Income and Financial Aid Effects on Persistence and Degree Attainment in Public Colleges

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Abstract

This study examined the distribution of financial aid among financially dependent four-year college students and the effectiveness of different types of financial aid in promoting student persistence and timely bachelor's degree attainment. The findings of descriptive statistical and logistic regression analyses using the NCES Beginning Postsecondary Students (1990-94) data show that subsidized loans taken in the first year of college have a positive effect on persistence. The first-year distribution of aid does not close the income gap in bachelor's degree attainment. Living on campus and first-year grade point average are the most important predictors of timely degree completion.

In the latter half of the twentieth century, the states and federal government of the United States developed a complex higher education financing system. This system serves many purposes, among them the stimulation of private investments in higher

education, economic development, and the redress of inequitable access to college for groups that were traditionally excluded. The financing system has many components, including direct subsidies for public colleges and universities and financial aid for students. Direct operating subsidies are the foundation on which states offer higher education to all citizens at a much lower price than that offered by the private sector. Further discounts on the subsidized price are available to eligible students through grants, scholarships, and loans. In addition, a student's ability to choose a private or public college is supported, as financial aid is also made available to enroll in the more expensive private sector (*Policy of Choice*, 2002). (Note 1) Alongside affirmative action, the creation of public colleges and the financial aid system has been a central mechanism for addressing economic and social inequality in the U.S. However, despite the development of this complex system over half a century, college participation in the United States continues to show marked differences by family income (*Access Denied*, 2001; Ellwood & Kane, 1998; Kane, 1999 Chap.4).

The higher education financing system serves students from all socioeconomic backgrounds. Not surprisingly, the distribution of benefits among these groups is continually being reshaped amid competing claims for resources. The work-study program, grants, and subsidized loans emerged as part of the War on Poverty. The federal subsidized loan program to aid low-income students was institutionalized in 1965 by the Higher Education Act, and today's Pell grants were established in 1972 as the Basic Education Opportunity Grant. Shortly thereafter, in 1978 when the Middle Income Student Assistance Act made subsidized federal loans available without income restrictions, the middle class was also firmly established as an important and powerful financial aid constituency (Hansen & Stampen, 1981). Today, new forms of aid, such as merit-based scholarships and tax credits, appear to favor the middle and upper classes (Heller & Schwartz, 2002; Kane, 1999; Selingo, 2002). The purchasing power of Pell grants has declined and students must finance a larger share of their education through loans. This shift in the financing burden to individuals and families has had a disproportionate impact on low-income students (*Empty Promises*, 2002; Heller, 2001). These changes may well represent a severe loss of opportunity for low-income students and failure of the financial aid system to achieve the goal of promoting equity in higher education enrollments.

At the same time, public colleges are under pressure from state legislatures and the federal government to educate students and produce graduates at lower cost. In an era of increasing demand for college and declining fiscal resources, colleges are expected to operate more efficiently (Zumeta, 2001). State accountability programs commonly identify college graduation rates as a measure of institutional performance (Burke, Rosen, Minassians, & Lessard, 2000; Burke & Serban, 1998). More recently, the federal government has also proposed tying grant funds to graduation rates (Burd, 2003). As part of this accountability movement and to increase the capacity of overwhelmed public campuses, many states are urging colleges to graduate students in a timely way and to reverse the trend of lengthening times to degree (Knight, 2002; Selingo, 2001).

A recent study by the National Center for Education Statistics shows that public four-year colleges graduate students within the traditional period at approximately half the rate of private colleges. On average, 26% of students starting out at

four-year public colleges earned a bachelor's degree within four years. The graduation rate increases to 57% within six years (Berkner, He, & Cataldi, 2002, p 23, Table 10). To explain low rates of persistence and degree completion in public colleges, administrators point to the diverse array of purposes and conditions under which students pursue collegiate studies today. Working parents who study part-time do not proceed at the pace of full-time students fresh out of high school. In addition, bachelor's degree completion differs by income status, whether measured in four years (26% of the lowest income students compared to 50% of high-income students) or in six years (54% versus 77%) (Berkner et al, 2002, pp. 26-32, Table 10). Timely degree completion is desirable both for students, who face opportunity and direct costs as long as they are enrolled in college, and for taxpayers who subsidize each student's place in public higher education (Choy, 2002). If efficient educational outcomes are desired, it is important to evaluate the factors that contribute to those outcomes.

This study contributes to such an effort by evaluating the relationship between parental income and student outcomes in college, as it is mediated by different forms of financial aid. It takes the strategy of observing the progress of public-college students who are in the strongest position for timely degree completion and examining the factors that affect their persistence and degree attainment. Students who are financially dependent on their parents and enrolled full-time in the public four-year sector constitute the sample selected for analysis. The experiences of this group of students in a study of timely degree completion and financial aid are of interest for several reasons. Students who are dependent on their parents in their first year of college are following a traditional path to higher education. They are not yet independent adults, with family and employment commitments that impede degree attainment in complex ways that are not easily mitigated by public policy interventions (Adelman, 1999).

In addition, as full-time students in four-year institutions, their objective is very likely to obtain a degree, a goal that is less clear among community college students who may be seeking short-term vocational training or among part-time students who may be "testing the waters" of college. Part-time students are unable to graduate in a traditional four-year period, while full-time students are. Their failure to do so can more accurately be interpreted as due to academic or financial barriers than to a partial involvement in higher education. The sample selected for analysis reduces variation to the group that has the most time to invest in their studies and, therefore, the most realistic possibility of completing a bachelor's degree. Having selected this relatively homogeneous sample, the study then focuses on observing whether parental income is a significant predictor of academic outcomes and whether different forms of financial aid reduce outcome gaps associated with income.

Finally, given that students in the public sector are first and foremost beneficiaries of direct operating subsidies from states to colleges and universities (Note 2), taxpayers have a particular interest in their successful academic attainment. Financial aid expenditures are in a sense marginal costs (albeit very large ones) to reduce financial barriers to participation in a system already established at great cost with a primary purpose of ensuring equitable access to higher education. While the extent to which taxpayer funds should finance enrollment in expensive private institutions is debatable (*Policy of Choice*, 2002), it is clear that as states are abandoning low and no-tuition policies (Hauptman, 2001) the provision of financial

aid takes on even greater importance in creating low-cost opportunities for higher education.

Literature Review

Educational researchers have extensively analyzed the educational pipeline to identify the mechanisms by which low-income students and students of color fall behind in their college aspirations (Carter, 1999; McDonough, 1994), enrollment (Heller, 1997; Jackson, 1990; Perna, 2000; St. John & Noell, 1989) and persistence in college among those who do enroll (Braxton, 2000; Tinto, 1975, 1987). (Note 3) The effect of tuition pricing and financial aid on persistence has received increasing attention with the development of theories that assign an important role to finances in determining students' college participation decisions (Bean & Metzner, 1985; Cabrera, Nora, & Castaneda, 1992; Paulsen & St. John, 2002; St. John, Cabrera, Nora, & Asker, 2000; St. John & Starkey, 1995). Empirical studies utilizing these theories have examined the effects of tuition and aid on within-year persistence (Paulsen & St. John, 2002; St. John, Andrieu, Oescher, & Starkey, 1994; St. John, Paulsen, & Starkey, 1996)and multi-year persistence (St. John 1989, 1990; Stampen & Cabrera, 1988; Cabrera, Nora, Castaneda, 1993, Titus, 2000).

The effect of financial aid on degree attainment has received considerably less attention. However, with increasing availability of data from the longitudinal Beginning Postsecondary Students (BPS) surveys, which follow students for up to six years, recent reports by the National Center for Education Statistics (NCES) and higher education policy institutes have analyzed a wide range of factors, including student finances, and their association with both persistence and degree attainment (Berkner, Cuccaro-Alamin, & McCormick, 1996; Lutz Berkner et al., 2002; Bradburn, 2002; Choy, 2002; Horn & Kojaku, 2001; King, 2002; Wei & Horn, 2002). (Note 4) This study builds on these reports and educational research by St. John and colleagues (Paulsen & St. John, 2002; St. John, 1990; St. John, 1989; St. John, Andrieu, Oescher, & Starkey, 1994) focusing on the effect of different forms of financial aid on persistence in four-year colleges using NCES data, particularly the National Postsecondary Student Aid Study (NPSAS). It extends the work of these researchers by studying persistence to the second year of college and to degree attainment.

The study also draws on the findings of recent work analyzing institutional and state-level data (Note 5), in which researchers have introduced new statistical techniques for studying persistence, including event history modeling (DesJardins, Ahlburg, & McCall, 2002; DesJardins, McCall, Ahlburg, & Moye, 2002), two-stage regression with sample selection (Note 6) (Singell, 2002a), and discontinuity analysis (Bettinger, 2002). These techniques specifically model the sequential, interrelated nature of students' enrollment and multi-year persistence decisions. The results of these studies indicate that the analysis of cross-sectional data using single-stage regression models produces biased estimates of the effects of financial aid on persistence. This is due to the fact that the personal and academic characteristics that lead students to decide to enroll and persist in certain types of colleges also play a role in determining the level and type of their financial aid awards. Although multivariate analyses include control variables for these characteristics, Dynarski (2002a) argues that variables measuring observable student characteristics are unlikely to provide an adequate control for unobserved

characteristics that are correlated with a student's college enrollment decisions. This study analyzes the effects of financial aid received in the first year of college on outcomes in subsequent years. Though the outcomes are longitudinal, the analysis is cross-sectional, based on measures obtained for one cohort at one point in time. This approach is consistent with prior educational research analyzing persistence using national data. This study draws on the new findings and methods introduced largely in the field of economics to understand the direction of potential bias in the estimates and to place the findings in the context of prior research on persistence in both academic fields. Thus the literature review informs the current study regarding the effects of different types of aid on persistence and degree attainment; the effectiveness of financial aid in improving college persistence by low-income students, and the interpretation of results obtained by single-stage logistic regression models.

Prior research provides mixed evidence regarding the effects of different forms of aid on persistence and degree attainment. In studies of national data, grants, loans, and work-study awards have been found to have positive effects on year-to-year persistence (St. John, 1990), but negative effects on within-year persistence (St. John, Andrieu, Oescher, & Starkey, 1994; Paulsen & St. John, 2002). The results of institutional data also provide inconsistent evidence. DesJardins, Ahlburg, and McCall (2002) find that loans have a negative effect on persistence, although this effect diminishes over the years in college. Singell (2002) finds a positive effect of subsidized loans and an insignificant effect of unsubsidized loans. Both studies find positive effects of merit- and need-based grants. In addition, Singell finds a negative effect of work-study awards. Bettinger (2002), who focuses only on federal Pell grants, obtains inconclusive results. Clearly, further research is needed to develop a strong consensus on the effects of different types of aid on persistence.

The conclusions of prior researchers suggest the financial aid system is failing to provide equitable access to college for low-income students. Studies of national data find family income to be consistently associated with higher levels of persistence, even with multivariate controls for demographic and academic factors (St. John, 1990). Aid is found to have negative effects on persistence among poor and working-class students, but not among higher-income students (Paulsen & St. John, 2002). In a study of students enrolled in the University System of Maryland, Titus (2000) also found that aid effects on second-year persistence differ by income group. He concluded that aid amounts are not sufficient to promote the retention of low-income students. Merit aid, which is often disproportionately awarded to higher income students (Heller & Schwartz, 2002), is found to have positive effects by DesJardins et al (2002) and by Singell (2002), with Singell also observing a differential effect in favor of higher income students. DesJardins et al find that graduation probabilities do not differ by income level, but this may be due to a more limited range of socio-economic status in the institutional data they study from the University of Minnesota. The work by Paulsen and St. John (2002) and Singell (2002) demonstrates the importance of evaluating differences in the effects of aid on students from different income groups. (Note 7) In this study, these differential effects are evaluated by testing the significance of interaction terms.

When Singell (2002) Note 8 and Bettinger (2002) compare the results of statistical models that do and do not control for sample selection bias—the bias inherent in not observing the effects of factors of interest on those with characteristics that

systematically remove them from the sample—they find statistically and substantively different results. For example, Singell's research indicates that institutional merit-based aid has the largest effect on second-year enrollment, with an increase of $1,000 predicted to increase the probability of reenrollment by 26.4%. This effect is half of what is estimated in a model that does not control for self-selection bias. This follows from the positive correlation of academic ability and persistence. The students who received merit aid were more likely to persist even in the absence of a scholarship. The difference in results is less dramatic for other types of aid, but the single-stage model appears to underestimate the effects of need-based grants and overestimate the effect of subsidized loans and work-study awards. Bettinger (2002) also finds that an estimation strategy that omits from the sample students who may have been eligible but did not apply for federal Pell grants underestimates the positive effects of Pell grants on persistence. This follows from the fact that Pell grant recipients have characteristics associated with withdrawal. Between the two models, the sign of the estimate changes, which indicates misestimation of both the magnitude and the direction of the effect. Such a misestimation would mask the positive effects of means-tested grant aid and lead to an incorrect conclusion that grant aid is not effective in promoting the college participation of low-income students.

Finally, Singell (2002) finds that the effects of aid on persistence (or "reenrollment") smaller than but similar in direction to effects on the initial enrollment decision. These findings indicate that researchers studying persistence can turn to the results of enrollment studies to predict the direction of aid effects on what can be conceptualized as students' "re-enrollment" decisions, though with the expectation that the magnitude of the effect is likely to be smaller. However, the findings of national cross-sectional studies of the effects of aid on enrollment are difficult to generalize, because the findings differ by type of aid and by type of student (Heller, 1997; Nora & Horvath, 1989). Generally the results indicate that aid does promote enrollment, but, in important departures from those findings, Perna (2000) found loans have a highly negative effect on African American students, and Jackson (Jackson, 1990) found positive effects of grants for African American and white students, but not for those of Hispanic descent. Summarizing findings of quasi-experimental studies, Dynarski (2002a) shows that this body of research generally demonstrates positive enrollment effects of both grants and loans. Once again, these effects appear to differ by income and racial group.

This literature review underscores the methodological complexity of estimating the effects of different types of aid on student decision-making. Student responses to different forms of aid appear to vary based on their income class and other personal characteristics. Whereas some studies find negative effects of aid on persistence, others find that certain types of aid have a positive effect for some groups of students. These methodological challenges and contrasting results indicate that further work is needed in this area. This study contributes to this literature by analyzing the effects of parental income and financial aid on second-year persistence and timely degree attainment among full-time dependent students in the four-year college sector. It analyzes national data, the Beginning Postsecondary Students 90/94, which has not previously been examined using the methods and sample presented here. Institutional data tend to have rich detail on individual student characteristics, academic performance, and aid packages, but typically lack information about student outcomes in the higher education system as

a whole for those students who transfer. Therefore, they overestimate student attrition (Adelman, 1999, Berkner et al 2002). In this respect, national data sets are preferable, as they allow the observation of system-wide persistence and degree attainment.

Conceptual Framework

This study adopts a theoretical perspective described by Beekhoven, De Jong, and Van Hout (2002) that combines "integration-based student departure models" (p.577) with rational choice theory to explain student enrollment decisions across the multiple years of baccalaureate study. Tinto's (1975, 1987) student integration model focuses on the degree of fit between student and institution and the extent to which a student's goal commitment is reinforced by academic and social integration on campus. Cabrera and colleagues (Cabrera, Castaneda, Nora, & Hengstler, 1992; Cabrera, Nora, & Castaneda, 1993) subsequently developed an integrated model of college persistence that combined Tinto's theory with the "student attrition" model of Bean and colleagues (Bean and Metzner, 1985). Bean's model differs most prominently from Tinto's by its inclusion of factors outside the college environment, such as work and finances, as explanatory variables. Through empirical testing, Cabrera et al found that the integrated model provided a better understanding of the persistence process than could be achieved with either model individually.

Similarly, Beekhoven, De Jong, and Van Hout (2002) believed that the student integration model would benefit from greater attention to the concept of individual agency in decision-making. Therefore, they tested a combined model of student integration theory and rational choice theory. Through an empirical test using college student data from the Netherlands, they found that their "extended model" performed better than either theory independently. Their model emphasizes that student withdrawal decisions are based on their expectations, modified from one year to the next, of successful program completion. These expectations are influenced by the extent to which students fit into the college environment and are satisfied with their experiences, where "fit" and "satisfaction" are constructs measured by integration theory. As these authors express it, "Students trying to integrate into the student community are likely to be rational actors who make cost-benefit analyses" (p. 581). Their empirical results are based on a longitudinal data base and provide support for the assertion that student integration in one period influences perceptions of the likelihood of graduating. Conversely, positive perceptions of the likelihood of graduation will positively affect integration (p. 597). Other researchers (DesJardins, Ahlburg et al., 2002; Manski & Wise, 1983; Paulsen & St. John, 2002; Singell, 2002a; Titus, 2000)have elsewhere emphasized the sequential nature of college students' enrollment decisions over time.

Rational choice theory (Becker, 1976, 1993; Elster, 1986)explains student enrollment decisions as a process of cost-benefit analysis and utility maximization. From this perspective, as the monetary and personal costs of college rise, the benefits must rise commensurately, or a potential student will perceive labor market opportunities as more attractive than higher education. Monetary costs are determined by direct expenses (such as tuition, fees, and books) and the loss of foregone wages. Personal costs are largely determined by a person's ability to complete and enjoy academic work. Those who are less academically prepared or

able take longer to learn and endure greater aggravation in the process. The use of Beekhoven, De Jong, and Van Hout's (2002) theoretical model combining rational choice and student integration theories is particularly appropriate for the data analyzed in this study. While the student integration theories include propositions modeling the effects of students' motivations, satisfaction, and institutional commitment, the BPS data are not rich in these variables. In combination with rational choice theory, which assumes students will rationally maximize their utility rather than attempting to measure psychological factors, these variables may be omitted, albeit with a loss of explanation of the mechanisms on campus that influence students' institutional experiences and loyalties. Beekhoven et al omitted measures of commitment and motivation in their combined model without loss of explanatory power; in fact, their model explains a greater proportion of variance than either of the theories applied independently. Further, the use of rational choice theory facilitates the integration of results from persistence studies in the field of economics, where it is a dominant theory.

Study Design
Data and Sample

The U.S. Department of Education National Center for Education Statistics (NCES) conducts the Beginning Postsecondary Students (BPS) survey as a longitudinal component of the National Postsecondary Student Aid Study (NPSAS). The BPS, which is a nationally representative survey, includes only those students who enrolled in postsecondary education for the first time in the NPSAS base year; it excludes returning students who had previously stopped out of college. This study analyzes BPS90/94, which has a NPSAS base year of 1989-1990 and a follow-up of student outcomes in the spring of 1994. This time frame allows for the observation of "second-year persistence" (re-enrollment in the second year) and "timely" bachelor's degree completion (within five years). Use of these data to analyze student outcomes complements relatively short-term analyses of within-year persistence. The exclusion of returning students ensures that the data represent a student's full persistence and stop-out history. The results of a more recent BPS survey covering the period 1996-2001 was not available for this analysis, but those data make possible replication of the study in a more recent time period, which is desirable given changes in financial aid policies and trends in the 1990s.

BPS is a stratified and clustered probability sample, where the strata represent the different sectors of higher education and the clusters represent geographic regions (*BPS9094 Technical report*, 1996).The public four-year doctoral granting and comprehensive sectors (two strata) were included in this sample. Due to the sampling design, this sub-sample is nationally representative of the population of students in these two sectors. Students were retained in the sample if they were financially dependent on their parents and began their studies on a full-time basis at a public four-year institution. The resulting sample size for this study is 1,087 cases, which is 67% of the original 1,612 BPS cases who started out in public four-year institutions. These sampling decisions restrict the analysis to "traditional" students, as evidenced by the sample's mean age of 18 years.

Persistence is defined in this study as full-time enrollment in the second year of the BPS survey (academic year 1990-91) at a public or private four-year institution. This

definition sustains the focus of this study on students who are on a traditional path towards the bachelor's degree, as well as the focus on public institutions because only a small proportion of the sample transferred to private colleges. This definition omitted those who left college or moved to part-time status (15%) and those who transferred to public two-year colleges (4%) or private postsecondary (not baccalaureate) institutions. These students were considered to have left the persistence track for timely bachelor's degree completion. Those who transferred to private four-year colleges in the second year (.006%) were treated as on track, given the higher rates of degree attainment in the private sector. This definition of persistence, which captures reenrollment behaviors in the second year of college that keep students on track for timely bachelor's degree completion, differs from other measures that focused on institutional retention or within-year persistence. Based on this definition, 78% of the BPS90/94 sample persisted from the first to the second year of college. Seventy-one percent were enrolled in the third year of the survey (with or without stop-out in year 2) and 63% were enrolled in the fourth year. Approximately 2% transferred each year to the private sector. Fifty-five percent of students obtained their bachelor's degree within five years. Thirty-nine percent of the sample was enrolled in the fifth year of the survey, which, depending on stop-out behaviors, may or may not have been the fifth year of study for the student.

Methods

The analysis focuses on the following research questions: (a) What is the distribution of different types of financial aid among dependent students in the public four-year sector by parental income quartile? (b) What is the influence of parental income and financial aid on reenrollment in the second year of study at a four-year college? (d) What is the influence of parental income and financial aid on timely (within five years) bachelor's degree completion?

Analyses of complex survey data, such as BPS, may be "model"- or "design"-based (Hosmer & Lemeshow, 2000; Thomas & Heck, 2001). Design-based analyses adjust estimates to reflect the sampling structure by using sample probability weights, the intra-class cluster coefficient, and robust measures of standard errors, while model-based analyses proceed as if the data were collected as a simple random sample. This study presents a design-based analysis. (Note 9) This approach is of particular importance when estimating differences in means and proportions, where the sampling "design effect" has a particularly large impact, greater than on the estimation of regression coefficients (Hosmer & Lemeshow, 2000, p. 220). (Note 10) The estimation of means for variables in this study is subject to design effects in the range of .9 to 2.0. (Note 11) The sampling weight for cross-sectional and retrospective analyses of data from the 1994 follow-up (BPS94AWT) is applied (National Center for Education Statistics, 1996). The analysis is conducted using Stata statistical software, version 7.

Descriptive statistics are analyzed by income quartile to characterize the relationship between income, financial aid, and other variables included in the regression analyses. (Note 12) Logistic regression analyses were conducted to observe the effects of factors bearing on student persistence and timely bachelor's degree attainment. Income was entered first as the sole predictor. Groups of additional variables were then entered sequentially to observe their mediating effect

on income. A final model includes interaction terms of the different forms of aid by parental income to test for differences in the effects of aid by income, following recent results that the effects of aid differ by income group (Singell, 2002; Paulsen & St. John, 2002).

The magnitude of the effect of the predictor variables is reported as odds ratios, with standard errors indicated as robust z statistics (*Stata*, 2001, User's Manual, section 23.11), and as "delta p" (change in the probability) statistics (Peterson, 1985).

The changes in the probability of the positive dependent outcome are reported for variables that were significant in the final step of the sequential regression. The "delta p" values are reported for a change from the minimum to maximum value for all variables (Note 13) and for a one-unit change at the mean for continuous variables. For dichotomous variables, the change from the minimum to maximum value represents a comparison between membership in one of two groups (e.g. on or off campus residence). These changes are estimated with dichotomous covariates held at their modal values (as proposed by Long, 1997)and continuous covariates held at their means. (Note 14) Statistically significant differences are reported at p<.05 based on two-sided tests, with the significance of design variables (race and income quartile) adjusted for multiple categories. The direction of insignificant effects that are expected by theory and prior research to be significant are noted if p<.10. (Note 15)

Several goodness-of-fit measures are presented. Some statisticians argue that likelihood ratio (LR) statistics should not be used for models that include weighting and clustering, because under these conditions a "pseudo-likelihood" is estimated rather than a true likelihood (Hosmer & Lemeshow, 2000; Scribney, 1997a, 1997b). Long (1997), on the other hand, notes the heuristic nature of logistic goodness of fit statistics and argues that the measures may appropriately be calculated using the pseudo-likelihoods. Consistent with Long, the following LR statistics are reported: the LR chi squared, McFadden's Rsquared, and the adjusted McFadden's Rsquared (which adjusts for increases due simply to the addition of predictors). Stata provides a Wald chi squared statistic, which is not based on the likelihood ratio, to test the significance of weighted, clustered models. This value is also reported. (Note 16)

Predictor Variables

All predictor variables in the logistic regression models were measured in the NPSAS base year, the students' first year of college. Therefore, the predictors are conceptualized as components of the first-year experience. These components take on four dimensions in this study: financial, cultural, social, and academic (as defined below).

Some of the variables, such as gender, mother's education, and race or ethnicity will not change in subsequent years. Other variables, particularly those measuring financial aid, may well change. Thus, it is important to emphasize that the observed financial effects are based on a student's situation in the first year.

Tuition is included to control for the amount of financial aid required to meet higher

education expenses. Tuition was defined as the annual in-jurisdiction charge for students enrolled in their home state and as the annual out-of-jurisdiction rate for students enrolled in other states (12% of the sample). The tuition price students faced in years subsequent to the first year is available in the BPS90/94 data. A correlation analysis of tuition across the five years of the survey shows that it is highly correlated at .97-.99, which is consistent with the limitation of the sample to four-year institutions and the small proportion of students exiting to the private sector. Therefore, first-year tuition is a good representation of the tuition charges students faced in subsequent years.

The financial variables represent different forms of financial aid, including federal and state grants, institutional need- and non-need-based grants, federal subsidized loans, and federal work-study awards. The state grant variable does not distinguish between need- and merit-based awards, but it should be noted that these data were collected in 1989 prior to the tremendous growth in state merit scholarships. The financial aid measures are entered in dollar amounts, rather than as binary variables indicating receipt of aid. Although researchers have previously tested the latter approach to model the effects of aid (Nora, Cabrera, Hagedorn, & Pascarella, 1996; St. John & Starkey, 1995), recent research demonstrates a preference for the use of actual aid amounts (DesJardins, Ahlburg, & McCall, 2002; Paulsen & St. John, 2002).

The cultural group of variables includes indicators of race or ethnicity in four categories: African American (8% of the sample), Hispanic (4%), Asian (5%), and White (the reference group, 87% of the sample). While these broad categories are likely to mask differences in educational experiences among students whose cultural heritage differs quite significantly, finer distinctions are not possible with these data. Gender is included in this group of variables; females are in the majority, accounting for 53% of the sample.

Based on the theoretical notion of "social capital" (Coleman, 1988), which posits that parental education level facilitates human capital production through knowledge of college processes, norms, and networks, a binary variable indicating whether the student's mother is a college graduate is included in the analysis. The other variables in this group also represent measures of a student's capacity to participate in college social networks. They are delayed enrollment (a time gap between high school and college, or disassociation from one's age cohort), living on or off campus, and the number of hours spent working each week. An index measuring social integration is also included, based on a four-item scale intended to measure Tinto's (1975, 1987) theoretical construct. These items, which respondents rated on a frequency scale, included making contact with faculty outside class; going places with friends from school; spending time in student centers or participating in student programs; and participating in school clubs. (Note 17)

Three academic variables measure academic experiences and performance. The first is a binary measure indicating whether the student's college is a doctoral-granting or a comprehensive institution. The doctoral-granting group (57% of the sample) is likely to enroll stronger students and to include flagship campuses. Like the social integration index, the academic integration index is based on a multi-item scale representing Tinto's (1975, 1987) construct. The items measure:

attending career-related lectures; participating in study groups with other students; talking with faculty regarding academic matters; and talking with an advisor about academic plans. The third variable is the first-year grade point average (GPA). A standardized measure of academic achievement would be desirable in controlling for academic ability. While the Standardized Achievement Test (SAT) scores are available in the BPS90/94 data, in the sample analyzed for this study 62% of the cases were missing. Therefore the variable was not included. High school grades are also not available, but the absence of this measure is mitigated by inclusion of actual academic performance in college, as indicated by the GPA.

One fifth of the sample was lacking data on one or more variables in the analysis. A missing cases analysis revealed that the data lacked a GPA for 26% of African American students, in comparison to 12% of students in other racial categories. Therefore, the values of the missing GPA cases were imputed by a linear regression using race and gender as predictors. A smaller proportion of cases (less than 5%) were missing data on the parental income and tuition variables. The missing values were similarly imputed. (Note 18)

Limitations

This study has several limitations. First, the analysis seeks to understand whether parental income is a determinant of a college student's persistence and degree attainment, even in the presence of state, federal, and institutional financial aid programs designed to remove financial barriers to college. The BPS90/94 data provides detailed financial information on students' financial aid packages only for the first year of study. Data from subsequent years indicate whether or not students received certain forms of aid, but do not reveal aid amounts. Therefore, the study is limited to understanding the mitigating effects of the first-year financial aid package on parental income effects. This is valuable for analyzing second-year persistence. However, aid packages and other variables, such as campus residence and work hours, do change over a student's four-year career, and these changes are not observed here.

Second, the intention of this study (and others that precede it using similar methods and data bases) is to draw conclusions about the effectiveness of financial aid policies in reducing college participation gaps based on family income. Dynarski (2002a) cautions that cross-sectional studies of the type presented here are not likely to estimate the relevant parameters accurately. She argues that variables measuring observable student characteristics are unlikely to provide an adequate control for unobserved characteristics that are correlated with "schooling decisions and schooling costs" (p.2). She notes, "This is particularly problematic because point estimates in this literature are often quite fragile, even changing sign with small changes in specification" (p.2). These concerns raise new challenges for higher education researchers studying financial aid policy, who should be careful to test the robustness of their findings across specifications and to interpret their findings in light of the potential bias of omitted variables and student self-selection into different types of colleges, programs, and financial aid packages. In addition, it highlights the need for strong theoretical frameworks in order to impose consistency on the interpretation of findings based on studies using different methods and data. The ongoing comparison of findings from the higher education and the economics literature is also likely to improve understanding of the effectiveness of financial aid

policy. With awareness of these limitations, the analysis of national data bases is worthwhile to establish benchmarking standards for institutional researchers and state-level policy analysts, who can compare results for similar populations of students enrolled on their own campuses.

Results

Distribution of Outcomes and Aid by Parental Income

The distribution of variables included in the regression analysis is reported by parental income quartile in column (4) of Table 1. The descriptive results indicate that rates of persistence from the first to second years of college do not differ by parental income quartile. However, timely bachelor's degree attainment does, rising from 47% in the first quartile to 65% in the fourth quartile. Separate analyses by income quartile of persistence to the third through fourth years of study indicate no statistically significant differences in these outcomes. These findings suggest that the difference in degree attainment depends on eligibility for graduation at the end of the fourth year, not on differences in year-to-year persistence.

Table 1
Variable Definitions and Descriptive Statistics

(1)	(2) Estimated Means	(3) Std. Error	(4) Quartile Means and Proportions[a]					
Variable (measurement units, range)	(mean of 0/1 is percent)		1st	2nd	3rd	4th	F-test[b]	t-test 1st v.4th Quartile
Persistence to year2, 0/1, yes=1	.7759	.0133	74.9	79.3	77.3	78.8	.689	
Bachelor's degree, 0/1, yes=1	.5470	.0180	46.9	51.1	56.3	64.8	6.27**	
Parental income ($170-250000)	46955	1207	17161	36542	51215	83599		25.03**
Tuition ($96-14095)	2838	77.44	2555	2742	2832	3232		4.0**
Grant federal ($136-5950)	1712	52.21	1698	1744	1702	1700		.02
Grant federal 0/1 Received, yes=1	.3047	.0134	31.8	33.7	26.9	29.6	1.24	
Grant state ($100-4900)	1035	58.12	1101	797.8	929.4	1585		1.07
Grant state 0/1 Received, yes=1	.1633	.0137	39.1	33.7	26.9	29.6	51.44**	
Grant institutional Need ($150-15166)	3311	246.8	2991	2928	3189	4031		1.40

Grant institutional need 0/1, Recd, yes=1	.1356	.0099	15.6	13.8	8.8	16.1	2.65*	
Grant institutional (non-need) ($100-9000)	2190	246.1	2100	2352	1763	2359		.37
Grant institutnl (non-need) 0/1, Recd, yes=1	.0644	.0084	8.9	8.1	3.3	5.5	2.55	
Loan federal ($184-4625)	1770	58.69	1790	1759	1608	2002		.60
Loan federal 0/1 Received, yes=1	.1929	.0158	38.2	27.3	7.9	3.6	48.32**	
Work study ($139-2998)	977.1	54.72	991.8	1140	597.3	573.3		1.59
Work study 0/1 Received, yes=1	.0762	.0088	20.2	6.6	2.9	0.7	32.82**	
White,0/1, yes=1	.8653	.0147	78.7	85.7	88.9	92.9	7.34**	
African American, yes=1	.0778	.0119	14.0	8.7	5.4	3.7	8.31**	
Hispanic, 0/1, yes=1	.0367	.0067	4.9	4.5	1.8	3.5	1.45	
Asian, 0/1, yes=1	.0499	.0089	6.0	5.3	5.0	3.7	.483	
Male, 0/1, yes=1	.4696	.0166	43.2	45.0	51.6	48.0	1.48	
Mom college grad, 0/1, yes=1	.2785	.0164	17.5	18.8	29.2	46.2	24.43**	
Delay enrollment, 0/1, yes=1	.0458	.0075	4.3	6.8	4.3	2.9	1.40	
Live on campus, 0/1, yes=1	.4706	.0211	44.7	43.0	47.9	52.7	1.80	
Social index (1-4)	2.475	.0213	2.45	2.40	2.51	2.53		1.32
Work hours (0-70)	20.40	.5326	19.21	19.16	20.90	22.37		2.16*
Doctoral institution 0/1, yes=1	.5734	.0350	51.2	53.0	58.2	67.0	4.49**	
Academic index, (1-4)	2.702	.0233	2.71	2.60	2.72	2.69		1.43
GPA (grade point average), 0-400	252.92	2.914	251	253	250	255		.60

Notes:
Observations = 1087, Population size = 433065.81
Data: BPS:90/94 NCES. Weight: BPS94AWT.
Subpopulation: public 4-year (OFCON1 = 3 or 4)
Estimates adjusted for stratification and clustering.
Number of strata = 2, Number of PSUs = 260

[a]Means of aid awards are conditional on aid type>0.
*p<.05 **p<.01
[b] The Pearson chi-squared statistic has been corrected for the survey design and converted into an F statistic.

The mean tuition charge of tuition and fees was nearly $3,000, a skewed value in comparison to the median of $2,200. This is due to the presence in the sample of

flagship public universities, which typically charge higher tuitions than other public four-year institutions. (Note 19) Students from the highest income families enrolled in higher priced institutions, on average, than other students and were disproportionately enrolled in doctoral-granting institutions.

In the first year, 30% of the sample received a federal grant averaging just over $1,700, an amount which is approximately three-quarters the median tuition price. (The mean financial aid values in Table 1 are reported conditional on the receipt of each aid type.) State grants were received by a smaller proportion of students (16%) and in smaller amounts (approximately $1,000 on average). Fourteen percent of the sample received institutional need-based grants with a relatively large mean value just over $3,300, while 6% received institutional non-need-based grants averaging nearly $2,200. These sizeable institutional awards were clearly an important source of funds for a small percentage of the sample. Eight percent received a federal work-study award averaging nearly $1,000.

Nineteen percent of the sample took subsidized federal loans, averaging $1,770. Over 98% of the sample borrowed an amount less than or equal to the Stafford loan maximum for first-year students, which was $2,625 in 1989. The maximum loan value in this sample is $4,625, which reflects additional loan dollars available to students with high financial need through the Perkins program. Note 20

The greater tuition expenses of higher income students are associated with the pattern of first-year aid awards exhibited in Table 1. Students in the fourth income quartile receive awards in proportions and amounts equal to those of the lowest income students. In fact, award amounts in the fourth quartile are often greater, though these differences are not statistically significant. This pattern is observed for federal and state grants and both need-based and non-need institutional awards, with the exception that higher proportions of low-income students receive state grants. Students in the third-income quartile receive these types of aid in amounts similar to that awarded low-income students, but smaller proportions receive state grants and institutional need-based aid.

In contrast, federal loans are taken by much larger proportions of low-income students (38% and 27% in the first and second quartiles, respectively) than high income students (8% and 4% in the third and fourth quartiles). Also, while 20% of students in the lowest income quartile receive work-study awards, that proportion falls steeply to 7% in the second income quartile and to less than 3% among high income students. Although students in the upper income quartiles do not typically receive work-study, they do work, with students in the fourth quartile reporting 22 hours per week in comparison to 19 hours per week for those in the 1st quartile.

The proportion of white students increases as parental income increases, while the proportion of African Americans falls. While higher proportions of Hispanic and Asian students are observed in lower income brackets, these differences are not statistically significant. The educational level of students' mothers is significantly higher in the fourth income quartile, with 46% of mothers in the fourth quartile having a college degree, in comparison with just 18% of mothers in the first income quartile. These differences by income group are not associated with differences in academic experiences. No statistically significant differences are observed by income quartile in delayed enrollment, grade point average, or the indices of academic and social integration.

A matrix of Pearson's correlations (not shown) between the variables in Table 1 showed that the federal and state grant, federal loan, and work-study variables had low to moderate positive correlations, with values in the range of r=.15 to .37. The social and academic integration indexes were positively correlated at r=.33. Other values were lower than r=.15. Overall, these results do not indicate a collinearity problem for the logistic regressions.

Factors Affecting Persistence

The results of the second-year persistence and bachelor's degree attainment regressions are reported as odds ratios in Tables 2 and 3, respectively, for the sequential steps through the addition of the academic variables. As demonstrated by joint tests of significance and the change in the adjusted Rsquared statistic, the addition of the terms representing the interaction of financial aid with income status was not significant in either model, and the results of this step are not shown. Table 4 presents the "delta p" statistics for variables significant in the final model, shown in column 5 of Tables 2 and 3. As indicated by the Wald chi-squared tests in Table 2, the persistence model is not significant in column 1, where income is the sole predictor, but becomes significant in column 2 and increasingly so as additional blocks of predictors are added. The McFadden's Rsquared statistics reported in Table 2 indicate that the goodness-of-fit of the persistence model improves with each additional block of predictors, reaching .1432.

Table 2
Persistence to Second Year

Variables	(1) income	(2) financial	(3) cultural	(4) social	(5) academic
Income quartile2	1.284	1.565	1.606	1.670	1.737
	(1.29)	(2.19)	(2.33)	(2.41)	(2.59)
Income quartile3	1.141	1.580	1.634	1.421	1.471
	(0.74)	(2.34)	(2.48)	(1.65)	(1.70)
Income quartile4	1.244	1.717	1.792	1.363	1.352
	(1.09)	(2.46)	(2.67)*	(1.31)	(1.19)
tuition		1.015	1.016	1.030	1.017
		(0.70)	(0.73)	(1.34)	(0.77)
federal grant		1.036	1.035	1.055	1.065
		(0.88)	(0.85)	(1.25)	(1.50)
state grant		1.192	1.198	1.180	1.134
		(2.13)*	(2.18)*	(2.15)*	(1.66)
inst'l need grant		1.016	1.016	1.019	1.021

		(0.60)	(0.64)	(0.72)	(0.80)
inst'l grant		1.005	1.009	1.018	1.033
		(0.10)	(0.18)	(0.33)	(0.54)
federal loan		1.126	1.120	1.093	1.126
		(2.29)*	(2.20)*	(1.69)	(2.12)*
work study		1.327	1.317	1.196	1.202
		(1.91)	(1.84)	(1.24)	(1.37)
African American			1.336	1.131	1.108
			(1.05)	(0.41)	(0.34)
Hispanic			0.855	0.964	0.806
			(0.44)	(0.10)	(0.57)
Asian			1.965	2.228	2.243
			(1.71)	(2.01)	(1.88)
male			0.849	0.971	1.234
			(1.10)	(0.19)	(1.29)
Mom college grad				1.427	1.300
				(1.79)	(1.27)
delay enrollment				0.244	0.238
				(4.36)**	(4.15)**
on campus				2.304	2.211
				(4.37)**	(3.97)**
social index				1.271	1.175
				(1.98)*	(1.20)
work hours				0.986	0.986
				(2.74)**	(2.80)**
Doctoral inst.					1.339
					(1.86)
academic index					1.253
					(1.74)
gpa					1.008
					(7.17)**
Model Statistics					

Wald chi2 (df)	1.90(3)	22.34(10)	27.87(14)	95.64(14)	132.33(22)
Prob>chi2	.5937	.0135	.0148	.000	.000
McFadden's Rsquared	.0016	.0165	.0211	.0831	.1432
Adjusted McFadden's Rsq	-.005	-.003	-.005	.050	.103
LR chi2(df)	1.801(3)	19.069(10)	24.455(14)	96.107(19)	165.69(22)
Prob>LR	.615	.039	.040	.000	.000
Baseline prob	.7759				

Notes:
Observations:1087
Robust z statistics in parentheses
* significant at 5%; ** significant at 1% (multiple comparisons tested jointly and significant joint tests reported at alpha/k for k categories, alpha = .05)
NCES Data: BPS:90/94   Weight: BPS94AWT.
Subpopulation: public 4-year OFCON1=3or4

Table 3
Bachelor's Degree Attainment Over Five Years

Variables	(1) income	(2) financial	(3) cultural	(4) social	(5) academic
Income quartile2	1.185	1.262	1.250	1.265	1.252
	(0.97)	(1.24)	(1.20)	(1.19)	(1.13)
Income quartile3	1.457	1.585	1.623	1.484	1.557
	(2.50)*	(2.69)*	(2.75)*	(2.14)	(2.29)
Income quartile4	2.082	2.165	2.173	1.831	1.940
	(3.77)**	(3.74)**	(3.62)**	(2.65)*	(2.91)*
tuition		1.049	1.048	1.061	1.060
		(2.61)**	(2.56)*	(2.99)**	(2.68)**
federal grant		0.995	0.999	1.011	1.018
		(0.14)	(0.02)	(0.32)	(0.49)
state grant		1.115	1.116	1.103	1.068
		(1.67)	(1.58)	(1.39)	(0.91)
inst'l need grant		1.027	1.023	1.026	1.029
		(1.34)	(1.15)	(1.26)	(1.19)
inst'l grant		0.980	0.996	1.000	1.013
		(0.50)	(0.11)	(0.01)	(0.33)

federal loan		1.018	1.019	0.995	1.021
		(0.36)	(0.39)	(0.10)	(0.41)
work study		1.004	0.978	0.934	0.927
		(0.04)	(0.20)	(0.59)	(0.62)
African American			0.687	0.610	0.630
			(1.59)	(2.02)	(1.77)
Hispanic			0.937	1.065	0.965
			(0.18)	(0.18)	(0.10)
Asian			1.210	1.329	1.233
			(0.53)	(0.81)	(0.56)
male			0.551	0.585	0.657
			(4.23)**	(3.66)**	(2.68)**
Mom college grad				1.253	1.167
				(1.47)	(1.01)
delayed enroll				0.316	0.334
				(3.13)**	(2.96)**
on campus				1.809	1.798
				(4.20)**	(4.04)**
work hours				0.994	0.995
				(1.53)	(1.28)
social index				1.186	1.126
				(1.72)	(1.14)
Doctoral inst.					1.037
					(0.23)
academic index					1.105
					(0.96)
gpa					1.008
					(7.45)**
Model Statistics					
Wald chi2 (df)	17.6(3)	32.2(10)	53.6(14)	91.44(19)	142.78(22)
Prob>chi2	.0005	.004	.000	.000	.000

McFadden's Rsquared	.0130	.0219	.0384	.0696	.1248
Adjusted McFadden's Rsq	.008	.007	.018	.043	.094
LR chi2(df)	19.477(3)	32.803(10)	57.470(14)	104.20(19)	186.906(22)
Prob>LR	.000	.000	.000	.000	.000
Baseline prob	.5470				

Notes:
Observations: 1087
Robust z statistics in parentheses
* significant at 5%; ** significant at 1% (multiple comparisons tested jointly and significant joint tests reported at alpha/k for k categories, alpha = .05)
NCES Data: BPS:90/94   Weight: BPS94AWT.
Subpopulation: public 4-year OFCON1=3or4

Income is not a significant predictor of persistence, with the exception that income quartile 4 is positive and significant in the third step of the model, when the race and gender variables are added. Income quartile 4 is not significant when social and academic factors are added. Among the financial aid variables, state grants and federal loans have a positive effect, while the effects of other forms of aid are insignificant. With the exception of mother's college education, the variables measuring social context are significant predictors with substantive effect sizes, where campus residence and social integration both have positive effects, and delayed enrollment and increasing work hours have negative effects. The social integration index loses significance when the academic variables are added and the model controls for GPA, which is a positive and significant predictor. This suggests that social integration promotes academic achievement. Attendance at a doctoral-granting institution and academic integration are positive, but not significant. Gender and the racial indicator variables are not significant predictors once the tests on individual categories are adjusted for multiple comparisons.

The conversion of the odds ratios of column 5 to changes in probability of persistence are presented in the top portion of Table 4. These indicate that, with covariates held at their mean or modal values, the probability of persistence increases .14 by living on campus, .05 with an increase of $1,000 in federal loans, and .16 with an increase of 100 (of 400) GPA points. The probability of persistence decreases

-.34 by delayed enrollment and -.03 for an increase of 10 hours of work. For continuous variables, the change in probability in persistence from the minimum to the maximum value of that variable is indicated in Table 4 to show the full range of probabilities associated with that factor.

Table 4
Odds Ratios from Final Models as Changes in Probability

"Delta P" of Persistence, Significant Variables, Final Model, Table 2, Step 5

Variable(1/0)[a]	Minimum to Maximum		
	from:	to:	deltaP
	x=0	x=1	0->1
Delay enroll	0.6911	0.3475	-0.3435
Live on campus	0.6911	0.8318	0.1407

Variable(delta)[b]	Change(d) Centered at Mean			Minimum to Maximum		
	from:	to:	deltaP	from:	to:	deltaP
	x-d/2	x+d/2	-+d/2	x=min	x=max	min->max
Loan fed ($1000)	0.6652	0.7158	0.0506	0.6715	0.8597	0.1881
Work hours (10)	0.7056	0.6761	-0.0295	0.7472	0.5292	-0.2180
GPA (100)	0.6037	0.7666	0.1629	0.2417	0.8733	0.6316

"Delta P" of Bachelor's Degree, Significant Variables, Final Model, Table 3, Step 5

Variable (1/0)[a]	Minimum to Maximum		
	from:	to:	deltaP
	x=0	x=1	0->1
income q3	0.4631	0.5731	0.1100
income q4	0.4631	0.6259	0.1628
Male	0.4631	0.3617	-0.1013
Delay enroll	0.4631	0.2234	-0.2396
Live on campus	0.4631	0.6079	0.1448

Variable(delta)[b]	Change(d) Centered at Mean			Minimum to Maximum		
	from:	to:	deltaP	from:	to:	deltaP
	x-d/2	x+d/2	-+d/2	x=min	x=max	min->max
tuition ($1000)	0.4487	0.4775	0.0288	0.3859	0.7607	0.3748
GPA (100)	0.3690	0.5599	0.1909	0.1072	0.7291	0.6219

Notes:

[a](1/0) Indicates a dichotomous variable. For dichotomous variables the minimum to maximum change is the difference between membership in the variable group coded zero and the group coded 1 (indicated by the variable label).

[b](delta) Indicates the unit change of a continuous variable.

The changes in probability are calculated with the dichotomous covariates indicated in Table 5

held at their modal value and continuous covariates held at their means.
Data: BPS:90/94   NCES. Weight: BPS94AWT.
Subpopulation:public 4-year (OFCON1=3or4)

Factors Affecting Timely Bachelor's Degree Attainment

The logistic regression model predicting bachelor's degree attainment becomes increasingly significant and the goodness of fit improves with the sequential addition of predictors, as indicated by the Wald chi-squared and McFadden's Rsquared statistics reported in Table 3. The Rsquared value of .1248, compared to .1432 for the persistence model, indicates the predictors do a poorer job of explaining outcomes over the long term to bachelor's degree attainment.

The variables measuring parental income in the third and fourth quartiles are positive and significant across the models. Among the financial variables, only tuition is significant. Contrary to theoretical expectations and prior empirical results, it has a positive effect, a finding that is likely due to the higher costs of selective flagship institutions. Being male has a significant negative effect, while the racial indicators are not significant when the tests on individual categories are adjusted for multiple comparisons. As in the persistence model, campus residence and first-year GPA are positive predictors of success, while delayed enrollment has a significant negative effect.

The conversion of the odds ratios of column 5 to changes in probability of persistence are presented in the lower portion of Table 4. These indicate that, with covariates held at their mean or modal values, the probability of bachelor's degree attainment increases .11 and .16 by being in the 3rd and 4th income quartiles, respectively; .14 by living on campus; .19 with an increase of 100 GPA points; and .03 with an increase of $1000 in tuition and fees. The probability of degree attainment decreases .-10 for men in comparison to women and -.24 for those who delay enrollment instead of starting college with their age cohort after high school.

Discussion

The results of this study demonstrate that among four-year public college students who are financially dependent on their parents, family income is not a determinant of second-year persistence, but it is a determinant of bachelor's degree attainment. State grants and federal subsidized loans received in the first year have positive effects on persistence, but no form of financial aid is observed to have a significant effect on degree attainment. Thus, financial aid packages as they are distributed in the first year do not offset the advantages of family income for timely degree completion. The most important factors positively affecting both persistence and degree attainment are living on campus and academic performance in the first year. The observed benefit of living on campus is consistent with student integration theory, as it is likely to promote a greater sense of belonging and commitment to an institution. As Beekhoven, DeJong, and VanHout (2002) argue in linking integration theory to a student's perception of costs, "if a student cannot succeed in feeling at home or 'fitting in,' the costs of proceeding will increase. At the same time, the perceived likelihood of success will decrease" (p. 581). These perceptions are important in determining outcomes because they affect a student's willingness to integrate in campus activities and invest in their studies.

Grants certainly do reduce the costs of college, and theoretically they should be associated with positive effects. Grants tend to have negligible or positive effects in this study, but no form of grant aid is statistically significant in either final model. The positive effects of grants are difficult to observe and are likely biased downwards because the model cannot fully control for the correlation between the receipt of need-based grants and student characteristics that are negatively associated with persistence (Bettinger, 2002; Dynarski, 2002a). Students have no reason not to accept the full amount of scholarship and grant aid offered them by financial aid officers. In contrast, students may decide to reduce their course load and increase work hours rather than incur debt by taking student loans, a form of financial aid that is observed to have a positive effect. Each student's decision about loans is likely based on personal risk aversion, information about loan availability and terms, and expectations for academic success and post-baccalaureate earnings. These decisions and variations in the amount borrowed serve to distinguish the effects of loans even among a group of already enrolled students.

The state grant variable has a substantive and statistically significant positive effect on persistence until the final step when the academic variables are entered. The sequential analysis suggests, then, that state grants foster academic success, but this positive effect could be due to the inclusion of merit awards for academically prepared students in this aid category. Both Singell (2002) and DesJardins et al (2002) observe strong positive effects of merit aid on persistence. The same positive effect is not observed for institutional non-need based grants, another source of aid which would include merit awards. This insignificant result may be due to the relatively small number of students receiving institutional non-need based grants (5-8% in comparison to 30-39% receiving state grants) or to the inclusion of non-merit awards in the variable. Studies of other NPSAS financial data in which researchers also could not clearly disaggregate need-based from merit aid have found insignificant and negative effects of grants on within-year persistence (Paulsen & St. John, 2002; St. John et al., 1994). Paulsen and St. John (2002) find a negative and significant delta p of -.04 for a $1,000 change in grant aid for students in the lowest income quartile and insignificant effects for other income groups. The authors interpret this effect as an indication that grant aid was inadequate to meet college costs for low-income students. This conclusion is not supported by this study. The difference in the findings may be due to the exclusion from this study of financially independent students, who may not be able to draw on additional family resources in the event they enroll and then find grant aid to be insufficient to meet their financial needs.

Loans have a positive effect on persistence, but not on degree attainment. Loan-taking patterns among students are likely to have shifted after the first year, as students gained a better sense of their prospects for degree completion and their capacity to combine work and schooling. Students who opted out of borrowing in their first year may have taken loans, the most readily available form of new aid, in subsequent years to reduce their out-of-pocket costs. This new borrowing may have had positive effects on degree attainment that are not observed here. The distribution of aid in the first year did not close the gap in timely degree attainment between low and high income students. This implies that the distribution of aid in subsequent years must have improved in favor of low-income students for the aid

system to achieve its equity goals. In fact, federal policies changed during the five-year span covered by the BPS data in a manner favorable to middle- and upper-income students, as revisions to the federal formula for calculating financial need allowed the exclusion of home equity (Berkner, 2000; Dynarski, 2002b). The early nineties also marked the beginning of the shift in state aid towards upper income students through merit and institutional awards (Heller & Schwartz, 2002). These changes, combined with evidence that the effects of different forms of aid decline with each subsequent year of study (DesJardins, Ahlburg et al., 2002), suggest that the benefits of the aid system were not effectively redistributed in subsequent years to reduce the degree attainment gap.

The effect estimated in this study of an increased probability of persistence of .05 given an increase of $1,000 in loans is consistent with the findings of Singell (2002) who found an increase of .06 (.04 when correcting for self-selection bias). These findings are contradictory to those of Paulsen and St. John (2002), who found negative effects of loans on within-year persistence in the range of -.01 to -.03 for low income and lower middle income students and insignificant effects for upper middle and upper income students. DesJardins et al (2002) also find a negative effect of loans on persistence. A test of interaction effects in this study indicated no significant differences in the effect of loans by income quartile. This may be due to small sample size in the upper quartiles when this comparison is made. In the population examined in this study, loans were taken by relatively large proportions of students in the 1st and 2nd quartiles and small proportions of students in the upper quartiles.

The final estimated effect of loans on persistence of a delta p of .05 may be overestimated due to the selection bias created when more confident and capable students decide to incur debt. In addition, the potentially differential effects of the "intangible" components (St. John et al., 2000) of loan-taking by ethnic group have not been examined in this study. There is some evidence to suggest that students of color are more risk averse than white students (Baker & Velez, 1996; Linsenmeier, Rosen, & Rouse, 2001).

One possible interpretation of the positive effect of loans on persistence is that it is due to a greater likelihood of loan-taking among students attending more expensive (and often more prestigious) institutions. However, the receipt of loans in this study is not correlated with the level of tuition and fees (r=.025). In addition, a supplementary cross-tabulation of the proportion of students taking loans by income quartile and tuition quartile shows the proportion of students taking loans to be similar across tuition quartiles, with no statistically significant differences for any income group. The positive effect of loans is consistent with theoretical expectations, as they lower the costs of college attendance. The present value of subsidized loans is considerable, approximately equal to one-third the value of grants, because the federal government pays the cost of credit while a student is enrolled (Dynarksi, 2002).

In addition, loans may enable students to work fewer hours and become more integrated into college activities, a conclusion previously reached by King (2001) in a study of BPS data covering the years 1996-98. Work hours are shown to have a relatively small negative effect on persistence in this study. The effect may be underestimated due to the inclusion of on-campus work hours, which have been

shown to be positive, with off-campus hours in one combined variable (Nora et al., 1996) .

Recent developments in student integration theory emphasize the indirect positive effects of aid on persistence (Cabrera, Nora, & Castaneda, 1993; Nora et al., 1996). This interpretation is supported by the sequential regression analysis. Loans are not significant in step 4 when the social variables are entered, but are significant in prior steps and regain significance once the control for GPA is added in step 5. This suggests that loans enable social integration, which has a positive effect by enabling better academic performance. The social index variable is significant in step 4, but not in step 5 once GPA and the academic integration index are added. When variation due to academic performance is controlled, the independent positive effect of loans due to the reduction in costs is once again observed.

Male students, who can earn higher wages than female students without a bachelor's degree and therefore have more lucrative opportunities when they stop out of college, have lower predicted probabilities of timely degree attainment. Those who delay enrollment are also less likely to attain their degree within five academic years, an outcome consistent with their prior progress at a slower rate than their high school graduation cohort. However, only 5% of the first-time full-time financially dependent students in this study delayed enrollment, so this factor affects relatively few.

Implications

Prior empirical work estimating the effects of financial aid on college student persistence have led to contradictory results. This study contributes to this literature by estimating the effects of different types of aid on the persistence of financially dependent full-time students in the public four-year sector using national data. The findings show that subsidized loans have a positive effect on persistence. Grants have a negligible non-significant effect. A review of developments in the econometric modeling of the effects of aid on persistence (Bettinger, 2002; DesJardins, Ahlburg et al., 2002; Dynarski, 2002a; Singell, 2002a) suggest that the single-stage regression model employed here is likely to underestimate the effects of grants and overestimate the effects of loans, because, as discussed above, it does not fully control for self-selection bias. The effect of loans is estimated here at an increased probability of persistence of .05 with a $1000 increase in loan value. This estimate falls between Singell's (2002) estimates of .06 in a single-stage model and .04 in a two-stage model correcting for self-selection bias, which suggests the magnitude of the overestimation is not substantial.

From a policy perspective, it is important to accurately estimate the magnitude of the relative effects of subsidized loans and grants. Loans have come to play an increasingly prominent role in the financial aid system, and in many states public higher education is not accessible to low-income students unless they incur substantial debt (Kipp III, Price, & Wohlford, 2002). As loans replace grants in aid packages, firmer estimates of their relative effects are needed. The application of new modeling techniques in this area is promising, particularly as they may be able identify differential effects of various types of aid on students of different economic classes, cultural backgrounds, and academic abilities and over different points in

time of their academic careers.

This study examined the persistence and degree attainment of students who were financially dependent on their parents. As evidenced by the mean age of eighteen, this was a traditional college-going population of young adults who were not raising families of their own or juggling careers while they pursued their degrees. Nevertheless, in the first year they worked an average of 20 hours per week, and only 55% earned their bachelor's degree within five years. Consistent with student integration theory, living on campus in the first year was a substantive and significant positive predictor of degree completion. This finding indicates that policy makers who wish to promote timely bachelor's degree completion should favor policies that enable public college students to live on campus. Campus living fosters immersion in the academic environment, the development of peer groups and social networks, and easier access to faculty and administrative advisors. In turn, students with these advantages develop a firmer goal commitment and confidence in their ability to complete their degrees.

In this population, family income is a determinant of timely bachelor's degree completion. Financial aid packages as they are distributed in the first year did not offset the advantages of family income. Therefore, the distribution of aid had to improve in subsequent years of the data collection in favor of low-income students in order for the aid system to fully achieve its equity goals of providing the benefits of higher education to all qualified students regardless of their financial status. Two financial aid trends indicate that the distribution of aid more likely shifted in favor of high-income students from 1989 to 1994. These are the increased popularity of state merit aid, which is distributed disproportionately to wealthier students who benefit from better schooling, and the revisions to the financial aid formula that allowed for the exclusion of home equity and opened the subsidized loan program to more affluent families.

If the amount of time public college students spend working to pay tuition and fees can be reduced by more favorable aid packages, it follows from both human capital and student integration theory that their graduation rates will increase. Similarly, if students who are tempted to live in the parental home in order to economize are offered enough aid to cover dormitory costs, they will more likely be able to immerse themselves in student life and proceed steadily towards completion. For those campuses without dormitories, the construction of campus housing may in fact be a good investment to improve student retention and outcomes. As significant public dollars are spent on public colleges through operating subsidies, it is important to align financial aid programs to support those investments. While existing aid levels appear adequate to promote year-to-year persistence, they do not promote timely degree completion for low-income students. If timely degree completion is truly a priority of state policymakers, they should look for ways to enable students to spend more time in academic environments pursuing their studies.

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Notes

1. See Kane (1999) and McPherson & Shapiro (1998) for timely reviews of public higher education finance goals, and the Carnegie Commission (*Who Pays?*, 1973) for a historic treatment.
2. Hauptman (2001) emphasizes "States spend roughly twice as much as the federal government to support higher education" (p. 65) and state student aid averages only about 5% of total state funding for higher education (p. 73).
3. Economists have also studied the effects of financial aid on student choices and outcomes, such as enrollment, institutional choice, academic performance, and major field of study. See Ehrenberg (forthcoming) for a comprehensive review.
4. Adelman (1999) analyzed several other national longitudinal data bases to construct a detailed portrait of enrollment patterns and bachelor's degree attainment. His analysis, which utilized rich high school curriculum data to emphasize the primary relationship between academic experiences and college outcomes, relied on more limited measures of student finances and is less informative on this topic.
5. With the development of accountability policies, institutional researchers have also analyzed individual campus and state system data to estimate the effect of financial and other factors on timely degree completion. Knight (2002) provides a review of these.
6. See Heckman (1979) and Willis (1979) regarding the concept of self-selection bias.
7. Dynarski (2001) reaches the same conclusion after reviewing studies showing that different forms of financial aid have different effects on enrollment depending on students' income group.
8. See also Singell (2002b) for additional methodological and empirical work by this author on this topic.
9. There are two exceptions. First, the logistic regressions do not adjust for stratification because preliminary analyses showed the strata had little effect on the estimates. This decision enabled use of a wider range of software features. Second, model-based Pearson correlation coefficients were obtained because the statistical software used (Stata, version 7) does not offer a design-based correlation function.
10. Some argue that it is better not to use sampling weights in regression analyses, particularly when the weights are a function of the dependent variable. See Winship and Radbill (1994) for a thorough discussion of this issue.
11. Skinner, Holt, and Smith (1989, Table 2.1, p. 29) show that a design effect of 1.5 or 2.0 will change a nominal confidence interval from 95% to an actual interval of 89% or 83%, respectively. Failure to adjust for design effects of this size will considerably inflate findings of statistical significance.
12. A design-based F statistic (calculated from the Pearson chi-squared statistic) is reported as the test of association for categorical variables (Stata, 2001, svytab, p. 86), while a design-adjusted t-test is reported to compare means of the continuous variables (Stata, 2001, svymean, p. 69-70).
13. See Peng, So, Stage, and St. John (2002) for a rationale for presenting the change in probability at other values besides the mean.

14. Both Long (1997) and Peng, So, Stage, and St. John (2002) advise against reporting marginal effects for binary response models, given the inherent non-linearity between the predictors and the probabilities. Peng et al. (p. 270) caution "the concept of marginal probability is not useful for explaining logistic regression models," whether the marginal effects are calculated at the mean or by computing the average over all the observations. The marginal effect is a good summary measure only when the "independent variable varies over a region of the probability curve that is nearly linear" (Long, p. 75).
15. This approach is consistent with the NCES Statistical Standards (Seastrom, 2002).
16. A comparison of the results obtained for the McFadden's adjusted R squared to results of a model estimated without weighting and clustering showed that the difference between these values does not exceed .01 for these models.
17. These items measuring social integration were included in the initial 1989 survey and precede more recent scholarship (see, for example, Nora, 2001-2002; Rendon, Jalomo, & Nora, 2000) that has enriched the conceptualization of social integration.
18. The variables measuring mother's education and race/ethnicity were predictors to impute 35 cases (3.14%) of parental income. The variables parental income, mother's education, and living on campus were predictors to impute 52 cases (4.66%) of tuition.
19. The higher cost of flagship institutions is reflected in the mean out-of-jurisdiction tuition charge, which was 2.5 times the mean in-state tuition. Prestigious institutions are more likely to attract academically talented students who conduct a national college search and travel out of their home state.

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