – the connections that exist between students, teachers, counselors and coaches, and the environment in which they are surrounded, impacts college enrollment. This is certainly the argument put forth by Stanton-Salazar (1997), as he suggests that social and cultural capital may be at the heart of influencing positive educational outcomes for disadvantaged students.

While not tested here, it is also likely that the positive influence of financial and human capital at the school translates primarily through social capital outlets. Future research should consider this an important avenue to explore. Additionally, the research here is limited by the measures of social capital utilized and further research should investigate additional measures and their potential impact on college enrollment.

Table 3.1. Descriptive Statistics for Variables Used in Analyses of Individual and School-Level Capital on College Enrollment.

	Percent or Mean (s.d.)	% Missing
Dependent Variable		
Two-year school enrollment	28.30	na
Four-year school enrollment	48.60	na
Student Group		
Male	47.91	na
Female (reference)	52.09	na
White (reference)	60.92	na
Black	14.65	na
Asian	10.50	na
Hispanic	13.93	na
Student Capital		
Academic track	56.57	0.00
High math	48.73	6.10
GPA	2.80 (0.71)	6.78
College expectations	83.04	8.52
ACT/SAT taken	66.04	0.00
FAFSA filed	48.59	0.00
College information	87.64	15.06
College is important – friend	60.48	29.45
Parent-student conversation	49.62	15.87
Parent education (no BA)	58.48	na
College aspirations for child	89.32	0.00
Single-parent family	21.75	0.79
Step-parent family	14.63	0.79
Siblings	2.27 (1.41)	16.35
Low-income	19.79	na
Parent saved for college	53.18	21.48
Computer in home	90.64	10.68
School Capital		
% Teachers certified	93.79	3.31
% Teachers teaching out of field	82.77	33.29
School lacks texts/supplies	1.51 (0.61)	16.51
Teacher salary (in thousands)	56.50 (10.98)	20.52
Prior class four-year bound	4.49 (0.94)	21.90
Learning high priority	2.55 (0.76)	15.89
Student-teacher ratio	16.95 (3.80)	2.99
School Controls		
Urban	31.19	0.00
Rural	20.75	0.00
Suburban (reference)	48.06	0.00
Private School	15.56	0.00
Public School (reference)	84.43	0.00

Number of Respondents	10820

SOURCE: Educational Longitudinal Study of 2002 (ELS).

Table 3.2: Multilevel Logistic Regression of Individual and School-Level Capital on College Enrollment (Two-Year and Four-Year Institutions)

Independent Variable	Model 1		Model 2		Model 3	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in School
Individual-Level						
Academic track	0.001	0.186 *			-0.007	0.160
	(0.079)	(0.085)			(0.079)	(0.085)
High math	-0.105	0.700 ***			-0.149	0.621 ***
	(0.102)	(0.105)			(0.101)	(0.105)
Grade point average	0.452 ***	1.440 ***			0.491 ***	1.535 ***
	(0.067)	(0.085)			(0.067)	(0.086)
College expectations (student)	0.425 ***	0.996 ***			0.420 ***	0.981 ***
	(0.086)	(0.129)			(0.087)	(0.130)
College is important – friend	0.063	0.124			0.069	0.109
	(0.073)	(0.083)			(0.073)	(0.084)
ACT/SAT taken	0.798 ***	1.670 ***			0.812 ***	1.660 ***
	(0.085)	(0.104)			(0.085)	(0.104)
FAFSA filed	1.433 ***	1.841 ***			1.478 ***	1.893 ***
	(0.093)	(0.100)			(0.094)	(0.102)
College information	-0.012	0.207 *			-0.021	0.219
	(0.091)	(0.115)			(0.091)	(0.116)
Parent-student conversation	0.172 *	0.174 *			0.179 *	0.183 *
	(0.074)	(0.079)			(0.073)	(0.080)
Parent education level (no BA)	-0.347 ***	-0.878 ***			-0.328 **	-0.828 ***
	(0.092)	(0.099)			(0.092)	(0.099)
College aspirations (parent)	0.338 **	0.609 ***			0.307 **	0.580 ***
	(0.097)	(0.153)			(0.098)	(0.154)
Single-parent	-0.010	0.041			-0.008	0.047
	(0.091)	(0.111)			(0.091)	(0.112)
Step-parent	-0.234 *	-0.343 **			-0.221 *	-0.330 **
	(0.098)	(0.118)			(0.098)	(0.119)
Siblings	-0.081 **	-0.074 *			-0.078 **	-0.065
	(0.027)	(0.032)			(0.027)	(0.033)
Low-income	-0.313 **	-0.489 ***			-0.296 **	-0.429 ***
	(0.090)	(0.113)			(0.090)	(0.114)
Parent saved for college	0.192 *	0.357 **			0.196 *	0.343 **
	(0.076)	(0.094)			(0.077)	(0.095)

Independent Variable	Model 1		Model 2		Model 3	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in School
Home computer	0.405 ***	0.688 ***			0.370 **	0.635 ***
	(0.105)	(0.147)			(0.106)	(0.148)
Student Controls						
Male	-0.221 **	-0.071			-0.211 **	-0.056
	(0.069)	(0.083)			(0.068)	(0.083)
Black	-0.179	0.304 *			-0.200	0.331 *
	(0.122)	(0.144)			(0.120)	(0.144)
Hispanic	0.088	-0.042			0.003	-0.021
	(0.112)	(0.141)			(0.116)	(0.145)
Asian	0.202	0.179			0.060	0.086
	(0.168)	(0.174)			(0.168)	(0.178)
School-level						
% Teachers certified			0.003	0.009 *	0.000	0.003
			(0.004)	(0.004)	(0.004)	(0.004)
% Teachers teach out of field			-0.000	0.003	-0.000	0.002
			(0.002)	(0.002)	(0.002)	(0.002)
School lacks texts/supplies			0.140 *	0.088	0.155 *	0.057
			(0.061)	(0.061)	(0.072)	(0.087)
Teacher salary			0.014 **	0.013 **	0.025 ***	0.029 ***
			(0.004)	(0.004)	(0.005)	(0.005)
Prior class four-year bound			0.110 *	0.548 ***	0.034	0.423 ***
			(0.059)	(0.056)	(0.067)	(0.079)
Learning high priority			-0.043	0.133 *	-0.049	0.064
			(0.059)	(0.059)	(0.065)	(0.079)
Student-teacher ratio			0.008	-0.020	0.019	0.008
			(0.013)	(0.012)	(0.013)	(0.016)
School Controls						
Urban	-0.049	0.332 **	-0.222 *	0.043	-0.059	0.367 **
	(0.101)	(0.119)	(0.092)	(0.089)	(0.100)	(0.117)
Rural	-0.115	-0.071	0.048	-0.055	-0.062	0.105
	(0.108)	(0.127)	(0.103)	(0.088)	(0.113)	(0.125)
Private	0.337 *	1.078 ***	0.992 ***	1.494 ***	0.704 ***	0.908 ***
	(0.181)	(0.177)	(0.193)	(0.177)	(0.208)	(0.205)
Intercept	-2.004	-7.192	-1.645	-3.943	-4.138	-11.771
Chi-squared	1121.396 ***	1135.082 ***	1138.762 ***	1183.022 ***	1057.229 ***	1017.262 ***

Note: Numbers in parentheses are standard errors; N= 10820. *p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 3.2 (cont.): Multilevel Logistic Regression of Individual and School-Level Capital on College Enrollment (Two-Year and Four-Year Institutions)

Independent Variable	Model 4		Model 5	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Individual-Level				
Academic track	0.073	0.295 **	0.069	0.287 ***
	(0.075)	(0.079)	(0.075)	(0.078)
High math	0.039	0.893 ***	0.033	0.877 ***
	(0.097)	(0.096)	(0.097)	(0.096)
Grade point average	0.766 ***	1./982 ***	0.772 ***	2.005 ***
	(0.063)	(0.079)	(0.063)	(0.079)
College expectations (student)	0.607 ***	1.345 ***	0.606 ***	1.353 ***
	(0.083)	(0.121)	(0.083)	(0.121)
College is important – friend	0.195 **	0.299 ***	0.194	0.293
	(0.067)	(0.076)	(0.069)	(0.077)
ACT/SAT taken				
FAFSA filed				
College information				
Parent-student conversation				
Parent education level (no BA)	-0.352 ***	-0.855 ***	-0.347 **	-0.832 ***
	(0.085)	(0.087)	(0.085)	(0.087)
College aspirations (parent)	0.394 ***	0.747 ***	0.393 ***	0.751 ***
	(0.093)	(0.144)	(0.093)	(0.146)
Single-parent	0.016	0.087	0.021	0.096
	(0.089)	(0.107)	(0.089)	(0.107)
Step-parent	-0.214 *	-0.302 **	-0.209 *	-0.292 **
	(0.091)	(0.107)	(0.091)	(0.107)
Siblings	-0.086 **	-0.071 *	-0.084 ***	-0.068 *
	(0.025)	(0.028)	(0.025)	(0.028)
Low-income	-0.261 **	-0.449 ***	-0.266 **	-0.431 ***
	(0.088)	(0.104)	(0.088)	(0.104)
Parent saved for college	0.124	0.245 **	0.122 *	0.238 **
	(0.072)	(0.087)	(0.072)	(0.097)

Independent Variable	Model 4		Model 5	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Home computer	0.409 ***	0.694 ***	0.406 ***	0.684 ***
	(0.102)	(0.136)	(0.101)	(0.136)
Student Controls				
Male	-0.250 ***	-0.109	-0.246 ***	-0.106
	(0.065)	(0.077)	(0.066)	(0.077)
Black	0.036	0.640 ***	-0.039	0.663 *
	(0.115)	(0.135)	(0.114)	(0.135)
Hispanic	-0.004	-0.127	0.007	-0.087
	(0.111)	(0.135)	(0.112)	(0.136)
Asian	0.135	0.158	0.141	0.181
	(0.164)	(0.167)	(0.165)	(0.169)
School-level				
% Teachers certified	0.001	0.004	0.001	0.006
	(0.004)	(0.004)	(0.004)	(0.004)
% Teachers teach out of field	-0.000	0.002	-0.000	0.002
	(0.002)	(0.003)	(0.002)	(0.002)
School lacks texts/supplies	0.145 *	0.046	0.148 *	0.066
	(0.067)	(0.083)	(0.067)	(0.079)
Teacher salary	0.018 ***	0.022 ***	0.017 ***	0.017 ***
	(0.004)	(0.004)	(0.005)	(0.004)
Prior class four-year bound			0.082	0.488 ***
			(0.064)	(0.071)
Learning high priority	-0.090 *	0.195 ***	-0.125 *	0.031
	(0.054)	(0.069)	(0.062)	(0.074)
Student-teacher ratio	-0.002	-0.054 ***	0.003	-0.020
	(0.012)	(0.015)	(0.013)	(0.016)
School Controls				
Urban	-0.106	0.332 **	-0.112	0.292 **
	(0.093)	(0.108)	(0.093)	(0.105)
Rural	0.048	0.034	0.048	0.083
	(0.110)	(0.124)	(0.110)	(0.120)
Private	0.757 ***	1.308 ***	0.684 ***	0.896 ***
	(0.193)	(0.199)	(0.199)	(0.201)
Intercept	-3.378	-8.885	-3.725	-10.909
Chi-squared	1084.042 ***	1117.779 ***	1081.690 ***	1044.145 ***

Note: Numbers in parentheses are standard errors; N= 10820. *p<.05, **p<.01, ***p<.001 (two-tailed test).

APPENDIX

Description of Variables Included in the Analysis of Individual and School-Level Capital on College Enrollment: Educational Longitudinal Study of 2002 (ELS)

Variable	Coding	Data Source
Dependent Variable		
Postsecondary school enrollment	Categorical variable: 0 = no postsecondary attendance, 1 = two-year institution enrollment, 2 = four-year institution enrollment.	ELS: 2nd Follow-Up (2006)
Student Capital		
Academic track	Dummy variable coded 1 for self-reported college prep track.	ELS: Base (2002)
High math	Dummy variable coded 1 for students whose highest math was trigonometry, pre-calculus or calculus.	ELS: 1st Follow-Up (2004)
GPA	Continuous variable ranging from 0 to 4.0.	ELS: 1st Follow-Up (2004)
College expectations	Dummy variable coded 1 for students who expect to achieve a bachelor's degree or higher in 10th grade.	ELS: Base (2002)
College is important – friend	Dummy variable coded 1 if a student's friends think the student should go to college after high school.	ELS: Base (2002)
ACT/SAT taken	Dummy variable coded 1 for students who took either the ACT or SAT.	ELS: 1st Follow-Up (2004)
FAFSA filed	Dummy variable coded 1 for students who filed the Free Application for Federal Student Aid (FAFSA).	ELS: 2nd Follow-Up (2006)
College information	Dummy variable coded 1 for students who went to any source to find college information.	ELS: Base (2002)
Parent-student conversation	Dummy variable coded 1 if the parents often provide advice to their student on course selection.	ELS: Base (2002)
Parent education (no BA)	Dummy variable coded 1 if neither parent achieved a 4-year degree.	ELS: Base (2002)
College aspirations for child	Dummy variable coded 1 if the student's parent wants the student to achieve a bachelor's degree or higher.	ELS: Base (2002)
Single-parent family	Dummy variable coded 1 if the student lives with only one parent or guardian.	ELS: Base (2002)
Step-parent family	Dummy variable coded 1 if the student lives with one parent and another guardian.	ELS: Base (2002)
Siblings	Continuous variable coded 0-6 for 0, 1, 2, 3, 4, 5 or 6 or more siblings.	ELS: Base (2002)
Low-income	Dummy variable coded 1 for family income less than or equal to $25,000/yr.	ELS: Base (2002)
Parent saved for college	Dummy variable coded 1 if the parent saved for college.	ELS: Base (2002)

Computer in home	Dummy variable coded 1 if there is a computer in the home.	ELS: Base (2002)
Student Controls		
Male	Dummy variable coded 1 for male.	ELS: Base (2002)
Race/ethnicity	Set of four dummy variables: white, black, Asian, Hispanic (white as reference). For students that indicated both Hispanic and either white, black or Asian, these students have been coded as Hispanic.	ELS: Base (2002)
School Capital		
% Teachers certified	Continuous variable coded 0-100 for percent of full-time teachers certified.	ELS: Base (2002)
% Teachers teach out of field	Continuous variable coded 0-100 for percent of full-time teachers who teach out of their field of study.	ELS: Base (2002)
School lacks tests/supplies	Categorical variable ranging from 1 (not at all) to 4 (a lot) for whether learning is hindered by lack of school texts or supplies.	ELS: Base (2002)
Teacher salary	Continuous variable coded 19-100 (in thousands) for highest salary paid to teachers.	ELS: Base (2002)
Prior class four-year bound	Continuous variable ranging from 0 (0 percent) to 6 (75-100 percent) of the prior year's graduating class that attended a four-year college.	ELS: 1st Follow-up (2004)
Learning high priority	Categorical variable ranging from 1 (not at all accurate) to 5 (very accurate) indicating whether learning is a high priority for students (Administrator answer).	ELS: Base (2002)
Student-teacher ratio	Continuous variable coded 4-40 for student-teacher ratio.	ELS: Base (2002)
School Controls		
School location	Set of dummy variables that indicate urban, rural and suburban (suburban as reference).	ELS: Base (2002)
School segment	Dummy variable coded 1 indicating enrollment in a private school (public as reference).	ELS: Base (2002)

CHAPTER 4

OVERCOMING THE FINANCIAL CAPITAL DEFICIT OF LOW-INCOME STUDENTS IN THE TRANSITION TO COLLEGE: SUBSTITUTABLE OR COMPLEMENTARY EFFECTS

Over four decades have passed since Congress initially passed the Higher Education Act of 1965. This landmark piece of legislation was created in response to the emerging issues of access to and affordability of higher education. Providing grants and subsidized loans for students interested in pursuing college, this Act changed the landscape for many students who would not have had the financial ability to attend college in the past.

While the introduction of need-based federal financial aid may have improved access to college for low-income students, striking differences remain today. In 2006, 50.9 percent of low-income students (bottom 20 percent) enrolled in college immediately after high school. Middle-income students (middle 60 percent) enrolled at 61.4 percent, compared to 80.7 percent of high- (top 20 percent) income students (NCES 2004b). Of those students who enrolled in college in 1995-96, 15 percent of those in the bottom quarter of the income bracket had achieved a bachelor's degree within five years compared to 23.7 percent of those in the middle fifty percent and 41 percent of those in the top quarter (NCES 2004a).

Research has long shown that income level has a direct effect on college enrollment. This was a clear finding of the initial status attainment models (Blau and Duncan 1967; Sewell, Haller and Portes 1969), and continues to be significant in more recent research (Bozick and DeLuca 2005; Duncan et al. 1998; Mayer 1997; Perna 2000). While the authors of the Higher Education Act of 1965 did not articulate this explicitly, the creation of those federal grant and loan programs was an attempt to find a positive substitute for the deficit in individual-level financial

capital that shut many low-income students out of post-secondary education. The introduction of these programs has not leveled the academic playing field between the rich and the poor, however the idea is sound, and leads to an important question: Are there other forms of capital that may help to alleviate the financial capital deficit of low-income students by acting as a substitute for lower income levels? Or, is it possible that other forms of capital, in combination with income, actually amplify the effects of both separate forms of capital creating a complementary effect of capital?

Using data from the Educational Longitudinal Study of 2002 (ELS:2002), the most current national data available on a recent graduating high school class, I examine both individual and state-level effects of different forms of capital on college-going. I then explore whether specific individual, family or state resources might act as substitutes for low income levels, and/or whether these forms of capital might operate as complementary forms of capital, producing effects above that of a single form of capital alone.

This research is important for two specific reasons. First, prior research has often ignored the effects of both individual and state-level variables within the same model. When effects at both levels are included, they generally ignore either important human or financial capital variables at one level. (See Perna and Titus (2004) and Beattie (2002) for notable exceptions.) Secondly, federal and state policies change often. This is the first study that I am aware of to examine the effects of college-going-related policy for a nationally representative cohort of students that graduated in the 21st century.

STUDENT AND FAMILY RESOURCES AND COLLEGE ENROLLMENT

Many forms of capital (human, social, cultural, financial) have been linked to college enrollment. In this study I focus on two specific types – human and financial – as these have

been shown to have direct and significant effects on college enrollment. Additionally, these individual-level factors are most likely to be important in an evaluation of state policy that is directed toward addressing the deficits of low-income students – namely that these students do not have the financial resources to attend college (a financial capital issue), and are among the least likely to enroll in college (a long-term human capital issue).

Human capital theory suggests that individuals make decisions about whether or not to pursue (or continue to pursue) education based on both potential future income as well as current opportunity costs (Becker 1975; Schultz 1961). This is done with the knowledge that returns may vary based on an individual's circumstances, and that there is some uncertainty in the eventual outcome. In part, this decision process is based on a person's analysis of their own skills and abilities. This is recognition of human capital – that which provides new skills or abilities to a person, which allows the person to then act in new ways. Higher levels of educational attainment, academic ability or knowledge in key subjects facilitate productive activity and additional opportunity.

Research indicates that human capital does impact college enrollment. For example, enrollment in the academic track, or similar curriculum, has been shown to increase the likelihood of both college enrollment and graduation (Lucas 1999; Rosenbaum 1980). Beattie and Thaden (2007) find students enrolled in academic math coursework in high school are about 2.5 times as likely as those who are not to complete a bachelor's degree. Similarly, higher grade point averages and test scores also improve the likelihood of college enrollment (Roscigno and Ainsworth-Darnell 1999).

Human capital theory also includes the understanding of the college process. The relatively simple act of gathering information on the college process has been linked to an

increased likelihood in college enrollment (Flint 1993; Plank and Jordan 2001). Plank and Jordan (2001) find students who plan early to take the ACT or SAT, and then do eventually take the exam, increase their likelihood of enrolling in a four-year college. Previous research has also shown a strong significant positive effect on the odds of college enrollment for students who file a Free Application for Federal Student Aid (Thaden 2010), which represents an understanding of the U.S. financial aid system. Similarly, Lloyd, Leicht and Sullivan (2008) find that Texas students who are aware of the Top 10% Law in the state are more likely to apply to college.

Specific to low-income students, the Federal government has implemented a number of programs under the TRIO program umbrella all focused on helping disadvantaged students move along the pipeline from secondary to post-secondary schooling.[1] GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs), a program that helps students learn about the college process and become "college ready", has been shown to help students improve academically and increase college expectations (ACT 2007). However, there is little longitudinal research available yet to discern whether this particular program affects college enrollment (U.S. Department of Education 2002).[2] Talent Search, another TRIO program that help disadvantaged students learn about educational and occupational options through tutoring, mentoring and other outreach kinds of activities, has been found to positively influence both in-school activities related to college preparation and college enrollment itself (U.S. Department of Education 2006).[3] Mixed results have been reported for the Upward Bound program which focuses on academic preparation in key subjects along with mentoring, with significant effects on college

[1] The TRIO label originally referred to three Federal programs – Upward Bound, Talent Search and Student Support Services. Today there are eight TRIO programs in existence that cover middle school through postbaccalaureate education.
[2] GEAR UP programs are Federally funded school-based programs that were started in 1999. Schools must have free or reduced lunch eligibility rates of 50 percent or higher to qualify for participation, and awards are made on a competitive grant basis. These programs are run on a cohort system, not based on individual student characteristics.
[3] Talent Search and Upward Bound were established in by Congress in 1965.

enrollment only related to students who had lower than average college expectations prior to participating in the program (U.S. Department of Education 2009).

At the same time parent human capital also influences student outcomes. Parents who themselves have achieved a bachelor's degree have children who are significantly more likely to attend college. In fact, parents' aspirations for their child's education, and a child's own expectations, also positively influence college enrollment (Blau and Duncan 1967; Jencks et al. 1979; Sewell, Haller and Portes 1969).

Financial capital also affects educational attainment. In addition to parent income (Bozick and DeLuca 2005; Duncan et al. 1998; Mayer 1997; Perna 2000), savings in terms of general family wealth has been shown to produce a positive effect on educational attainment (Conley 2001). Research has also found a positive relationship between parents who save for their child's potential post-secondary education and college enrollment (Thaden 2010). While educational resources in the home, such as books and reference materials, have been positively linked to higher educational attainment levels (Teachman 1987), there is reason to focus on technological resources. Recent research on college admission and financial aid processes recognizes that the application process for both has become primarily electronic, which may be especially detrimental to low-income students who often have little or no electronic access, especially at home (Jackson 2003; Wright, Stewart and Burrell 1999).

STATE RESOURCES AND COLLEGE ENROLLMENT

Just as human capital at the individual level produces positive effects for individuals, the general environment in which a student lives is also likely to have an effect. Communities with higher levels of bachelor's degree recipients may produce a stronger human capital base for students to draw from by providing role models in the community to provide context and

information about college-going. While little research exists in this area, there are those that suggest that not only may the percentage of a state's adult population that is college educated be a form of human capital, this may also translate into state financial resources in the form of voter-approved school funding initiatives (Perna and Titus 2004).

The most salient financial strategies employed by states to influence college enrollment rates include tuition prices at public institutions and whether the state offers some form of grant for college attendance. Not surprising, student enrollment rates have been found to decrease as tuition increases. In state-level analyses, Heller (1999), Kane (1995) and St. John (1990) all find tuition sensitivity – especially at community colleges. In individual-level analysis, Kane (1999) finds in a study of the National Educational Longitudinal Survey of 1988 (NELS) that low-income students are more sensitive to tuition prices than middle or high-income students. Beattie (2002), using the High School and Beyond survey (HSB) also finds that differences in college costs affect college enrollment with variation by student group. For example, men from low-SES backgrounds that live in states with low college costs, but with high returns for a degree, are much more likely to enroll in college than their counterparts who live in low-return states.

Along with Federal financial aid programs, many states have also developed financial aid programs. While some states developed need-based programs on their own, many states also took advantage of incentive funds provided by the Federal government to jump start their programs. The Leveraging Educational Assistance Partnership (LEAP) program was introduced in 1972 with the explicit purpose of helping states create undergraduate need-based programs. In 2001-2002, the federal portion of the LEAP program included over $50 million to 44 participating states (NASSGAP 2004).

In addition to need-based grant programs, some states have also developed merit-based programs. While need-based programs are intended to alleviate issues of access for lower-income students, merit-based programs were introduced primarily to alleviate "brain-drain" or "talent loss" from individual states. In a study of the Georgia Hope Scholarship Program, Dynarski (2000) finds that the presence of a state merit-based program is associated with an increase in college enrollment – although more effective for high-income students. Heller and Rasmussen (2001) also find that low-income and non-white students are less likely to be the recipients of these merit-based programs in an analysis of programs in Florida and Michigan. These findings makes sense as low-income and minority students are less likely to be enrolled in coursework that adequately prepares them for college and also tend to have lower grade point averages – two oft-used criteria for the receipt of merit-based aid.

Beyond state financial aid programs, state per capita income and unemployment rates may also be related to college enrollment. Research using neighborhood-level effects suggests that income levels in a community are associated with the likelihood of high school dropout (Crane 1991; Brooks-Gunn et al.1993). Perna (2000) finds that the probability of enrollment at a four-year school decreases with an increase in state employment rate. This makes sense if as employment rates increase people choose to work instead of obtaining additional schooling. Conversely, the odds of enrollment in two-year institutions have been shown to increase when unemployment rates rise (Heller 1999). It is likely that as unemployment rates increase, displaced workers are looking for low-cost and low-time options (two-year schools, certificate programs) to increase job skills and employability. However, other research has shown state unemployment rates have no effect on college enrollment (Perna and Titus 2002).

While many studies have been conducted on the state-level influences of financial aid, including those noted above (see Heller 1997 and Leslie and Brinkman 1988 for extensive reviews), there has not yet been a study that has included the important state-level variables and individual-level variables that account for both the importance of academic preparation and financial preparation for college – which is at the heart of both college admission and financial aid policies set by states. As Zeidner (2006) points out, much of the literature poses academic preparation and financial aid preparation as separate and opposing hypotheses. However, at issue is that information and planning for both academics and finances are necessary for enrollment to become possible. While Zeidner does not empirically test his hypothesis, this is clearly shown in Plank and Jordan's (2001) work reviewed earlier which did find that both academic and financial aid information and action positively influence college enrollment.

FAMILIES AND STATES: SUBSTITUTABLE OR COMPLEMENTARY EFFECTS

Research often considers each form of capital separately in analysis, and assumes that effects of each are independent. However, there is reason to believe that forms of capital may actually interact with each other and produce effects of their own in this interaction. Following the logic of Hoffman and Dufur (2008) and a similar argument of Parcel and Dufur (2001), different forms of capital may in fact be "substitutable" or "complementary" (compensating or boosting). Substitution effects would suggest that one form of capital may actually compensate for a lower level of capital in another area. An interaction of these terms would vary inversely on the outcome – in this case, college enrollment. (Because low-income status is a negative association variable, interaction terms that vary inversely with low or middle-income would result in a positive coefficient.) Alternatively, different forms of capital may also complement

each other, suggesting that an interaction of two forms of capital would actually enhance or boost the effect of either alone on the outcome.

While previous research has indicated direct effects of many forms of individual and state-level capital on college-going, many of the programs developed to enhance college enrollment were designed specifically to increase enrollment of low-income students. In school programs such as GEAR UP, Talent Search and Upward Bound were all created to help low-income students learn how to become college ready and take the necessary steps for college enrollment. If this provides a substitution effect, then we would see the interaction between low-income status and participation in one of these programs should be positive. In essence, this would mean that program participation attenuates the effect of being a low-income student. A possible complementary effect of merit-based programs is likely to be found with high income students, where the interactive effect of higher income and receipt of a merit scholarship exceeds that of the direct effects alone.

Prior research is limited in terms of evaluation of some of the programs and policies mentioned earlier, however the policy intent suggests some straightforward hypotheses. In general, I expect that all forms of human and financial capital at the individual level should have a positive impact on college enrollment for low, middle and upper-income students. That is, getting good grades, enrolling in academic track courses, taking high-level math, taking college entrance exams, gathering information on college, participating in a college preparation program, filing the FAFSA and completing other financial aid applications should all improve the likelihood of college enrollment. Similarly, both student and parents expecting the student to achieve a bachelor's degree, parents having achieved a bachelor's degree themselves, saving for college and having a computer in the home should positively influence college enrollment.

In addition, I expect that for low-income students in particular, substitution effects are likely for engaging in activities designed to increase their awareness of, and ultimately resources for college. This would include filing the FAFSA, applying for financial aid, and participating in a college preparation program.

At the state level, I expect to find that state grant programs of any form should have a positive effect on college enrollment. As tuition at the state's four-year institutions goes up, I expect enrollment to decrease. A higher unemployment rate in the state is likely to drive up college enrollment, as is per capita income.

As with individual-level capital, I also expect that substitution effects for low-income students are also likely to be present at the state level. Lower public school tuition rates and need-based financial aid programs should help alleviate these students' a priori financial deficit. At the same time, merit-based programs may in fact produce a boosting effect for high-income students.

DATA AND METHODS

The analyses are based on the Educational Longitudinal Study of 2002 (ELS:2002). Sponsored by the National Center for Educational Statistics of the U.S. Department of Education, ELS:2002 covers the transition from high school to later life. ELS:2002 began with a nationally representative sample of 10th grade students in public and private school in 2002. Follow up data was collected in 2004 and 2006. The base-year sample included 17,591 students drawn from approximately 750 schools.

The base-year data includes demographic information for these 10th grade students, along with parent, teacher and school information. The first follow up provides data from the 12th grade year. The second follow up occurs in 2006, two years after high school graduation for most

respondents. Importantly, this dataset provides information on students who both go on to college *and* those who do not. Other nationally representative studies that cover this more recent timeframe, such as the Beginning Postsecondary Students Longitudinal Study of 2004 (BPS:04/09) and the National Postsecondary Student Aid Study of 2004 (NPSAS:04) which both follow students first entering college in 2004, provide information on post-high school enrollment but are limited to those students who enroll in a post-secondary institution.

I obtained data for the state-level indicators from three sources. The National Association of State Scholarships and Grant Programs (NASSGAP) collects state grant funding information from each state's education oversight committee. I use information on state need-based, merit-based and need and merit-based grants from the 2002-2003 school year to correspond to student base-year data (NASSGAP 2004). Information on the average costs of public four-year institutions was obtained from figures reported by schools to the Integrated Postsecondary Data System (IPEDS) in 2002 for the 2002-2003 school year (U.S. Department of Education 2003). Information regarding the economic condition of each state is accessed from the 2000 United States Census. This includes data on each state's per capita income, unemployment rate and bachelor's degree recipients (U.S. Census Bureau 2002a, 2002b, 2002c).

For this analysis, I first restrict the sample to the 14,006 students who completed all three rounds of the survey. I further restrict the sample to students who did not drop out of high school, and who completed their high school program or received a GED, as students without this credential cannot enroll in a post-secondary institution (777 cases, 5.5 percent). I further limited the sample to students with complete information on the dependent variable, two-year or four-year college enrollment (1296 cases, 9.3 percent). American Indians, Hawaiian/Pacific Islanders and "other" were dropped due to small sample sizes (293, 146 and 328 cases, 5.5 percent).

I utilized Stata's multiple imputation command "ice" to impute data for the missing data elements on the remaining independent variables (StataCorp 2007).[4] While the use of multiple imputation relies on the assumption that missing data be "missing at random" – a condition that is often violated in practice – listwise deletion also presents obstacles. Data eliminated through listwise deletion are also subject to selection bias. In addition, the loss of these additional cases reduces the precision of the model. Multiple imputation (as opposed to mean substitution or other single replacement techniques) introduces random error in to each imputed data set which helps to approximate unbiased estimates over the sets. (See Allison 2000 and Rubin 1987 for further discussion of this method.)

For multiple imputation to be effective, an appropriate statistical technique must also be used. Stata's "ice" program relies on "multiple imputation using chained equations" (van Buuren et. al 1999) which is a switching regression technique that creates values for each missing variable in to each of a user-determined number of imputed data sets. (See Royston 2007 for the most recent programming update.) Three to ten imputed data sets have been shown to be sufficient to produce reliable estimates of missing data (Rubin 1987). I utilize five imputations, which results in a final unweighted sample of 11,166 students within the 50 states.

Since the sampling procedure over-sampled some student groups (Asians, Hispanics), sampling weights are used in all analyses.

Measures

The dependent variable, college enrollment, is measured in the second follow up of the ELS:2002 survey – two years after these students have graduated from high school. I distinguish between not enrolled and first enrollment into a two-year or four-year institution. I make this

[4] Academic track and parent aspirations were previously imputed by NCES. The full ELS sample missing rate was 4.01 and 4.23 percent on these two items (Ingels et al. 2005). ACT/SAT scores and FAFSA completion were obtained directly from secondary sources by NCES, and thus have no missing cases.

distinction between two-year and four-year institutions primarily because the criteria for acceptance in to four-year institutions are generally more rigorous, and the costs are often higher.

At the individual level, I include a number of standard measures of student and family capital. Student capital is measured by a set of dummy variables (1 = yes): enrolling in their high school's academic track (or similar course-taking), taking high-level math (trigonometry, pre-calculus or calculus), expecting a bachelor's degree or higher in the 10th grade, and taking the ACT or SAT. Additionally, a continuous variable ranging from 0 to 4.0 that measures each student's point average is included. The specific college planning variables include dummy variables (yes = 1) that indicate filing the FAFSA, applying for college-specific financial aid (beyond the FAFSA application), seeking college entrance information from any source, and participating in a college preparatory program for financially disadvantaged students[5].

Parent human capital is measured with two dummy variables (yes = 1): an indicator of first-generation college status which is measured by whether or not either parent has achieved a four-year degree; and whether the parent(s) expect their child to achieve a bachelor's degree or higher. Parent financial capital is measured with another series of dichotomous variables (yes = 1): an indicator of whether they are low-income (family income of less than $25,000 year) or middle income ($25,000 - $75,000)[6], whether the parent saved any money for their child's education; and whether there is a computer in the home. All of these variables were obtained from the parent survey conducted in the base year.

On the state-level, the average in-state tuition rate of public four-year institutions is included. Three variables about state financial aid grant programs are included: the average

[5] While these programs were designed specifically for low-income students, some programs like GEAR UP include students of all income levels because inclusion in the program is based on school eligibility, not student eligibility.
[6] Parent income is a categorical variable in this data set. Low income students represent almost 20 percent of this sample, with middle income students comprising 50 percent of the sample.

award of a merit-only state grant, the average award of a need-only state grant program, and the average award of a combined merit and need-based program. This data was obtained from the National Association of State Student Grant and Aid Programs for the 2002-2003 school year (NASSGAP 2004). Average per capita income and the average unemployment rate of each state is also included as prior research has indicated student sensitivity to these measures. This data was obtained from the United States Census Bureau (U.S. Census 2002a, 2002b).

In addition, I include controls for a number of factors. I include dichotomous variables for gender (male = 1) and race/ethnicity[7] (Hispanic, black, Asian, white – white as reference). Two dichotomous measures for family structure are included (1 = yes) – a measure for whether this is a single parent family and a measure for whether this is a stepparent family (two-parent family as reference). A continuous variable ranging from 0 to 6 that measures number of siblings is also included[8]. I also include the following school-level characteristics as control variables: high school sector (public or private; public as reference); and school location (urban, rural, suburban – suburban as reference).

The Appendix provides specific coding information and descriptions of each variable. Table 4.1 provides the descriptive statistics for each variable, along with the percent of imputed cases for each variable. (All variables have correlation coefficients of less than 0.6 and variance inflation factor levels are under 2.1.)

Analyses

Because the interest of this study is to determine if both individual and state-level variables impact college enrollment – an individual-level variable – it is important to statistically

[7] For students that indicated both Hispanic background and also indicated black, Asian or white, these students have been coded as Hispanic. Thus, black, Asian and white refer to non-Hispanic black, non-Hispanic Asian and non-Hispanic white throughout this analysis.

[8] While students could have more than six siblings, ELS answer choices restrict respondents to answer from "0" to "6 or more" siblings.

account for the levels of analysis. The primary benefit of utilizing a multilevel statistical model is to account for variation that occurs both at the individual level itself, and across levels. On a basic level, this helps to effectively determine if school context impacts individual students. At the same time, estimates for the direct effects of individual-level variables are also modeled – while accounting for the clustering (non-independent) effects of students within schools that are likely present. On a statistical level, this approach is slightly more conservative and yields more appropriate standard errors by keeping error terms at each level instead of pooling to the individual level.

The models presented here use Bryk, Raudenbush and Congdon's (2004) HLM program to address the issue of multilevel data. In addition, I utilize multinomial logistic regression within this multilevel model to access different patterns that may exist between those students who do not enroll, students who enroll in a two-year institution and those students who enroll in a four-year institution. This produces separate equations for the probability of enrollment for each of the possible enrollment outcomes in relationship to not being enrolled. The full first-level equation for two-year enrollment takes the form of:

$$\begin{aligned}
&Log(\text{probability of enrolling in a 2 year institution/probability of not enrolling}) = \\
&\beta_{0j(1)} + \beta_{1j(1)}(\text{academic track}) + \beta_{2j(1)}(\text{high level math}) + \beta_{3j(1)}(\text{grade point average}) \\
&+ \beta_{4j(1)}(\text{college expectations}) + \beta_{5j(1)}(\text{ACT/SAT taken}) + \beta_{6j(1)}(\text{FAFSA filed}) \\
&+ \beta_{6j(1)}(\text{financial aid application}) + \beta_{7j(1)}(\text{college information}) \\
&+ \beta_{8j(1)}(\text{college prep program-general}) + \beta_{9j(1)}(\text{college prep program – low-income}) \\
&+ \beta_{10j(1)}(\text{parent education level}) + \beta_{11j(1)}(\text{parent college aspiration})
\end{aligned}$$

$$+\beta_{12j(1)}\,(single\ parent) + \beta_{13j(1)}\,(step\ parent) + \beta_{14j(1)}\,(siblings) + \beta_{15j(1)}\,(low\ income)$$

$$+ \beta_{16j(1)}\,(middle\ income) + \beta_{17j(1)}\,(parent\ saved\ for\ college) + \beta_{18j(1)}\,(computer\ in\ home)$$

$$+ \beta_{19j(1)}\,(male) + \beta_{20j(1)}\,(black) + \beta_{21j(1)}\,(Hispanic) + \beta_{22j(1)}\,(Asian) + r_{ij}$$

and a matching equation is executed for four-year enrollment. Each first-level record corresponds to student *j*, with β_{qj} representing the level-one coefficients and r_{ij} representing the random effect at level one.

The full second-level equation takes the form of:

$$\beta_{0j(1)} = \gamma_{00(1)} + \gamma_{01(1)}\,(need\ grant\ amount) + \gamma_{02(1)}\,(need\text{-}merit\ amount)$$

$$+ \gamma_{03(1)}\,(merit\ grant\ amount) + \gamma_{04(1)}\,(in\text{-}state\ tuition) + \gamma_{05(1)}\,(unemployment\ rate)$$

$$+ \gamma_{06(1)}\,(per\ capita\ income) + \gamma_{07(1)}\,(tuition\ difference) + u_{qj}$$

$$\beta_{1j(1)} = \gamma_{10(1)}$$

$$\beta_{2j(1)} = \gamma_{20(1)}$$

.

.

.

$$\beta_{22j(1)} = \gamma_{220(1)}$$

for each of the dependent variable outcomes. Similar to the level-one model, here the level-two coefficients correspond to the state, while u_{qj} represents the level-two random effect associated with a specific state. Each of the additional $\gamma_{10} - \gamma_{220}$ represent the non-random level-one coefficients and are also included as dependent variables in the regression equation at level two.

The models themselves are fitted by maximum likelihood estimates. These estimates are produced with a likelihood function which calculates how likely the observed data would be if the parameter estimates provided were the true parameters. Maximum likelihood methods are most consistent and stable with larger sample sizes (those above 500), and with independent variables that are constructed to have similar scaling – producing a more consistent magnitude of

standard errors (Long and Freese 2003). The data used here conform to these generally accepted standards.

The disadvantage of multinomial logistic regression is that the estimation for each equation is based on a different sample. Therefore, data must be present for each independent variable as well as the dependent variable to produce equivalent results across models. As explained above, I utilized multiple imputation techniques to retain cases that would have otherwise been necessarily eliminated by the necessity of list-wise deletion for this method to be appropriate. An additional disadvantage of multinomial logistic regression is that goodness-of-fit methods that are traditionally used for binary or count outcomes, such as the chi-squared statistic, do not appropriately reflect similar measures for ordinal or nominal data. However, these measures of fit can provide some context about fit from one model relative to another and are therefore reported in the analyses below.

I begin the analysis with a base model of college enrollment that includes student and parent capital. I test the individual-level substitution effects by introducing them in to the model one at a time. I then add the state-level variables to the model, and then the cross-level interaction terms to test the possibility of substitution effects of the state-level programs on individual-level college enrollment.

RESULTS

The initial analyses of Model 1 in Table 4.2 show results consistent with most expectations. Higher grade point average, expecting to attend college, taking the ACT or SAT, filing the FAFSA and completing additional financial aid applications all are positively related to both two and four-year college enrollment. Being enrolled in the academic track and taking high-level math are also significantly and positively related to enrollment in to four-year institutions.

However, getting college information, enrolling in a general college preparation program or in a college prep program specifically for low-income students has no significant effect on either two-year or four-year enrollment.

On the parent side, parent aspirations for their child's education are positively and significantly related to both two and four-year enrollment, as is saving for college and providing a computer in the home. Having parents who did not complete a bachelor's degree is negatively related to enrollment, as is coming from a low or middle-income family (compared to upper-income families). While coming from a single-parent family has no significant effect on college enrollment, coming from a step-parent family does reduce the likelihood of college enrollment as does the addition of siblings.

The hypotheses concerning individual-level substitution effects are tested by interaction terms and are shown in Table 4.2. As Model 2 shows, there is a significant and positive effect of the interaction term between filing the FAFSA and being either low or middle-income for students who enrolled in a two-year institution and is also significant and positive for the interaction between filing the FAFSA and being middle-income on the likelihood of enrolling in a four-year institution. At the same time, the FAFSA variable itself becomes insignificant in this model. These results support the hypothesis that FAFSA filing does act as a substitute for both low-income students – and also for middle-income students. This is likely due to the receipt of both federal financial aid, which is only accessible to students who complete the FAFSA, and additional state and/or institutional aid which is often based on financial need as determined by the FAFSA.[9]

[9] All students, regardless of income level, are eligible to receive federal student loans. This does not appear to be a necessary incentive for upper income students by this measure.

Model 3 shows the interaction between filing additional college specific financial aid forms and low and middle-income is positive and significant on the likelihood of college enrollment for both two and four-year institutions and for both low and middle-income students. This supports the hypothesis that filing these forms does act as a substitute for lower levels of income – again likely through the receipt of additional sources of financial aid (in this case likely institutional or state aid). However, in this model, the direct effect of the financial aid application variable also remains significant – suggesting that not only does this action help substitute for lower levels of income, but also assists students at all income levels.[10]

The hypothesis that participation in either a general college preparation course – or a course designed specifically to assist low-income students – would compensate for lower income levels was not supported, as the interaction term was not significant for either two-year or four-year enrollment for either low or middle-income students (not shown).

Table 4.3 shows the models that include state-level data. In this case, the HLM program was utilized to account for the variation that occurs both at the individual level and across levels. Model 4 shows results consistent with the original model presented with only individual-level capital. However, with the addition of the state-level variables, there is now a significant positive effect of gathering college information on the probability of enrolling into a four-year institution.

Contrary to expectations, no significant effects on college enrollment were found based on the in-state tuition rate, the amount of need-based grant or the amount of merit-based grant available in a student's state. And, while the amount of a combination need and merit-based grant program had no significant effect on the probability of enrolling in a two-year institution, there is a significant negative effect found on the probability of enrolling in a four-year

[10] In a model not shown, I tested the difference of the indicator of financial aid application between low and middle income students. These differences were not significant.

institution. This is a perplexing effect, as one would expect "free money" to attend college to positively influence enrollment – not vice versa. (This may be a case of too few cases in the sample in these particular states – caution is urged in interpretation.) Consistent with prior research that suggested students are sensitive to possible future earnings, there is a positive and significant effect of increased per capita income on the likelihood of enrollment in to both two and four-year institutions. No effect was found based on a state's unemployment rate.

Model 5 tests a slightly different idea on tuition and grant sensitivity. Instead of including both in-state tuition rate and grant programs, I substitute a "tuition difference" variable which is the difference between the in-state tuition rate and the average amount of that state's need-based grant. Prior research suggested that this measure of out-of-pocket cost might be more significant to students. However, at least in these analyses, no significant effect is found on the probability of college enrollment with this measure.

While the direct effect of these state-level variables was generally insignificant, testing for the possibility of substitution effects did yield one interesting result. The hypotheses that lower state tuition rates would substitute for lower income levels is contradicted. The interaction term between low-income students and the tuition difference variable is positive and significant (at the .10 level) on the probability of two-year school enrollment. This suggests that as the tuition difference increases, low-income students are actually more likely to enroll in two-year schools. There was no significant effect on four-year enrollment. The hypotheses that state grant programs would substitute for lower income levels was not supported for any type of state grant program.

DISCUSSION

The results presented here confirm that individual levels of human and financial capital produce the greatest effects on college enrollment. In particular, student actions that are directly associated with the college application and financial aid process, such as maintaining a high grade point average, taking the ACT or SAT, filing the FAFSA and completing other financial aid applications, have a significant and positive effect across models. Supportive actions by parents are also important, such as providing a computer in the home, saving for college, and having college aspirations for their child.

State-level forms of capital produce much smaller effects on college enrollment. Overall these results are dissatisfying. It is somewhat surprising that tuition rates and state grant programs either have no statistically significant effect on college enrollment, or are actually negatively related to college enrollment (in the case of the need and merit-based program). With the persistent finding that low-income students are less likely to attend college, and to a lesser extent middle-income students, need-based grant programs were created to help alleviate financial barriers that these students face.

The results here imply that current grant programs are not helping much in this regard. While there was a small positive effect found for the probability of low-income students enrolling in two-year institutions when the difference between the tuition and need-based grant increases (a counter-intuitive finding), it may simply be that in general the divide between college costs and the availability of financial aid at this point in time no longer is enough to bridge the gap of affordability. With the average amount of a need-based state grant in 2002-2003 being $1181, the average merit-based grant being $999, and the average need and merit-based grant reaching $1114 – along with average an average in-state tuition rate of $4,019

(which does not include books, room, board or any other expenses) – this may simply be too small of a drop in the proverbial bucket as tuition rates continue to climb.

This may also be an issue of measurement. It may be that it is not the amount of a grant program or low tuition in one's state, but the actual personal receipt of such aid and the individual bottom line. While ELS does include information on grant, work study and loan receipt, this data was only collected for those students who attended college – not for those who did not attend. Therefore, a definitive answer on the likely effect of these programs is not possible. It may also be that these programs are limited on their effect on initial college enrollment, but instead impact retention and eventual graduation rates. The next round of ELS data may be able to shed some light on this possibility.

At the same time, these results do provide a glimpse of promise for both low and middle-income students. Some mechanisms in place that are meant to help substitute for a lack of financial resources seem to be working. Low and middle-income students alike are receiving an extra benefit from filing their Free Application for Federal Student Aid which is likely providing them access to federal grants, work-study and/or loans. Similarly, filling out additional financial aid forms also acts as a substitute for increased income, with students likely seeing additional scholarship and grant funds from these efforts, which in turn help these students to afford a college education.

What more can be done to help alleviate the financial deficit of low and middle-income students? Table 4.4 shows descriptive statistics by income group on some of the relevant areas that could be addressed. Lower and middle-income students in this cohort continue to be enrolled at lower rates in both overall academic track courses and in higher-level math courses. These students are also significantly less likely to take college entrance exams such as the ACT or

SAT. While waivers are available for these tests, students must obtain them from the guidance counselor. And, with many schools struggling with excessive case burdens for their counselors, students may be unaware of these waivers or unable to even see their counselor to receive one. The same may be true for course guidance.

Students across income groups are filing FAFSAs and filling out financial aid forms at more uniform levels. However, since the requirement to receive federal financial aid (and most state and some institutional aid) is to complete a FAFSA, more emphasis should be put on programs that help students and families learn about this tool and take advantage of it. About 49 percent of low-income students and 52 percent of middle-income students completed their FAFSA, which leaves a great number of students unaware of the possible financial aid available to help them get in to college. More students completed other financial aid applications (59 and 65 percent for low and middle-income students), but these rates still leave room for improvement. This is especially the case since both of these resources were clearly shown to help substitute for lower income levels in the college-going equation.

Therefore, a comprehensive state plan that calls for a college-planning course that encourages college exploration, taking the ACT or SAT, and filing the FAFSA may alone jump start college enrollment. While the results above did not show a significant effect of participation in a college preparation program, it may be that these programs do not have a direct effect on enrollment itself, but rather influence enrollment through encouraging participating students to engage in academic-level coursework, take their entrance exams and file their FAFSA. It may also be that there is a wide variance in the direction students enrolled in these programs receive since these programs currently have no standard curriculum in place.

In addition, the positive impact shown here for parents saving for college suggests that a program that helps parents understand the importance of saving for college – and perhaps incentivizing this, may be one avenue to explore. Some schools and states are beginning this journey. Many states now offer college savings investment vehicles – commonly called 529 plans. In addition, many of these same states offer tax credits or tax deductions to parents who make these contributions. Other states are getting even more creative. Iowa launched a program where new parents can register their child to win a $1000 College Saving Iowa 529 Plan account. Maine provides new babies with $500 when an adult opens a 529 account for them. With an approved application, low and middle-income residents of Colorado, Arkansas, Rhode Island, Michigan, Minnesota and Utah can receive a matching contribution to their state's 529 Plan.

Private philanthropists are also getting involved. The Bill and Melinda Gates Foundation has partnered with schools in the state of Washington to assist low-income and minority students (who are disproportionately low-income as well) attend college through not only financial support, but through academic readiness and college preparation. This includes engaging in higher-level math and science courses, taking college entrance exams, and completing their FAFSA – all forms of capital that are shown to make a difference in college enrollment in this research.

Since these programs are all relatively new, it may be years before we can test to see whether or not they truly make a difference in today's adolescents achieving a college diploma. But, in a time when individuals, schools, and states are all facing economic difficulties, rethinking current practices and trying new approaches that directly tap in to meaningful activity at the individual level may be one practical and effective approach. As Bourdieu (1977) argued, capital is not simply static. Instead, one form of capital can be used to transform another. If

students and parents can use knowledge of the college enrollment and financial aid process, and translate that in to actions that are associated with an increased likelihood of college enrollment, then transformation can occur. Finding ways to help communicate the important steps and actions – and making it easy and inexpensive to follow through – may yield positive results for low and middle-income students.

Table 4.1. Descriptive Statistics for Variables Used in Analyses of Substitution Effects for the Financial Capital Deficit of Low-Income Students.

	Percent or Mean (s.d.)	% Missing
Dependent Variable		
Two-year school enrollment	27.67	na
Four-year school enrollment	52.06	na
Student Background		
Male	47.87	0.00
Female (reference)	52.13	0.00
White (reference)	61.83	na
Black	14.16	na
Asian	10.47	na
Hispanic	13.54	na
Student Capital		
Academic track	59.12	0.00
High math	51.35	0.71
GPA	2.86	6.39
	(0.69)	
College expectations	85.03	8.38
ACT/SAT taken	69.56	0.00
College information	87.80	14.45
College prep program (general)	21.73	0.00
College prep program (low-income)	3.74	0.00
FAFSA filed	50.09	0.00
Financial aid application	62.56	0.22
Parent Capital		
Parent education (no BA)	55.27	0.00
College aspirations for child	90.22	0.00
Single-parent family	20.80	0.78
Step-parent family	13.57	0.78
Siblings	2.22	15.11
	(1.40)	
Low-income	18.28	0.00
Middle-income	50.73	0.00
Parent saved for college	55.30	19.64
Computer in home	91.48	10.69
State Capital		
In-state tuition (in thousands)	4.02	na
	(1.27)	
$ Need-based grant amount (in thousands)	1.00	na
	(0.86)	
$ Merit-based grant amount (in thousands)	1.23	na
	(1.95)	
$ Need/merit grant amount (in thousands)	0.81	na
	(1.34)	
School Controls		
Urban	33.01	na
Rural	18.50	na
Suburban (reference)	48.49	na
Private School	24.06	na
Public School (reference)	75.94	na
Number of Respondents	11166	

SOURCE: Educational Longitudinal Study of 2002 (ELS:2002), National Association of State Grant and Aid Programs for the 2002-2003 school year (NASSGAP), Integrated Postsecondary Data System for the 2002-2003 school year (IPEDS), and United States Census Bureau.

Table 4.2: Multinomial Logistic Regression of Individual and Family Capital on College Enrollment (Two-Year or Four-Year Institution)

Independent Variable	Model 1		Model 2		Model 3	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Interactions						
FAFSA filed x low-income			0.636 *	0.332		
			(0.295)	(0.322)		
FAFSA filed x middle-income			0.728 **	0.633 *		
			(0.278)	(0.289)		
FA application x low-income					0.824 **	1.277 ***
					(0.261)	(0.338)
FA application x middle-income					0.800 **	0.847 **
					(0.239)	(0.255)
Student Capital						
	(0.081)	(0.092)	(0.081)	(0.092)	(0.081)	(0.092)
High math	-0.128	0.697 ***	-0.128	0.695 ***	-0.109	0.716 ***
	(0.081)	(0.104)	(0.098)	(0.104)	(0.098)	(0.105)
Grade point average	0.342 ***	1.212 ***	0.345 ***	1.215 ***	0.343 ***	1.215 ***
	(0.069)	(0.085)	(0.069)	(0.085)	(0.069)	(0.085)
College expectations (student)	0.439) ***	0.859 ***	0.438 ***	0.859 ***	0.438 ***	0.855 ***
	(0.091)	(0.136)	(0.091)	(0.136)	(0.091)	(0.136)
ACT/SAT taken	0.630 ***	1.583 ***	0.624 ***	1.580 ***	0.624 ***	1.570 ***
	(0.086)	(0.104)	(0.086)	(0.105)	(0.086)	(0.105)
FAFSA filed	0.767 ***	0.968 ***	0.166	0.475	0.763 ***	0.966 ***
	(0.098)	(0.109)	(0.249)	(0.253)	(0.098)	(0.109)
Financial aid application	1.563 ***	2.250 ***	1.560 ***	2.240 ***	0.850 ***	1.478 ***
	(0.089)	(0.107)	(0.089)	(0.107)	(0.213)	(0.217)
College information	-0.004	0.199	-0.009	0.194	-0.006	0.199
	(0.104)	(0.126)	(0.104)	(0.127)	(0.105)	(0.128)
College prep program (general)	-0.091	-0.029	-0.092	-0.031	-0.101	-0.038
	(0.097)	(0.109)	(0.097)	(0.110)	(0.097)	(0.110)
College prep program (low-inc)	-0.050	-0.139	-0.041	-0.121	-0.058	-0.154
	(0.197)	(0.219)	(0.198)	(0.219)	(0.199)	(0.222)
Family Capital						

Independent Variable	Model 1		Model 2		Model 3	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Parent education (no BA)	-0.328 ***	-0.840 ***	-0.324 **	-0.837 ***	-0.322 **	-0.834 ***
	(0.095)	(0.104)	(0.095)	(0.104)	(0.095)	(0.104)
College aspirations for child	0.398 ***	0.679 ***	0.395 ***	0.678 ***	0.397 ***	0.682 ***
	(0.101)	(0.157)	(0.102)	(0.157)	(0.102)	(0.159)
Single-parent family	-0.029	0.114	-0.034	0.113	-0.030	0.116
	(0.099)	(0.117)	(0.099)	(0.116)	(0.099)	(0.118)
Step-parent family	-0.292 **	-0.366 **	-0.292 **	-0.366 **	-0.290 **	-0.361 **
	(0.104)	(0.125)	(0.104)	(0.125)	(0.104)	(0.125)
Siblings	-0.103 ***	-0.127 ***	-0.104 ***	-0.127 ***	-0.102 ***	-0.126 ***
	(0.028)	(0.034)	(0.028)	(0.034)	(0.028)	(0.034)
Low-income	-0.730 ***	-1.441 ***	-0.851 ***	-1.392 ***	-0.897 ***	-1.978 ***
	(0.139)	(0.161)	(0.154)	(0.194)	(0.160)	(0.262)
Middle-income	-0.463 ***	-1.039 ***	-0.593 ***	-1.140 ***	-0.635 ***	-1.245 ***
	(0.115)	(0.124)	(0.125)	(0.141)	(0.131)	(0.153)
Parent saved for college	0.239 **	0.340 ***	0.242 **	0.249 **	0.249 **	0.352 ***
	(0.081)	(0.094)	(0.082)	(0.082)	(0.082)	(0.094)
Home computer	0.480 ***	0.827 ***	0.476 ***	0.819 ***	0.487 ***	0.846 ***
	(0.112)	(0.162)	(0.112)	(0.161)	(0.113)	(0.164)
Student Controls						
Male	-0.104	0.060	-0.104	0.060	-0.105	0.061
	(0.078)	(0.090)	(0.078)	(0.090)	(0.078)	(0.090)
Black	-0.284 *	0.171	-0.284 *	0.173	-0.282 *	0.172
	(0.122)	(0.142)	(0.123)	(0.142)	(0.123)	(0.143)
Hispanic	0.153	0.031	0.156	0.031	0.148	0.025
	(0.108)	(0.142)	(0.108)	(0.142)	(0.109)	(0.144)
Asian	0.255	0.224	0.255	0.227	0.255	0.218
	(0.166)	(0.181)	(0.167)	(0.181)	(0.167)	(0.182)
School Controls						
Urban	-0.045	0.383 **	-0.049	0.375 **	-0.046	0.382 **
	(0.097)	(0.111)	(0.097)	(0.111)	(0.097)	(0.112)
Rural	-0.072	-0.106	-0.074	-0.107	-0.070	-0.108
	(0.097)	(0.113)	(0.097)	(0.114)	(0.097)	(0.114)
Private	0.417 **	0.905 ***	0.412 **	0.902 ***	0.405 **	0.886 ***
	(0.138)	(0.142)	(0.138)	(0.142)	(0.138)	(0.142)
Intercept	-1.729	-6.747	-1.757	-6.724	-1.429	-6.205

Independent Variable	Model 1		Model 2		Model 3	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Chi-Squared	215.397 ***	192.086 ***	247.895 ***	220.622 ***	210.810 ***	213.031 ***

Note: Numbers in parentheses are standard errors.
N= 11166; p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 4.3: Multinomial Logistic Regression of Individual, Family and State Capital on College Enrollment (Two-Year or Four-Year Institution)

Independent Variable	Model 4		Model 5		Model 6	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Interactions						
Tuition difference x low-income					0.170 +	0.083
					(0.097)	(0.109)
Tuition difference x middle-income					0.001	-0.062
					(0.083)	(0.087)
Student Capital						
Academic track	0.032	0.234 **	0.032	0.232 **	0.035	0.233 **
	(0.068)	(0.077)	(0.067)	(0.077)	(0.067)	(0.077)
High math	-0.147	0.626 ***	-0.148	0.623 ***	-0.143	0.627 ***
	(0.080)	(0.085)	(0.080)	(0.085)	(0.080)	(0.085)
Grade point average	0.335 ***	1.340 ***	0.338 ***	1.344 ***	0.341 ***	1.347 ***
	(0.059)	(0.071)	(0.059)	(0.071)	(0.059)	(0.071)
College expectations	0.456 ***	0.874 ***	0.459 ***	0.879 ***	0.456 ***	0.877 ***
	(0.078)	(0.114)	(0.078)	(0.114)	(0.078)	(0.114)
ACT/SAT taken	0.680 ***	1.622 ***	0.673 ***	1.617 ***	0.668 ***	1.614 ***
	(0.074)	(0.088)	(0.074)	(0.088)	(0.074)	(0.088)
FAFSA filed	0.810 ***	1.035 ***	0.808 ***	1.031 ***	0.807 ***	1.030 ***
	(0.081)	(0.089)	(0.081)	(0.090)	(0.081)	(0.090)
Financial aid application	1.566 ***	2.216 ***	1.565 ***	2.214 ***	1.572 ***	2.220 ***
	(0.074)	(0.088)	(0.074)	(0.088)	(0.075)	(0.087)
College information	-0.005	0.237 *	-0.006	0.235 *	-0.009	0.233 *
	(0.088)	(0.108)	(0.088)	(0.108)	(0.088)	(0.108)
College prep program (general)	-0.098	-0.003	-0.098	-0.003	-0.098	-0.003
	(0.080)	(0.091)	(0.080)	(0.090)	(0.080)	(0.090)
College prep program (low-inc)	-0.074	-0.160	-0.072	-0.155	-0.079	-0.162
	(0.162)	(0.195)	(0.162)	(0.185)	(0.162)	(0.185)
Family Capital						
Parent education (no BA)	-0.309 ***	-0.848 ***	-0.310 ***	-0.844 ***	-0.316 ***	-0.849 ***
	(0.077)	(0.085)	(0.077)	(0.085)	(0.077)	(0.085)
College aspirations for child	0.359 ***	0.646 ***	0.357 ***	0.643 ***	0.360 ***	0.664 ***
	(0.088)	(0.128)	(0.088)	(0.128)	(0.088)	(0.128)

Independent Variable	Model 4		Model 5		Model 6	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Single-parent family	-0.032	0.133	-0.032	0.133	-0.031	0.133
	(0.083)	(0.098)	(0.083)	(0.098)	(0.083)	(0.098)
Step-parent family	-0.293 **	-0.364 **	-0.284 **	-0.367 **	-0.286 **	-0.368 **
	(0.087)	(0.104)	(0.086)	(0.103)	(0.087)	(0.103)
Siblings	-0.102 ***	-0.123 ***	-0.101 ***	-0.121 ***	-0.101 ***	-0.121 ***
	(0.023)	(0.027)	(0.023)	(0.027)	(0.023)	(0.027)
Low-income	-0.696 ***	-1.384 ***	-0.695 ***	-1.382 ***	-1.184 ***	-1.615 ***
	(0.115)	(0.135)	(0.115)	(0.134)	(0.306)	(0.345)
Middle-income	-0.445 ***	-1.050 ***	-0.442 ***	-1.047 ***	-0.445 +	-0.865 **
	(0.093)	(0.101)	(0.093)	(0.101)	(0.262)	(0.278)
Parent saved for college	0.229 **	0.349 ***	0.228 **	0.349 ***	0.228 **	0.349 ***
	(0.067)	(0.077)	(0.067)	(0.077)	(0.067)	(0.077)
Home computer	0.430 ***	0.800 ***	0.431 ***	0.802 ***	0.426 ***	0.795 ***
	(0.096)	(0.129)	(0.096)	(0.129)	(0.096)	(0.129)
State Capital						
Need-based grant amount	0.032	-0.136				
	(0.098)	(0.103)				
Need/merit grant amount	0.079	-0.160 **				
	(0.053)	(0.056)				
Merit-based grant amount	-0.053	0.003				
	(0.037)	(0.039)				
In-state tuition	-0.060	0.053				
	(0.066)	(0.069)				
Unemployment rate	-0.073	0.075	-0.055	0.071	-0.054	0.071
	(0.071)	(0.072)	(0.069)	(0.071)	(0.068)	(0.071)
Per capita income	0.065 *	0.127 ***	0.064 *	0.116 ***	0.065 *	0.117 ***
	(0.028)	(0.030)	(0.025)	(0.026)	(0.024)	(0.026)
Tuition difference			-0.050	0.059	-0.091	0.069
			(0.061)	(0.066)	(0.089)	(0.093)
Student Controls						
Male	-0.098	0.070	-0.098	0.071	-0.100	0.069
	(0.065)	(0.076)	(0.065)	(0.075)	(0.065)	(0.075)
Black	-0.336 **	0.240	-0.338 **	0.233 *	-0.341 **	0.232 *
	(0..102)	(0.117)	(0.101)	(0.116)	(0.101)	(0.116)
Hispanic	-0.079	0.176	-0.076	0.176	-0.069	0.176
	(0.096)	(0.119)	(0.095)	(0.118)	(0.095)	(0.118)

Independent Variable	Model 4		Model 5		Model 6	
	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school	2-Year vs. Not in school	4-Year vs. Not in school
Asian	0.004	0.261	0.006	0.259	0.006	0.259
	(0.186)	(0.202)	(0.186)	(0.201)	(0.095)	(0.201)
School Controls						
Urban	-0.007	0.409 ***	-0.007	0.410 ***	-0.009	0.408 ***
	(0.080)	(0.092)	(0.080)	(0.091)	(0.080)	(0.091)
Rural	-0.008	-0.088	-0.003	-0.087	-0.001	-0.082
	(0.084)	(0.099)	(0.087)	(0.098)	(0.084)	(0.099)
Private	0.410 *	0.915 ***	0.413 *	0.917 ***	0.413 *	0.920 ***
	(0.176)	(0.180)	(0.176)	(0.179)	(0.176)	(0.179)
Intercept	-2.525	-9.821	-2.691	-9.834	-2.599	-9.884
Chi-square	162.536 ***	138.037 ***	191.609 ***	167.671 ***	189.003 ***	168.551 ***

Note: Numbers in parentheses are standard errors; N= 11166.
+p<.10, *p<.05, **p<.01, ***p<.001 (two-tailed test).

Table 4.4. Descriptive Statistics (Means) for Select Variables by Income Group with Significance Tests Showing the Difference between High-Income Students and their Low and Middle-Income Counterparts.

	Low-Income (<$25,000)	Middle-Income	High-Income (>$75,000)
Dependent Variable			
Postsecondary school attendance (2-year)	32.83 ***	31.07 ***	20.03
Postsecondary school attendance (4-year)	31.80 ***	47.03 ***	72.25
Student Capital			
Academic track	48.75 ***	56.22 ***	69.97
High math	34.64 ***	47.48 ***	67.54
GPA	2.59 ***	2.83 ***	3.07
College expectations	74.91 ***	83.46 ***	93.55
ACT/SAT taken	50.37 ***	68.00 ***	83.44
College information	86.23 ***	87.00 ***	90.03
College prep program (general)	24.06 *	21.48	20.75
College prep program (low inc)	7.20 ***	3.80 ***	1.62
FAFSA filed	48.95	52.48 **	46.94
Financial aid application	59.38 **	65.30 *	59.94
Parent Capital			
Parent education (no BA)	80.16 ***	64.27 ***	25.87
College aspirations for child	83.64 ***	88.61 ***	96.73
Single-parent family	50.02 ***	18.96 ***	6.59
Step-parent family	12.05	15.60 ***	11.13
Siblings	2.63 ***	2.24 ***	1.96
Parent saved for college	33.12 ***	51.32 ***	74.91
Computer in home	77.95 ***	92.48 ***	97.83

*p<.05, **p<.01, ***p<.001 (two-tailed test).

APPENDIX

Variable Descriptions: Educational Longitudinal Study of 2002 (ELS), National Association of State Scholarships and Grant Programs (NASSGAP), Integrated Postsecondary Data System (IPEDS), U.S. Census Bureau

Variable	Items	Data Source
Dependent Variable		
Postsecondary school attendance	Categorical variable: 0 = no postsecondary attendance, 1 = two-year institution, 2 = four-year institution.	ELS: 2nd Follow-Up (2006)
Student Capital		
Academic track	Dummy variable coded 1 for self-reported college prep track.	ELS: Base (2002)
High math	Dummy variable coded 1 for students whose highest math was trigonometry, pre-calculus or calculus.	ELS: 1st Follow-Up (2004)
GPA	Continuous variable ranging from 0 to 4.0.	ELS: 1st Follow-Up (2004)
College expectations	Dummy variable coded 1 for students who expect to achieve a bachelor's degree or higher in 10th grade.	ELS: Base (2002)
ACT/SAT taken	Dummy variable coded 1 for students who took either the ACT or SAT.	ELS: 1st Follow-Up (2004)
FAFSA filed	Dummy variable coded 1 for students who filed the Free Application for Federal Student Aid (FAFSA).	ELS: 2nd Follow-Up (2006)
Financial aid application	Dummy variable coded 1 for students who indicated they applied for financial aid.	ELS: 2nd Follow-Up (2006)
College information	Dummy variable coded 1 for students who went to any source to find college information.	ELS: Base (2002)
College prep program (general)	Dummy variable coded 1 for students who indicated they participated in a college preparation program.	ELS: Base (2002)
College prep program (low-income)	Dummy variable coded 1 for students who indicated they participated in a college preparation program for disadvantaged students	ELS: 1st Follow-Up (2004)
Parent Capital		
First-generation	Dummy variable coded 1 if neither parent achieved a 4-year degree.	ELS: Base (2002)
College aspirations for child	Dummy variable coded 1 if the student's parent wants the student to achieve a bachelor's degree or higher.	ELS: Base (2002)
Single-parent family	Dummy variable coded 1 if the student lives with only one parent or guardian.	ELS: Base (2002)
Step-parent family	Dummy variable coded 1 if the student lives with one parent and another guardian.	ELS: Base (2002)

Siblings	Continuous variable coded 0-6 for 0, 1, 2, 3, 4, 5 or 6 or more siblings.	ELS: Base (2002)
Low-income	Dummy variable coded 1 for family income less than or equal to $25,000/yr.	ELS: Base (2002)
Parent saved for college	Dummy variable coded 1 if the parent saved for college.	ELS: Base (2002)
Computer in home	Dummy variable coded 1 if there is a computer in the home.	ELS: Base (2002)
Student Controls		
Gender	Dummy variable coded 1 for male.	ELS: Base (2002)
Race/ethnicity	Set of four dummy variables: white, black, Asian, Hispanic (white as reference).	ELS: Base (2002)
State Capital		
In-state rate (4-year public)	Continuous variable ranging from 2 to 8 (in thousands) for the average in-state tuition rate at state public 4-year institutions.	IPEDS (2002-2003)
Need-only grant	Dummy variable coded 1 indicating the presence of a need-based state grant program.	NASSGAP (2002-2003)
Merit-only grant	Dummy variable coded 1 indicating the presence of a merit-based state grant program.	NASSGAP (2002-2003)
Need/merit grant	Dummy variable coded 1 indicating the presence of a combination need and merit-based grant program.	NASSGAP (2002-2003)
Need-only amount	Average dollar amount per-student of need-only grant.	NASSGAP (2002-2003)
Merit-only amount	Average dollar amount per-student of merit-only grant.	NASSGAP (2002-2003)
Need/merit amount	Average dollar amount per-student of a combination need and merit-based program.	NASSGAP (2002-2003)

CHAPTER 5

CONCLUSION

The goal of this study was to provide an integrated approach to the question of college-going for students in the 21st century. Despite gains in educational attainment levels across student groups since the passage of the Higher Education Act of 1965, inequality in educational access remains. Among the sample I used in Chapter 2, over 75 percent of ELS:2002 participants had attended some form of postsecondary education by the second follow-up survey – just two years after most of the original sophomore class of 2002 had graduated from high school. Despite the significant numbers of students heading off to college, enrollment rates continue to vary by group. For example, in this same sample, the following enrollment rates by group were reported:

- 79.3% of females vs. 71.04% of males.
- 79.62% of whites vs. 69.37% of blacks, 85.70% of Asians and 64.26% of Hispanics.
- 59.09% of low-income (family income of $25,000 or less) students vs. 79.26% of middle and upper-income students.
- 66.66% of potential first-generation college students vs. 87.98% of students who had at least one parent with a bachelor's degree or higher.

Previous research has shown that many forms of capital – at the individual, family, school and state levels – influence the probability of college enrollment. However, despite the acknowledgement that this process is truly a result of the complicated interaction of many forms of capital at multiple levels, empirical studies have rarely tested models of college enrollment that include multiple forms of capital, or that include different forms of capital at multiple levels. While a few authors have ventured in to these waters, the best of this research either does not test

across levels (Dumais 2006), does not test college enrollment (Parcel and Dufur 2001b), does not utilize multilevel modeling while utilizing multilevel data (Beattie 2002), or does not include sampling weights in analysis (Perna and Titus 2004).[1] In addition, despite the breadth of literature that covers college-going, there has remained a gap in the literature between that of the importance of academic preparation for college and the financial ability to pay for college (Zeidner 2006) – which results in important variables being omitted from each of the above studies.

In an effort to expand our knowledge about the interrelated effects of multiple forms of capital across levels, the chapters here addressed the following related questions: 1) Do students' background characteristics (gender, race/ethnicity, income, parent education level) systematically alter the effects of different forms of capital (human, social and financial) on the probability of college enrollment? 2) Do parallel forms of human and financial capital at the individual and school level improve the likelihood of college enrollment? 3) Do specific forms of capital provide a substitution effect to help alleviate the financial capital deficit of low-income students?

Chapter 2 confirms that all students benefit from certain types of human, social and financial capital. Traditional measures of human capital including grade point average, student expectations and parent aspirations for educational attainment are all associated with increased odds of enrolling in to both two and four-year institutions. Enrolling in academic track coursework and high level math, along with having friends that think it is important to go to college, also increases the probability of enrollment in to four-year schools. Importantly, college planning activities on both the academic *and* financial side such as taking college entrance exams

[1] Whether utilizing sampling weights is important has been debated. However, the authors cite it as a critique of their own work.

and filing the Free Application for Federal Student Aid also significantly improve the odds of college enrollment in to both two and four-year schools, as does having parents who provide a computer in the home and save for college. Additionally, seeking college information from any source and students and parents talking together about coursework also improves the likelihood of enrolling in a four-year school.

Not surprisingly, coming from a low-income family and having parents who did not graduate from college significantly decreases the likelihood of college enrollment at both two year and four-year institutions. Living in a step-parent family – although not a single-parent family – also reduces the likelihood of enrolling in college, as does the presence of additional siblings.

Perhaps more interesting are the ways that membership in different student groups condition the effects of these different forms of capital. While college-going rates between men and women are now the closest in parity among student groups, with women out-enrolling men at both the two-year and four-year level, there are still differences in how capital works for them. Women benefit from higher grade point averages more than their male counterparts in terms of the probability of enrolling into a four-year institution, while men benefit more from increased expectations about educational attainment. And, male students increase their likelihood of enrolling in a two-year school by talking with their parents about course-selection – although this benefit does not extend to the probability of four-year school enrollment.

On the federal policy front, it was heartening to find that potential first-generation college students benefit from filing the Free Application for Federal Student Aid in both two and four-year enrollment. And, at the same time, it was disappointing to find that low-income students whose parents saved for college actually reduce their likelihood of enrolling in a four-year

institution. This points to both the benefits of our federal financial aid program, and the inherent flaws in the current financial aid formulas.

Consistent with previous research, black and Hispanic students continue to receive less benefit from holding college expectations than their white counterparts in terms of the probability of four-year enrollment, and black students also receive less benefit from having educational resources (in this case, a computer) in their home than their white counterparts. However, the experience of Hispanic students is an interesting case study, as these students are less negatively impacted than white students are by being from a low-income, first-generation or single-parent home. While the research here cannot explain the causal mechanism that produces this "benefit" for Hispanic students (in comparison to their white counterparts), it is worth further research consideration.

Chapter Three built on the findings of Chapter Two by introducing parallel forms of human, social and financial capital at the school level. Individual-level forms of capital substantially mirrored the results found above. While school-level effects are smaller in magnitude than individual-level forms of capital, the percent of teachers certified, the percent of the prior-year class attending college, and an environment that supports learning as a high priority and teacher salary all affect the probability of enrolling in a four-year school. The omission of the college planning indicators on the individual level – such as taking college entrance exams, filing the Free Application for Federal Student Aid and reaching out for college information – produced a significant effect of the student-teacher ratio and an increased effect of an environment with learning as a high priority. This important finding suggests that the student-teacher ratio may be less a measure of financial capital, and may instead be a proxy for social capital. It is likely the effect here is really capturing the time that students and teachers have to

interact, and that information about the college process is being passed on through that interaction. And, an environment that supports learning also reinforces the importance of learning at the next level.

Chapter Four focused on the financial capital deficit of low and middle-income students. This chapter introduced parallel forms of human and financial capital at the state level, along with additional indicators of college planning. Again, individual-level forms of human and financial capital have the greatest influence on both two and four-year enrollment. While participation in a college preparation program – either a general program or a program specifically designed for low-income students – had no significant effect on either two-year or four-year enrollment, completing financial aid applications – in addition to completing the Free Application for Federal Student Aid – had a significant effect on the probability of enrollment for all students in to both two and four-year institutions. And, importantly for low and middle-income students, both completing the FAFSA and completing additional financial aid forms both provided a substitution effect, helping to reduce the financial capital deficit of lower income levels.

State-level forms of capital were much less influential in the college-going equation, at least as measured in this study. Per capita income, a proxy for the wage potential in a state, did produce a consistent positive effect across models. However, the presence of state need-based or merit-based grants had no significant effect on either two-year or four-year college enrollment. This effect persisted across income groups. [2] Students overall were not significantly affected by the unemployment rate, the in-state tuition rate ("sticker rate") or the difference between the in-state tuition rate and the need-based grant amount of the state ("net price"). However, low-

[2] While I did find an effect for combination need and merit based grants, the effect was actually negative and is likely related to sample size.

income students did show some sensitivity to the tuition difference for enrollment into two-year schools.

Overall, the results of this research present opportunities for both policy-makers and researchers alike. The persistent effect of not just being academically prepared and motivated for college (as measured by grade point average, academic track, high math class enrollment, and student and parent expectations), but being engaged in the college planning process both academically *and* financially (by seeking college information, taking college placement exams, filing the FAFSA, completing financial aid forms, saving for college, and having access to resources), is an important outcome of this research. This supports the theoretical importance of a more integrated approach to college enrollment models – at least at the individual level.

The findings here suggest that there is further work to be done to enhance the understanding of the complexities that lie in the enrollment process. Foremost is the possible impact of parallel forms of social capital – particularly at the individual and school level – on student enrollment. The impact of student-teacher ratio, coupled with the positive impact of teacher salary (a likely indicator of teacher human capital), suggests that connection between students and teachers (or other important adults) may yield results. While the research presented here focused on parallel forms of human, social and financial capital, it may be that the transference of human capital through social interaction is really the important mechanism that benefits students. However, it likely takes both human and financial capital to facilitate this transaction most effectively.

Better measures are also needed to improve this research. For example, while the lack of effect of state need-based grant programs for low-income students may well point to the simple lack of affordability of a college education with the expense of college these days, it may also be

that students are not informed about the availability of these programs. As Lloyd et al. (2008) found, awareness of the Top 10% Law in Texas improved the likelihood of applying to college. Specific questions that tap awareness of state and federal financial aid programs may help in the understanding of whether it is a matter of not knowing or not affording – or a combination – that matters in the college enrollment process. Similarly, gathering information about student receipt of financial aid offers among both students who enroll and those who do not, would also more clearly delineate this process.

In the meantime, these results provide avenues for students, parents, schools and states to explore together to help further reduce the group differences in college enrollment still evident among today's students. The following suggestions stem from this research:

1. *Improve information to disadvantaged students about the college process and encourage action toward the concrete steps necessary for college enrollment.* These students are currently the least likely to enroll in academic coursework, take college entrance exams and complete financial aid forms. Parents who talked to their student about course selection increased their student's likelihood of enrolling in a four-year school. Schools with smaller student-teacher ratios also positively influenced four-year school enrollment – through college planning mechanisms.
2. *Increase college savings rates.* Some states have begun programs that provide incentives to new parents to begin saving for their child's education. While results are not yet available, this may become an important state investment.
3. *Change the federal FAFSA formula*. While saving improved the likelihood of college enrollment overall, it was actually detrimental to low-income students. These families should not be penalized for taking positive actions toward college enrollment. Current

discussions underway in Congress about both changing the formula and simplifying the form may help both alleviate the issue of the negative impact of low-income saving and improve overall rates of completing this important form.

While individuals, schools, states and our federal government continue to spend billions of dollars each year on education from kindergarten through graduate school, we must continue to assess the best ways to utilize our limited resources. As the current economic crisis indicates, we have to get better at doing more with less. At the same time, we must not forget the importance of striving for equality in educational attainment levels for all students. Without educational equality, economic and social equality is unlikely to occur in this country. All of our citizens are owed the opportunity of equality as we struggle to overcome the injustices of the past and the effects of our history that linger in the present.

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