Towards the Education Nation? Revisiting the Impact of Financial Aid, College Experience, and Institutional Context on Baccalaureate Degree Attainment for Low-Income Students

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Version: March 2014*

Keywords: degree completion, financial aid, loans, low-income, institutional influence, multilevel analysis, propensity-score-matching

* Prepared for Presentation at the Annual Meeting of the American Educational Research Association (AERA)
Philadelphia, Pennsylvania, April 3-7, 2014

Introduction

To compete in the global marketplace, the U.S. economy heavily relies on higher education institutions to educate the college graduates and knowledge workers needed to create the innovative products and services of tomorrow. And yet, where once America led the world in educational attainment, recent data from the Organization for Economic Cooperation and Development indicates that the U.S. now ranks only 15th among major industrialized nations in college completion rates (OECD, 2011). As a result, increasing degree attainment and reclaiming America's spot at the top have become major policy objectives, as evidenced by the launch of the *American Graduation* and *Keeping College Affordable Initiatives* (The White House, 2009, 2012).

Increasing college graduation rates is not an easy venture. To do this, we must not only build a K-12 system that ensures sufficient academic preparation and a successful transition into higher education, we also have to utilize the full potential of American society and increase the number of students of color, first-generation and low-income students. Research shows there are vast human resources largely untapped in the U.S. Focusing only on low- and moderate income students, the Advisory Committee on Student Financial Assistance estimates that 1.4 to 2.4 million more bachelor's degree could have been earned in the first decade of the millennium, if financial barriers were reduced (ACSFA, 2006). Thus, increasing access to and success in higher education for low-income students alone, could make a sizeable contribution towards the stated goal of adding five million college graduates to the American workforce by 2020 (The White House, 2009).

Providing financial assistance for the "needy and deserving" has been a longstanding element in American higher education (McPherson & Schapiro, 1998). However, it was not until

the 1960s that the federal government became extensively involved in the provision of student financial aid. Today, the U.S. spends $235 billion in financial aid of all forms and from all sources. To put this into perspective, this is approximately the entire GDP of Finland, currently the 35th largest economy in the world (The World Bank, 2010). The federal government alone spent $174 billion in financial aid in 2011-12, which represents an increase of 140% over the past decade (College Board, 2012).

By most accounts, this is a remarkable investment by the federal government. And yet, a closer examination reveals disconcerting trends. Although funding for the Pell Grant – the largest grant program directed at students from low- and moderate-income backgrounds – rose sharply in the years after President Obama took office, most federal aid is allocated to various loan programs. Out of the $174 billion spent by the federal government in 2011-12, more than $105 billion (60.3%) were dedicated to various student loan programs. Among these, spending on unsubsidized Stafford loans, increased remarkably over the past decade. In 2011-12, the federal government spent $45.8 billion, an increase of 145% over the last ten years. Spending on subsidized Stafford loans (for which interest does not accrue while still enrolled in college) reached $39.9 billion, representing a growth of merely 81% over the same period (College Board, 2012). Given current fiscal and budgetary constraints in the U.S., funding for loan programs is projected to increase even further; 6% for unsubsidized and 2% for subsidized loans, respectively, for FY 2014 alone (Field, 2013). In light of the spiraling costs of higher education, this shifts the burden to finance a college degree even further to students and their families.

Despite a heightened interest in degree attainment and the importance of financial aid for many students, research specifically directed at degree attainment – not solely *access* to higher education – is surprisingly slim in quantity and, particularly at the intersection of financial aid impact, challenged methodologically (Alon, 2005; Chen, 2008; Dowd, 2008; Hossler, Ziskin,

Gross, Kim, & Cekic, 2009). Specifically, very limited empirical research has been devoted to study the effects of various forms of loans on measures of student success and further distinguishes by income or socioeconomic status (Avery & Turner, 2012; Dowd & Coury, 2006). Beyond that, only few studies examine institutional and contextual impact factors that, in addition to individual characteristics and college experiences, can influence students' likelihood to obtain a degree. Even fewer scholars address methodological issues when examining the influence of economic factors and student financial aid on higher education success (Chen, 2008).

This study seeks to address limitations in the literature and contribute to our understanding of influential factors on student success for low-income students. For this, I examine the impact of various forms of financial aid, student characteristics and experiences, and institutional context on six-year degree attainment, using a propensity score matching, multilevel modeling approach.

Review of the Literature

Over the past decades, student success[1] in postsecondary education, particularly persistence and degree completion, has been of interest to scholars from various disciplines and multidisciplinary fields. To study these outcomes, higher education researchers have often resorted to interactionalist theory and Tinto's (1975, 1993) model of student departure. However, other conceptual frameworks and theoretical models have been applied successfully to explain persistence decisions that can lead to degree attainment, for instance the student attrition model (Bean, 1980, 1982, 1990), the student adjustment model (Nora & Cabrera, 1996), and the student/institution engagement model (Nora, 2004).

[1] *Success* is broadly defined as student persistence *or* degree completion. Given the intricate nature of both of these measures, and due to the fact that scholarly attention has focused primarily on persistence, the literature review will encompass both aspects. However, the focus of this study is degree completion.

Drawing mostly on human capital theory (Becker, 1962, 1980) and price response theory (Heller, 1997; Leslie & Brinkman, 1987), economists have focused on financial aspects in student college-going behavior. However, scholarly attention has centered mostly on aspects of student access to postsecondary education and institutional choice, less on persistence and degree completion (Chen, 2008; St. John, Cabrera, Nora, & Asker, 2000). To study the impact of finance and financial barriers, scholars have examined the effects of price (tuition and fees), grants, loans, and work-study (Alon, 2007; Bettinger, 2004; Cabrera, Nora, & Castañeda, 1992; Cuccaro-Alamin & Choy, 1998; DesJardins & McCall, 2010; Dowd & Coury, 2006; Dynarski, 1999; Herzog, 2008; Hu & St. John, 2001; Perna, 1998; Scott-Clayton, 2011; Singell Jr, 2004; St. John, 1998; St. John, Andrieu, Oescher, & Starkey, 1994). Historically, most studies found that student aid was positively associated with persistence and degree completion.

Over the past decades, a host of studies has examined effects of financial aid (for recent reviews, see Hossler et al., 2009; Long, 2008; St. John, 2000). Results for most rigorous studies show that financial assistance in general (not distinguished by type or income) has a positive impact on persistence and degree completion. However, there are a few prominent exceptions that find either negative or not significant influences on these outcomes (Herzog, 2005; Stinebrickner & Stinebrickner, 2004). A few studies that do differentiate by type of aid focus specifically on the effects of grants, although most do not distinguish effects for need-based or merit-based aid awards. When assessing the impact of grants in aggregate form, most high-quality studies find either positive or not significant results, suggesting that this form of aid has a positive effect on the likelihood of persistence or degree completion (Bettinger, 2004; Dynarski, 1999). Although research on aid effects differentiated by income group or SES is very limited, findings indicate that low-income students are more sensitive to costs and available financial aid when compared to more affluent peers (Heller, 1997; Hu & St. John, 2001; St. John, 2003).

Sociologist and organizational theorists have also studied student persistence and college departure. Most recently, Bourdieu's (1977, 1986) social reproduction theory gained attention and has been applied to study social stratification processes and unequal educational outcomes by focusing on a broader definition of capital that incorporates social and cultural aspects. Organizational theorists are mostly concerned with the impact of the college environment on student behavior (Berger & Milem, 2000). To examine potentially influential factors, scholars have focused on aspects of institutional and organizational behavior (Berger & Milem, 2000; Bolman & Deal, 2008), student/peer climate (Astin, 1984, 1993; Hurtado & Carter, 1997; Oseguera & Rhee, 2009; Rhee, 2008; Weidman, 1989), and, most recently, resource-dependency of institutions (J. Pfeffer & Salancik, 1978, 2003; Titus, 2006a).

Despite these various approaches and the advancement in our understanding of the factors that influence student success in higher education, there is much we still need to comprehend. As Chen (2008) and St. John et al. (2000) note, the bulk of research has focused on individual persistence decisions and student departure. The specific factors and processes that can impact *degree completion*, however, have received considerable less attention. Even fewer scholars examine the crucial intersection of degree completion and financial aid, and how specific aid components can impact students differently across various income and socioeconomic groups (Chen, 2008; Goldrick-Rab, Harris, & Trostel, 2009; Hossler et al., 2009; St. John et al., 2000). Scholarly work on the impact of financial aid on persistence and degree completion traditionally assumed homogeneity of effects and largely disregarded potential variations for students from different subgroups (e.g. income; racial/ethnic) (Chen & DesJardins, 2010; Hossler et al., 2009; St. John et al., 2000). Consequently, a large number of studies treat the impact of financial aid as an aggregate effect on the student population as a whole. Only few studies examine how specific aid components can impact students differently across various income and socioeconomic groups

(Chen, 2008; St. John et al., 2000). Research is even more limited that examines differential effects on degree completion by specific aid subtypes, such as subsidized and unsubsidized loans, merit and need-based grants, and federal work-study (Goldrick-Rab et al., 2009).

To improve our understanding and overcome limitations in the literature, this study draws from the *heterogeneous research approach* for the study of financial aid (Chen, 2008; Chen & DesJardins, 2010). This approach builds on earlier studies examining effects of higher education costs and financial aid on student behavior, differentiated by socioeconomic groups (Heller, 1997; Leslie & Brinkman, 1987; St. John et al., 2000), and recently has been conceptualized by Chen (2008). The heterogeneous approach builds on two pivotal elements. First, as suggested by Perna (2006), student success is best understood when using multiple theoretical perspectives, and second, research focusing on aid effects and student behavior should be differentiated by subgroups, such as income/SES or race/ethnicity.

Building on Chen's approach, I draw from multiple theories and theoretical models in economics, sociology, organizational theory, and persistence studies in higher education. On economic theory, this study builds on human capital (Becker, 1962, 1980) and price response theory (Heller, 1997; Leslie & Brinkman, 1987), and also incorporates the concept liquidity constraint to examine potential differences in aid effects for low-income student success. From sociology and organizational theory, I mostly draw upon social and cultural capital theory (Bourdieu, 1977, 1986; McDonough, 1997), organizational impact (Berger & Milem, 2000), and resource dependency theory (Pfeffer & Salancik, 1978, 2003). Lastly, the conceptual framework builds on theoretical models and empirical evidence on student persistence and degree attainment (Bean, 1980, 1982; Nora, 2004; Nora & Cabrera, 1996; Tinto, 1987, 1993)

Conceptual Model

The conceptual model for this study builds on Chen's (2008) heterogeneous research approach and the literature in the fields of economics, sociology, organization, and persistence studies in higher education. For the organization of the model, I draw from Titus's (2004, 2006a, 2006c) multilevel approach in that I conceptualize student-level and institutional-level influences on six-year degree attainment. On the student level, I build on theoretical/empirical models (Bean, 1980; Nora, 2004; Tinto, 1993) that have been introduced and tested in the literature and incorporate additional variables based on the literature review. Figure 1 displays the general conceptual model.

--- Insert Figure 1 here (see Appendix) ---

Student-level characteristics and experiences hypothesized to impact the individual's probability of degree completion are displayed in the top section of Figure 1, whereas institutional-level influences are shown in the bottom part. Drawing from conceptualizations in Tinto (1993) and Nora (2004), I organize student-level influences temporally to better reflect the trajectory of students from secondary into postsecondary education. In this model, I incorporate three main phases: pre-college phase, transition from high school to higher education, and college attendance phase. Pre-college characteristics and experiences, and influences during college have been conceptualized in most theoretical/empirical models on persistence and student departure (Bean, 1980; Nora, 2004; Tinto, 1993). The transition phase, in contrast, has not been explicitly theorized; educational commitments and goals have been used to "link" pre-college and college constructs (Nora, 2004; Tinto, 1993). Using a process-oriented perspective and drawing from the

conceptualization of intertemporal linkages in the financial nexus theory (Paulson & St. John, 2002; St. John et al., 1996), which emphasized the importance of financial aspects during the college choice process and later while enrolled, I include the transition phase to better model influences and decisions during this crucial (re)orientation-phase for individuals.

Each of the phases contains multiple variable blocks, representing characteristics, influences, and experiences specific to the individual phase that are hypothesized to affect degree attainment. In addition, each phase incorporates pull factors, hypothesized to negatively impact degree completion, in extension of Bean's (1980, 1982) and Nora's (2004) work. Furthermore, each phase contains economic/financial factors in a separate variable block, to highlight the hypothesized pivotal role of financial aspects in student degree attainment and their intertemporal linkage[2].

The second main section (bottom part) of the conceptual model in Figure 1 shows institutional-level influences on student degree completion. Drawing from organizational impact theory (Berger & Milem, 2000), resource dependency theory (Pfeffer & Salancik, 1978, 2003), and conceptual models in the literature (Oseguera & Rhee, 2009; Titus, 2004, 2006a, 2006c), I incorporate measures that are hypothesized to impact the average institutional probability of degree attainment in three sectors. In contrast to the student level, sectors are not ordered temporally, as measures and characteristics included represent different influential aspects of the normative context that are not causally or temporally linked.

Drawing from previous work, I account for contextual effects, such as institutional control (public or private) and selectivity. These characteristics are incorporated into the structural-demographic sector.

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[2] Intertemporal links are represented through dotted lines in Figure 1.

Drawing from Berger and Milem's (2000) organizational impact model, which in turn builds on organizational behavior theory (Bolman & Deal, 2008), literature on peer group effects and peer climate (Astin, 1993; Weidman, 1989), I incorporate two additional sectors: institutional and peer climate, and organizational behavior. Institutional and peer climate seeks to capture the effects on student degree attainment resulting from shared patterns of organizational life and individuals' perceptions of these patterns. For this, I include measures on institutional size, the share of students that are part-time, share of minority students, and measures for income/SES, such as the share of students receiving federal grants and loans. Scholars interested in the contextual effects of organizational and peer climate have also incorporated student aggregates, based on student-level variables (Arellano, 2012; Oseguera & Rhee, 2009; Titus, 2006a, 2006c). Measures can include, for instance, aggregated levels of academic and social integration, and transfer inclination, which will be tested in this study.

Examining the influence of institutional finances on student outcomes, particularly revenues and expenditure patterns, is a more recent development. Building on Titus's (2004, 2006a, 2006c) work and resource dependency theory (Pfeffer & Salancik, 1978, 2003), I conceptualize the various revenue streams an institution can tap into and expenditure patterns as manipulable and representative of implicit or explicit institutional priorities and relationships with the institution's environment. In other words, I hypothesize that institutional revenues and expenditures can be influenced through administrative and institutional action, and resulting (measurable) patters are an expression of institutional priorities and organizational behavior. To test this, I include price of attendance (logged) and the percent share of tuition and fees of the core revenue on the revenue side. To examine whether expenditure patterns might impact low-income student success, I incorporate a measure for core expenditures per FTE and the share of expenditures dedicated for student services.

Methodology

The purpose of this study is threefold. First, I seek to advance our understanding on the effects of various financial aid elements on six-year degree attainment. For this, I incorporate disaggregated financial aid measures and seek to reduce estimation bias through a quasi-experimental research design. Second, using a nationally representative dataset, I seek to examine institutional/contextual influences on degree completion. Third, in support of recent calls for multi-theoretical perspectives in the study of persistence and degree attainment (Chen, 2008; Goldrick-Rab et al., 2009; St. John et al., 2000), I advance a multi-theoretical framework to examine influential factors at the student and institutional level. The main research questions guiding this study are:

1) What is the influence of various forms of financial aid, particularly subsidized and unsubsidized loans, and need-based and merit-based aid on six-year degree completion for dependent, full-time, low-income students at 4-year institutions?
2) What background characteristics, pre-college and college experiences, and pull factors impact six-year degree completion, after controlling for financial aid received?
3) Accounting for individual-level characteristics, which institutional-level factors influence students' likelihood of degree attainment?

Data Source, Sample, and Dependent Variable

The Beginning Postsecondary Students (BPS:04/09) and IPEDS/Delta Cost Project (DCP) data are the two primary data sources for this study. The BPS:04/09 is a longitudinal, nationally representative database containing detailed financial aid and degree attainment data and information on a variety of individual-level aspects, such as students' background, educational goals, and academic and social experiences in college. Institutional-level data is drawn from

IPEDS/DCP, which contains information on a variety of institutional characteristics, such as size, costs, faculty and staff, and institutional finances.

The full BPS:04/09 dataset is comprised of 18,640 students, of which 16,680 (89.5%) had enough data from the student interviews and administrative sources at the conclusion of the data collection to be classified as BPS:04/09 study respondents. Given the purpose of the BPS, this included a variety of students with multiple educational and occupational pathways, for instance first-time beginners in postsecondary education starting at a 2-year or 4-year institution, studying part-time or full-time.

The sample for this study is restricted to full-time, dependent students who enrolled in bachelor's granting degree programs at 4-year institutions in 2003-04. Given the centrality of financial aid in this study, the sample was further restricted to U.S. citizens and permanent residents; student athletes have been excluded. After applying these data restrictions, the sample contained N=6,561 students at n=651 4-year institutions. Subsequently, the BPS measure INCGRP was used to select low-income students, defined as individuals with family income below $32,000. The final sample for this study encompasses N=1,342 students attending n=351 4-year colleges and universities in the U.S.

The dependent variable is degree attainment status six years after initial enrollment (derived from ATHTYF6Y) and coded (1) for students who received a 4-year degree at the initial institution of enrollment, and (0) for students who did not.

Analytic Approach - Propensity Score Matching and HGLM

To estimate effects on six-year degree completion and minimize endogeneity, I rely on a combination of two statistical approaches. First, I use propensity score matching to reduce endogeneity bias in the estimation of financial aid effects (Rosenbaum & Rubin, 1985; Rubin,

2006). Second, I use hierarchical generalized linear modeling (HGLM) to examine factors impacting degree completion at the student and institutional level and better account for the nested data structure (Raudenbush, Bryk, Cheong, & Congdon, 2004). Integrating these two advanced estimation techniques is a recent phenomenon and a field of increasing scholarly attention (Kim & Seltzer, 2007; Rickles, 2012). For the analyses, I also incorporate adjustments for complex survey designs through the Taylor series linearization procedure in MPlus 7 (Levy & Lemeshow, 2008).

Propensity Score Matching

Propensity score techniques rely upon the counterfactual framework advanced by Neyman (1923) and Rubin (Rubin, 1978, 1979), which builds on the premise that selection bias in observational data can be removed, or at least sufficiently reduced, by eliminating differences between the groups that received and did not receive a treatment (Graham & Kurlaender, 2011). Guo and Fraser (2010) describe the counterfactual as a *potential outcome*, or "the state of affairs that would have happened in the absence of the cause" (p.24). Through the use of the counterfactual, it is possible to make causal inferences from observational data (Shadish, Cook, & Campbell, 2002).

In regard to this study, for a student that received a specific financial aid package (i.e. grants and loans), the counterfactual is the hypothetical impact on six-year degree completion (outcome), had the student *not* received financial aid. In contrast, for a student not receiving financial aid the counterfactual is the potential likelihood of graduating within six years if that student *had* received this form of financial assistance. The treatment in this study is defined as receiving a specific financial aid package, for instance receiving financial aid in the form of

grants-only, compared to not receiving such aid (note: two treatments in form of different aid packages will be examined, which necessitated separate estimations).

According to Rosenbaum and Rubin (Rosenbaum & Rubin, 1985; Rubin, 2006), the propensity score is defined as the conditional probability of an individual of being in the treatment group (receiving aid), given a group of observed covariates. Given the binary nature of the treatment variable (1=receipt of a specific financial aid package; 0=no aid), they suggest using logistic or probit analyses to estimate an individuals' propensity (probability) score for being in the treatment group. The model is described as:

$$e(x_i) = pr(W_i = 1 \,|X_i = \, x_i) \tag{1}$$

where W_i represents the binary treatment ($W_i = 1$ for receiving financial aid, $W_i = 0$ for control condition) for the *i*th student (*i*=1, …; *N*); X_i represents a vector of covariates predicting selection into the treatment group (Guo & Fraser, 2010).

For propensity score estimations, I fit logistic regression models of the following form to the data:

$$P(W_i \mid X_i = \, x_i) = E(W_i) = \frac{e^{\,x_i\beta_i}}{1+\, e^{\,x_i\beta_i}} = \, \frac{1}{1+e^{-x_i\beta_i}} \tag{2}$$

where W_i represents the binary treatment ($W_i = 1$ for receiving financial aid, $W_i = 0$ for control condition) for the *i*th student (*i*=1, …; *N*); X_i represents a vector of conditioning variables, and β_i the vector of regression parameters (Guo & Fraser, 2010).

In selecting the specific predictors to be included in the logistic regression model, the researcher must consider pretreatment factors that may impact selection into the treatment or control group that are also related to the outcome (Graham & Kurlaender, 2011). The treatment in this study is financial aid in the form of two distinct financial aid packages. Thus, various background and socioeconomic characteristics, academic preparation, educational goals, and

precollege factors were included in the estimation model. Variable selection also utilized previous research, for instance Herzog's (2008) propensity score estimation model, which contained first-year college residence, and initial transfer inclination. In total, the propensity score estimation model contained 22 covariates and additional interaction terms (see Table 9, Appendix).

This study uses a reweighting, propensity score approach. In reweighting the dataset, I rely on suggested calculations by Guo and Fraser (2010) and Nichols (2008) to create a weight for the average treatment effect (ATE). The average treatment effect represents the average response to treatment for a random sample from the population. Thus, the ATE effect provides an estimate of the difference in an outcome between individuals receiving a certain financial aid package and individuals that did not receive it among students that had similar probabilities of receiving financial assistance. In other words, the ATE provides an estimate for causal financial aid effect, after biases in the data are reduced or even removed. Beyond the ATE, scholars interested in evaluating policy efficacy frequently assess the average treatment effect for the treated (ATT), which represents the average response to treatment for a sample of individuals that chose (or were assigned) treatment (Guo & Fraser, 2010; Reynolds & DesJardins, 2009). However, due to increasingly small sample size, the ATT was not estimated in this study. The following formula was used to calculate the weight for the average treatment effect:

$$\omega\,(W,x) = \frac{W}{\hat{e}(x)} + \frac{1-W}{1-\hat{e}(x)} \tag{3}$$

where W corresponds to the value of treatment (1,0) and ê(x) represents the propensity score.

The estimation and evaluation of the quality of the propensity score involved multiple steps. For the estimation, STATA's *pscore* command was used, which employs a highly rigorous variable balance test within estimated strata and removes outlying cases. After the final model

was fit for the estimation, the *pstest* procedure was carried to test for variable imbalance before and after reweighting the dataset. Results are presented in Tables 7-8 and show a significant reduction in variable bias for the estimations, indicated by the reduction in mean and median biases. During the estimation, cases too far outside the common support area were removed to improve balance in the data[3]. The common support area for treated and non-treated cases was also inspected visually (see Figures 2-3, Appendix).

After creating final propensity score weights, a series of t-tests was carried out to compare conditional variable means before and after adjustment. For this, variable means were compared for all covariates in the two financial aid package estimations. Detailed results for t-tests between raw and propensity-score-reweighted data are presented in the Appendix.

Hierarchical Generalized Linear Modeling (HGLM)

The main analysis in this study is carried out using a hierarchical generalized linear model (HGLM) approach. In addition to estimating the effects of student-level variables, this technique takes the nested data structure into account and properly estimates the influence of institutional-level characteristics on student degree completion.

Prior research examining persistence and degree completion has frequently ignored the nested structure of students within institutions (Chen, 2008; Hossler et al., 2009), particularly before the year 2000. Only in recent years and through the proliferation of advanced statistical techniques, such as HLM, scholars have begun to account for student-level and institutional-level

[3] Propensity score estimations were carried out on the entire data set (N=6,561), before analytic filters were applied for the examination of effects on low-income student degree completion in later stages. During the PS estimation, cases that contained missing values were listwise deleted, resulting in N=6,430 cases used for the propensity score estimations. After *pscore* estimations, balance tests, and common support area analyses, N=6,419 cases remained in the grants-only treatment (8 strata), and N=6,395 in the grants and loans treatment (7 strata).

influences on these crucial student outcomes (Oseguera & Rhee, 2009; Rhee, 2008; Titus, 2004, 2006a, 2006b).

Hierarchical Linear Modeling (HLM), or multilevel modeling, is an appropriate statistical technique to analyze clustered data. The approach provides a statistical model that allows examination of the distinct effects of individual/student-level and institutional-level variables. For this, HLM separates variance occurring at the various levels in the analysis (Raudenbush & Bryk, 2004). By partitioning the variance—for this study between individuals and institutions—analysts can more accurately identify significant predictors at multiple levels of observations and produce more reliable estimation for standard errors (De Leeuw & Meijer, 2008; Raudenbush & Bryk, 2004).

Given the binary outcome variable in this study, I use hierarchical generalized linear modeling. HGLM, also known as generalized linear mixed models, is a special case of HLM that allows examination of a binary dependent variable, using a Bernoulli sampling distribution and logit link function.

$$\text{Prob}\left(Y_{ij} = \middle| \beta_{ij}\right) = \Phi_{ij}, \tag{4}$$

The level-1 (student-level or within-institution) model is given by:

$$\text{Log}\left[\frac{\Phi_{ij}}{1-\Phi_{ij}}\right] = \beta_{0j} + \beta_{1j} * (\text{Pre} - \text{College})_{ij} + \beta_{2j} * (\text{Transition})_{ij} + \beta_{3j} * (\text{College Experience})_{ij} + \beta_{4j} * (\text{Financial Aid})_{ij} \tag{5}$$

where *i* denotes the individual student and *j* represents the institution. The variable blocks included in the model represent characteristics and experiences at the three main phases of the empirical model: pre-college and background characteristics, measurements on the transition from secondary to postsecondary education, college experiences, and financial aid measures.

In the multilevel model, the intercept in equation (4), β_{0j}, varies between institutions. All other coefficients (β_{1j} through β_{4j}) in this study are restricted to be uniform across all institutions (random intercept model). Thus, a student's average likelihood of degree completion is hypothesized to depend on institutional context and organizational behavior variables; effects of student-level measures (i.e. college experiences, financial aid) are assumed to be the uniform across all institutions.

The level-2 (institution-level or between-institution) model is represented by:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * (\text{Structural} - \text{Demographic})_{ij} + \gamma_{02} * (\text{Peer/Institutional Climate})_{ij} + \gamma_{03} * (\text{Organizational Behavior})_{ij} + u_{oj} \quad (5)$$

where *j* denotes the institution, γ_{00} represents the average likelihood of degree completion across all institutions, and u_{oj} the random variance component for institution j. The variables included in the institutional-level describe how the context at 4-year colleges and universities affect the student's average likelihood of completing a bachelor's degree within six years. These variables include structural-demographic, peer/institutional climate, and organizational behavior measures, and were sequentially entered into the analysis.

For the final analyses, I ran separate models for the two aid packages under consideration (grants only, grants and loans). Within these groups, I ran separate analyses on the unmatched (non-propensity-score-reweighted) data, and analyses using ATE weights. Due to small sample size, ATT results could not be estimated if only low-income students were selected. For ease of interpretation, results will be reported as delta-P statistics (d-P) (Cruce, 2009; Petersen, 1985).

Limitations

There are multiple limitations to this study. First, like all secondary data analysis, this study is limited by the availability of variables in the dataset, and sample size. Despite the inclusion of additional pre-college experience variables and measures for educational goals, social and academic experience measures in the latest version of the BPS, the survey is predominantly designed to examine financial and economic aspects in the context of postsecondary education. Thus, detailed measures on the individual's specific college experience, validation experiences, peer climate measures, and psychological aspects are largely absent. Further, due to the design of this study, only first-year college experience measures were included. This limits the extent to which more profound institutional and contextual effects that can occur later in an individual's college experience may influence the likelihood of degree completion.

Second, this study, as many others, is limited by missing data both at the student and institutional level. Although less problematic at the student level through rigorous imputation methods carried out by NCES, the combination of three sources of data for this analysis containing missing cases each, results in a reduced number of observations. In addition, during the propensity score estimation, cases too far removed from the common support area were identified and excluded from final estimations, which reduced the number of cases even further.

Third, even though a propensity score matching technique has been employed in this study, which has been shown to significantly reduce estimation bias, endogeneity may not have been fully removed. For this, a true experiment with full randomization would have to be carried out. Further, despite a broad theoretical and empirical model that incorporated essential variables such as students' educational aspirations, goals, and academic performance in addition to

background and socio-economic measures, omitted variable bias may still influence estimation results. Given the restrictions of the dataset, latent constructs such as an individual's motivation, which can influence both the likelihood of financial aid receipt and degree attainment, may not be fully assessed with the variables included in this study.

Lastly, this study has to acknowledge that the field of statistics and empirical estimation techniques, like any other area of scholarly attention, is imperfect and constantly evolving. Methodologies at the intersection of causal inference with propensity score methods, multilevel modeling, and complex survey data are still in their infancy and lack reliable theoretical and empirical backing. Thus, estimations and techniques used in this study may be obsolete within a short period of time, as technology and our knowledge on these important topics evolve.

Results

Descriptive Statistics

The overall six-year degree completion rate for dependent, full-time students that enrolled in a bachelor's degree program at a 4-year institution in 2003-04 was 59.8%. However, this aggregate masks an important underlying trend. When assessing degree attainment rates across income groups (see Table 1, Appendix), the data show that only 46.0% of the students coming from low-income backgrounds obtain a degree within six years at their initial institution of enrollment. This compares to 55.6% for lower-middle-income students, 62.1% for upper-middle-income students, and 70.2% for their high-income peers.

The data also show that more women attend 4-year institutions as full-time, dependent students. Women are slightly higher represented among low income and lower-middle income students with 57.8% and 59.5%, respectively. Gender distribution among upper-middle and high-income students is somewhat more balanced, with 55.4% and 53.2%, respectively.

In regard to race/ethnicity, more than three-fifth (70.3%) of the population are White, compared to 8.6% African American, 10.1% Latino/a or Hispanic, 5.8% Asian, and 5.2% students identifying as other race/ethnicity. African American, Latino/a, and Asian students are more concentrated in the low and lower-middle income groups. Generally, representation declines for these racial/ethnic groups as income increases; from 20.5% to 2.7% for African Americans, 22.6% to 5.0% from Latino/as and Hispanics, and 10.5% to 4.3% for Asian students across the four income groups.

Student-Level Influences

It was hypothesized that various measures and characteristics during the pre-college, transition, and college attendance phase would predict the outcome variable. In addition to the financial aid measures, which will be discussed in the subsequent section, there are eight student-level (level-1) variables statistically significant in the final model; two pre-college, three transition, and three college experience measures. All results are reported in Table 5 (see Appendix).

Pre-College Phase

Among low-income students' background characteristics tested in the model, only two produce significant results – parental education level and academic preparation, measured through GPA in high school. Parental education and having at least on sibling in college were conceptualized as social capital measures (Bourdieu, 1986), and were found influential in previous studies (Dika & Singh, 2002). Results in this study show that students whose parents hold a Master's degree or higher are 17.24% ($p<.05$) more likely to graduate within six years (reference group Bachelor's degree). Although sibling status did not yield significant results, the strong positive effect for parental education provides further support to the notion that, once other

influences are controlled for, social and cultural capital is highly influential on student success in higher education.

In regard to other socio-demographic characteristics, none of the tested measures for age, gender, race/ethnicity, and English as primary language yielded significant results. Once pre-college, transition, college experience, and financial aspects are accounted for, demographic background does not seem to influence the likelihood of degree attainment for low-income students. Although not the primary interest in this study, this is a very interesting finding, as previous research that specifically examined six-year degree completion found minority students to be significantly less likely to obtain a degree (DeAngelo, Franke, Hurtado, Pryor, & Tran, 2011; Titus, 2006a) or women to be more likely to graduate than men (Astin & Oseguera, 2005; Pascarella & Terenzini, 2005).

Pre-college academic preparation and high school background have been found influential on student persistence and degree completion in much of the literature (Astin, 1993; Pascarella & Terenzini, 2005), thus were included in this study. Results in the final model show, however, that once pre-college, transition, and college experience measures are controlled for, only high school grade point average (GPA) remains a significant predictor of degree completion for low-income students. For every one-point increase in high school GPA, students are 8.78% ($p<.001$) more likely to graduate within six years. This generally shows the importance of the K-12 system – even though other measures for high school preparation did not produce significant results – and confirms that prior academic achievement and adequate preparation at secondary level is highly predictive of success in postsecondary education. However, it also shows that admissions test scores are less predictive of degree completion, once other measures have been accounted for.

A less examined relationship in the literature on persistence and degree completion is the impact of family wealth. Based on recent empirical work that hypothesizes an independent

impact of family wealth on degree attainment (Jez, 2010; F. T. Pfeffer, 2011), I tested the effects of a measure indicating whether students' parents owned investment greater than $10,000. However, results in this study show no significant effects for low-income students.

Transition from High School to Higher Education

During this phase, four variable blocks are entered into the analysis, educational goals, school choice and institutional commitment, pull factors, and economic/ financial influences. Educational aspirations and goals have been found influential on student outcomes such as persistence and degree completion (McDonough, 1997, 2005; Reed, 2011; Walpole, 2003, 2007), thus were incorporated in this study. Given the importance of educational aspiration, I have included four aspiration indicators and two variables that seek to assess students' overall educational goals, based on previous findings in the literature. Results show, students with aspirations to the doctorate are significantly more likely to graduate with a Bachelor's degree. Low-income students with such high educational aspirations are 19.14% ($p<.01$) more likely to graduate within six years, when compared to their peers who aspire to the baccalaureate. In combination with the strong positive effect found for parental education, this appears to be another indication for the importance of social and cultural capital for student success.

Previous work has also shown that students who seek to live close to their family/relatives, or seek to attend higher education for financial reasons and economic advancement are more likely to persist or graduate (Astin & Oseguera, 2005). Examining the results in this study, however, I find no significant relationship on the likelihood of degree completion.

To capture the impact of institutional commitment (or lack thereof) towards attending a specific institution, as hypothesized in the literature (Hossler, Braxton, & Coopersmith, 1989;

Nora, 2004; Nora, Barlow, & Crisp, 2005; Tinto, 1987, 1993), I incorporated measures for the reason students chose their particular college and a variable for transfer intentions. Results in Table 5 show, only the measure for transfer plans yielded significant results, with transfer-inclined students being 21.48% ($p<.001$) less likely to graduate from the same institution within six years. This result, and particularly the magnitude of the effect, are astounding and generally confirm the negative influence on degree attainment that has been previously found in the literature (DeAngelo et al., 2011; Oseguera & Rhee, 2009). Although, the measure used does not provide any information on the reason students held transfer intentions or what their particular alternative plans were (transfer to another 4-year institution, transfer to a 2-year or other institution, or leave higher education entirely), the finding in this study underscores the importance of measuring students' initial goals and commitments.

Two measures were included into the model that sought to capture influences leading to student departure, based primarily on Bean's (1980) and Nora's (2004) conceptualization of pull factors. Of the two, only one measure showed initial significant results – whether parents expected students to work while enrolled in college. Interestingly, results show that low-income students who indicated such parental expectations are 12.90% ($p<.05$) more likely to graduate. The positive directionality of the result is very intriguing and necessitates further inquiry.

Based on St. John's et al. (1996) financial nexus theory, I also incorporated a variable that measured whether students chose the institution they attended for financial reasons or affordability in general. As conceptualized in the nexus theory, financial aspects – tuition and fees, cost of attendance, financial aid – are weighed during the college choice process and proponents of the theory point towards the importance of congruence or fit to foster persistence and degree completion, and inter-temporal linkages of economic factors. Other studies have

confirmed such a relationship (Paulsen & St. John, 1997, 2002; St. John et al., 2005). However, results in this study show no significant impact for low-income students.

College Attendance Phase

Based on the conceptual framework guiding this study, three variable blocks were simultaneously inserted at this phase – measures seeking to capture students' academic and social experiences, pull factors, and financial aid measures.

Students' academic and social experiences during college are key elements in theories on college impact, persistence, and degree completion drawn upon for this study. Based on early conceptualizations (Bean, 1980, 1983; Tinto, 1976, 1983) and empirical studies that have been conducted over the past decades, this study incorporated eleven measures for the social and academic integration dimension. In particular, I sought to estimate the effects from students' living arrangements, formal academic interactions, social integration and volunteering, major, and academic performance in the first year.

Consistently, students' living arrangements have been found to be influential on multiple measures of student success (Adelman, 1999, 2006; Astin, 1993; Tinto, 1993). Examining the effect on six-year degree completion in this study, results show that living on campus is also one of the strongest positive predictors for low-income students. Individuals living on campus in their first year, opposed to off-campus housing, are 16.43% ($p<.01$) more likely to graduate with a bachelor's degree. This finding highlights the immensely important role that living on-campus plays in integrating students into collegiate life.

Aspects of students' academic and social integration were examined through a combination of two composite indices, derived from multiple survey items in the BPS:04/09, and three additional measures. However, none of the predictors hypothesized to influence student

degree attainment showed significant results in the estimation. This finding is in accordance with reviews in the literature that found little to no support for the impact of academic integration on student outcomes (Braxton & Lee, 2005; Braxton, Shaw Sullivan, & Johnson, 1997). Only academic performance, expressed through students' grade point average in the first year, is found highly predictive of degree attainment. In the final model, for every one-tenth increase in college GPA, students are 2.34% ($p<.001$) more likely to graduate. Thus, for a full digit increase in GPA (measured on a 5-point scale), students are 23.40% more likely to obtain a bachelor's degree within six years. This finding substantiates the importance of academic performance during the first year – a time students get acquainted with their new environment – for long-term college success. Assessing one's own potential to succeed and, subsequently, the weighing of the likelihood to obtain a bachelor's degree at the institution attended appears to be a highly influential determinant of overall degree attainment.

Two pull factors were considered to be influential for students while in college – time spent working and distance the college is away from home. Interestingly, results show no significant negative impact even for students working more than 20 hours, contradicting findings in the literature (Cuccaro-Alamin & Choy, 1998; Titus, 2006a). Another interesting finding is the result for distance from home. For every percent increase in the distance between the college attended and an individual's home, low-income students are 3.57% ($p<.05$) less likely to obtain a degree. Although the focus of this study is whether students graduated from their initial institution of enrollment, and results do not reveal whether students transferred to another institution and graduated within the same timeframe, this is an import finding, particularly from an institutional perspective, and further research is required to determine specific effects and possible causes.

Financial Aid Results

Tables 3 and 4 (see Appendix) list the estimated influence of various forms of financial aid on six-year degree attainment for low-income students. The tables display effects for students receiving two different aid packages – grants only, and grants and loans. Parameter estimates are presented in a way that decomposes the treatment effect so that potential selection bias associated with the receipt of aid can be assessed. For this, results are presented in the 'unmatched' column for HGLM estimations without matching students on the propensity of aid support. The second main column in Tables 3 and 3 displays estimates for the average treatment effect (ATE), which controls for selection bias via propensity score estimation and reweighting techniques.

ATE parameters are estimated using a survey-adjusted HGLM estimation model. The model includes controls for student and institutional level characteristics, shown in the final model in Table 5. In addition to pre-treatment measures that have been used in the estimation of the propensity scores, the estimation incorporates all transition and college experience variables, as well as institutional structural-demographic, context/climate, and organizational behavior measures.

Grants-only Financial Aid Package (Treatment 1)

Results in Table 3 for the average treatment effect suggest that, for low-income students receiving a grant-only aid package, need-based grants positively influence degree attainment. For students with limited financial means to attend higher education, receiving need-based aid that does not have to be repaid, substantially increases their chances to obtain a bachelor's degree within six years. For every $1,000 dollar increase in aid received in federal grants, individuals are 2.82% ($p<.05$) more likely to graduate. For every $1,000 they receive additionally in state and institutional need-based aid, their probability of degree attainment increases by 2.40% ($p<.05$)

and 1.62% ($p<.01$), respectively. Comparing ATE results to parameter estimations in the unmatched sample show results are relatively comparable. However, effects in the unmatched estimation for need-based grants from federal and state sources are marginally underestimated; 2.72% compared to 2.82% (ATE) for federal grants and 2.17% compared to 2.40% (ATE) for state grants, respectively. In contrast, effects for institutional need-based grants in the unmatched estimation are underestimated, with 1.77% compared to 1.62% (ATE) for every additional $1,000 received.

Overall, these results confirm the positive impact of grant aid for low-income students presented in Singell (2004). None of the other financial aid elements showed significant results for this students group, receiving only grants in their financial aid package, underscoring the importance of need-based grant aid to increase low-income students' chances of college completion.

Grants and Loans Financial Aid Package (Treatment 2)

To extend the analysis to students who borrowed money to finance their college degree – an ever-increasing share of the student population – the impact of aid is estimated for freshmen that received grants *and* loans in their financial aid package. Parameter estimates are presented in Table 4. Results show that low-income students, similarly to the grants-only estimation, appear to receive the highest benefits from need-based grant aid. Effect sizes are comparable to the previous estimation, with students who receive an additional $1,000 in state and institutional need-based grants being 2.59% ($p<.01$) and 1.31% ($p<.05$), respectively, more likely to graduate in six years. Although marginally not significant in the ATE estimation for low-income students, federal grant aid increases students' chances to complete college by 2.52% ($p=.059$).

Among the various tested loan categories, the only measure found influential for students from low-income backgrounds is unsubsidized Stafford loans. Results in Table 4 reveal a comparatively large, negative association with the outcome measure. For every $1,000 in additional money borrowed in unsubsidized loans, low-income students are 5.66% ($p<.01$) less likely to graduate within six years. No other form of student loans is found significant in this estimation. As hypothesized, the high costs associated with this form of financial assistance and the relatively low value when compared to other forms of aid, particularly grants and subsidized loans, has detrimental effects on student success for individuals from low-income backgrounds. To illustrate the magnitude of this finding: The positive effect that would result from increasing a low-income student's aid package by $1,000 in federal, state, and institutional grant aid each (total of $3,000) would be undone through the negative effect of taking out an additional $1,134 in unsubsidized Stafford loans.

Similar to the estimation for students receiving only grants (treatment 1), unmet financial need is not found to significantly impact the likelihood of degree completion for low-income students, although only marginally. In contrast to previous findings in the literature (Titus, 2006a), after accounting for all financial aid received and other student-level and institutional-level measures, this study shows no effect for unmet student need.

Institutional-Level Influences

Based on previous research, measures hypothesized to influence degree attainment at the institutional level were grouped into three main blocks. Two institutional characteristics were tested in the structural-demographic block: institutional control and selectivity. Results in Table 5 show that attending a private institution does not influence the average likelihood of degree attainment. Although positive effects for private institutions have been documented in the

literature on four-year degree attainment (Oseguera & Rhee, 2009; Titus, 2004, 2006a), results in this study show no impact on six-year completion rates.

Similarly, institutional selectivity is not found to significantly influence degree attainment for low-income students. Estimates show that individuals attending high or low selectivity institutions, compared to moderate selectivity, are not found significantly different in their propensity to obtain a degree within six years. These results contradict scholarly work that found selectivity (in general) influential on students' likelihood of degree completion (Oseguera & Rhee, 2009; Titus, 2004, 2006a).

The second variable block at the institutional level sought to capture effects of institutional context and peer climate. Institutional size (measured through enrollment) has been found influential on student success in previous research (Berger & Milem, 2000; Blau, 1994) and I hypothesized a positive association with the outcome measure. However, results show no significant difference for this variable. Results further show that of the remaining context measures, only the share of students enrolling part-time is found to significantly impact student degree attainment. For every percent increase in the share of part-time students on campus, the average likelihood of degree completion decreases by .47% ($p<.05$). Other measures, such as the percent of minority enrollment, and the percent of students receiving federal grants or loans were not found statistically significant. These findings are interesting insofar as none of the more direct measures for institutional-level social and cultural capital produced significant results, after student-level variables have been controlled for in the estimation. Only increased part-time student attendance appears to negatively influence campus and peer climate, so that average likelihood of degree completion for students attending such a college or university are adversely affected. It could be argued that these effects might be influenced by the financial strength of an

institution. However, negative effects remain significant even after revenue and expenditure measures are incorporated in the final model.

Based on Berger and Milem's (2000) conceptualization and subsequent work (Oseguera & Rhee, 2009; Titus, 2004, 2006a), I included aggregated student-level measures (peer aggregates) in the model that were assumed to impact the outcome measure. Specifically, I hypothesized that aggregated transfer plans, and academic and social integration assert an influence on student degree attainment. Results in Table 5 show that only the aggregated academic integration measure is found significant. For every one-point increase on the aggregated academic integration index for an institution, low-income students are 3.11% (p=.05) less likely to graduate within six years. This finding is interesting in that it appears somewhat counterintuitive and contradictory to the frequently discussed notion of academic integration at the individual level (Tinto, 1993), thus necessitates further inquiry.

The last variable block at the institutional level examines the influence of institutional prioritization in revenue generation and expenditures, based on resource dependency theory and previous conceptualization in the literature (Titus, 2004, 2006c). Previous studies have found that the share of revenues generated from tuition and fees, positively influences persistence. In this study, I examined the effect of the share of tuition and fees in core revenues. Additionally, I hypothesized that price of attendance (logged) influences the likelihood of degree attainment. In regard to aspects of institutional expenditures, I included a measure for core expenditures per full-time equivalent student (logged) and a variable intended to capture institutional prioritization of student success (percent share of expenditures spent on student services). However, none of the four measures for revenues and expenditures yielded significant results.

Discussion

Assessing financial aid-related influences for low-income students, this study finds that need-based grants from all sources increase chances to complete a degree within six years, whereas unsubsidized (federal) loans are found to drastically lower chances to obtain a degree. More specifically, federal grant aid is found to increase the chances for low-income students to graduate between 2.52% and 2.82% for every $1,000 in additional aid, the largest positive financial aid factor. Effects for state need-based grants are only marginally smaller, increasing the likelihood to graduate between 2.40% and 2.59%. For an additional $1,000 in institutional need-based grants, results show that students have a 1.31% to 1.62% higher chance to obtain a baccalaureate degree. Interestingly, merit grant aid from state or institutional sources and other/outside grants are not found significant in the estimation.

The results show that for students coming from the lowest income backgrounds, need-based grants do have a large impact on their chances to graduate. In particular, federal and state need-based grants are found most influential, with the former showing even slightly larger positive effects. These results and effect sizes confirm findings for grant aid found in the literature (Alon, 2007; Singell Jr, 2004), although these studies did not test such nuanced aid measures. However, it contradicts recent findings that showed no impact of grant aid on persistence rates for low-income students (Herzog, 2008).

The second important finding in regard to financial aid and low-income students is the result for unsubsidized loans. Results confirm the hypothesized negative influence on degree completion, as students who receive an additional $1,000 in unsubsidized (Stafford) loans are 5.66% less likely to graduate within six years – the only negative factor for all aid estimations. Subsidized federal loans and loans from other sources are not found significant in the analyses.

Liquidity constraints on the part of low-income students may cause this effect and would also help explain the strong positive influence found for need-based grants, as these directly reduce the costs students pay to attend college. Also, these results provide evidence for different rates of price elasticity among students from various income backgrounds, with poorer students generally more sensitive to price changes and more affected by higher costs of borrowing. Certainly, more research is needed to explore the reason *why* this may be the case, and explore possible ways to reduce the detrimental effects reported in this study.

In regard to *institutional influences*, it was hypothesized that structural-demographic characteristics would have a strong influence on six-year degree attainment, as some of the variables included have emerged as significant in previous studies (Astin & Oseguera, 2005; Oseguera & Rhee, 2009; Titus, 2004, 2006a). However, results reported in this study did not confirm hypothesized relationships, as institutional control and selectivity are not found influential on student degree completion. This provides support, however, for recent findings showing that attending a private college or university is beneficial for degree completion within four years, but may not affect the likelihood to graduate within six years (DeAngelo et al., 2011; Oseguera & Rhee, 2009; Titus, 2006a). Thus, low-income students attending a public and/or highly selective institution are not more or less likely to graduate with a baccalaureate degree within six years when compared to peers at other colleges or universities.

Of the eight measures on institutional and peer climate included, two were found significant in the final model. With the measures incorporated in this sector, I sought to capture contextual influences that are less tangible, yet are hypothesized to be highly influential on student persistence and degree completion (Berger & Milem, 2000; Hurtado, 2001; Hurtado, Milem, Clayton-Pedersen, & Allen, 1998, 1999; Oseguera & Rhee, 2009). Both, the share of students attending part-time and the aggregated academic integration index significantly reduce

students' chances to graduate within six years by .47% and 3.11%, respectively. Particularly the negative effect for aggregate academic integration and low-income student success is troublesome and necessitates further investigation.

Measures for organizational behavior were inserted last into the model. Drawing from theoretical models in the literature and resource dependency theory (J. Pfeffer & Salancik, 2003; Titus, 2004), I hypothesized that institutional revenue and expenditure patterns affect student degree attainment. However, of the measures tested, none were found to significantly predict degree completion. This is somewhat surprising, as previous research (Titus, 2006c) showed significant influences in student success.

Conclusion and Implications

Educational attainment is important both at the individual and societal level. For the individual, obtaining a baccalaureate degree increasingly becomes a necessity for personal advancement and upward mobility. Among other things, bachelor's degree holders have access to a much broader job market and enjoy significantly higher lifetime earnings when compared to individuals with associate's degrees or less. At the same time, educational attainment is a pivotal element for economic advancement, and the U.S. economy relies on higher education institutions to provide the college graduates and knowledge workers needed to remain competitive in the global marketplace. And yet, America lost ground and educational attainment continuously declined over the past decades.

This study examined factors that influence low-income student degree completion. Results have implications at the federal, state, and institutional level. First, financial aid effects found in this study provide further evidence that need-based grant programs are effective in fostering low-income student success, and respective programs at the federal and state level

should be strengthened. This is particularly important for current discussions on the future of the federal PELL program and in preparation for the reauthorization of the Higher Education Act. State policy makers contemplating further cuts to higher education and aid programs should weigh the long-term effects on the state's economy when reducing funding for crucial need-based aid programs.

Second, the large negative effect found for unsubsidized federal loans on degree attainment is important for the discussion on loan programs and interest rates, and provides evidence that rates should be kept low. Given the results in this study, unsubsidized loans seem not only detrimental for low-income students' chances to graduate, they also appear to be inefficient as they counteract positive effects found for need-based grants. Based on presented estimations, the negative effects of unsubsidized loans outweigh the positive impact of federal grant aid, roughly by a ratio of 2.25:1. Thus, for every $2.25 spent additionally in federal grant assistance, positive effects on degree attainment for low-income students are undone by borrowing just $1 in unsubsidized loans. Although more research is required, practitioners and policy makers should reconsider the practice of allocating unsubsidized loans to these students.

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Table 1:
Selected Descriptive Statistics - Full-time, Dependent Students Enrolled at 4-Year Institutions (Percent)

	All Students	Income Groups			
Variable	(N=6,561)	Low (N=1,342)	Lower-Middle (N=1,575)	Upper-Middle (N=1,665)	High (N=1,979)
DV: Six-year degree completion	59.8	46.0	55.6	62.1	70.2
Gender: Female	56.2	57.8	59.5	55.4	53.2
White	70.3	41.2	68.5	79.5	83.2
African American	8.6	20.5	9.4	5.3	2.7
Latino/a or Hispanic	10.1	22.6	10.6	6.0	5.0
Asian	5.8	10.5	5.8	3.9	4.3
Other Race/Ethnicity	5.2	5.1	5.7	5.3	4.7
English is primary language	90.0	74.5	89.7	95.2	96.1
Grants only financial aid pkg.	24.7	27.8	21.3	21.1	28.4
Grants and loans in financial aid pkg.	21.3	33.4	26.7	17.7	12.2

Note: Weighted with normalized BPS:04/09 study respondents weight (WTA000). Numbers reflect full-time, dependent students, enrolled in a Bachelor's degree program at 4-year institutions in the U.S. International students and student athletes are excluded.

Table 2:
Average, First-Year Financial Aid Amounts and Student Need

	All Students	Low-Income	Financial Aid Pkg. Received, All Students (Treatment)	
			(1) Grants only	(2) Grants & Loans
Variables	(N=6,561)	(N=1,342)	(N=1,620)	(N=1,397)
Federal need-based grants (Pell, SEOG, other)	924	3,323	890	1,528
State need-based grants	585	1,305	530	866
Institutional need-based grants	1,292	1,453	801	1,515
State merit grants	221	189	456	221
Instititutional merit grants	1,412	915	2,111	1,512
Outside grants (priv. and employer)	574	518	1,017	673
Federal subsidized loans (Stafford, Perkins)	1,127	1,775	-	2,078
Stafford unsubsidized loans	532	479	-	1,177
Private (altern.) loans	369	303	-	695
Unmet need (after EFC and all aid)	3,122	5,156	3,507	2,877

Note: Data weighted by normalized WTA000 weight.

Table 3:

HGLM Parameter Estimates Financial Aid on Six-Year Degree Completion for Low-Income Students, Treatment 1 (Grants)

Low Income (<$32,000)	Raw Scores (Unmatched) N=1,342					Average Treatment Effect (ATE) N=1,205				
	C	SE	t	p	d-P	C	SE	t	p	d-P
Fed. need-based grants ($1,000)	0.117	0.052	2.239	0.025 *	2.78	0.119	0.058	2.040	0.041 *	2.82
State need-based grants ($1,000)	0.091	0.045	2.030	0.042 *	2.17	0.101	0.048	2.133	0.033 *	2.40
Instit. need-based grants ($1,000)	0.074	0.023	3.266	0.001 **	1.77	0.068	0.025	2.771	0.006 **	1.62
State merit grants ($1,000)	0.074	0.091	0.807	0.420		0.036	0.102	0.354	0.723	
Instit. merit grants ($1,000)	0.009	0.034	0.266	0.790		0.005	0.037	0.146	0.884	
Outside grants ($1,000)	0.003	0.045	0.058	0.954		-0.003	0.048	-0.067	0.947	
Unmet need ($1,000)	0.026	0.012	2.121	0.034 *	0.62	0.023	0.014	1.604	0.109	

* p<.05, ** p<.01, *** p<.001

Note: Parameters estimated using student-level and institutional-level covariates (see final HGLM model).

Table 4:

HGLM Parameter Estimates Financial Aid on Six-Year Degree Completion for Low-Income Students, Treatment 2 (Grants and Loans)

Low Income (<$32,000)	Raw Scores (Unmatched) N=1,342					Average Treatment Effect (ATE) N=1,209				
	C	SE	t	p	d-P	C	SE	t	p	d-P
Fed. need-based grants ($1,000)	0.098	0.054	1.834	0.067		0.106	0.056	1.887	0.059	2.52
State need-based grants ($1,000)	0.113	0.046	2.439	0.015 *	2.82	0.109	0.046	2.361	0.018 *	2.59
Instit. need-based grants ($1,000)	0.068	0.028	2.440	0.015 *	1.69	0.055	0.025	2.210	0.027 *	1.31
State merit grants ($1,000)	0.088	0.095	0.927	0.354		0.095	0.098	0.967	0.334	
Instit. merit grants ($1,000)	0.005	0.040	0.127	0.899		-0.008	0.035	-0.236	0.813	
Outside grants ($1,000)	0.014	0.047	0.293	0.770		0.003	0.049	0.058	0.953	
Federal subsid. loans ($1,000)	0.072	0.054	1.336	0.182		0.076	0.053	1.436	0.151	
Stafford unsubsid. loans ($1,000)	-0.226	0.073	-3.105	0.002 **	-5.54	-0.231	0.077	-2.997	0.003 **	-5.66
Private loans ($1,000)	0.073	0.055	1.309	0.190		0.053	0.065	0.815	0.415	
Unmet need ($1,000)	0.029	0.017	1.717	0.086		0.028	0.014	1.960	0.050	0.67

* p<.05, ** p<.01, *** p<.001

Note: Parameters estimated using student-level and institutional-level covariates (see final HGLM model).

Table 5:
HGLM Model Results Predicting Six-Year Bachelor's Degree Completion for Low-Income Students

Independent Variable	Model 6 - Final (N=1,342)				
	C	SE	p		d-P
Student-Level Variable (Level 1)					
Pre-College					
Demographic					
Age: 19+ years	-0.078	0.170	0.646		
Gender: Female	0.241	0.160	0.133		
African American (White)	-0.030	0.271	0.912		
Latino/a or Hispanic (White)	-0.287	0.346	0.407		
Asian (White)	-0.138	0.401	0.731		
Other Race/Ethnicity (White)	-0.591	0.449	0.188		
English is primary language	-0.049	0.291	0.868		
Parental educ: HS or less (BA)	0.174	0.253	0.492		
Parental educ: AA degree (BA)	-0.093	0.236	0.693		
Parental educ: MA or higher (BA)	0.697	0.303	0.021	*	17.24
Parents: Single parent (Married)	-0.380	0.293	0.195		
Parents: Div./sep./wid. (Married)	-0.082	0.199	0.681		
Sibling in college	0.305	0.208	0.142		
Academic Preparation					
Admission test scores	-0.036	0.064	0.567		
High school GPA	0.352	0.090	0.000	***	8.78
Earned college credits in HS	0.179	0.190	0.345		
4 yrs of English in HS	-0.323	0.209	0.122		
4 yrs of Math in HS	0.154	0.196	0.433		
Economic/Financial Factors					
Parents own investment >$10k	0.353	0.224	0.115		
Transition					
Educaitonal Goals					
Master's degree aspiration (BA)	0.150	0.224	0.504		
Doctorate aspiration (BA)	0.775	0.293	0.008	**	19.14
Prof. degree aspiration (BA)	-0.060	0.349	0.863		
Goal: Be financially well off	-0.148	0.216	0.493		
Goal: Live close to relatives	0.114	0.183	0.533		
School Choice & Institutional Commitment					
Chose institution b/c of coursework	-0.307	0.184	0.096		
Chose institution b/c of reputation	-0.007	0.197	0.972		
Chose institution b/c of location	-0.080	0.193	0.678		
Plan to transfer	-0.920	0.267	0.001	**	-21.48
Pull Factors					
Chose institution for personal/family reasons	-0.231	0.179	0.199		
Parents expected to get a job	0.519	0.243	0.032	*	12.90
Economic/Financial Factors					
Chose inst. for financial reason	-0.071	0.174	0.681		
College					
Academic and Social Experiences					
Live on campus	0.669	0.235	0.004	**	16.43
Acad. integration index	0.043	0.023	0.062		
Social integration index	-0.009	0.022	0.698		
1-10 hrs volunteering (no volunt.)	-0.123	0.199	0.538		
11-20 hrs volunteering (no volunt.)	-0.622	0.318	0.051		
20+ hrs volunteering (no volunt.)	-0.348	0.331	0.293		
Major declared	0.248	0.203	0.222		
GPA in first year	0.094	0.013	0.000	***	2.34
Any remedial courses taken	0.212	0.215	0.324		
Pull Factors					
1-10 hrs working (not working)	-0.226	0.277	0.414		
11-20 hrs working (not working)	0.135	0.262	0.606		

Independent Variable	Model 6 - Final (N=1,342)			
	C	SE	p	d-P
20+ hrs working (not working)	-0.309	0.333	0.353	
Distance from home	-0.145	0.062	0.019 *	-3.57
Economic/Financial Factors				
Fed. need-based grants	0.098	0.054	0.067	
State need-based grants	0.113	0.046	0.015 *	2.82
Instit. need-based grants	0.068	0.028	0.015 *	1.69
State merit grants	0.088	0.095	0.354	
Instit. merit grants	0.005	0.040	0.899	
Outside grants	0.014	0.047	0.770	
Federal subsid. loans	0.072	0.054	0.182	
Stafford unsubsidized loans	-0.226	0.073	0.002 **	-5.54
Private (altern.) loans	0.073	0.055	0.190	
Unmet need (after EFC and aid)	0.029	0.017	0.086	
Institutional-Level Variables (Level 2)				
Structural-Demographic				
Control: Private	0.352	0.34	0.301	
High selectivity (Mod. selectivity)	0.307	0.237	0.195	
Low selectivity (Mod. selectivity)	0.096	0.269	0.721	
Institutional Context and Climate				
Inst. size/enrollment	0.105	0.123	0.394	
Pct. minority enrollment	0.005	0.005	0.323	
Pct. part-time enrollment	-0.019	0.008	0.022 *	-0.47
Pct. receiving federal grants	-0.012	0.010	0.233	
Pct. receiving loans	0.004	0.006	0.544	
Peer Aggregates				
Transfer plans	-0.006	0.007	0.391	
Acad. integration index	-0.126	0.064	0.050 *	-3.11
Social integration index	0.081	0.05	0.104	
Organizational Behavior - Revenues and Expenditures				
Price of attendance, logged	-0.329	0.460	0.475	
Tuit & fees as pct. of core reven.	-0.001	0.007	0.912	
Core expend./per FTE, logged	-0.235	0.248	0.343	
Pct. stud. services share of exp.	-0.021	0.017	0.221	
Threshold	0.722	0.594	0.224	
Variance Component	0.161	0.171	0.348	
Loglikelihood	-532.42			
AIC	1216.84			
BIC	1592.59			
Explained Variance at Level-2[1]	0.72			

* p<.05, ** p<.01, *** p<.001

Note 1: Based on calculation using uncoditional model variance component.

Notes: Refence groups are displayed in parentheses.

Analysis of BPS:04/09. Final sample includes N=1,342 low-income students, and n=351 institutions.

Student and institutional-level data weighted by disaggregated WTA000 weight.

Table 6:
Descriptive Statistics, Low-Income Students (N=1,342)

Variable	Min	Max	Mean	S.D.
Financial Aid Packages				
Grants only financial aid pkg.	0	1	.25	.43
Grants and loans in financial aid pkg.	0	1	.21	.41
Dependent Variable				
DV - 6-year degree completion	0	1	.46	.50
Student-Level Variables				
Age: 19 years or older	0	1	.36	.48
Gender: Female	0	1	.58	.49
White	0	1	.41	.45
African American	0	1	.21	.40
Latino/a or Hispanic	0	1	.23	.42
Asian	0	1	.10	.31
Other Race/Ethnicity	0	1	.05	.22
English is primary language	0	1	.75	.44
Parents own investment >$10,000	0	1	.19	.40
Parental Education				
High school or less	0	1	.39	.49
Associate degree or some college	0	1	.29	.45
Bachelor's degree	0	1	.21	.45
Master's degree or higher	0	1	.13	.33
Family Status				
Married	0	1	.44	.43
Single parent	0	1	.13	.33
Divorced/separated/widowed	0	1	.43	.50
Sibling in college	0	1	.22	.41
Admission test scores (ACT or SAT; 100)	4.20	16.00	9.74	1.93
Earned college credits in high school	0	1	.34	.47
High school GPA	1.00	5.00	3.97	1.13
4 years of English in high school	0	1	.83	.37
4 years of Math in high school	0	1	.70	.46
Education Goals				
Be financially well off	0	1	.81	.39
Live close to relatives	0	1	.44	.50
Degree Aspitations				
Bachelor's degree aspiration	0	1	.25	.42
Master's degree aspiration	0	1	.45	.50
Doctorate aspiration	0	1	.22	.41
Professional degree aspiration	0	1	.09	.28
Plan to transfer	0	1	.17	.38
Distance institution from home (log)	0	9.21	3.76	1.65
Did not work (excl. work-study)	0	1	.55	.50
1-10 hours working (excl. work-study)	0	1	.10	.30
11-20 hours working (excl. work-study)	0	1	.19	.39
20+ hours working (excl. work-study)	0	1	.16	.36
Parents expected to get a job	0	1	.27	.44
Chose institution b/c of location	0	1	.77	.42
Chose institution b/c of coursework	0	1	.59	.49

Variable	Min	Max	Mean	S.D.
Chose institution b/c of reputation	0	1	.58	.49
Chose institution for personal/family reasons	0	1	.42	.49
Volunteering				
No volunteering	0	1	.62	.50
1-10 hours volunteering	0	1	.24	.43
11-20 hours volunteering	0	1	.08	.27
20+ hours volunteering	0	1	.06	.23
Live on campus	0	1	.54	.50
Academic integration index	0	20	8.88	4.51
Social integration index	0	20	5.66	5.02
Major declared	0	1	.74	.44
GPA in first year	0	40	27.09	8.54
Any remedial courses taken	0	1	.21	.40
Unmet need (after EFC and all aid)	0	46.15	5.16	6.42
Federal need-based grants (Pell, SEOG, other)	0	8.05	3.32	1.82
State need-based grants	0	10.00	1.30	1.89
Institutional need-based grants	0	20.00	1.45	3.35
State non-need and merit grants	0	10.00	.19	.77
Institutional non-need and merit grants	0	20.00	.92	2.39
Outside grants (private and employer)	0	16.66	.52	1.48
Federal subsidized loans (Stafford and Perkins)	0	7.50	1.78	1.72
Stafford unsubsidized loans	0	4.00	.48	1.22
Private (alternative) loans	0	21.39	.30	1.50
Institutional-Level Variables				
Public Institution	0	1	.69	.48
Private Institution	0	1	.31	.46
High selectivity	0	1	.22	.42
Middle selectivety	0	1	.65	.50
Low selectivity	0	1	.12	.33
Institutional size: Enrollment (log)	4.50	10.82	8.86	1.13
Pct. minority enrollment	0.07	98.84	37.98	30.49
Pct. part-time enrollment	0.21	93.98	18.45	13.02
Pct. students receiving federal grant aid	5.00	95.00	37.78	19.86
Pct. students receiving loans	0.00	100.00	50.91	20.87
Transfer plans (aggregate)	0.00	100.00	15.88	15.39
Acadmic integration index (aggregate)	0.00	20.00	8.69	1.92
Social integration index (aggregate)	0.00	16.65	5.94	2.67
Price of attendance (log)	8.11	10.78	9.65	.42
Tuition and fees as a pct. of core revenues	4.00	100.00	39.88	25.79
Core expenditures per FTE student (log)	8.80	12.41	9.75	.49
Student services share of education and related expenses	1.32	43.90	12.17	6.67

Source: BPS:04/09

Numbers reflect full-time, dependent students enrolled in a Bachelor's degree program at 4-year institutions in the U.S. International students and student athletes are excluded.

Table 7:

Propensity Score Estimation, Summary Statistics Bias Analysis for Logistic Regression - Grants only in Aid Package (Treatment 1)

Before Matching					After Matching				
Percentiles	Smallest	Largest			Percentiles	Smallest	Largest		
1%	0.281	0.281			1%	0.042	0.042		
5%	0.301	0.301			5%	0.169	0.169		
10%	1.116	0.906	Obs	31	10%	0.253	0.188	Obs	31
25%	3.904	1.116	Sum of Wgt.	31	25%	1.077	0.253	Sum of Wgt.	31
50%	7.494		Mean	9.233	50%	2.122		Mean	2.213
			Std. Dev.	7.338				Std. Dev.	1.614
75%	14.137	16.808			75%	3.146	4.722		
90%	16.808	20.749	Variance	53.844	90%	4.722	4.828	Variance	2.606
95%	24.586	24.586	Skewness	1.123	95%	4.863	4.863	Skewness	0.837
99%	31.094	31.094	Kurtosis	4.020	99%	6.786	6.786	Kurtosis	3.461

Sample	Pseudo R2	LR chi2	p>chi2	Mean Bias	Median Bias
Raw Data	0.053	372.85	0.000	9.2	7.5
Matched Data	0.041	78.3	0.000	2.2	2.1

Table 8:

Propensity Score Estimation, Summary Statistics Bias Analysis for Logistic Regression - Grants and Loans in Aid Package (Treatment 2)

Before Matching					After Matching				
Percentiles	Smallest	Largest			Percentiles	Smallest	Largest		
1%	0.234	0.234			1%	0.035	0.035		
5%	0.262	0.262			5%	0.141	0.141		
10%	0.950	0.382	Obs	31	10%	0.291	0.259	Obs	31
25%	2.097	0.950	Sum of Wgt.	31	25%	0.733	0.291	Sum of Wgt.	31
50%	7.766		Mean	9.795	50%	2.289		Mean	2.454
			Std. Dev.	8.890				Std. Dev.	1.940
75%	15.535	23.446			75%	3.344	5.077		
90%	23.446	23.875	Variance	79.030	90%	5.077	5.703	Variance	3.763
95%	26.708	26.708	Skewness	0.755	95%	6.769	6.769	Skewness	0.794
99%	30.707	30.707	Kurtosis	2.451	99%	7.161	7.161	Kurtosis	2.932

Sample	Pseudo R2	LR chi2	p>chi2	Mean Bias	Median Bias
Raw Data	0.045	295.85	0.000	9.8	7.8
Matched Data	0.047	70.7	0.000	2.5	2.3

Table 9:
Comparison of Conditional Variable Means Before and After Adjusting with Propensity Score Weights (Summary)

	Regular Weight (WTA000)				Reweighted (PS Weight, ATE)							
					Treatment 1 (Grants)				Treatment 2 (Grants & Loans)			
	Not Treated	Treated	T	p	Not Treated	Treated	T	p	Not Treated	Treated	T	p
Age: 19 years or older	.34	.34	.35	.726	.34	.32	1.12	.263	.34	.32	1.42	.156
Gender: Female	.55	.59	-3.02	.003 **	.56	.55	1.06	.287	.56	.57	-.38	.702
Caucasian (Ref.)	.71	.68	2.61	.009 **	.72	.71	.72	.474	.71	.71	.05	.961
African American	.10	.06	5.01	.000 ***	.08	.09	-.87	.386	.08	.09	-.09	.927
Latino/a or Hispanic	.09	.14	-6.23	.000 ***	.09	.09	.48	.633	.09	.09	.24	.813
Asian	.05	.08	-3.72	.000 ***	.06	.06	-.43	.668	.06	.06	-.39	.694
Other Race/Ethnicity	.05	.05	.70	.483	.05	.06	-.50	.617	.05	.05	.13	.898
English is primary language	.91	.86	6.95	.000 ***	.91	.91	-.01	.993	.91	.90	.79	.431
Low income	.19	.23	-2.94	.003 **	.19	.19	-.23	.815	.19	.19	-.32	.751
Lower-middle income	.25	.21	3.59	.000 ***	.24	.23	.91	.363	.24	.24	-.15	.879
Upper-middle income	.27	.22	4.01	.000 ***	.26	.26	.21	.832	.26	.27	-.63	.526
High income	.29	.35	-4.56	.000 ***	.31	.32	-.83	.407	.31	.30	1.02	.309
Parents own investment >$10,000	.30	.36	-4.91	.000 ***	.32	.32	-.50	.619	.32	.32	.03	.979
Parental Education												
High school or less	.20	.17	2.63	.008 **	.18	.18	.17	.862	.18	.19	-.60	.550
Associate degree or some college	.24	.18	4.63	.000 ***	.22	.21	.73	.463	.22	.22	.02	.986
Bachelor's degree	.28	.31	-2.17	.030 *	.29	.28	1.40	.163	.29	.29	.20	.839
Master's degree or higher	.28	.34	-4.32	.000 ***	.31	.33	-2.15	.032 *	.30	.30	.29	.771
Parent Family Status												
Married	.74	.79	-4.34	.000 ***	.75	.75	-.03	.979	.75	.76	-.19	.847
Single parent	.04	.04	1.07	.286	.04	.03	1.55	.120	.04	.04	.44	.658
Divorced/separated/widowed	.22	.17	4.10	.000 ***	.21	.21	-.68	.499	.21	.21	.00	.997
Sibling in college	.30	.31	-.53	.595	.31	.32	-.85	.393	.31	.30	1.11	.267
Admission test scores (ACT or SAT)	10.61	11.19	-10.76	.000 ***	10.76	10.74	.41	.681	10.75	10.76	-.08	.939
High school GPA	4.16	4.44	-10.04	.000 ***	4.26	4.22	1.37	.171	4.26	4.26	.07	.947
Private high school attended	.15	.15	-.06	.956	.15	.17	-1.38	.169	.15	.15	.18	.860
4 Years of English in high school	.85	.88	-2.40	.016 *	.86	.86	.37	.708	.86	.87	-.08	.934
4 Years of Math in high school	.77	.82	-4.63	.000 ***	.79	.79	-.27	.788	.79	.79	.07	.944
Importance												
Be a community leader	.47	.47	-.48	.628	.47	.47	.16	.873	.47	.48	-.46	.646
Be financially well off	.74	.70	3.10	.002 **	.73	.72	.43	.668	.73	.73	-.18	.856
Live close to relatives	.41	.42	-.79	.430	.41	.38	1.98	.052	.41	.40	.58	.565
Degree Aspirations												
Bachelor's degree aspiration	.24	.21	2.05	.041 *	.23	.24	-.71	.479	.23	.22	.51	.607
Master's degree aspiration	.49	.46	1.83	.067	.48	.48	.47	.641	.48	.49	-.38	.701
Doctorate aspiration	.19	.22	-2.83	.005 **	.20	.19	.55	.583	.20	.20	-.15	.883
Professional degree aspiration	.08	.10	-2.30	.022 *	.09	.09	-.52	.601	.09	.09	.12	.902
Plan to transfer	.14	.11	2.74	.006 **	.13	.14	-.41	.679	.13	.13	-.24	.814
Live on campus	.71	.61	7.28	.000 ***	.70	.70	-.40	.691	.70	.71	-.67	.504

* p < 0.05, ** p < 0.01, *** p < 0.001

Note: Variables reported are used in the estimation of propensity scores. Interaction terms are omitted.

Figure 2: Common Support Area, Propensity Score Estimation - Grants (Treatment 1)

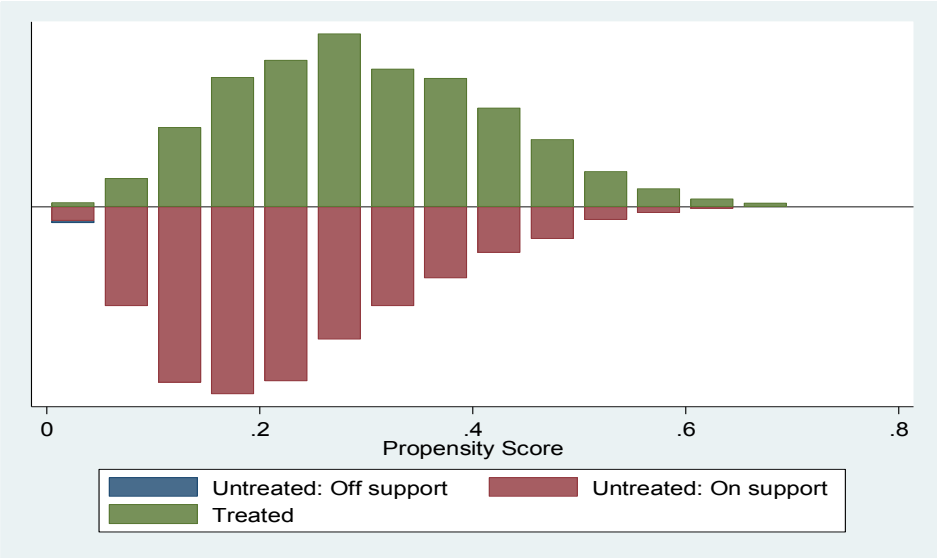

Figure 3:
Common Support Area, Propensity Score Estimation - Grants and Loans (Treatment 2)