State Postsecondary Finance Policies and Community College Students: Do Larger Expenditures Promote Degree Attainment?

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A substantial portion of students in the United States enter postsecondary education through a community college.[1] Thirty-eight percent of all freshmen enrolled in community colleges in 2004 (NCES 2005). In 2003, 37 percent of postsecondary students overall—and 48 percent of postsecondary students enrolled in public institutions—attended community colleges. For minority and low-SES students, reliance upon the community college is even more prevalent. In 2004, 43 percent of minority college students enrolled in community colleges, as compared to 34 percent of white students. A majority of Hispanic students enter postsecondary education through community colleges and 51 percent of all Hispanic college students attended public community colleges in 2004 (NCES 2005). More low-income African American and Hispanic students attend a single community college—Bronx Community College—than attend all Ivy League institutions (Bailey and Jacobs 2009).

Rates of credit and degree attainment are so low at community colleges that many students are not recouping their investments. While attainment rates differ depending on the time window afforded by each study, the non-completion rate—the percentage of students who have dropped out without attaining a degree—often ends up at approximately 50 percent (Goldrick-Rab 2010). For example, among students whose first institution was a community college in 1996, 26 percent had attained a bachelor's or associate's degree by 2001; 10 percent had attained a certificate; and 17 percent were still enrolled (Bailey, Jenkins et al. 2005). In studies employing longer time windows, roughly 25 percent of community college entrants attain an associate's degree and 20 percent transfer to a four-year institution and attain a bachelor's degree (Kane and Rouse 1995).[2] In contrast, over 65 percent of four-year entrants attain a degree.[3]

Given the degree of consensus regarding the importance of college attainment, there is a need for policies that incentivize and support increased attainment at community colleges. Yet, despite consensus on the importance of attainment, and the leading role that community colleges play in fostering access to postsecondary education, relatively little is known about the conditions that lead to success for community college students. Despite a promising surge of studies during the past five years, authors with a community college focus continue to emphasize

the need for further research. According to Goldrick-Rab, “A much more rigorous research agenda focused on community college students is needed in order to inform and evaluate future actions.” (2010). This study answers this call by examining the relation between states’ postsecondary finance policies and postsecondary attainment for traditional-age high school graduates who enter postsecondary education through a community college.

This study approaches the task of estimating impacts for state-level policies as one that requires addressing a sample selection problem. While policy analysis techniques often address *selection into the treatment*, this study addresses *selection into the sample* because the treatments—state policies—exists at a high level of aggregation and students are unlikely to change states to access a different policy. Owing to differences in state policies, postsecondary system structures, and labor market conditions, the community college population varies significantly across states. To address these dynamics, this study models the differential sorting of students into postsecondary options across states as a necessary precursor to assessing policy impacts. To engage a comprehensive approach to state financing of postsecondary education, this study introduces a “three pillars” model which includes direct appropriations, tuition, and financial aid.

The analysis finds that direct appropriations from states to community colleges significantly spur degree attainment among community college students. Tuition prices do not depress attainment, while tuition revenues appear to facilitate attainment. State and federal need-based financial aid policies are both positively related to degree attainment, whereas non-need-based aid is unrelated to degree attainment.

LITERATURE REVIEW

Sector of Postsecondary Entrance

Postsecondary enrollment options fall into ordered categories based upon academic preparation, cost, and credentials. Community colleges tend to require less academic preparation and lower financial investments than four-year institutions, but more preparation and investment

than entering the labor market directly after high school completion. Because of lower tuition rates at community colleges, the financial investment required for enrollment is less than for four-year entry, but still much larger than the zero cost of not entering college. In terms of obtainable credentials, the two-year associate's degree is the highest degree offered by community colleges,[4] while all four-year institutions offer at least the bachelor's degree. Although researchers disagree on the magnitude of the wage benefit associated with the associate's degree (Grubb 1993; Kane and Rouse 1995),[5] they generally agree that community college attainment provides labor market benefits that exceed those of high school graduates, but do not match those obtained by bachelor's degree recipients. Along each of the three dimensions just noted, the community college clearly sits in the middle between not entering college and entering a four-year institution.

I argue that the community college population is heterogeneous and comprises three groups. The center group—those who express consistent associate degree expectations—is fairly small, making up approximately one-fifth of traditional-age entrants (U.S. Department of Education 2003). Thus, to build enrollments, community colleges draw from two additional groups who sit on different margins. Another group, comprising approximately one-fifth of the community college population, sits on the margin between direct labor market entry and community college enrollment. Students in this group tend to have lower achievement and expectations than the center group. On the other margin, bachelor's degree aspirants compose three-fifths of the overall community college population. Students in this group—who tend to have moderate levels of achievement and bachelor's degree expectations—enter a community college as a perceived way station between high school and a four-year institution.

Within enrollment choice models, stronger academic resources give students more confidence that they can succeed in postsecondary education, reinforce their postsecondary expectations (Morgan 2005), and increase the expected utility of enrollment (Hilmer 2001). Even when statistically controlling for measured achievement—which reflects the contribution of social background to academic resources—socioeconomic background still exerts a significant

impact on the enrollment decision (St. John 1990). Demographic measures are included, because, for example, females are less likely (than males) to enter postsecondary education through a four-year institution (compared to a two-year institution); and more likely (than males) to enroll in a two-year institution part-time (versus full-time) (Peter and Horn 2005). Also, because additional siblings compete for parental financial resources, choice models includes a measure of family size (Fuller, Manski et al. 1982; Manski and Wise 1983; Powell and Steelman 1993; Rouse 1994). In addition to measures of social background and academic preparation, selection models include measures of economic context—especially labor market opportunities for young people—which can impact the enrollment decision (Kienzl, Alfonso et al. 2007) also (Pennington, McGinty et al. 2002). A student's choice is also a function of the postsecondary options accessible to her. Turley (2009) counted the number of institutions (by type) within commuting distance of the student's residence during high school, and treated these measures as indicators of access. Structural measures of accessibility assess the broad availability of institutions relative to the number of college-eligible young adults in a state (Rouse 1994; Hilmer 1998; Hilmer 2001).

The Challenge of Assessing Policy Impacts for Community College Students

The task of arriving at unbiased estimates of policy effects for community college students is complicated by three main factors. First, despite the average achievement gap between community college and four-year students, there is also a great deal of variation among community college students in terms of academic skills, preparation for college, family support and other observed factors that predict college success. Accurate measures of family background and academic resources can effectively address observed differences, but it is rare that the analyst has complete knowledge on all relevant factors. In addition to unmeasured characteristics that can be observed, community college students can also vary significantly on unobserved characteristics—such as motivation—which are associated with attainment. Finally, it is likely that student characteristics interact with varying state postsecondary structures and policies to

produce significantly different community college populations across states. State-specific descriptive statistics indicate substantial inter-state differences in observable student characteristics and wide variation in the proportion of two-year and four-year students across states (see Barbett 1997).

Thus, the task of assessing policy impacts for community college students is one that requires accounting for the decision to enroll in a community college. Students choose from a handful of postsecondary options when they complete high school. Unless the selection mechanism that leads to the choice of a community college can be completely specified, unobserved factors among students are correlated with the enrollment choice *and* the outcome, leading to endogeneity in the outcome equation. When the selection mechanism is not fully specified—as is common data are incomplete— correlation between the errors in the enrollment and attainment equations will link unspecified factors shaping students' enrollment choices to the model of their attainment outcomes. Moreover, when the policy under consideration influences the student's enrollment decision, it is known *a priori* that the error in a standalone outcome model will not be orthogonal to the policy and thus the policy parameter cannot be estimated without bias.

The Heckman model which accounts for sample selection bias addresses the problem of outcome-equation endogeneity in the case of a binary choice that determines sample membership (Heckman 1979; Heckman and Robb 1986). However, one cannot specify the choice of community college enrollment among other options as a binary choice when—for reasons just discussed— this choice clearly stands between not enrolling in college and enrolling in a 4-year institution. Thus, this study employs the work of Breen (1996), who extended the Heckman model to the case in which sample selection occurs among a group of ordered alternatives. The two-stage model of a binary outcome with ordered selection employed in this study is implemented by Greene (2007) in LIMDEP 9.0. This analytical approach reflects the recent trend of accounting for selection issues as an integral part of arriving at unbiased estimates of

policy impacts for community college students (e.g. Doyle 2009; Long and Kurlaender 2009; Bettinger and Long forthcoming).

The Three Pillars of a State's Postsecondary Finance Strategy

This study places a priority on measuring each of the dimensions in states' postsecondary finance strategies. In general, researchers have tended to overlook the direct appropriations dimension. This oversight occurs for at least two reasons. First, researchers have often tried to take the perspective of a student customer. For example, St. John and Starkey (1995) refer to a state's finance policy as including only tuition pricing and financial aid awards. This perspective assumes that the student only see costs that she incurs. Depending on a student's financial need, financial aid plays the role of reducing or eliminating the amount owed for tuition living expenses. However, although the student does not see a state's balance sheet, she does see the educational resources into which institutions convert appropriations: libraries, computer labs, smaller class sizes, and additional services. Like all careful consumers, the student develops perceptions about the general quality of educational services offered by institutions. Thus, while students are much more familiar with their own budgets than state or institutional budgets, they are likely to respond—in their enrollment or persistence decisions—to direct appropriations.

A second reason why direct appropriations may be omitted from some examinations of postsecondary finance strategies is that fiscal austerity is seen as a given. The perennial shortage of state revenues for postsecondary education stems from the general difficulty in enacting tax increases, and increased competition from other public needs such as elementary and secondary education, health care, and infrastructure (Johnstone 2004). In the midst of states' fiscal problems during the 1980s and early 1990s, Wallace (1992), a college administrator, promoted the "high tuition, high aid" strategy.[6] Within this framework, expansion of public funding for higher education is unrealistic given the perennial shortage of available tax revenues for higher education in most states. The perceived intractability of state budget shortfalls, however, is not a valid reason for treating direct appropriations as off-limits in discussions and analyses of

postsecondary finance. Because direct appropriations matter to all actors—students, state officials, and educators—I include them as the first pillar in states' postsecondary finance strategies.

States Create Variation in Postsecondary Education

The case for analyzing finance policies at the state level is straightforward, because states are a primary source of variation in per-student expenditures, tuition prices, and financial aid awards. States either directly provide, or mandate through tuition pricing, the majority of funding for public postsecondary education. For example, in the 1980 academic year, states provided 46 percent of total funding to public, degree-granting postsecondary institutions in the form of appropriations (Snyder, Dillow et al. 2009). Almost all of this funding was in the form of direct appropriations for institutional operating budgets.[7] During the same year, tuition fees—set by states—accounted for an additional 13 percent of funding for public institutions, bringing the state-controlled portion of the public postsecondary budget to 59 percent.[8] The state share of the total has decreased somewhat over time, and tuition revenues have become a larger share of the state total.

The federal government plays a smaller role in the area of appropriations, and uses different funding streams to support institutions.[9] Instead of providing direct appropriations for operating budgets, the federal government supports postsecondary education through program-specific grants and contracts. In 1981, this funding stream accounted for 13 percent, and by 2000 that portion had shrunk to 11 percent of the overall total postsecondary budget. The majority of restricted grants and contracts go to four-year institutions rather than community colleges. Financial aid is the finance policy area in which the federal role is larger than the state role. Despite large federal contributions to grant and loan programs, states continue to exercise control over a majority proportion of funding for postsecondary education.

State financing strategies differ significantly, resulting in varying amounts for each of the three finance pillars, and varying levels of integration among them. Hearn, Griswold, and Marine

(Hearn, Griswold et al. 1996) assessed the causes of inter-state variation in state's approaches to postsecondary financing. They found significant regional differences in prices for public four-year and two-year institutions, with the Northeast having the highest tuitions and the Southwest having the lowest. Per-capita financial aid payments to students mirrored tuition prices, with states in the Northeast spending the most on financial aid, and states in the Southwest spending the least. A measure of "rationalization" between tuition pricing and financial aid disbursements—an operationalization of the "high tuition, high aid" strategy (Wallace 1992)—also found that states in the Northeast had the most rationalized policies, while states in the Southwest policies were the least rationalized. Governance arrangements impacted tuition differentials between two-year and four-year institutions, with *weaker* governance structures producing pricing schemes that more strongly favored two-year institutions. These findings point to some potential causes of interstate variation in finance strategies. This study builds on these findings by assessing whether differences in finance strategies lead to differences in student outcomes.

The Attainment Model

I build on the Bean and Metzner (1985) model of postsecondary attainment for non-traditional students, which distinguishes between on- and off-campus environments. This model includes insights from the predominant persistence model (Tinto 1975; Tinto 1993), which cogently describes a positive relation between academic and social integration of students into formal and informal social processes taking place on campus. Despite its elaboration of the on-campus environment, the Tinto model overlooks the imbeddedness of community college students within residential, family and employment contexts external to the campus. Bean and Metzner (1985) argue that environmental forces in the off-campus environment substantially shape the postsecondary experiences of nontraditional[10] students. These forces include off-campus employment, as well as family relationships and obligations.

To date, models of postsecondary attainment have not explicitly included educational policies. Thus, I modify the Bean and Metzner model to include the broader policy environment. The broader policy environment can promote attainment by directly impacting the quality of curriculum and instruction within colleges and universities. Improvements to the within-college environment enhance students' academic experiences, which make successful academic outcomes more likely. Policies can influence the utility and satisfaction that students connect to their college experience. Finally, the policy environment—especially financial aid policies—can alter the 'outside-college' environment in ways that promote attainment. Such alterations can include a reduction in lengthy work hours or debt load, which in turn improve students' psychological experiences of postsecondary education.

Direct Appropriations: The Foundation of Postsecondary Finance

Direct appropriations are public funds transferred directly to colleges—without passing through the student—for general or specific educational purposes. Funds can come from local, state or federal sources. On average, direct appropriations are the largest of the finance pillars, followed by tuition and financial aid, and states provide the largest share of direct appropriations to postsecondary institutions. Unlike four-year institutions, community colleges receive significant appropriations from local governments. While federal government does provide direct funding to public postsecondary institutions, only a very small proportion of this funding comes in the form of direct appropriations. The majority share of federal funding is disbursed through restricted grants and contracts, and four-year institutions control the majority of these arrangements.

When states experienced fiscal difficulties in the 1980s, legislatures began to withhold increases in direct appropriations. Despite increasing demand for postsecondary education during this period, legislatures held constant or reduced direct appropriations. This led to a downward trend in the proportion of public postsecondary funding provided through direct appropriations which continued during the 1990s, and continues to this day. During the period from 1981 to 2001, state appropriations fell as a share of community college revenues from almost 50 percent

to 32 percent (Roessler 2006). Although the proportion of community college budgets funded by direct state appropriations has decreased significantly since 1981, state appropriations still cover the largest proportion of community college budgets, when compared to other sources.[11]

Direct appropriations and attainment.

Large direct appropriations may lead to increases in school quality through measurable improvements in curriculum and instruction, which may in turn facilitate higher rates of attainment. Direct appropriations may also boost perceived quality. In this scenario, students expect larger labor market returns to education when attending a college that they believe—or that is generally understood—to be of good quality, and therefore they exert extra effort to persist until degree completion. In an alternate scenario, students persist to degree completion solely as a consequence of higher expected labor market returns in a state's economy, rather than as a consequence of educational quality.

Because a limited body of research addresses the relation between direct appropriations and attainment, related literatures on school investment, school quality, and college selectivity inform the three pillars model. In contrast to the literature on school quality and test scores (Coleman, Campbell et al. 1966; Jencks, Smith et al. 1972), the school investment literature has consistently found a significant relation between school quality and attainment, although the relation is not always robust to specific features of the data set or model specification (Card and Krueger 1998). For example, Heckman, Layne-Farrar, and Todd (1996) found their measures of school quality—each driven by larger expenditures—consistently and significantly related to high school and college completion.[12] Students who attended primary and secondary schools in states with lower pupil-teacher ratios, higher teacher salaries, and longer school years were less likely to drop out of high school, and more likely to complete a college degree.

Arum's (1998) work provides empirical support for the notion that school quality matters for vocationally-oriented students. Assessing high school graduation rates for vocational students, he found significantly higher graduation rates for students in states that invested heavily in their vocational education programs. The higher graduation rates were present for students

who were primarily vocational in their coursework, as well as for students who combined vocational course work with academic courses. Observed graduation differences were identified from within-school comparisons—rather than interstate comparisons—among students with similar test scores engaged in different high school curricula. Because vocational and non-vocational students entered the same labor markets, the observed graduation effects are likely the consequence of improved (vocational) program quality, rather than the byproduct of unobserved interstate differences in labor market opportunities for students with high school degrees.

Quality-oriented research at the postsecondary level has tended to focus on institutional selectivity rather than monetary expenditures or quality measures, and findings from this work are consonant with the hypothesis of a positive relation between resources and attainment. Bowen and Bok (1998) found that students' probabilities of degree attainment increase as the selectivity of the colleges they attend increases—even for students who enter college with lower-than-average entrance scores. Recent research by Melguizo (2008), employing an advanced econometric technique to account for academically-motivated students choosing selective institutions, also finds a benefit for students with lower-than-average test scores who attend selective institutions.

Researchers addressing the importance of resources within community colleges have focused on per-student expenditures within two key areas of college budgets: student support services and instructional staffing. Within Tinto's (1975) student integration model as applied to community college students (Tinto and Russo 1994), student support services are seen as one way in which community colleges can increase academic and/or social integration. Analyzing administrative data from South Carolina community colleges, Wyman (1997) found a significant positive relation between a combined measure of instructional and student support expenditures and first-year retention. Using a nationally-representative sample, Gross and Goldhaber (2009) found that increased expenditures on student support services promoted transfer from two-year to four-year institutions. Using institution-level data from the Integrated Postsecondary Education Data System (IPEDS) Jacoby (2006) found that college-level increases in the proportion of part-

time faculty leads to decreases in graduation rates. Using administrative data from California, Jaeger and Eagan (2009) found that increased contact with part-time faculty decreases the probability of associate's degree attainment. [13] Sample selection issues complicate causal inference from staffing studies. Colleges with more able students may be more likely to attract full-time faculty, or may be surrounded by communities more willing to augment state contributions to teacher salaries. Nevertheless, the findings from these studies support the notion that direct appropriations matter for the graduation probabilities of community college students.

This study asks whether—net of observable student characteristics and the decision to enroll in a college—students in states that directly appropriate larger amounts of financial resources to two-year colleges have a higher probability of attaining a college degree. When assessing this relation between government appropriations and student attainment, are direct appropriations from states more strongly associated with the outcome than federal and local appropriations? Are observed appropriations-attainment relations robust to additional model specifications that control for institutional and economic features of states, regions, and geographic divisions?

Tuition Pricing

The tuition price is the primary component of the "sticker price" of postsecondary education (Heller 1997). For students, Leslie and Brinkman (1987) summed up the meaning of tuition as such: "Tuition is the most visible college price, and it is the one that is most inescapable" (page 196). In contrast to the relative obscurity of revenue and expenditure line items, tuitions are publicized, and often the subject of vigorous public debate. Because public institutions have limited pools of institutional aid with which to alter tuition prices, tuition prices are fixed—rather than controllable—costs. In most cases, tuition must be paid, or offset through financial aid. Within public institutions, course load is the main source of variation in tuition prices between students. While room and board prices are also included in the sticker price of postsecondary education, students tend to see these costs as controllable (Paulsen and St. John 2002). [14]

Legislators and educators view tuition differently than students. For them, tuition is a revenue line item that, apparently, is much more flexible than direct appropriations. Beginning in the early 1980s, legislators and educators have increased tuition prices substantially while, on average, increasing direct appropriations slightly. Real tuition rose in all sectors during the 1980s (Heller 1997). This study documents that two-year and four-year tuitions grew in real dollars by 77 and 67 percent, respectively, during the 1980s (see Table 2). Recent research by Roessler (2006) documents that, between 1980 and 2000, tuition grew as a share of community college revenues, while the size of state and local appropriations declined.

Tuition pricing and attainment.

Most tuition-attainment studies have considered year-to-year persistence, rather than degree completion. Using NPSAS data, St. John and Starkey (1994) found a negative relation between tuition prices and within-year persistence for traditional-age college students. Each 100 dollar increase in price decreased the probability of persistence by 1.4 percentage points. Using the same data, Hippensteel, St. John, and Starkey (1996) found a similar effect for adult[15] community college students: the probability of persistence decreased by 1.8 percentage points for each 100 dollar increase in tuition. These effects, however, are triple the effect size obtained in an identical analysis of tuition effects for traditional-age college students in public universities (St. John, Oescher et al. 1992), suggesting that two-year students may be more price sensitive than four-year students.

This study assesses the relation between tuition and degree attainment, while taking into account the relation between tuition and enrollment. The analysis assesses whether students in states with higher tuition are more or less likely to complete degrees than students in states with lower tuitions. Does the tuition-attainment relation change when accounting for tuition revenue instead of tuition price? Are observed tuition-attainment relations robust to alternate model specifications that account for state and regional context?

Financial Aid

The term financial aid comprises institutional aid, federal grants from four sources,[16] state grants from several sources,[17] private grants, and federal student loans (subsidized and unsubsidized) to students and their parents.[18] This study focuses on need- and non-need-based grant aid from state and federal sources. As a percentage of total grant outlays, state contributions have grown from 32 percent of the total (The College Board 2002) in 1992-93 to 56 percent of the total (22 billion) in the 2006-07 academic year (The College Board 2008).[19] As states have increased their spending on financial aid, they have devoted larger portions to non-need-based aid. This trend emerged after the 1980s. During the 1980s the ratio of non-need- to need-based aid was constant at 10 percent.[20] By 2006-2007, non-need-based aid had grown to 30 percent of state appropriations to grant aid (The College Board 2008).

The presence and absence of financial aid can represent both material and psychological opportunities and constraints on student behavior. The underlying logic of the federal approach to financial aid, as represented in the Free Application for Federal Student Aid (FAFSA) process, is that the lack of sufficient financial aid poses a material barrier to college entry. The application process is oriented toward determining the student's amount of financial need. The gap between the immediate costs of a specific college education and the financial resources—from family support and working—represents financial need. "Unmet need" (Paulsen and St. John 2002) represents the extent of need (tuition plus living costs) not covered by financial aid and student loans. An excessive amount of unmet need clearly poses a material barrier to college entry or continuation. Moderate levels of unmet need, however, can create psychological stress for a student. Thus, a broader view of financial aid acknowledges a psychological dimension to how students perceive their financial situation, and how they view the relation between college costs and enrollment decisions (Paulsen and St. John 2002). Moreover, psychological orientations to college costs and the various means of paying for them may differ among students, and across groups of students (St. John, Paulsen et al. 2005).

Financial aid and persistence.

Researchers have tended to find a positive relation between financial aid and persistence. Analyzing a pre-Pell Grant sample, Astin (1975) found that grant aid encouraged persistence, while loans depressed persistence. Using a large sample including Pell recipients from the mid-1970s, Astin and Cross (1979) found that grant aid encouraged persistence, and that the effect size increased with the size of the grant received. Examining aid effects for students at an urban four-year commuter college, Voorhees (1985) found that Pell Grant aid was positively and significantly associated with persistence, although the effect size was smaller than for work-study assistance and direct student loans.

Recent studies have employed more sophisticated quasi-experimental techniques to arrive at causal estimates of aid effects. Noting the need for "a source of variation in aid that is plausibly exogenous to unobservable attributes that influence college attendance," Dynarski (2003) employed a difference-in-differences analysis to examine enrollment and persistence rates for two groups of students temporally located on each side of the break in financial aid provided to offspring of Social Security beneficiaries, which took place during 1981.[21] While her findings indicate a strong relation between aid receipt and first-year enrollments, they indicate only a positive but non-significant relation between aid receipt and first-to-second-year persistence, and between aid receipt and years of college completed.[22] Singell (2004) used a two-step procedure to model first-to-second-year retention conditional upon initial enrollment in the University of Oregon. After accounting for unobserved factors reflected in the initial enrollment decision, he found a positive relation between grant aid and re-enrollment.

Recent experimental evidence provides some additional support for a positive relation between grant aid and persistence for community college students. A recent report from a randomized trial conducted by MDRC finds increases in semester to semester persistence and credit attainment associated with a 1,000 dollar-per-semester subsidy provided to adult female students with children in New Orleans (Richburg-Hayes, Brock et al. 2009). Persistence from the first to second semester was 18 percent higher in the treatment group than the control group.

However, this difference decreased during the following three semesters, and the study was not completed due to disruption from Hurricane Katrina.

Financial aid studies specific to community college students have produced mixed findings. Using nationally-representative data from NPSAS-1987, St. John and Starkey (1994) found a negative relation between grant aid and within-year persistence for community college students. They arrived at similar findings—using the same national database—for students at four-year institutions (St. John and Starkey 1995). However, these findings contrast those of St. John when using data from the high school longitudinal studies. Analyzing data from the NLS72 and HSB, St. John (St. John 1989) consistently found a positive relation between grant aid and year-to-year persistence. The lack of control for high school experiences and academic achievement in the NPSAS database likely accounts for the difference in results between these two studies.

This study assesses the relation between per-student state expenditures on financial aid and attainment, for all students regardless of aid receipt. This analysis captures an intent-to-treat impact of unit increases in a state's financial aid expenditures. Are students in states with generous programs more likely to attain degrees? Do the effects of financial aid differ according to whether aid is allocated by financial need, or according to other criteria? Does the aid-attainment relation differ for state and federal programs? Are observed aid-attainment relations robust to additional model specifications that account for contextual features of states, regions, and divisions? Because the empirical literature finds low-income and African American students more price-sensitive than high-income and white students, the analysis also assesses whether financial aid increases have statistically different impacts on low-income and black students.

DATA AND METHOD

Two Comparable Samples of High School Students

This study employs the two most recent nationally-representative databases of high school students for whom full postsecondary transcript data are available.[23] The first cohort of students

entered the tenth grade during the fall of 1980, and was sampled for The High School and Beyond Survey (HSB) (National Opinion Research Center 1995); the HSB cohort was scheduled to graduate from high school in the spring of 1982. The second cohort of students attended eighth grade during the spring of 1988, and was sampled for the National Educational Longitudinal Study of 1988 (NELS) (Research Triangle Institute 2002); the NELS cohort was scheduled to graduate from high school in the spring of 1992.

To maximize comparability across the two cohorts, this study employs matched panels of students representing the population of U.S. tenth grade students.[24] The sampling design for the two studies was similar, in that both were multi-stage, stratified samples representative of U.S. students at the time of their fielding. Because the HSB study was fielded in tenth grade, it is more clearly representative of U.S. tenth graders within high schools than the NELS study. To compensate for the fielding of the NELS study for eighth graders within middle schools—and to enhance comparability between the NELS and HSB studies—NCES freshened the NELS sample during 10th grade (1990). Freshening compensated for sample attrition, thus creating a new panel representative of 10th graders nationwide (U.S. Department of Education 2002). This study employs this freshened panel of tenth graders and the sophomore cohort from HSB, along with their respective sampling weights.[25]

The HSB and NELS databases provide an extensive record of students' high school accomplishments, their family background, and their experiences and course taking patterns, as well as psychological measures regarding self-confidence and postsecondary aspirations. The breadth of these background measures far exceeds those offered in the NCES postsecondary studies (i.e. NPSAS and BPS). In addition, the HSB and NELS databases provide records of cognitive tests during 10th and 12th grades. Although the NELS survey includes a survey of all parents that is sorely lacking in the HSB,[26] measures of family background are comparable across the two surveys. When choosing measures from the two databases, care was taken to employ, whenever possible, measures that NCES constructed for the purpose of comparability across the two surveys.

Analytical Sample of High School Graduates and Two-Year College Starters

Because of the two-stage analytical approach, this study requires two analytical samples: an inclusive sample of college-eligible students, and a select sample of students who began their postsecondary careers at two-year institutions. I define as college-eligible those high school students who completed high school—via diploma or GED—within 4.5 years of their scheduled graduation. This window provides ample time for students without severe learning difficulties to complete high school, and is inclusive of almost all students who eventually completed high school during either of the study periods. The positioning of this window also allows the graduates sufficient time for postsecondary attainment within the study period. All students who were not confirmed completers by their respective cut-off dates were eliminated from the analytical sample, thus resulting in a sample size of 22,110 students: 11,550 from the HSB cohort and 10,560 from the NELS cohort. Of these two groups, 3,420 HSB students and 3,410 NELS students began their postsecondary careers at a two-year institution.[27] This category is inclusive of public two-year institutions (community colleges) as well as private non-profit and for-profit two-year institutions. The focus of this study is community college students, who represent 90 and 92 percent of two-year entrants in the HSB and NELS cohorts. Private two-year students are included in this study because selection processes appear similar for students entering two-year institutions,[28] and because increasing numbers of students have enrolled in private two-years during recent years.

Key Analytical Measures

Postsecondary sector.

For the full sample of college-eligible students, a three-category ordinal measure of entrance sector records whether a high school completer did not enter postsecondary education at all; entered postsecondary education through a two-year institution; or entered through a four-year institution. The postsecondary experiences panel of Table 1 indicates that 38.2 percent of college-eligible HSB students and 23.4 percent of college-eligible NELS students did not enter postsecondary education. The balance of students in each cohort entered through a community

college, a private two-year institution or a four-year institution. The selection model groups all two-year entrants in the same entry category. A binary measure flags private two-year entrants in the selection and outcome models.

Undergraduate Degree Attainment.

The binary degree attainment measure received a code of one for any student that completed either an associate's or bachelor's degree. This measure derives from summary measures of the highest degree attained, from the HSB and NELS postsecondary transcript studies. A small fraction of cases received an imputed degree score, inferred by NCES analysts from multiple data sources. The highest degree measures presented in Table 1 indicate that although the rate of degree attainment within the full cohort samples increased across the two cohorts, degree attainment was stable within the two-year and four-year student populations.

The HSB and NELS studies differ in the time window afforded for degree attainment by their postsecondary transcript studies. The HSB postsecondary transcript study (PETS) was carried out in February through October of 1993, and tracked students' postsecondary careers until the end of September 1993, thus providing an 11-year horizon for postsecondary attainment (U.S. Department of Education 1995). The NELS PETS—which was carried out upon completion of the fourth follow-up study in 2000—followed students' postsecondary careers until September of 2000, thus providing a postsecondary horizon of 8 years—for modal high school graduates (Curtin, Wu et al. 2004). The 3-year difference in the duration of time horizons makes it more difficult to observe increases in attainment across the study period, and could bias the estimation of policy impacts if a specific policy differed substantially across the two cohorts.

Direct government appropriations.

Average per-student direct governmental appropriations to two-year institutions from all sources includes appropriations from local, state, and federal government sources that pass directly to institutions, without passing through students. This is a per-student computation based on institution-specific totals. To temporally match state-level finance data to the HSB database, I relied on measures from the eighteenth Higher Education General Information Survey (HEGIS

XVIII),[29] which queried college administrators about revenues and expenditures during the 1982-1983 academic year. To compute an appropriations measure concurrent with modal college entry for NELS students, I relied on items from the Integrated Postsecondary Education Data System (IPEDS) for the 1992-93 academic year.[30] The numerator for government appropriations to two-year institutions includes direct appropriations—unconditional per-student appropriations—as well as revenues from conditional grants and contracts from local, state and federal sources.[31] The enrollment denominator for the 1982-83 appropriations measure comes from the Institutional Characteristics component of HEGIS XVIII, which provides the corrected enrollment figures for fall 1982. From IPEDS, I drew the corrected enrollment figure for fall of 1992. For each public two-year institution for which data were present, I computed a campus-specific average (per-student) appropriation figure, and then computed an enrollment-weighted statewide average from the campus-specific figures. State averages for the 1982-83 academic year were adjusted to 1993 dollars, so that average governmental appropriations to two-year institutions represents average per-student governmental appropriations to two-year institutions in 1993 dollars, for each state during both periods.[32]

Separate state and non-state revenue measures were constructed using the same approach as for the combined measure, with the exception that grant and contract income from federal and local sources were grouped into a separate measure. Local appropriations compose the majority of appropriations included in the measures of federal and local appropriations to two-year institutions. Approximately half of all public two-year institutions in the HEGIS database reported no appropriations from the federal government. Thus, the comparison between state and non-state appropriations is primarily a comparison between state and local appropriations.

Tuition price and revenue.

The tuition price measure is based on the tuition price that students see. To compute the tuition prices faced by students in the HSB cohort, I drew data from the Basic Student Charges Component of the HEGIS XVII database for the 1982-1983 academic year. The HEGIS survey form instructed college administrators to report a modal tuition figure: the per-annum tuition

figure most commonly paid by students. Because this study focuses on community colleges, only free-standing publicly-controlled two-year institutions or branch campuses of larger two-year systems were included in the two-year tuition computations. To arrive at an accurate statewide average tuition price for two-year and four-year students, I weighted the modal tuition price for students at each institution according to the corrected fall enrollment at that college, obtained from the Institutional Characteristics component of HEGIS XVIII. Next, I computed the full set of sector-specific statewide average tuition price figures by summing the weighted institution-specific figures and dividing by the total number of students enrolled in each sector, for all states.

To compute tuition measures concurrent with the entry of NELS cohort members into postsecondary education, I drew data from the IPEDS database for the 1992-93 academic year, for public two- and four-year institutions, again excluding two-year branches of university systems from the two-year computations. Over the period from 1983 to 1992, NCES shifted from surveying modal tuitions to average tuitions for full-time students during the period. Under the reasonable assumption that most institutions considered full-time enrollment as the modal enrollment intensity when reporting to HEGIS, the HEGIS and IPEDS measures are comparable. As with the HEGIS data, I computed weighted-average tuition prices for two-year and four-year institutions in each state, with the exception of South Dakota.[33] Tuition revenue measures were computed using the same data sources—HEGIS and IPEDS—and the same computational strategy as for the appropriations measures.

Financial aid.

To assess the relation between state aid programs and attainment, I constructed per-student measures of need- and non-need-based financial aid for each state during the 1982-83 and 1992-93 academic years. The National Association of State Student Grant and Aid Programs (N.A.S.S.G.A.P. 1983; N.A.S.S.G.A.P. 1994) provided measures of total state disbursements (to undergraduates) from these two types of aid programs during both of these years. The denominator for the 1982-83 computations comes from an NCES report entitled “Fall enrollment in Colleges and Universities, 1982” (Broyles 1984), which is based on fall enrollment data from

HEGIS XVIII. The 1992-93 denominator comes from Table 195 of the 1995 Digest of Education Statistics (National Center for Education Statistics 1995). To measure enrollment, I employ the total full-time-equivalent (FTE) undergraduate enrollment figures for fall 1982 and 1992. To compare equal dollars across the two periods, I converted the 1982-83 aid amounts to 1993 dollars.

Covariates.

This study draws on the detailed socio-demographic measures provided in the HSB and NELS databases. Binary gender and race/ethnicity measures, as well as a continuous number of siblings measure, were derived directly from composite measures within the HSB and NELS databases. Social background measures within the ordered probit selection model include a set of five parental educational categories and a continuous measure of family income during high school, in 1991 dollars for students in both cohorts. The parental education measures track the highest level of education for either parent into categories including high school or less; less than two years of college; two or more years of college; college degree; and advanced degree. To cut down on the number of predictors and decrease collinearity between the selection and outcome models, the outcome model employs a smaller set of dichotomous socioeconomic quartile measures provided by NCES. A binary measure for "outside responsibilities after high school" draws on NCES marriage and child-bearing measures to account for family structure during college, flagging students who were either married or had children.

To represent academic resources, both models employ a twelfth-grade composite reading and math achievement test score, which retains the NCES scaling to a mean of 50 and a standard deviation of 10. Two mutually exclusive binary measures indicate each student's location in either the vocational or academic track, as indicated by high school transcript data.

Two measures of psychological resources are employed. The "consistent" expectations measure examined students' survey responses during both years and picked the lower of the two values. For example, if a student responded in tenth grade that they expected to complete a bachelor's degree and responded in twelfth grade that they expected an associate's degree, the

consistent measure coded the student as having associate's degree expectations. Locus of control, an additional measure employed in the selection model, comes directly from the scale scores constructed by NCES from a common set of items included in the tenth and twelfth grade surveys of HSB and NELS students.

Binary flag variables are used to distinguish NELS from HSB cohort members; to distinguish students attending proprietary 2-year institutions from community college students; to flag students who delayed postsecondary entrance (1 to 4 years after scheduled graduation), as well as those considered late entrants (enrolled more than 4 years after scheduled graduation); and to flag students with an imputed college transcript.

Analytical Technique

Latent construct within the selection model.

The enrollment choice model developed by previous researchers (Fuller, Manski et al. 1982; Manski and Wise 1983; Weiler 1989; Rouse 1994; Hilmer 1998; Hilmer 2001)—and the one used in this study—is a random utility model. While the actual utilities that each prospective student attaches to options within the model cannot be known, they can be probabilistically estimated by the researcher (Rouse 1994). From the information available to her—much of which is not available to the researcher—the student forms a "subjective probability of graduation" (Hilmer 2001) which is the latent force that drives the enrollment decision.

Estimating the ordered probit selection model.

Accounting for the non-random selection of students into the community college population is a pre-condition for arriving at accurate parameter estimates for policy measures within the outcome model. The selection process is modeled as one in which the young adult chooses from an ordered set of postsecondary entrance options: no entrance; the community college sector; and the four-year sector. The student's categorical entrance decision is conceptualized as reflecting a continuous latent preference for postsecondary education, which is driven by observable and unobservable student attributes, geographic proximity of college sector

choices, labor market demand, and by the policy itself. An ordered probit model provides an accurate depiction of this choice set, with z_i representing the actual ordered choice and z_i* representing the latent preference of the student for postsecondary education:

$$z_i = w_i'\alpha + e_i$$

The observed selection, z_i, takes on three possible values: 0, 1, and 2. The latent outcome, z_i* is assumed continuous and normally distributed with a standard deviation of 1, the customary distribution for a probit model.

$$z_i* = w_i'\alpha + e_i$$

In the observed and latent equations, w_i is a column vector that includes student-specific traits including gender, family size, race/ethnicity, postsecondary expectations, and achievement.

Estimating cut-points for the latent postsecondary preference.

The student's observed choice of college sector depends on the range of $z*$ within which z_i* falls, leading to three possible entrance-sector choices:

when $-\infty < z_i* \le c_1$, $z_i = 0$, and the student does not enter college;

when $c_1 < z_i* \le c_2$, $z_i = 1$, and the student enters community college;

and when $c_2 < z_i* < \infty$, $z_i = 2$, and the student enters a four-year institution.

There are two cut-points at which the student's latent preference crosses a threshold. Cut-point one (c_1, equal to zero[34]) is the point at which the student's latent preference crosses from not entering college to entering a community college. The second cut-point occurs at a location determined by the parameter estimate for c_2, the point at which the latent preference crosses from community college to four-year entrance. Parameter estimates for the threshold parameter c_2 and the parameter vector α are arrived at through probit regression, using the full sample of students from both cohorts.

Thus, the unbiased expected value of the outcome, conditional upon the student's attributes and his or her choice to enter community college is as follows:

$$E[y_i \mid (x_i, z = 1)].$$

Using this condition to revise a simple policy analysis model yields the full outcome equation:

$$E[y_i] = x_i'\beta + v_i\eta + E[u_i \mid z_i = 1].$$

The outcome is represented by y_i; x_i is a column vector of student attributes, and β the corresponding column vector of parameter estimates; v_i indicates whether or not the student was exposed to the policy, and η denotes the parameter estimate for the corresponding policy impact. This model, however, cannot be estimated as written because it is impossible to know (from this formulation) the expected of value of the error, u_i, conditional on a selection ($z_i = 1$) made by all of the students in the selected sample of community college students.

Using the bivariate normal distribution to estimate the conditional error.

Drawing on a handful of well-established insights from the statistical literature on bivariate normal distributions, it is possible to re-express the conditional expectation of u_i in terms of estimated parameters from the selection model, such that the full outcome equation can be estimated. Drawing on foundational work by Tobin (1979) regarding truncated distributions, this two-step process has been formalized by Heckman (Heckman 1979; 1986) Breen (1996), and Greene (Greene 2003; Greene 2007).

Because the observed sector selection z_i is expressed as a function of the underlying latent preference z_i*, it can in turn can be expressed as a function of the selection regression equation, $w_i'\alpha + e_i$. From above, it is also known that values of z_i* for community college students are bounded by the cut-points c_1 (zero) and c_2. Thus the conditional relationship between u_i and z_i can be re-expressed:

$$E[u_i \mid c_1 \leq (w_i'\alpha + e_i) \leq c_2].$$

It is well-known in the statistical literature on bivariate normal distributions (Johnson and Kotz 1972) that, when two variables—in this case the selection and outcome errors—share a bivariate normal distribution, the expected value of one variable (in this case u_i)—when censored with respect to a value of the other variable (e_i)—can be expressed as a function of the product of the following values: the correlation coefficient ρ for the two variables; the standard deviations for each of the variables; and the ratio of the probability density for the second variable to the probability of the second variable (Breen 1996):

$$E[u_i \mid e_i > 0] = \rho\sigma_e\sigma_u \frac{\phi(e_i)}{\Phi(-e_i)}$$

Computing the inverse Mills Ratio in the case of double truncation.

The current case—where the selection equation predicts community college entry—is one of double truncation, in which z_i*is bounded on the lower end by c_1 (zero), and on the upper end by c_2. Thus, to assess the expectation that z_i*falls between these two bounds, it is necessary to assess the density at each of these bounds, and the probability for e_i taking on a value that is in the range between c_1 and c_2. Applying basic principles regarding the probability density (numerator) and the cumulative distribution function (denominator) yields the following inverse Mills ratio:

$$\lambda_i = \frac{\phi(c_1*) - \phi(c_2*)}{\Phi(c_2*) - \Phi(c_1*)}$$

Using this formulation of the inverse Mills ratio, the expected value of the outcome—conditional upon the error term from the selection equation falling between the two boundaries—can be expressed using the following equation derived by Breen (1996; Equation 4.4a, page 52).

$$E(y_i|c_1 \leq e_i \leq c_2) = x_i'\beta + \sigma_{ue}\left[\frac{\varphi_i(c_1) - \varphi_i(c_2)}{\Phi_i(c_2) - \Phi_i(c_1)}\right]$$

Computing the complete outcome equation.

Substituting the simplified full term into the full outcome equation for the expected value of y_i yields the following complete equation:

$$E[y_i] = x_i'\beta + v_i\eta + \sigma_{ue}\left[\frac{\phi(c_1*) - \phi(c_2*)}{\Phi(c_2*) - \Phi(c_1*)}\right] + u_i*$$

The computation of this equation is the culmination of the two-step procedure which first computes the probit model for sector selection, thus estimating the parameter vector w', as well as c_2 and e_i. Once the estimates from the probit model are used to construct λ_i, the second step employs probit regression to compute the complete outcome model. The new error term u_i* captures the unexplained variance in the outcome model, without encompassing the portion of the errors that co-varies between e_i and u_i (in a simple regression model); this shared portion of error now appears *within* the model as the parameter estimate for σ_{ue}.

Predictors in the Two-Stage Model

Predictors are distributed across the selection and outcome stages of the model in a manner reflecting the literature on two-stage models, as well as some practical considerations regarding the temporal sequence of student decision making, model size and collinearity between predictors. As is common in two-stage models, the collection of individual-level covariates is quite similar in the selection and outcome models. The selection model used for all computations in this study includes the socio-demographic measures: gender, race/ethnicity, parental education, and family income; the test score and high school track measures; and the expectations and locus of control measures.

Three instruments are included in the selection model. This approach conforms to the methodological literature which strongly poses in identifying restriction for two-stage models which is best served by at least one instrument in the selection model (Breen 1996; Hilmer 2001). Such instruments should only affect the outcome through their influence on the selection process. In keeping with Turley's (Turley 2009) work on college proximity; this study includes two sector-specific measures of proximate college opportunities in the w_i vector: the distance in miles from the student's high school to the nearest community college, and the distance in miles to the nearest four-year institution. In addition to the college proximity measures, the vector w_i also includes measures for the structural accessibility of postsecondary options within a student's state. As indicated in Appendix 1A, structural accessibility is operationalized as the number of

institutions per 10,000 young adults (ages 17-25 years old) in a state. Like the geographic proximity measures, they are assumed to affect the outcome only through their influence on the selection process. Within the selection model, the accessibility of four-year institutions adds significantly to the proportion of successful predictions, over and above what the model predicts with the geographic proximity measures alone. Finally, a measure of the state unemployment rate—as an indicator of labor market demand—is included in the model of sector choice. The unemployment rate exerts a differential effect on two-year and four-year enrollments. As the rate increases, two-year enrollments tend to increase while four-year enrollments decline (Kane 1995).

FINDINGS

Comparing 1980s and 1990s Postsecondary Finance

Finance policy comparisons across decades in Table 2 underscore the shift toward increased reliance on tuition as a means of funding postsecondary education. Tuitions rose 77 and 67 percent, in constant dollars, in the 2-year and 4-year, sectors, respectively. In contrast, the inflation-adjusted amounts of direct appropriations from states dropped slightly in the two-year sector (-4.4 percent) and remained even in the four-year sector (0.8 percent) between 1983 and 1993. Stagnation in state contributions was offset somewhat by an increase in federal and local appropriations, as federal and local sources increased by 40.7 percent in the two-year sector, and 33.9 percent in the four-year sector. Thus, consistent with Roessler's (Roessler 2006) findings, the proportion of direct appropriations from state sources decreased over the study period. Financial aid from state and federal sources did not increase in real dollars over the study period.

Direct Government Appropriations

The probit coefficient for total (two-year) appropriations in Model 1 of Table 3 indicates a 0.008 probability unit increase (t=2.974) in the probability of degree completion. A one standard deviation increase in two-year appropriations yields a probability unit increase of 0.078, which indicates a 0.030 increase in the probability of graduation for the modal community

college student.[35] The size of the coefficient for lambda—the enrollment selection parameter — indicates a large effect of correcting for selection (lambda = -0.205; t=-3.937). Lambda is increasingly negative for students who are increasingly likely to choose a four-year institution—and who are also increasingly likely to attain credits and degrees in whatever sector they enroll. A one standard deviation decrease in lambda is associated with a 0.056 increase in the probability of degree attainment for the modal community college student.

The finding of a significant relation between direct government appropriations and attainment is robust to additional specifications that adjust for extra-policy features at the state and regional levels.[36] The first alternate model accounts for the socioeconomic composition of states by including a measure of the percentage of adults over age 25 with a bachelor's degree in the outcome model.[37] This specification assumes that adults with bachelor's degrees will demand high quality educational services. Controlling for this compositional attribute of states helps to isolate the specific policy effect from broader attributes of states' postsecondary systems that are associated with attainment. Controlling for state socioeconomic composition does not alter the finding of a positive relation between government appropriations and attainment.

The second alternate model introduces region dummy variables into the outcome model, with the region variables serving as proxies for broad institutional features of postsecondary educational systems shared within these large groupings of states. Inclusion of region measures alters the research question to ask whether an increase in government appropriations leads to an increase in attainment, holding constant the institutional features shared within regions. The third alternate model introduces dummy variables for each Census division into the outcome model. This model specification assumes that narrow clusters of states share institutional features in their postsecondary systems. Using this quasi-fixed effects model, the research question asks whether the appropriations-attainment relation persists while holding constant the institutional and economic features shared within divisions. Across each of these contextual models, direct appropriations remain positively and significantly related to degree attainment, with the coefficient size remaining equal to the total appropriations coefficient in Model 1of Table 3

when employing the region model, and shrinking slightly (0.007; t=2.427) in the model with the Census division variables. Taken together, these findings provide strong evidence that direct government appropriations to community colleges are causally related to degree attainment.

Both state and non-state forms of appropriations appear linked to degree attainment, although the size and significance of the relations differ. The state two-year appropriations coefficient of 0.009 (Model 2, Table 3) is associated with an increase in the probability of graduation of 0.028 for the modal college student. The non-state appropriations coefficient (0.007) converts to a slightly smaller increase (0.018) in the probability of degree completion for a modal student. However, the non-state appropriations coefficient barely meets the significance threshold of $p<0.05$.

Thus, the disaggregation of state and non-state revenues suggests a more robust relation between state appropriations and degree attainment. The positive relation between state appropriations and degree attainment is robust to each of the alternate specifications that account for broad features of state and regional postsecondary systems. When controlling for state socioeconomic context, as well as when using the quasi-fixed effects models to account for unobserved features of regional institutional and economic environments, the coefficient for state two-year appropriations retains its size and significance. Such was not the case for the non-state two-year appropriations coefficient. Only in the alternate model with the measure of state socioeconomic composition does this coefficient remain significant, while barely meeting the threshold for statistical significance. These findings provide evidence that the relation between state appropriations and degree attainment is causal. Moreover, the linkage between appropriations and degree attainment appears stronger for state than non-state appropriations.

Tuition Price and Revenue

Both tuition models indicate a significant positive relation between tuition and degree attainment. The coefficient for two-year tuition price in Model 3 indicates an increment of 0.007 probability units for every 100 hundred dollar increase in tuition price. Adding a standard

deviation worth of this increment to the probability of degree attainment for the modal community college student yields a small increase of 0.014 in the probability of degree completion. The tuition revenue model (Model 4) reveals a stronger relation between tuition revenue and degree attainment (0.027; t=5.614). To illustrate the effect size, I multiplied the probit increment (0.027) by a standard deviation increase in tuition revenue (3.24 hundred dollars), and added it to the probability of degree attainment for the modal community college student. This computation yields an increase in the probability of degree completion of 0.034, or 3.4 percent.

The relation between tuition revenue and degree attainment is robust to each of three additional specifications that control for the broad policy environment in states, regions and divisions. The positive relation between tuition revenue and degree attainment persists in the model that controls for state socioeconomic context in the selection and outcome stages, as well as in the quasi-fixed effects models that control for contextual regional and divisional attributes. The relation between tuition price and degree attainment persists when accounting for state socioeconomic context, but not in the quasi-fixed effect specifications that employ the region and division dummy variables. Thus, tuition revenue appears positively related to degree attainment, even when holding constant the institutional features and economic dynamics shared within regions and divisions. This finding supports the notion of a causal relation between tuition revenue and attainment.

These findings cut against the grain of reasoning suggesting that tuition increases are universally bad for students. Rather, the findings described above are consonant with the notion that institutions can convert financial resources to educational resources for students in ways that make degree completion more likely. However, it is possible that the benefits of educational resources do not accrue equally to students from different socioeconomic and racial/ethnic backgrounds. To assess this issue, I added tuition-by-SES and tuition-by-race interaction terms (separately) to the degree attainment models described above. In the tuition price model, the SES-by-policy interaction coefficient is negative and significant (-0.009; t=-2.660) while the

main effect of the tuition price is positive (0.007; t=2.778), and the main effect of SES is positive (0.176; t=3.530), as they are in models without the interaction term. The negative interaction coefficient indicates that higher tuitions attenuate the relation between SES and degree attainment. In other words, the policy appears to benefit low-SES students more than high-SES students, and the size of the effect is sufficient to balance out the main SES effect. This finding is consistent with institutions in states with higher tuitions having more money to fund financial aid disbursements to students with financial need. For tuition revenue, the tuition-by-SES interaction is also negative, but small and non-significant. Thus, tuition revenue appears to benefit all students equally.

To test for interactions between tuition price and race/ethnicity, additional corrected probit degree attainment models include measures that interact African American and Hispanic race/ethnicity with tuition. In these models, the coefficients for the tuition-by-race interaction terms are small, positive, and non-significant for both race-ethnic groups. Neither of the interaction coefficients in these models approaches statistical significance, and the sizes of the (positive) coefficients are only small fractions of the negative coefficients for both of these racial/ethnic categories of students. In summary, this analysis finds no evidence that higher tuitions adversely impact students from disadvantaged racial minority backgrounds; nor do I find any evidence that they provide a compensatory benefit.

Financial Aid

The coefficient for state need-based aid in Model 5 of Table 3 (0.046; t=4.854) indicates that state need-based aid is positively associated with degree attainment. Comparing degree completion probabilities for the modal community college student with an extra standard deviation (1.40 hundred dollars) worth of need-based aid yields an estimated increase in the probability of degree completion of 0.025, or 2.5 percent. The finding of a positive relation between state need-based aid and degree attainment is robust to additional specifications that control for state-level and regional factors in addition to the need-based aid policy. In the

alternate model that accounts for the socioeconomic composition of states, as well as in the quasi-fixed effects models that account for institutional and economic features within regions and Census divisions, the coefficient for state need-based aid remains significant. In two of these alternate specifications, the coefficient for state need-based aid is larger than in the model presented in Model 4. The model accounting for state socioeconomic context produces a coefficient for state need-based aid of 0.051 (t=5.175). The model with dummy variables for Census divisions produces a coefficient for state need-based aid of 0.062 (t=3.091). These findings suggest a causal relation between state need-based aid and degree attainment.

Supplemental analyses assess differences in the state aid-degree attainment relation for students from different socioeconomic and racial/ethnic groups. Given the targeting of financial aid toward students with financial need, it is reasonable to expect that these benefits would primarily accrue to lower-SES students. However, analytical findings do not follow this prediction. The coefficient for the aid-by-SES interaction measure (0.004; t=0.250), for need-based aid—obtained from a probit model identical to that used for the Model 5 results—is negligible in size and non-significant. An identical model with aid-by-race interaction measures also yields negligible coefficients for need-based aid, indicating that the benefits of need-based-aid do not differ across racial/ethnic groups.

As reflected in Table 2, students receive more need-based financial aid from the federal government than from any state. These figures indicate that, as of the 1992-93 academic year, students on average received 647 dollars from federal need-based programs, while receiving only 127 dollars from state need-based programs, a factor of 5.1 federal dollars for every state dollar. Because of the magnitude of the federal contribution to need-based aid, assessing the relation between federal financial aid and attainment is a priority. Considering federal need-based aid in the same model with state programs makes it possible to assess which aid program is most strongly related to student attainment.

Model 6 of Table 3 indicates positive relations between state and federal forms of need-based aid and degree attainment. Assessing the impact of a standard deviation increase (165

dollars) in federal aid on the modal community college student indicates that such an increase would boost the probability of degree attainment by 0.039, or 3.9 percent, for the modal community college student. Assessing the impact of a standard deviation increase in state need-based aid on degree attainment yields an increase in the probability of degree attainment of 0.014 (1.4 percent), smaller than the increase associated with federal need-based aid.

Supplementary analyses illuminate a benefit to federal need-based aid for African American and Hispanic students. In models with race-by-policy interaction terms for African American and Hispanic students, the race-by policy interaction coefficients indicate an increment of 0.097 probability units (t=2.103) for African American students and 0.127 units (t=2.658) for Hispanic students. Both of these increments are larger than the federal aid main effect (0.041; t=2.712), but smaller than the negative main effects for African American (-0.734; t=-2.578) and Hispanic students (-0.954; t=-3.487). Thus, the federal policy partially compensates for the historical disadvantage of black and Hispanic racial/ethnic groups. On the other hand, the policy-by-African American interaction terms are negative for the state aid policies. The coefficient for the aid-by-African American interaction term is negative and significant for state need-based aid (-0.065; t=-1.869), and for non-need aid (-0.463; t=-2.308). The aid-by-Hispanic interaction coefficients are non-significant. This interaction analysis suggests that federal financial aid programs reduce racial inequality in degree attainment, while state programs do not. Supplementary analysis does not uncover any differences in the policy-degree attainment relation across socioeconomic groups, for any of the three financial aid policies.

Alternate model specifications confirm the positive relations between both sources of need-based aid and degree attainment. In each of the alternate specifications, however, the federal aid coefficient meets a stronger test for statistical significance. In the model accounting for state socioeconomic composition, the coefficient for state need-based aid is smaller than the corrected model presented in Model 6 of Table 3 and has a t-statistic equal to 1.926, which indicates that it barely fails the significance test at $p<0.05$. However, in the same model, the coefficient for federal need-based aid maintains size (0.063) and has a t-statistic of 4.212. In the

alternate specification using region dummies, the t-statistic for the state need-based aid coefficient falls considerably below the $p<0.05$ level of statistical significance, while the coefficient for federal need-based aid drops in size to 0.051 but remains significant (t=3.497). In contrast, using the alternate specification employing the division dummies, the coefficient for state need-based aid (0.052; t=2.504) is similar in size to the coefficient for federal need-based aid (0.045; t=2.773). Looking across all models in the combined analysis of aid, the relation between federal aid and degree attainment is more consistent and larger than the relation between state need-based aid and degree attainment. However, the state need-based aid measure does persist in the quasi-fixed effect model using the division controls, and due to this strict test of the policy, I conclude that both state and federal need-based aid are causally related to degree attainment for community college students.

The Combined Three Pillars Model of Postsecondary Finance

Model 7 of Table 3 presents results from analysis of the three pillars model, which includes measures for direct appropriations, tuition revenue, and three forms of financial aid. Tuition revenue, rather than price, is included because previous models show a stronger relation between tuition revenue and degree attainment. Federal aid is included along with state aid because of its robust relation to degree attainment in the financial aid analysis.

The finding of fewer and less robust coefficients in this model is consistent with the large number of predictors, and correlations between them. The state appropriations coefficient (0.007; t=2.088) is positive and significant, and converts to a boost of 0.022 in the probability of degree attainment for the modal student. The coefficient for federal need-based aid is 0.044 (t=2.809), indicating a boost of 0.028 in the probability of degree attainment for the modal college student.

Other finance policies that were significant in single-policy analyses are now non-significant. In particular, the coefficient for non-state appropriations to two-year colleges is of negligible size. Also, the coefficient for tuition revenue (0.009; 1.403) is one-third the size it is in the corrected single-policy analysis for degree attainment. In both the simple and corrected

degree attainment models, the coefficient for state need-based aid (0.024; t=1.960) sits on the boundary for statistical significance at $p<0.05$. Given that its size is equal to that for state need-based aid in the financial aid model in Model 6 (0.025; t=2.311), it is difficult to dismiss a positive role for state need-based aid in relation to degree attainment, as the larger standard errors in the three pillars model are likely a consequence of the number of variables in the model.

Findings from supplementary models using the three alternate specifications noted above support the existence of positive relations between direct state appropriations and degree attainment, and between need-based aid and degree attainment. The positive relation between state appropriations and degree attainment is present in the alternate specification that accounts for state socioeconomic composition, and in the specification that includes regional dummy variables. However, the size of the two-year appropriations coefficient (0.004; t=0.932) shrinks in the model with the division dummy variables, and falls far below statistical significance.

State and federal need-based aid measures perform differently depending on the alternate specification. In the model that accounts for state socioeconomic composition, the coefficient for federal need-based aid (0.047; t=2.825) is significant, while the coefficient for state need-based aid is not (0.021; t=1.516). The same pattern of significance and effect sizes is present in the model with regional dummy variables. However, when using division dummy variables to control for contextual features that vary across smaller clusters of states, the coefficient for state need-based aid (0.050; t=2.398) is larger in size than the coefficient for federal need-based aid (0.032; t=1.817). When looking across models, the aid-attainment relation is most consistent for the federal aid measure. However, in the financial aid and three pillars models, the state need-based aid measure is robust to the alternate specification with the division controls. For this reason, I conclude that federal *and* state need-based aid is positively related to degree attainment.

Findings from the Selection Model

Findings from the selection model indicate that two-year tuition price is positively related to enrollment. This finding contradicts the econometric meta-analyses (Leslie and Brinkman 1987;

Heller 1997), but is consistent with the findings of McPherson and Schapiro (McPherson and Schapiro 1998) who found that enrollment increased during the 1980s despite net increases in college costs. The decline of earnings for jobs requiring only a high school degree is an exogenous labor market factor that encourages college enrollment, even when net costs to students and families are rising (McPherson and Schapiro 1998).

Findings from the selection models in the appropriations analysis are consistent with the perspective that financial resources draw students toward institutions. In the selection model for the government appropriations analysis, the relation between appropriations to two-year institutions and enrollment is positive, suggesting that increased appropriations make two-year colleges more attractive to students. Conversely, appropriations to four-year institutions appear to discourage enrollment. This relation is difficult to interpret, given the ordering of enrollment choices in the selection model. Net of appropriations to two-year colleges, appropriations to four-year institutions should increase the proportion of students enrolling in the four-year sector without discouraging students at the margin of college attendance from enrolling in a two-year institution. More work is needed to assess this observed relation between four-year appropriations and enrollment.

Selection model findings indicate that state need-based aid programs encourage enrollment. Coefficients for state need-based aid in the selection stages of Models 5-7 indicate a positive impact of this form of aid on enrollment. In contrast, non-need-based aid appears unrelated to enrollment. Taken together, these findings indicate that non-need aid does not encourage students who otherwise wouldn't enroll in college to do so. The results from Models 6 and 7 also indicate that, net of appropriations and tuition price, federal need-based aid is negatively related to enrollment. Accounting for governmental appropriations in the three pillars model brings this negative relation into focus. This finding combined with the degree attainment finding obtained in this chapter counters the notion that federal need-based aid programs draw students into college but don't help them complete a degree.

DISCUSSION

Direct Appropriations

I hypothesized that direct appropriations are positively related to attainment, because institutions can use direct appropriations to improve educational quality. The findings presented herein are consistent with this hypothesis. Models including measures of state and non-state direct appropriations tend to show that state appropriations are more salient for attainment than non-state appropriations. This is especially the case in the three pillars model, where inclusion of all the finance measures produces coefficients for federal and local appropriations that equal zero. This finding suggests that state appropriations may be targeted toward expenditures in educational resources that are directly linked to attainment, whereas federal and local appropriations may be spent in a less strategic manner. Further research is needed to assess the connections between these different revenue streams and attainment.

Tuition

Findings from this chapter are not conclusive regarding the relation between tuition and attainment. Comparing across the tuition price and tuition revenue models yields the insight that tuition revenue is more robustly related to degree attainment than tuition price, as the coefficient for tuition price is not significant in the quasi-fixed effects models. The coefficient for tuition revenue in the tuition revenue model (Model 4) is significant and robust to the correction for selection, as well as the alternate specifications that control for broader contextual features within states, divisions, and regions. However, when considering the salience of tuition revenue alongside direct appropriations and financial aid in the three pillars model, the coefficient for tuition revenue is non-significant in the corrected degree attainment model. This combined model poses a high threshold for significance, given the number of measures in the model, and the correlations between some of the measures. Thus, findings from the three pillars model suggest that direct appropriations and need-based financial aid are more directly linked to student attainment than tuition revenues.

The analysis also considers the hypothesis that tuition price is negatively related to attainment, and this assertion is clearly not supported by the findings presented herein. The positive relation between tuition price and degree attainment provides evidence that tuition prices do not impede degree attainment. Moreover, the analysis does not find evidence that tuition prices adversely impact low-SES and minority students. These findings are consistent with recent findings from Kienzl, Alfonso, and Melguizo, who found that tuition price was one consideration among several financial concerns—including local labor market conditions—and was not, on its own, pushing students out of college (Kienzl, Alfonso et al. 2007).

Financial Aid

Findings from this chapter are consistent with the hypothesis that need-based financial aid promotes attainment, while non-need-based aid does not. This finding is consistent across the state financial aid model (Model 5), the combined financial aid model (Model 6) and the three pillars model (Model 7). In each of these models, need-based aid is positively related to degree attainment, while non-need-based aid is not significant in relation to degree attainment. Within the category of need-based aid, I find some evidence that federal aid is more salient than state aid. In Model 6, the coefficient for federal aid is larger than for state aid, and a standard deviation increase in federal aid leads to a larger boost in degree attainment than a standard deviation increase in state aid. Also, federal aid is more consistently significant in relation to degree attainment in the alternately specified models accounting for broader contextual features.

The findings presented herein are consistent with the notion that federal aid dollars are more likely to go to students for whom they make a difference that promotes attainment. This line of reasoning is consistent with the notion that local actors may find it more difficult to divert federal aid dollars to students who don’t really need them. It is also possible that students trust federal aid programs more than they do state-based programs, and as a result, the federal aid programs more effectively reduce finance-related stress among students. The data included in this study are insufficient to confirm or deny these scenarios. What is clear from the analysis is

that federal aid is positively related to degree attainment; it plays a compensatory role in supporting degree attainment for African American and Hispanic students; and its disbursement varies across states in a way that promotes attainment for students in states that receive more federal aid. State aid is also positively related to degree attainment, but it does not compensate for black-white and Hispanic-white gaps in degree attainment. More research is needed to understand how both forms of aid impact the within-college and outside-college experiences of students. In addition, more research is needed to compare how students respond to federal and state need-based aid programs.

CONCLUSIONS

The finding that direct appropriations matter for attainment suggest that the relation between expenditures and educational outcomes may be different in postsecondary education compared to primary and secondary education, where researchers have tended not to find a significant expenditure-outcome relation (Hanushek 1996). This finding is the most unique of the finance policy findings because previous research at the national level has not examined the relation between appropriations and attainment with an exclusive focus on community college students. However, this finding echoes findings from two recent studies. Bound et al. (2009) find that resources per student (at the institution level) matter for the attainment of two-year and four-year students. Trostel and Smith (2009) find that state-level expenditures per student are positively related to degree attainment. These findings suggest a linkage between resources and quality that until previously was only apparent in the literature on institutional selectivity and attainment (see Alon and Tienda 2005; Melguizo 2008). These findings are also consistent with Arum's (1998) finding of a positive relation between states' investments in vocational education programs and students' probabilities of graduating from high school. More research is needed to assess how the expenditures-attainment relation may differ from the expenditures-achievement relation, and more research is needed to assess how institutions can most effectively allocate resources to promote attainment.

The financial aid findings highlight the centrality of the federal need-based financial aid program in promoting attainment, as well as the additional aid benefits for African American and Hispanic students. This finding is consonant with previous empirical work (see Dynarski 2003; Dynarski and Scott-Clayton 2006), and consistent with human capital theory, which posits that reducing college costs will facilitate students finishing college (Goldrick-Rab, Harris et al. 2009). The findings include an unexpected difference in the impact of federal and state need-based programs. In contrast to federal aid, state-based aid does not compensate for the historical disadvantage of African American and Hispanic students in college completion. Is it possible that minority students trust federal programs more than state programs? Do state programs have loopholes that allow for discriminatory patterns of aid disbursement? These questions can only be answered through further inquiry in which data are collected that capture how students and institutions respond to state-based aid programs. A significant caveat regarding the financial aid findings in this study is that they do not examine the relation between *receiving* aid and attainment. The significant findings are remarkable in light of the fact that uptake of financial aid is generally low among community college students (Cofer and Somers 2000). While more research is needed to examine how the benefits of aid can be extended to a larger proportion of community college students, this study underscores the assertion that financial aid matters for community college students.

The findings support the notion that a macro-level policy dimension should be included in models of postsecondary attainment, especially when considering student attainment within two-year institutions. This is not a ground-breaking conclusion, as postsecondary researchers have addressed the macro-level policy influences of federal financial aid for over thirty years (Dynarski 2003). And recently, researchers have begun to examine the influence of direct appropriations on attainment (Trostel and Smith 2009). While the focus on macro-level policy influences is not a new discovery, it challenges a dominant paradigm within attainment theory. Although Tinto (1993; Tinto 2002) has revised his interactionalist theory of college persistence to include the influence of finances (Goldrick-Rab, Harris et al. 2009), the macro policy level is

not a fundamental dimension in this dominant model. Tinto's recommendations for improving persistence and attainment still target interventions occurring at the institution level, such as learning communities (see Tinto 2008). The findings from this and other policy analyses suggest that the macro level is an essential dimension in models of postsecondary attainment.

REFERENCES

Alon, S. and M. Tienda (2005). "Assessing the "Mismatch" Hypothesis: Differences in College Graduation Rates by Institutional Selectivity." Sociology of Education **78**: 294-315.

Arum, R. (1998). "Invested Dollars or Diverted Dreams: The Effect of Resources on Vocational Students' Educational Outcomes." Sociology of Education **71**(2): 130-151.

Astin, A. W. (1975). Preventing Students from Dropping Out. San Francisco, CA, Jossey-Bass Publishers.

Astin, H. S. and P. H. Cross (1979). Student Financial Aid and Persistence in College. Los Angeles, CA, Higher Education Research Institute**:** 412.

Bailey, T. and J. Jacobs (2009). Can Community Colleges Rise to the Occasion? Yes -- with fundamental internal reforms and a new vision of their role in higher education. The American Prospect.

Bailey, T., D. Jenkins, et al. (2005). Is Student Success Labeled Institutional Failure? New York, Teachers College, Columbia University**:** 46.

Barbett, S. F. (1997). Enrollment in Higher Education: Fall 1995. Washington, DC, National Center for Education Statistics**:** 184.

Bean, J. P. and B. S. Metzner (1985). "A Conceptual Model of Nontraditional Undergraduate Student Attrition." Review of Educational Research **55**(4): 485-540.

Bettinger, E. P. and B. T. Long (forthcoming). "Addressing the Needs of Under-Prepared Students in Higher Education: Does College Remediation Work?" Journal of Human Resources: 34.

Bound, J., M. Lovenheim, et al. (2009). Why Have College Completion Rates Declined? An Analysis of Changing Student Preparation and Collegiate Resources. NBER Working Paper Series. Cambridge, MA, National Bureau of Economic Research**:** 64.

Bowen, W. G. and D. Bok (1998). The Shape of the River: Long-term Consequences of Considering Race in College and University Admission. Princeton, NJ, Princeton University Press.

Breen, R. (1996). Regression Models: Censored, Sample Selected, or Truncated Data. Thousand Oaks, Sage Publications.

Broyles, S. M. (1984). Fall Enrollment in Colleges and Universities, 1982. Washington, DC, National Center for Education Statistics**:** 269.

Card, D. and A. B. Krueger (1998). "School Resources and Student Outcomes." Annals of the American Academy of Political and Social Science **559**: 39-53.

Cofer, J. and P. Somers (2000). "Within-Year Persistence of Students at Two-year Colleges." Community College Journal of Research & Practice **24**: 785-807.

Coleman, J. S., E. Q. Campbell, et al. (1966). Equality of Educational Opportunity. Washington, DC, U.S. Department of Health, Education, and Welfare, Office of Education - National Center for Education Statistics**:** 737.

Curtin, T. R., S. Wu, et al. (2004). Postsecondary Education Transcript Study (PETS:2000): Supplement to the NELS:88/2000 Base-year to Fourth Follow-up Data File User's Manual. Washington DC: National Center for Education Statistics, U.S. Department of Education.

Doyle, W. R. (2009). "The Effect of Community College Enrollment on Bachelor's Degree Completion." Economics of Education Review **28**(2): 199-206.

Dynarski, S. M. (2003). "Does Aid Matter? Measuring the Effect of Student Aid on College Attendance and Completion." The American Economic Review **93**(1): 279-288.

Dynarski, S. M. and J. E. Scott-Clayton (2006). "The Cost of Complexity in Federal Student Aid: Lessons from Optimal Tax Theory and Behavioral Economics." National Tax Journal **59**(2): 319-356.

Fuller, W. C., C. F. Manski, et al. (1982). "New Evidence on the Economic Determinants of Postsecondary Schooling choices." The Journal of Human Resources **17**(4): 477-498.

Goldrick-Rab, S. (2010). "Challenges and Opportunities for Improving Community College Student Success " Review of Educational Research **80**(3): 60.

Goldrick-Rab, S., D. N. Harris, et al. (2009). "Why Financial Aid Matters (or Does Not) for College Success: Toward a New Interdisciplinary Perspective." Higher Education Handbook of Theory and Research **TBA**: 1-47.

Greene, W. H. (2003). Econometric Analysis. Upper Saddle River, NJ, Prentice Hall.

Greene, W. H. (2007). LIMDEP Version 9.0: Econometric Modeling Guide. Plainview, NY, Econometric Software.

Gross, B. and D. Goldhaber (2009). Community College Transfer and Articulation Policies: Looking Beneath the Surface, Center on Reinventing Public Education**:** 46.

Grubb, W. N. (1993). "The Varied Economic Returns to Postsecondary Education: New Evidence from the Class of 1972." The Journal of Human Resources **28**(2): 365-382.

Hanushek, E. A. (1996). School Resources and Student Performance. Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success. G. Burtless. Washington, DC, Brookings Institution Press**:** 43-73.

Hearn, J. C., C. P. Griswold, et al. (1996). "Region, Resources, and Reason: A Contextual Analysis of State Tuition and Student Aid Policies." Research in Higher Education **37**(3): 241-278.

Heckman, J., A. Layne-Farrar, et al. (1996). Does Measured School Quality Really Matter? An Examination of the Earnings-Quality Relationship. Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success. G. Burtless. Washington, DC, Brookings Institution Press**:** 192-289.

Heckman, J. and R. Robb (1986). Alternative Methods for Solving the Problem of Selection Bias in Evaluating the Impact of Treatment on Outcomes. Drawing Inferences from Self-selected Samples. H. Wainer. New York, Springer-Verlag**:** 163.

Heckman, J. J. (1979). "Sample Selection Bias as a Specification Error." Econometrica **47**(1): 153-161.

Heller, D. E. (1997). "Student Price Response in Higher Education: An Update to Leslie and Brinkman." Journal of Higher Education **68**(6): 624-659.

Hilmer, M. J. (1998). "Post-secondary fees and the decision to attend a university or a community college." Journal of Public Economics **67**: 329-348.

Hilmer, M. J. (2001). "A Comparison of Alternative Specifications of the College Attendance Equation with an Extension to Two-Stage Selectivity-Correction Models." Economics of Education Review **20**(1): 263-278.

Hippensteel, D. G., E. P. St. John, et al. (1996). "Influence of Tuition and Student Aid on Within-Year Persistence by Adults in 2-Year Colleges." Community College Journal of Research & Practice **20**: 233-242.

Jacoby, D. (2006). "Effects of Part-Time Faculty Employment on Community College Graduation Rates." The Journal of Higher Education **77**(6): 1081-1103.

Jaeger, A. J. and M. K. Eagan Jr. (2009). "Unintended Consequences: Examining the Effect of Part-Time Faculty Members on Associate's Degree Completion." Community College Review **36**(3): 167-194.

Jencks, C., M. Smith, et al. (1972). Inequality: A Reassessment of the Effect of Family and Schooling in America. New York, Harper and Row.

Johnson, N. L. and S. Kotz (1972). Distributions in Statistics: Continuous Multivariate Distributions. New York, John Wiley and Sons, Inc.

Johnstone, D. B. (2004). "The Economics and Politics of Cost Sharing in Higher Education: Comparative Perspectives." Economics of Education Review **23**: 403-410.

Kane, T. J. (1995). Rising Public College Tuition and College Entry: How Well Do Public Subsidies Promote Access to College? NBER Working Paper Series. Cambridge, MA, National Bureau of Economic Research**:** 31.

Kane, T. J. and C. E. Rouse (1995). "Comment on W. Norton Grubb: "The Varied Economic Returns to Postsecondary Education: New Evidence from the Class of 1972"." The Journal of Human Resources **30**(1): 205-221.

Kane, T. J. and C. E. Rouse (1995). "Labor-Market Returns to Two- and Four-Year College." The American Economic Review **85**(3): 600-614.

Kienzl, G. S., M. Alfonso, et al. (2007). "The Effect of Local Labor Market Conditions in the 1990s on the Likelihood of Community College Students' Persistence and Attainment." Research in Higher Education **48**(7): 751-774.

Leslie, L. L. and P. T. Brinkman (1987). "Student Price Response in Higher Education." Journal of Higher Education **58**(2): 181-204.

Long, B. T. and M. Kurlaender (2009). "Do Community Colleges Provide a Viable Pathway to a Baccalaureate Degree?" Educational Evaluation and Policy Analysis **31**(1): 30-53.

Manski, C. F. and D. A. Wise (1983). College Choice in America. Cambridge, MA, Harvard University Press.

McPherson, M. S. and M. O. Schapiro (1998). The Student Aid Game: Meeting Need and Rewarding Talent in American Higher Education. Princeton, NJ, Princeton University Press.

Melguizo, T. (2008). "Quality Matters: Assessing the Impact of Attending More Selective Institutions on College Completion Rates for Minorities." Research in Higher Education **49**: 214-236.

Morgan, S. L. (2005). On the Edge of Commitment: Educational Attainment and Race in the United States. Stanford, CA, Stanford University Press.

N.A.S.S.G.A.P. (1983). 15th Annual Survey Report 1983-84 Academic Year: State/Territory Funded Scholarship/Grant Programs to Undergraduate and Graduate Students with Financial Need to Attend Public or Private Post-secondary Educational Institutions, National Association of State Student Grant and Aid Programs**:** 121.

N.A.S.S.G.A.P. (1994). 25th Annual Survey Report 1993-94 Academic Year: State Funded Scholarship/Grant Program for Students to Attend Postsecondary Educational Institutions, National Association of State Student Grant and Aid Programs**:** 121.

National Center for Education Statistics (1995). Digest of Education Statistics 1995. Washington, DC, U.S. Department of Education**:** 515.

National Opinion Research Center (1995). High School and Beyond Fourth Follow-up Methodology Report. Chicago, Illinois, National Opinion Research Center**:** 136.

NCES (2005). Digest of Education Statistics Tables and Figures NCES.

Paulsen, M. B. and E. P. St. John (2002). "Social Class and College Costs: Examining Nexus Between College Choice Persistence." **73**(2): 189-236.

Pennington, K. L., D. McGinty, et al. (2002). "Community College Enrollment as a Function of Economic Indicators." Community College Journal of Research & Practice **26**: 431-437.

Peter, K. and L. Horn (2005). Gender Differences in Participation and Completion of Undergraduate Education and How They Have Changed Over Time. Washington, DC, U.S. Department of Education, National Center for Education Statistics.

Powell, B. and L. C. Steelman (1993). "The Educational Benefits of Being Spaced Out: Sibship Density and Educational Progress." American Sociological Review **58**(3): 367-381.

Research Triangle Institute (2002). National Educational Longitudinal Study of 1988: Base-Year to Fourth Follow-up Data File User's Manual. Washington, DC, U.S. Department of Education**:** 237.

Richburg-Hayes, L., T. Brock, et al. (2009). Rewarding Persistence: Effects of a Performance-Based Scholarship Program for Low-Income Parents. New York, MDRC.

Roessler, B. C. (2006). A Quantitative Study of Revenue and Expenditures at U.S. Public Community Colleges, 1980-2001. Doctor of Philosophy, University of North Texas.

Rouse, C. E. (1994). What to Do after High School: The Two-Year versus Four-Year College Enrollment Decision. Choices and Consequences: Contemporary Policy Issues in Education. R. G. Ehrenberg. Ithaca, NY, ILR PRess**:** 59-88.

Shear, M. D. and D. de Vise (2009). Obama Announces Community College Plan: $12 Billion Will Fund New Web Courses, Construction and Innovation Costs. The Washington Post. Washington, DC, The Washington Post Company.

Singell Jr., L. D. (2004). "Come and Stay A While: Does Financial Aid Effect Retention Conditioned on Enrollment at A Large Public University?" Economics of Education Review **23**: 459-471.

Snyder, T. D., S. A. Dillow, et al. (2009). Digest of Education Statistics 2008. Washington, DC, National Center for Education Statistics, Institute for Education Sciences, U.S. Department of Education.

St. John, E. P. (1989). "The Influence of Student Aid on Persistence." Journal of Student Financial Aid **19**(3): 52-68.

St. John, E. P. (1990). "Price Response in Enrollment Decisions: An Analysis of the High School and Beyond Sophomore Cohort." Research in Higher Education **31**(2): 161-176.

St. John, E. P., J. Oescher, et al. (1992). "The Influence of Prices on Within-Year Persistence by Traditional College-Age Students in Four-Year Colleges." Journal of Student Financial Aid **22**(1): 27-38.

St. John, E. P., M. B. Paulsen, et al. (2005). "Diversity, College costs, and Postsecondary Opportunity: An Examination of the Financial Nexus between College Choice and Persistence for African Americans and Whites."

St. John, E. P. and J. B. Starkey (1994). "The Influence of Costs on Persistence by Traditional College-Age Students in Community Colleges." Community College Journal of Research & Practice **18**: 201-213.

St. John, E. P. and J. B. Starkey (1995). "An Alternative to Net Price: Assessing the Influence of Prices and Subsidies on Within-Year Persistence." The Journal of Higher Education **66**(2): 156-186.

The College Board (2002). Trends in Student Aid: 2002. New York, College Entrance Examination Board**:** 23.

The College Board (2008). Trends in Student Aid: 2008. Washington, DC, College Entrance Examination Board**:** 19.

Tinto, V. (1975). "Dropout from Higher Education: A Theoretical Synthesis of Recent Research." Journal of Higher Education **53**: 687-700.

Tinto, V. (1993). Leaving College: Rethinking the Causes and Cures of Student Attrition. Chicago, IL, University of Chicago Press.

Tinto, V. (2002). Promoting Student Retention: Lessons Learned from the United States. 11th Annual Conference of the European Access Network. Prato, Italy**:** 8.

Tinto, V. (2008). Access without Support is Not Opportunity. 36th Annual Institute for Chief Academic Officers, The Council of Independent Colleges. Seattle, WA**:** 10.

Tinto, V. and P. Russo (1994). "Coordinated Studies Program: Their Effect on Student Involvement at a Community college." Community College Review **22**(2): 16-26.

Trostel, P. A. and M. C. Smith (2009). The Effect of Public Support on College Attainment. WISCAPE Working Paper Series. Madison, WI, Wisconsin Center for the Advancement of Postsecondary Education**:** 24.

Turley, R. N. L. (2009). "College Proximity: Mapping Access to Opportunity." Sociology of Education **82**: 126-146.

U.S. Department of Education (1995). HSB PETS (see NORC ref for HS&B FU4 Meth Rept) Washington, DC, National Opinion Research Center**:** 136.

U.S. Department of Education (2002). National Education Longitudinal Study of 1988: Base-Year to Fourth Follow-up Data File User's Manual. Washington, DC, U.S. Department of Education-National Center for Education Statistics**:** 238.

U.S. Department of Education (2003). Community College Students: Goals, Academic Preparation, and Outcomes. Washington, DC, National Center for Education Statistics.

Voorhees, R. A. (1985). "Financial Aid and Persistence: Do the Federal Campus-Based Aid Programs Make a Difference? ." The Journal of Student Financial Aid **15**(1): 21-30.

Wallace, T. P. (1992). "The Inequities of Low Tuition." AGB Reports **34**(3): 24-27.

Weiler, W. C. (1989). "A Flexible Approach to Modelling Enrollment Choice Behavior." Economics of Education Review **8**(3): 277-283.

Wyman, F. J. (1997). "A Predictive Model of Retention Rate at Regional Two-Year Colleges." Community College Review **25**: 29-58.

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[1] A community college is a public two-year institution that offers the associate's degree.

[2] These two statistics are not mutually exclusive.

[3] See Table 1 of this study.

[4] In 2009, a small number of community colleges offer the Bachelor's degree.

[5] Grubb attributed these enhanced labor market returns to associate's degree credentials opening doors to valuable labor market experiences. In an editorial response to Grubb, Kane and Rouse (1995) argued that Grubb's analysis overlooked the direct effects of the associate's degree on wages. In their analysis, Kane and Rouse (1995) found that, when comparing wages between two-year and four-year college students who did not complete degrees, a year of community college was roughly equal to a year of four-year college, with each providing approximately a 5 percent wage benefit. Both authors agreed that associate's degree attainment was especially beneficial for women, who appeared to receive more direct benefits from degree attainment, and more of a wage penalty for dropping out. Taken as a whole, these findings support the claim that students who can persevere at a community college will reap labor market returns for doing so.

[6] The concept of high tuition and high aid dates back to the 1970s.

[7] In other words, these appropriations were not tied to grants, or grants for specific purposes.

[8] I computed this figure, and subsequent ones within this paragraph, using data from Table 349 of the 2008 Digest of Education Statistics (Snyder et al. 2009).

[9] President Obama's proposed American Graduation Initiative would depart from the federal government's traditional approach of funding community colleges only through tuition assistance to students participating in federal financial aid programs. The initiative (if adopted) would provide 9 billion dollars through a competitive grant program to community colleges with innovative programs for graduating more students (Shear and de Vise, 2009). An additional 2.5 billion dollars would be provided for construction and renovation, with the intention of jump-starting capital fundraising campaigns, and 0.5 billion dollars would go toward developing online instruction al courses.

[10] Bean and Metzner's (1985) definition of 'nontraditional' comprises 3 dimensions: age, distinguishing between traditional-age (18-24 year old) and adult (25 or older) students; commuter status (campus resident versus commuter) ; and enrollment intensity (part-time or full-time). While students in the HSB and NELS cohorts entered postsecondary education as traditional-age students, most were commuter students, and some attended part-time. Thus, Bean and Metzner's approach is appropriate for addressing the conditions of this student population.

[11] The other sources included in Roessler's analysis include local appropriations, tuition and fees, and contracts. The state share of overall community college budgets varies with urbanicity. Suburban colleges cover larger shares of their budgets with funds from local appropriations than do rural and urban colleges.

[12] The authors obtained their findings using data for five cohorts from the 1970, 1980 and 1990 decennial censuses. While each quality measure—pupil-teacher ratios, teacher salaries, and school year length—did not significantly impact attainment for each cohort at each level of attainment, an overall pattern of significant relations between these measures and attainment is quite clear. See Tables 7C-13 (1980 Census), 7C-14 (1970 Census) and 7C-15 (1990 Census) on pages 275-280. Negative signs for the pupil-teacher ratio coefficients indicate that lower pupil-teacher ratios made attainment more likely.

[13] Jaeger and Eagan used two measures of part-time faculty: (1) the proportion of part-time faculty at an institution; and (2) contact: the proportion of part-time faculty teaching classes attended by an individual student. Their findings indicate that contact had a significant impact on attainment, whereas the overall proportion of part-time faculty did not.

[14] Students who have the option of living at home can control living expenses in this manner. For students living away from home, the perception of living expenses as controllable may be unrealistic.

[15] The authors defined adults as those exceeding 23 years old.

[16] Federal grant programs: the Federal Pell Grant; the Federal Supplemental Educational Opportunity Grant; the Federal Academic Competitiveness Grant; and the Federal Work Study Program.

[17] Grant programs vary across states; some pertain to students in specific sectors and occupations (see N.A.S.S.G.A.P., 1983, 1994).

[18] Subsidized loans compose approximately half of the Stafford loans made each year, and the other half are unsubsidized. Federal student loans to parents (made through the PLUS program) are all in the form of unsubsidized loans.

[19] These computations added Pell and educational opportunity (SEOG) grants to form the federal total. The state total includes both need- and merit-based state grant programs.

[20] My computations from the N.A.S.S.G.A.P. reports cited above.

[21] Between 1965 and May 1982, the Social Security student benefit program provided $7,000/year support to traditional college-age offspring in families where the Social Security beneficiary (the parent) was either retired, disabled, or deceased. Dynarski was able to replicate eligibility for the benefit among the 1982 and 1983 college cohorts by flagging those students with deceased parents.

[22] The findings indicate two-thirds of a year of additional schooling completed, but the coefficient is not statistically significant (Dynarski, 2003; page 284).

[23] Postsecondary transcript data will not be available for the most recent national survey of high school students (ELS:2002) until at least 2012. Transcript data were not collected for the senior cohort within the HSB study.

[24] Within the HSB database, I used FU4PART to flag all students who were chosen to participate in the fourth HSB follow-up during. Because measures from the second and third follow-ups were not important for this study, I did not impose an additional restriction that students must have participated in all intervening survey waves between tenth grade and the fourth follow-up. The appropriate matching panel within the NELS database is the F1-to-F4 panel; this panel of students includes those freshened into the sample in tenth grade, and was followed from tenth grade through the fourth follow-up. Because almost all NELS students who participated in the fourth follow-up also participated in the intervening third follow-up, the NELS sample is not more restrictive than the HSB sample.

[25] FU4WT is the sampling weight for the sophomores in the HSB study who were followed from tenth grade through the fourth follow-up, and F4F1PNWT is the sampling weight for NELS students followed from tenth grade to the fourth follow-up.

[26] The HSB includes a parent survey for a sub-sample of 20 percent of HSB students' parents.

[27] This determination was made based on the NCES determination of first institution attended—from transcript data—with no additional conditions pertaining to the length of enrollment or the number of course credits completed.

[28] This was determined from preliminary models, available from the author.

[29] HEGIS is a census of all postsecondary institutions within the United States, and pre-dates the Integrated Postsecondary Education Data System. The data collection form was a paper survey. Response rates were generally high, and suitable for computing state averages.

[30] Because the IPEDS database is essentially a newer-generation of the HEGIS database, measures across the two surveys are quite similar, and often identical.

[31] Conditional grants and contracts are a small minority of the government appropriations totals.

[32] The measure for direct government appropriations to four-year institutions, AGAPP4 (which is included in the selection model), was constructed in the same manner as AGAPP2.

[33] At the time of the HEGIS survey, South Dakota did not have any public two-year institutions other than federal institutions operated on reservations for Native Americans, and data were not available from which to compute the tuition and finance measures.

[34] In a probit model with an intercept, the first cut-point will by necessity equal zero, because of limited degrees of freedom for identifying the parameters.

[35] Computations reflecting the modal community college student reflect the most prevalent (for categorical measures) and the mean characteristics of 2-year students reported in Table 1. The modal community college student was a female; from a middle-class family with a parent that had some college experience; took an academic curriculum during high school; expected at least a 2-year degree; and has a degree attainment probability of 0.542.

[36] Coefficients from alternate models available from the author upon request.

[37] This measure is already included in all selection models for this chapter.

Table 1: Percentages of Students in Categories and Average (standard deviation) Student Attributes for Eligible Students (Full Sample), Two-Year Entrants, and Four-Year Entrants in the HSB and NELS Cohorts.

	HSB Cohort			NELS Cohort		
	Full Sample (N = 11,550)	Two-year entrants (N = 3,390)	Four-year entrants (N = 3750)	Full Sample (N = 10,560)	Two-year entrants (N = 3,630)	Four-year entrants (N = 4460)
Demographic Characteristics						
Female	51.0	54.8	51.9	50.1	48.7	53.0
Number of siblings	2.8	2.8	2.6	2.2	2.3	2.0
African American	11.5	10.9	9.2	12.1	11.4	11.0
Asian/Pacific Islander	1.3	1.6	1.9	4.0	4.3	5.0
Hispanic/Latino	12.0	11.3	6.9	10.2	11.9	6.9
Native American	1.0	1.2	0.9	1.5	1.3	0.5
White	73.0	74.0	80.8	72.1	70.8	76.6
Highest Parental Education						
Missing	4.9	3.5	2.0	10.3	10.2	6.4
Less than high school	11.7	9.9	5.4	8.1	8.5	4.0
High school completion	31.0	31.1	20.3	17.7	18.9	11.5
Less than two years of college	12.6	14.8	12.4	20.8	24.7	16.9
At least two years of college	15.7	18.0	16.4	16.7	19.4	17.7
Bachelor's degree	12.2	12.8	19.8	14.7	11.8	21.7
Advanced degree	11.9	10.0	23.7	11.7	6.4	21.9
Other Background Measures						
SES	-0.018 (0.675)	-0.026 (0.620)	0.332 (0.680)	0.021 (0.760)	-0.061 (0.680)	0.351 (0.722)
Low SES (quartile 1)	19.8	17.6	8.9	20.7	20.4	9.6
Lower-middle SES (quartile 2)	21.6	23.7	16.5	24.6	29.0	17.5
Upper-middle SES (quartile 3)	22.3	25.7	24.2	27.2	31.0	29.6
High SES (quartile 4)	22.5	20.1	41.0	25.7	17.8	42.5
SES missing	13.8	12.8	9.4	1.8	1.9	0.9

	HSB Cohort			NELS Cohort		
	Full Sample (N = 11,550)	Two-year entrants (N = 3,390)	Four-year entrants (N = 3750)	Full Sample (N = 10,560)	Two-year entrants (N = 3,630)	Four-year entrants (N = 4460)
Family income (1991 dollars)	40829 (22101)	40272 (20884)	47614 (23979)	47140 (36330)	42018 (27426)	59353 (43557)
Family income imputed	8.2	7.9	3.9	6.8	6.6	4.5
HS Academic Resources						
Composite 12th grade achievement	50.79 (8.78)	50.42 (7.58)	56.84 (7.89)	50.94 (9.64)	48.60 (8.39)	56.47 (8.14)
12th grade achievement imputed	3.0	3.1	1.8	1.8	2.0	1.2
Academic track	44.1	41.3	74.3	63.5	59.2	85.3
Vocational track	28.4	28.5	9.8	10.9	12.0	3.3
HS transcript missing	9.5	9.2	7.0	16.7	18.2	15.0
Psychological Measures						
Consistent postsecondary expectations						
Expects less than 2 years of college	40.6	36.1	10.4	19.8	19.1	5.1
Expects at least 2 years of college	25.6	38.6	21.6	26.3	35.8	13.2
Expects bachelor's degree	20.1	16.2	41.9	35.3	33.9	49.5
Expects advanced degree	11.1	7.0	25.1	18.4	11.2	32.2
Expectations - missing	2.6	2.0	0.9	0.2	0.0	0.0
Locus of control	0.017 (0.636)	0.019 (0.616)	0.251 (0.553)	0.024 (0.749)	-0.059 (0.744)	0.210 (0.666)
Locus score imputed	2.6	2.1	1.4	1.5	1.7	0.9
Proximity of Postsecondary Options						
Nearest community college (miles)	18.5 (28.2)	15.6 (23.4)	19.9 (31.0)	11.5 (13.3)	10.0 (10.5)	11.8 (14.6)
Nearest 4-year institution (miles)	18.4	19.4	15.8	18.1	19.2	16.0

	HSB Cohort			NELS Cohort		
	Full Sample (N = 11,550)	Two-year entrants (N = 3,390)	Four-year entrants (N = 3750)	Full Sample (N = 10,560)	Two-year entrants (N = 3,630)	Four-year entrants (N = 4460)
	(22.2)	(22.6)	(20.9)	(19.9)	(19.9)	(19.0)
Postsecondary experiences						
No PSE	38.2	0.0	0.0	23.4	0.0	0.0
Entered community college	26.7	90.7	0.0	31.9	92.8	0.0
Entered alternate 2-year	2.7	9.3	0.0	2.5	7.2	0.0
Entered 4-year	32.4	0.0	100.0	42.2	0.0	100.0
Delayed entry (1 to 4 years)	11.2	24.4	8.0	14.5	29.5	8.4
Late entry (more than 4 years)	3.9	9.0	2.2	2.8	6.0	0.9
Number of years delayed PSE	n/a	1.09 (2.08)	0.31 (1.12)	n/a	0.73 (1.42)	0.18 (0.70)
Entrance date unknown	3.1	7.3	2.2	7.6	5.2	4.0
Married 2 years after HS	13.0	10.9	4.7	8.6	8.8	2.9
Has child 2 years after HS	9.4	7.5	2.2	11.3	13.1	3.1
Outside responsibilities after HS	16.6	13.4	5.6	15.8	17.6	5.0
Postsecondary Outcomes						
Total undergraduate credits	50.0 (56.7)	51.8 (48.7)	102.0 (48.0)	64.7 (60.8)	54.8 (52.3)	106.6 (50.5)
Highest degree: associate's	6.0	15.8	3.7	6.2	13.3	3.5
Highest degree: bachelor's	24.7	14.5	63.0	32.4	15.6	63.9
Undergraduate degree (associate's or bachelor's)	30.8	30.3	66.7	38.6	29.0	67.4

Note: These statistics were obtained using the fourth follow-up panel weights for students in both cohorts: HSB (FU4WT) and NELS (F4F1PNWT).

Table 2: Average Per-student Tuition, Financial Aid*, Expenditures, and Revenue (standard deviations) within States, for Public Two-Year and Public Four-Year Institutions, as of the 1983 and 1993 Academic Years; all figures in 1993 dollars (N=50).

	Public Two-year Institutions			Public Four-year Institutions		
	1983	1993	Change (%)	1983	1993	Change (%)
Direct Appropriations						
Average per-student direct governmental appropriations from all sources	2,628 (1,061)	2,880 (863)	9.6	6,570 (2,344)	7,136 (1,985)	8.6
Average per-student direct appropriations from state sources	1,812 (956)	1,733 (649)	-4.4	5,017 (1,975)	5,058 (1,459)	0.8
Average per-student direct appropriations from federal and local sources	816 (594)	1,148 (717)	40.7	1,553 (645)	2,079 (800)	33.9
Tuition						
Average academic year tuition price for full-time student	831 (360)	1,468 (690)	76.7	1,508 (540)	2,523 (901)	67.3
Average annual per-student tuition revenue	638 (290)	908 (359)	42.3	1,653 (711)	2,653 (1158)	60.5
Financial Aid						
State need-based financial aid*	119.3 (135)	126.8 (146)	5	119.3 (135)	126.8 (146)	5
State non-need Financial Aid*	15.1 (29)	15.3 (27)	0	15.1 (29)	15.3 (27)	0
Federal need-based financial aid*	664.1 (173.0)	647.4 (158.2)	-2.6	664.1 (173.0)	647.4 (158.2)	-2.6

* These are per-student figures based on the total number of undergraduates (at 2-year *and* 4-year institutions) in each state.

Table 3. Probit Regression Coefficients for Finance Measures from Seven Two-Stage Models of Postsecondary Finance and Degree Attainment. Each Column Represents a Full Selection-Outcome Model with a Full Set of Covariates at the Selection and Outcome Stages, for Community College Entrants in the HSB and NELS Cohorts; N=22,049 Eligible Students; N=6,821 Community College Students.

	Appropriations		**Tuition**		**Financial Aid**		**Combined**
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Outcome Model							
Average per-student units ($100) of government appropriations to 2-year institutions from all sources	**0.008**** **(2.974)**						
Average per-student units ($100) of state appropriations to 2-year institutions		**0.009**** **(2.753)**					**0.007*** **(2.088)**
Average per-student units ($100) of federal and local appropriations to 2-year institutions		**0.007*** **(2.117)**					-0.001 (-0.374)
Average tuition prices ($100) at public 2-year institutions			**0.007**** **(2.572)**				
Average per-student tuition revenues ($100) at public 2-year institutions				**0.027***** **(5.614)**			0.009 (1.403)
Average per-FTE units ($100) of need-based aid from states					**0.046***** **(4.854)**	**0.025**** **(2.311)**	0.024 (1.960)
Average per-FTE units ($100) of non-need-based aid from states					-0.014 (-0.244)	-0.058 (-0.971)	-0.076 (-1.241)
Average per-FTE units ($100) of need-based aid from federal government						**0.061***** **(4.470)**	**0.044**** **(2.809)**
Lambda	-0.205*** (-3.937)	-0.221*** (-5.117)	-0.215*** (-4.918)	-0.211*** (-4.855)	-0.229*** (-5.277)	-0.220*** (-5.064)	-0.208*** (-4.810)
Successes correctly predicted	(0.354)	(0.358)	(0.362)	(0.369)	(0.372)	(0.371)	(0.368)
Chi-squared (degrees of freedom)	1306.5 (21)	1317.2 (22)	1315.4 (21)	1340.6 (21)	1337.2 (22)	1355.6 (23)	1360.4 (26)

Selection Model							
Average per-student units ($100) of government appropriations to 2-year institutions from all sources	**0.006*** (3.486)**						**0.006 (3.023)**
Average per-student units ($100) of government appropriations to 4-year institutions from all sources	**-0.005*** (-6.013)**						**-0.006*** (-7.264)**
Average per-student units ($100) of state appropriations to 2-year institutions		**0.005* (2.250)**					
Average per-student units ($100) of federal and local appropriations to 2-year institutions		**0.006** (3.222)**					
Average per-student units ($100) of state appropriations to 4-year institutions		**-0.003* (-2.543)**					
Average per-student units ($100) of federal and local app. to 4-year institutions		**-0.01*** (-5.718)**					
Average tuition prices ($100) at public 2-year institutions	**0.006*** (4.093)**	**0.006*** (4.259)**	**0.010*** (4.712)**	**0.010*** (4.712)**	**0.005*** (2.982)**	**0.005*** (2.683)**	-0.000 (-0.141)
Average tuition prices ($100) at public 4-year institutions			-0.002 (-0.971)	-0.002 (-0.971)			
Average per-student tuition revenues ($100) at public 2-year institutions							
Average per-FTE units ($100) of need-based aid from states					**0.022** (3.762)**	**0.030*** (4.253)**	**0.045*** (5.909)**
Average per-FTE units ($100) of non-need-based aid from states					**-0.076* (-2.533)**	**-0.062* (-1.998)**	-0.040 (-1.268)
Average per-FTE units ($100) of need-based aid from federal government						**-0.016* (-2.018)**	**-0.032* (-3.766)**
Threshold parameter	1.231***	1.232***	1.230***	1.230***	1.231***	1.232***	1.233***

	(94.013)	(94.194)	(94.094)	(94.094)	(93.994)	(93.997)	(93.997)
Chi-squared (degrees of freedom)	12733.5 (32)	12744.8 (34)	12705.3 (32)	12705.3 (32)	12727.2 (33)	12731.3 (34)	12784.6 (36)
Proportion correct 2-year predictions	0.360	0.362	0.361	0.361	0.357	0.358	0.361

***significant at p<0.001; **significant at p<0.01; *significant at p<0.05

Appendix 1A. State-level Measures Included in the Selection Model.

	In Effect for HS Class of 1982 (N = 50)	In Effect for HS Class of 1992 (N = 50)	Inter-cohort Policy Change
State unemployment rate	9.3 (2.3)	6.8 (1.6)	-2.5 (1.9)
Access to 2-year institutions (number of public 2-year institutions per 10,000 young adults)	0.330 (0.213)	0.424 (0.271)	0.095 (0.253)
Access to 4-year institutions (number of public 4-year institutions per 10,000 young adults)	0.226 (0.134)	0.284 (0.179)	0.058 (0.060)
Average tuition at public 2-year institution	831.2 (359.6)	1483.2 (691.2)	637.2 (506.4)
Percent of adults over 25 with a bachelor's degree	16.0 (2.9)	19.8 (3.8)	3.8 (1.4)