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Understanding the Increased Time to the Baccalaureate Degree

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Abstract

Time to completion of the baccalaureate degree has increased markedly among college graduates in the United States over the last three decades. Between the cohorts graduating from high school in 1972 and 1992, average time to degree increased by more than one-quarter of a year, the completion rate among college attendees dropped from 51.1% to 45.3% and, among those receiving degrees, the percent receiving a degree within 4 years dropped from 56.8% to 43.6%. Using data from the NLS72 and NELS:88 longitudinal surveys, we assess the extent to which these shifts result from changes in the preparation of college students over time, reductions in collegiate resources, an erosion in family circumstances, or other broad macro-economic adjustments. We show that the increase in time to degree is localized among those who begin postsecondary education at public colleges outside the most selective flagship universities. The net effect of changes in student characteristics including pre-collegiate achievement and parental characteristics does not explain the observed increase in time to degree or the drop in completion rates. We produce evidence that increased stratification in U.S. higher education and reductions in collegiate resources outside the top-tier of institutions are a primary component of the explanation for the observed increases in time to degree, with increases in time to degree relatively concentrated in states that have experienced rapid growth in the size of the college-age population and dilution in resources per student at many public colleges. The shift toward initial enrollment at two-year institutions rather than four-year institutions accounts for some of the decline in completion rates. In addition, we find evidence of increased hours of employment among students, which is consistent with students working more to meet rising college costs.

Section 1. Introduction

Time to completion of the baccalaureate (BA) degree has increased markedly among college graduates in the United States over the last three decades. Among high school graduates from the class of 1972 completing college within eight years of high school graduation, 56.8% completed BA degrees within four years; two decades later, among graduates of the class of 1992, college completion within four years had slipped to 43.6%. Further, while college enrollment rates have increased over this time period, among those who enroll, college completion rates have dropped substantially from 51.1% for the high school class of 1972 to 45.3% for the high school class of 1992. With both college graduation rates and time to degree prominent in recent policy reports and press accounts,[1] a central question is whether the slowdown in the rate of collegiate attainment is caused by a shift in who goes to college, a decline in the resources available for post-secondary education, or other factors.

The time it takes individuals to complete an undergraduate college degree reflects both individual choices about the "intensity" of study and the availability and price of courses offered by colleges and universities. Among the reasons students may extend collegiate experiences beyond the four-year norm include a need for academic remediation, inability to finance full-time attendance resulting in part-time enrollment and employment, or simply a desire to extend the consumption experience of collegiate life. It is also possible, particularly in a collegiate market dominated by public and non-profit providers, that reductions over time in resources per

[1] A recent front page article in the *New York Times* focused on the low graduation rates and extended time to degree at many urban universities. To illustrate, the graduation rate at Chicago State University was 16% after six years, rising to 35% after seven years (Finder, 2006). Similarly, one of the findings of the recently released Spellings Commission report was "While educators and policymakers have commendably focused on getting more students into college, too little attention has been paid to helping them graduate. The result is that unacceptable numbers of students fail to complete their studies at all" (U.S. Department of Education, 2006).

student at the institutional level limit the availability of course offerings and slow the rate at which students are able to complete undergraduate degrees.

Time to completion of the undergraduate degree is an important outcome in higher education, ultimately affecting the private and social returns to investment in higher education. While it is possible that increased time to degree might reflect greater human capital acquisition, the empirical evidence we produce suggests this positive interpretation is unlikely, as increased time to degree has been associated with slower accumulation of degree credits. That students are accruing credits more slowly implies deferral of the higher wages associated with college completion, lowering the rate of return to college and reducing the availability of college-educated workers in the labor market. With the substantial increase in the college wage premium since 1980 and the sluggish increase the rate of collegiate attainment among the U.S. labor force (DeLong, Goldin and Katz, 2003), understanding the rate of collegiate attainment in terms of both demand-side and supply-side determinants has significant implications for economic growth.

We find both increased time to degree and decreased completion rates have been disproportionately concentrated among those students starting at community colleges and public colleges and universities outside the most selective few, reflecting the increased stratification of higher education in the United States. We find that changes in individual characteristics taken together, including college preparedness and parental education, account for none of the decline in either the percentage of college entrants receiving a BA nor the shift in time it takes students to complete a BA.

Our analysis emphasizes the importance of increased stratification in U.S. higher education and reductions in collegiate resources outside the top-tier of institutions as a primary component of the explanation for the observed increases in time to degree. The shift toward initial enrollment at two-year institutions rather than four-year institutions plausibly accounts for some of the decline in completion rates. In addition, we find increases in time to degree are relatively concentrated in states that have experienced rapid growth in the size of the college-age population, suggesting that the increased demand for college education generates “crowding” in higher education as resources per student in public higher education do not fully match increases in enrollment demand. With selective admissions and inelastic supply at top-tier institutions, the result is an increased concentration of college students at community colleges and open-access four-year schools where resources per student are likely to be diluted with expansion in enrollment.

Increases in college costs relative to family income may further limit the progression through degree programs if credit constraints lead students to increase employment at the cost of reductions in the rate of credit attainment. We observe substantial increases in employment while in college in association with extension of time to degree. Given the endogeneity of hours worked, it is difficult to quantify the effect this shift might have had on the pace of collegiate attainment. Still, the magnitude of the shift is large enough that it is likely this shift has played a role as a proximate factor in increased time to degree.

The rest of this paper is organized as follows: Section 2 describes the increase in time to degree and decline in completion rates found in the data. Section 3 outlines the potential explanations for these trends that inform our empirical analysis. Section 4 presents the results from our empirical analysis, and Section 5 concludes.

Section 2. Increased Time to Degree and Reduced Collegiate Attainment

Evidence of increased time to degree and reductions in college completion conditional on enrollment can be found in a range of data sources. The Current Population Survey (CPS) provides a broad overview of these trends in collegiate attainment by age (or birth cohort). While the share of the population with some collegiate participation increased substantially between the 1950 and the 1975 birth cohorts, Figure 1 shows that the share of the birth cohort obtaining the equivalent of a college degree by age 23 increased only slightly over this interval. Looking at college completion through age 28, however, shows the proportion of college graduates rising more significantly among recent birth cohorts. Taken together, the inference is that time to degree has increased.[2]

To measure changes in time to degree in connection with micro data on individual and collegiate characteristics, this analysis utilizes the National Longitudinal Survey of the High School Class of 1972 (NLS72) and the National Educational Longitudinal Study (NELS:88). These surveys draw from nationally representative cohorts of high school and middle school students, respectively, and track the progress of students longitudinally through collegiate and employment experiences. To align these surveys, we focus on outcomes within eight years of cohort high school graduation for the sample of high school graduates who entered college within two years of their cohort's high school graduation.[3]

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[2] Data from cross-sections of recent college graduates assembled by the Department of Education from the Recent College Graduates and Baccalaureate & Beyond surveys corroborate this finding. For example, from 1970 to 1993, the share of graduates taking more than six years rose from less than 25% to about 30%, while the share finishing in four years or less fell from about 45% of degree recipients in 1977 to only 31% in the 1990s (see McCormick and Horn, 1997 and Bradburn et al., 2003).

[3] Cohort high school graduation is June 1972 for NLS72 respondents and June 1992 for NELS:88 respondents. We define time to degree as the elapsed time from high school cohort graduation. An alternative would have been to measure time to degree from the point of college entry. The results are not sensitive to this choice and, with the NELS:88 cohort only followed for eight years after high school graduation, our approach is consistent in affording eight years of observation for both cohorts. While we measure time to degree from cohort high school graduation, the sample includes those who do not graduate high school on time. Because the NLS72

The college attendance rate among high school graduates from the NLS72 and NELS:88 microdata increased substantially over the two decades of analysis, as shown in Table 1. For the high school class graduating in 1972, 53.1% entered college within two years, with this rate rising to 80.8% for those graduating in 1992. While overall college participation rates have increased, the rate at which beginning college students complete the requirements for the BA degree has declined in recent decades. Within eight years, there is a more than 5 percentage point decline in the college completion rate, from 51.1% to 45.3%.

As college attendance rates have increased over this interval, the distribution of students across institutions has shifted. While about 71% of students started at four-year institutions from the 1972 cohort, only about 61% of students in the later cohort started at a four-year public or private institution (Table 1, columns (ii) and (v)). Concurrently, the share starting at a two-year institution rose from 29% to 39%.[4] The share of students starting at private colleges and universities decreased only slightly from 20.0% to 17.5%.[5]

Panel B of Table 1 illustrates the dramatic differences in the likelihood of BA completion associated with type of first institution. At a descriptive level, students starting at community colleges are considerably less likely to complete than students starting at four-year institutions in the public and private sectors. For the high school cohort of 1992, the BA completion rate

survey follows a 12th grade cohort and the NELS:88 survey follows an 8th grade cohort, there are more late high school completers in the latter sample. However, when one conditions on college completion within eight years, over 99% of respondents finish high school on time in both samples. See Appendix B for further discussion of the NLS72 and NELS:88 datasets.

[4] All references to two-year schools and community colleges refer to public institutions only. We exclude private two-year schools as they are often professional schools with little emphasis on eventual BA completion. In the NLS72 cohort, 1.7% attended a private two-year school, and 1.1% of the NELS:88 sample attended such an institution.

[5] Tabulations from institutional sources based on counts of first-time students in higher education suggest that this shift occurred somewhat earlier. For example, the fraction of first-time students starting at community colleges rose most dramatically between 1960 and 1970 (from 20% to 41%), with a peak of 51% reached in 1975 before returning to 45% in 1992. [See: http://nces.ed.gov/programs/digest/d04/tables/xls/tabn180.xls] Notably, measures from sources like the CPS that allow for the consideration of a single age cohort confirm the substantial rise in attendance at community colleges among recent high school graduates between 1972 and 1992.

among those starting at public two-year institutions slipped to 17.4% from 23.2% for those graduating in the high school class of 1972. At the other extreme, completion rates among students starting at private four-year institutions increased across cohorts from 68.4% to 78.2%. To wit, there are substantial and increasing differences in the likelihood of degree completion associated with a student's initial college choice.

2.1. Time to degree

We measure time to degree in each survey as the number of years between cohort high school graduation and BA receipt.[6] Because the last NELS:88 follow-up was conducted in 2000, we are forced to truncate the time to degree distributions at eight years, reflecting the time between cohort high school graduation and the last follow-up. We are therefore truncating on a dependent variable, which may introduce a bias into our analysis if the truncation occurs at different points in the full degree time distribution for the two cohorts. Empirically, the proportion of eventual college degree recipients receiving their degrees within eight years has not changed appreciably. The National Survey of College Graduates (2003) allows us to examine year of degree by high school cohort. For the cohorts from the high school classes of 1960 to 1979 for which there are more than 20 years to degree receipt, we find the share of eventual degree recipients finishing with eight years holds nearly constant at between 0.83 and 0.85. Focusing on more recent cohorts (and, hence, observations with more truncation) we find that in the 1972 high school graduating cohort, 92.3% of those finishing within twelve years had finished in eight years, with a figure of 92.4% for the 1988 cohort. This evidence supports the

[6] Given our measure of time to degree, some of the differences across cohorts could be accounted for by delayed entry into college. Empirically, the shift that occurred was too small to account for any of the shift in time to degree. In our samples of those that finished college, only 5.5% of the NLS72 cohort and 7.4% of the NELS:88 cohort delayed initial entry.

assumption made throughout this analysis that the eight year truncation occurs at similar points in the time to degree distribution in both surveys.

To understand the change in the timing of degree receipt across surveys, we show the cumulative share of eight-year degree recipients receiving their degree in years four through eight beyond their cohort's high school graduation[7] (see Appendix B for details on the construction of the time to degree variables). Table 2 presents cumulative distributions for the full sample and by initial school type. For each year of the time to degree distribution, we calculate the difference between the proportion having graduated in that year or earlier in the NELS:88 survey and the NLS72 survey, along with the p-value of the test that this difference is statistically different from zero. We also present the p-value of a test that the NLS72 distribution first-order dominates the NELS:88 distribution for years 4, 5, and 6 post high school cohort graduation. Appendix C outlines the calculation of p-values and other statistical issues related to the distributional comparisons.

There is a significant increase in time to degree over the time period studied in this analysis, as the cumulative distribution function for NLS72 first-order dominates the observed NELS:88 time-to-degree distribution. While more than one half (56.8%) of degree recipients finished within four years from the 1972 high school cohort, the share finishing within four years dropped to 43.6% for the 1992 high school cohort.

The extension of time to degree is far from uniform across types of undergraduate institutions, with much larger increases occurring among students starting at public 4-year and 2-year institutions than among those starting at private colleges and universities, as shown in the

[7] Because our analysis focuses on eighth and twelfth grade cohorts, our estimates should not be affected by any increases in the delay of initial kindergarten or primary school entry. As such, the increase in "academic red-shirting" is further justification for using grade-specific rather than age-specific measures of time to degree. See Dynarski and Jacob (2007) and Elder and Lubotsky (2007) for further discussion of academic redshirting.

additional panels of Table 2. The fraction of observed degree recipients finishing within four years falls from 54.6% to 37.1% among students starting at 4-year public universities and from 35.9% to 21.0% at the 2-year publics. Among students enrolling at private institutions, the decline in 4-year completion is a more modest 5.3 percentage points, and the NLS72 distribution does not first order dominate the NELS:88 distribution for this group.

Public colleges and universities are central to our analysis because the majority of undergraduate degrees are awarded by these institutions, and this is the institutional sector where changes in time to degree are most pronounced. Given the considerable heterogeneity in program offerings and resources among BA-granting colleges and universities within the public sector, we present differences in the rate of collegiate attainment and the distribution of time to degree by rank of the initial institution attended by respondents whose first collegiate attendance was at a 4-year public institution in Table 3.[8]

While the choice of ranking method and the division of schools is necessarily arbitrary, the results are consistent in showing the distinction between the most resource-intensive universities and other public institutions in the changes observed over time. At one extreme, time to degree decreased and completion rates increases in the cross-cohort comparison of the narrow slice of students at top 15 public institutions.[9] When the band is widened to include the top 50 institutions in the subsequent panel of Table 3, the increase in overall completion rates persists, though there is a small increase in time to degree. Table 3 illustrates that it is among

[8] We employ the rankings of public universities assembled by *U.S. News and World Report* in 2005. Other metrics such as resources per student or selectivity in undergraduate admissions give similar results. The top 15 public universities are, in order: University of California – Berkeley, University of Virginia, University of Michigan, University of California – Los Angeles, University of North Carolina, William and Mary, University of Wisconsin, University of California – San Diego, University of Illinois, Georgia Institute of Technology, University of California – Davis, University of California – Irvine, University of California – Santa Barbara, University of Texas, and University of Washington.

[9] Notably, students at top-15 ranked public universities are only a small share of all undergraduate enrollment (2.9% for the high school class of 1992) and BA recipients (5.8%).

students starting at public institutions outside the top 15 public schools where any erosion in outcomes is apparent.

2.2. Credit Attainment

Given observed increases in time to degree, it is natural to ask whether these changes reflect increased difficulty in passing through the course sequences or increased course taking.[10] At the extreme, if increased time to degree were to capture only more attainment in the form of course credits, then policy concern over the effects of time to degree would be misplaced as the additional attainment should also translate to labor market benefits. With access to transcript data, we are able to chart the time path of credit accumulation in order test for such an explanation. Average credit accumulation schedules by initial school type are presented in Figure 2. What is evident from the figure is a slower pace of credit accumulation in the 1992 cohort relative to the 1972 cohort for students at four-year public institutions outside the most selective group as well as those students at community colleges. In the first year after high school graduation, students beginning at two-year schools accumulated, on average, about 4.6 fewer credits in the later cohort relative to the class of 1972, while students starting at four-year public schools outside the top 15 accumulated, on average, about 4.1 fewer credits.[11] For students at public non-top 15 universities, earned credits from degree recipients in NELS:88 plainly lag those in NLS72 at the 4 year mark, though differences largely converge after 8 years, with little

[10] In the cross-section, time to degree is negatively associated with wages (Flores-Lagunes and Light, 2007). The implication of this relationship is those who take more time to obtain a BA accumulate less human capital than those who take less time. This fact is also consistent with the notion that those who take more than four years tend to be less well prepared for college and/or attend lower quality institutions.

[11] One point of note is that credits completed actually increase moderately among those beginning at the top public universities and private institutions. We believe this shift reflects several related trends: first, students at these institutions may be more selected (and higher achieving) than in previous cohorts; secondly, students at these institutions are increasingly likely to pursue double majors that require higher total credit accumulation; and, finally, a number of these institutions offer five-year programs that allow students to combine an undergraduate degree with a one-year MA in areas like education or engineering.

net change in total credit accumulation. However, students beginning at two-year schools accumulate over 6 fewer credits on average after eight years in the NELS:88 survey.

We have also explored changes in the ratio of attempted credits to credits completed and find only a modest increase; these changes are not large enough to explain much of the increase in time to degree. With no supporting evidence in the form of credit accumulation to suggest a link between time to degree and human capital accumulation, we interpret observed increases in time to degree as a reduction in the rate of human capital accumulation rather than an increase in human capital, with this change concentrated outside the top public schools and private institutions.

Section 3. Potential Explanations for Increased Time to Degree and Decreased College Completion

In this section, we consider multiple theoretically plausible explanations for the changing rate of college completion and time to degree as a framework for interpreting our empirical methodology and results. The explanations on which we focus can be split into demand-side changes brought about by increased enrollment among students with lower pre-collegiate achievement and more limited capacity to pay for college and supply-side institutional constraints in higher education. Our demand-side analysis focuses on the characteristics of students at the margin of college completion: if the pre-collegiate achievement of these individuals eroded, time to completion would be expected to increase. Secondly, if students find it increasingly difficult to finance college, with limited access to credit markets to fund an investment like education that cannot be directly collateralized, they may need to increase hours worked to pay for living expenses and tuition, thereby potentially decreasing the rate of collegiate attainment. On the supply-side of the market for higher education, the limited enrollment response of top-tier institutions combined with less than dollar-for-dollar increases in public subsidies with expansion in enrollment present a concurrent explanation for extension of time to degree and reduction in completion rates.

3.1. Changes in Student Characteristics at the Margin

A simple selection model illustrates the connection between changes in the pool of students entering college, the college completion rate and time to degree. When the returns to a college education increase, as has occurred in the U.S. over the past three decades, more high school graduates will be induced to attend college, thereby changing the composition of enrolled students. The effect of such a compositional shift on time to degree and college completion depends on who is induced to attend college when the returns to obtaining a BA increase. If the students drawn to college are less academically prepared than the infra-marginal student, time to degree is likely to increase and completion rates will likely decrease. At the same time, increased rewards to obtaining a BA will put pressure on students to both finish college and to finish faster as the opportunity cost of another semester of enrollment has increased. Such a model thus suggests the net effect on time to degree and completion rates of an increase in the return to a college education is theoretically ambiguous. Still, the composition of academic preparedness among incoming college students is significantly reduced, it is reasonable to expect time to degree to increase and completion rates to decrease.

3.2. Resources per Student and Institutional Constraints

The supply-side of the market for higher education defined in terms of the quantity and quality of enrollment opportunities at any point in time is an important determinant of both completion rates and time to degree. With colleges and universities receiving considerable subsidies from state, federal, and private sources, consumers pay only a fraction of the cost of production; student fees cover only about 12 percent of total educational costs at public colleges and universities in the U.S. (Winston, 1999). Moreover, total resources and public subsidies are highly stratified across institutions within states, with expenditures per student in public universities more than double those in community colleges (Courant, McPherson and Resch, 2006). There also exists considerable variation across states and within states over time in the level and distribution of public subsidies.

In this context, public colleges and universities are unlikely to accommodate fully changes in demand (Bound and Turner (2007) discusses these issues at greater length). First, non-tuition revenues and capital stock – including state appropriations, donations from private sources, and campus infrastructure – are unlikely to respond in full to short run changes in demand. In addition, tuition charges, particularly at public institutions under significant political pressure, are unlikely to increase such that enrollment is regulated through the price mechanism.

The adjustment of public colleges and universities to demand increases takes somewhat different forms across the strata of higher education. For top-tier colleges and universities in both the public and private sectors, there is little adjustment in degree (or enrollment) outcomes to demand shocks. To the extent these institutions use selectivity in admissions (which increases with increases in demand) to regulate enrollment, it is likely outcomes such as completion rates and time to degree are unchanged, or, perhaps, even improve, with increased demand. At the same time, enrollment is relatively elastic among public universities outside of the most selective few. Here, we expect increased demand to lead to increased enrollment and consequent reductions in resources per student (Bound and Turner, 2007).[12]

[12] Bound and Turner (2007) emphasize that direct assessment of the effect of resources per student on degree outcomes using measures of current expenditures or state appropriations is difficult because only part of any

In addition to changes in outcomes linked to the availability of public subsidies within institutions, increases in collegiate demand shift the distribution of college enrollment within a state to open-access four-year institutions and community colleges. Increasing enrollment at community colleges relative to universities will tend to reduce the overall resources per college student within a state. Estimating the causal impact of type of collegiate experience on attainment and earnings is difficult given the endogeneity of college choice, with students attending community colleges likely to be systematically different than those attending four-year colleges. However, available evidence suggests that, *ceteris paribus*, for a student intending to obtain a BA, starting at a two year school both lowers the probability of BA attainment and increases the expected time to degree.[13]

Queuing and enrollment limits in response to limited resources in the public sector may affect the pace of degree receipt and the overall college completion rate. Despite nominal claims of "open enrollment," there is ample evidence of enrollment limits and course closings, particularly in high growth states. Case studies with press clippings from high growth states such as California, North Carolina and Utah are instructive and presented in Appendix A. Some institutions become more selective in response to increases in demand as illustrated by the cases of the University of Utah and Utah State.[14] In turn, courses at the community college and open

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observed change in current expenditures is likely to be exogenous, and expenditures translate into resources with long lags. They use variation in the size of the college-age cohort within states to generate plausibly exogenous variation in the availability of higher education resources per student. They find that the elasticity of undergraduate enrollment with respect to cohort size is close to 0.2 at flagship public universities, and the corresponding elasticities are 0.8 at community colleges and about 0.6 at "non-flagship" public universities.

[13] Researchers have consistently found college students starting at two-year schools are less likely to complete the BA than their peers beginning at four-year schools. Reynolds (2007) uses matching estimators to approach this question, while earlier work uses regression techniques to adjust for observable differences between those starting at two and four-year schools (Rouse, 1995, Leigh and Gill, 2003 and Sandy, Gonzales and Hilmer, forthcoming).

[14] For example, one report notes "Both the University of Utah and Utah State University are raising the bar for enrollments this fall. Other colleges and universities in the system have traditionally tried to take all comers, but they are warning ahead of time that budget cuts, coupled with unprecedented demand, may limit enrollment as classes fill and potential students are turned away" (Van Leer, 2002).

access four-year institutions fill up rapidly, leaving many students "admitted" but unable to enroll in needed classes. For example, the registrar at Utah Valley State noted, "We admit everyone, but if they come and find that the courses they want are already full, they may either look at other options or wait until the next semester. Although 'open enrollment' remains the objective, the availability of classes is a limiting factor" (Van Leer, 2002). Another example of visible overcrowding at four-year institutions is the account of a Florida State student who wrote about students unable to get the classes they needed as well as constraints in services, concluding it was "almost impossible to collect financial aid, to buy a sandwich, or even to go to the bathroom." (*The Chronicle of Higher Education*, 1996)

It is straightforward to see how such institutional barriers lead to delays in degree progress. While queuing and shortages of courses are inefficient, such limitations may result from the absence of adjustments in tuition and enrollment at public universities when appropriations per student decrease, leading to increases in time to degree. With substantial state subsidies and below market tuition that may insulate public colleges and universities from some competitive pressures, it is also possible that some of the queuing on the supply-side is indicative of the failure of public institutions to adjust to changes in demand by reallocating resources (Smith, 2007).

3.3. Student Responses to Increases in College Costs

That college costs have increased dramatically in recent years has been widely noted by the press and policy makers. Models based on full flexibility in the allocation of hours between academic study, work and leisure typically assume the capacity to fully finance collegiate study with intertemporal borrowing and full access to credit markets. In practice, it is quite likely students face some limits in access to capital markets (Becker, 1993). With relatively modest availability of federal aid and limited institutional financial aid funds outside the most affluent colleges and universities, it is plausible an increasing number of students attend college part time – thus extending time to degree – because they are credit constrained and unable to borrow to finance full-time attendance.[15] In the context of the Becker-Tomes (1979) model of intergenerational transfers (see also Solon, 2004 and Brown, Mazzocco, Scholz, and Seshadri, 2006), rising tuition charges and falling family income lead to the expectation that students will shoulder a higher fraction of college costs. As such, if students are limited in their capacity to borrow, rising college costs may increase the incidence of employment while in school.[16]

If tuition increases combined with imperfect credit markets induce students to work more hours while in college to finance attendance, time to degree may increase if working time crowds out time that would be spent on academic pursuits. It is straightforward to show that in a simple Ben Porath (1967) human capital accumulation model in which a student chooses the rate and level of human capital acquisition, reductions in institutional resources, erosion in student ability and background, and increased working behavior will all serve to increase time to degree and reduce the level of human capital investment. For those who would optimally borrow more than the available credit for education, the reductions in human capital acquisition due to increases in tuition or decreases in family resources will be magnified.

Student response to increases in college costs will depend in part on the pricing structure chosen by colleges and universities. One point of distinction across the sectors of higher education is the extent to which institutions price per unit or per term, with students effectively allowed to take as many courses as they can handle within the academic term. If students are

[15] With the maximum Pell grant at $4050 and the borrowing under the Stafford program limited to $2625 for first year dependent students, a low-income student hoping to attending a residential college full time would face substantial unmet need. See Fitzpatrick and Turner (2007) for further discussion.

[16] Keane and Wolpin (2001) show that, in a forward-looking dynamic model with limited access to credit, increases in employment while enrolled in school are the expected response to tuition increases.

free to select the number of credits taken in each term, increases in tuition charges provide an incentive to substitute away from leisure toward academic study; for some students, increased intensity of study can reduce time to degree and, in turn, total college costs. Examples of institutions with this type of "fixed term" pricing structure include many residential private institutions such as Princeton, Harvard, Amherst, and Williams and selective public universities like the University of Virginia. Institutions serving constituencies focused on full-time residential undergraduates are much more likely to post "flat fee" tuition schedules while those with many working and adult students tend to offer pricing per credit hour. Looking at tuition structures offered by public four-year colleges and universities in 1992, more than 52% report a per credit pricing system. Yet, when we focus on the more selective top-15 public institutions, only 1 institution reported tuition on a per credit basis.[17] When we split institutions according to the pricing structure they use rather than by the quality rank of the institution, we find only modest increases have occurred at institutions that charge by the term, with the bulk of the increases occurring at institutions that charge by the unit.[18]

In sum, theoretically plausible explanations for declines in completion rates and increases in time to degree include demand-induced shifts in the characteristics of new college entrants and students at the margin of college completion, changes in the supply-side of higher education reducing resources per students, and increased difficulties in paying for college that may lead to

[17] While historical trends in tuition structure are difficult to find nationally, we collected information from Michigan, California, and Virginia for all public universities going back to the 1970s. The data suggest the structure of tuition is remarkably stable within institution with respect to charging per term or per credit hour.

[18] At all public fixed-fee institutions, the proportion of graduates who obtain a BA within 4 years decreased from 56.5% to 48.7%, but within the institutions that charge by the credit hour, the four-year completion rate dropped from 52.7% to 35.4%. It is important to note the pricing structure of universities are often complex and contain aspects of both fixed and hourly pricing. While this simple breakdown presents suggestive evidence that the predominant pricing system is correlated with the increases in time to degree observed in the data, pricing structure is also correlated with other institutional attributes such as the availability of financial aid and the degree of commitment to open access admission policies.

increased employment and reductions in the rate of collegiate attainment. In the next section, we evaluate the empirical evidence in support of these explanations.

Section 4. Empirical Analysis of Increased Time to Degree and Decreased Completion Rates

4.1. The Role of Changing Student Attributes

4.1.1. Methodology to Assess the Role of Changing Student Attributes

Our methodological approach begins with the investigation of the relationship between changes in the pre-collegiate characteristics of college students and the outcomes of college completion and time to degree. The motivation is similar to the Blinder-Oaxaca decomposition in that our objective is to determine the extent to which changes in the distribution of student attributes can explain the observed changes in completion rates and the distribution of time to degree. We re-weight the NELS:88 time to degree distribution and completion rate using the characteristics of students from the NLS72 survey.[19] This calculation leads to a counterfactual time to degree distribution and a counterfactual completion rate in which the proportion of students with a given characteristic has not changed between the two surveys. By comparing the observed NELS:88 outcomes and the re-weighted NELS:88 outcomes, we can determine the proportion of the difference between them that is due to changes in the mix of students with a given attribute attending college. The remainder, or the difference between the reweighted outcomes and the observed outcomes, reflects changes in other determinants of time to degree or changes over time in how a given characteristic affects degree completion. We perform re-

[19] Reweighting estimators have a long history in statistics dating back at least to the work of Horvitz and Thompson (1952) and have become increasingly popular in economics (see, for example, Dinardo, Fortin and Lemieux , 1996; Heckman, Ichimura and Todd , 1997 and 1998; and Barsky, Bound, Charles and Lupton , 2002). One advantage of these methods over standard regression methods is that they allow researchers to examine distributions, not just means.

weighting calculations separately for specific characteristics such as ethnicity, family income and pre-collegiate achievement and for all characteristics together.

The validity of our counterfactual calculations (e.g. what would the college completion rate for those attending college in the 1990s had they been as academically prepared for college as those who attended in the 1970s) depends crucially on the cross sectional association between background characteristics and college outcomes reflecting a causal relationship not seriously influenced by confounding factors. For example, we simulate completion rates under a counterfactual distribution of test scores. For this simulation to accurately represent the counterfactual, it must be the case that the test scores are a measure of pre-collegiate academic preparedness and that the cross-sectional relationship between test scores and the likelihood of college completion and time to degree reflects the impact of preparedness on these outcomes.

Regardless of whether the counterfactual interpretation of the reweighting exercise is valid, it is possible to interpret the results descriptively. What we are estimating is the change in completion rates conditional on various observable characteristics, integrating this change over the distribution of characteristics (see Barsky, Bound, Charles and Lupton, 2002 for a further discussion of this issue).

4.1.2. Data Used in the Re-weighting Analysis

The student attributes we analyze are high school math test quartile, high school reading test quartile,[20] father's education level, mother's education level, real parental income levels,

[20] The math and reading tests refer to the NCES-administered exams that were given to all students in the longitudinal surveys in their senior year of high school. Because the tests in NLS72 and NELS:88 covered different subject matter, were of different lengths, and were graded on different scales, the scores are not directly comparable across surveys. Instead, we construct the quartiles of the score distributions for each test type and for each survey. The comparison of students in the same test quartile across surveys is based on the assumption overall achievement did not change over this time period. This assumption is supported by the observation that there is little change in the overall level of test scores on the nationally-representative NAEP over our period of observation. Similarly, examination of time trends in standard college entrance exams such as the SAT provides little support for the proposition that achievement declined appreciable over the interval within test quartiles.

gender, and race; see Appendix B for further discussion. For the measurement of family income, we are interested in assessing parents' ability to finance college and the variable of interest is the real income level, not one's place in the income distribution. We align the income blocks representing responses to categorical questions across the two surveys using the CPI.

The NLS72 and NELS:88 datasets contain a significant amount of missing information on test scores, parental education, and parental income brought about by item non-response. While a very small share of observations are missing all of these variables (in NLS72 and NELS:88, respectively, 0.60% and 1.26% have no information on any of these variables), a substantial number of cases are missing either test scores, parental education or parental income. For example, in NLS72, 40% of those who enroll in college and 39% of those receiving a BA within eight years of cohort high school graduation are missing information on at least one of these background characteristics. These percentages are 51 and 43, respectively, in NELS:88. Because the data are not missing completely at random, case-wise deletion of observations with missing variables will bias the unconditional sample means of completion rates and time to degree. We use multiple imputation methods (Rubin, 1987) on the sample of all high school graduates to impute missing values using other observable characteristics of each individual.[21]

Table 4 presents the changes in background characteristics and measured ability of college attendees and graduates across the NLS72 and NELS:88 surveys. The table shows the substantial shift in background characteristics of students entering college over time to include those from lower on the high school test score distribution and an increase in Asian and Hispanic students. For example, the proportion of college attendees from the highest math test quartile

[21] Under the assumption that the data are missing conditionally at random, multiple imputation is a general and statistically valid method for dealing with missing data (Rubin, 1987; Little, 1982). The relative merits of various approaches for dealing with missing data have been widely discussed (e.g. Little and Rubin, 2002; Schafer, 1997). See Appendix B for complete details of the imputation procedure.

dropped from 40.6% to 32.5% and from the lowest math test quartile increased from 11.2% to 16.2%. For reading tests, the proportion in the top quartile dropped from 35.0% to 31.4%, and the proportion in the bottom quartile increased from 14.5% to 18.0%. Similarly, the percent of college attendees with race classified as white decreased from 85.8% to 73.8%.

Table 4 also illustrates these changes in the demographics of college attendees were not translated fully into changes among college graduates. Among BA recipients, changes in attributes with a presumed effect on time to degree are of small; thus it is of no surprise that these factors are of little importance in explaining the increase in time to degree. For example, the proportion in the highest math quartile decreased by less than 2 percentage points and the share of BA recipients from the highest reading quartile increased. In addition, the growth in the college enrollment of Hispanic and black students -- who are traditionally underrepresented at the college level – is appreciably larger among all college attendees than among college graduates, suggesting that changing demographic composition is likely to be less important as an explanatory variable for the time to degree outcome than for the completion rate outcome. The implication of comparisons across columns in Table 4 is that many of the students who were pulled into the higher education system between 1972 and 1992, including minorities and students with relatively weak test scores, did not complete college.

For both college attendees and graduates, the direction of the change in outcomes caused by the change in observables is hard to predict because some variables, such as family income and parental education, became more favorable among both college attendees and graduates. Echoing the general increase in educational attainment during the post-war period, the proportion of college attendees whose father (mother) had at least a BA increased by 8.1 percentage points (12.9 percentage points) for all college attendees and 15.6 percentage points (20.8 percentage points) for BA recipients. Such shifts implicitly go in the "wrong direction" to explain the observed changes in either time-to-degree or completion rates.

4.1.3. Results from Multivariate Reweighting using Individual Characteristics

To understand how the change in the distribution of individual characteristics affected collegiate attainment, we use a logit estimation to generate weights based on cohort of observation. These weights are used to generate the reweighted distributions shown in Table 5, reflecting the distribution of completion expected if the distribution of individual characteristics in 1992 resembled the distribution of individual characteristics in 1972. As with all reweighting analyses, the choice of indexing is arbitrary. We chose to reweight the NELS:88 distribution due to ease of interpretation. Given the fact that the strength of the association between test scores, family income, parental education and educational outcomes have all increased over time, if anything, reweighting the NLS72 outcomes using the distribution of observable characteristics in NELS:88 accounts for less of the NLS72/NELS:88 shift in completion rates and time to degree. Results from reversing the indexing are presented in Appendix D, Tables D-4 and D-5**.** We also present the p-value on the test that the difference between the NELS:88 reweighted distribution and the NLS72 distribution at each point is statistically significant. The p-value of the test for first order stochastic dominance is presented in the final column of Table 5.

The top Panel of Table 5 presents estimates of the distribution of time to degree that would have been expected to prevail if individual attributes among those receiving degrees had remained at their 1972 level. Also shown are the completion rates that would have been expected in the later cohort had the characteristics of college students reflected those observed among college students from the class of 1972. Overall, changes in background characteristics of college graduates go in the opposite direction to explain the increase in time to degree or the decline in completion rates.[22]

For completion rates, it is unambiguous that the test scores of students enrolled in college declined over the two-decade interval and, if we were to employ test scores as the only variable in the re-weighting scheme, we would explain a considerable share of the change in the completion rate over time.[23] What these results suggest is, on their own, test scores explain much of the 1972 to 1992 change in completion rates; yet, the effect of changes in the distribution of achievement of entering college students on completion is more than offset by the parental income effect and parental education effects in the multivariate reweighting.[24]

For the distribution of time to degree, the reweighted proportion of four-year BA recipients declined from 43.6% to 39.6%. However, unlike the case of completion rates where there were substantial changes in the distribution of student achievement across cohorts, changes in the achievement distribution of degree completers are minimal across cohorts, contributing little to the change in time to degree, while other changes in this population such as parental education go in the wrong direction to explain much of the change in time to degree. We found that regardless of which variables we standardized on (Appendix D, Table D-3 contains

[22] In interpreting the effect of parental education on collegiate attainment, one might question whether it is relative parental education (as a proxy for underlying ability) or the level of parental education (as an indicator of skills affecting students' skill acquisition in the family). There is no empirically feasible test that would allow us to distinguish between these two interpretations.

[23] As shown in Appendix Table D-3, univariate reweighting of the NELS:88 distribution with the distribution of test scores observed in NLS72 among those enrolled in college leads to a predicted completion rate of 49.5% and 47.3% using math and reading test quartile distributions, respectively. Of note, reversing the indexing (adjusting NLS72 to reflect the distribution observed in NELS:88) produces less powerful effects for test scores, reflecting the observation that test scores are more closely linked with completion likelihood in the later cohort.

[24] While parental education tended to increase over the period of observation, it is well-known that the overall likelihood of growing up in a two-parent family declined over this period of observation. For example, Census Bureau tabulations show the proportion of all children living with two parents falling from 83% to 73% between 1972 and 1992. While we are able to observe family structure in the NELS:88 survey (and the relationship with collegiate outcomes), this variable is not observed for NLS72. Yet, because changes in family structure measured in the CPS among those enrolling in college are quite modest, we conclude that changes in this variable cannot be a primary determinant of changes in either time to degree or completion rates.

univariate reweighting results) or how we performed the standardization, changes in the characteristics of students graduating from college could not explain more than a trivial amount of the increased time to degree. It is true that the distribution of the characteristics of those enrolling in college shifted towards groups that, along some dimensions, would have been expected to take longer to get through college, but the distribution of those finishing changed much less. To illustrate, while the share of all college attendees in the bottom math and reading quartiles increased somewhat (from 0.14 to 0.18 in reading and from 0.112 to 0.162 in math), the share of low-achieving students among those receiving BA degrees actually decreased (from 0.088 to 0.081 in reading and from 0.059 to 0.037 in math) between the NLS72 and NELS:88 cohorts (see Table 4).

In Panels B and C of Table 5, we perform the reweighting analysis separately for those whose initial institution is a public non-top 15 university and those whose initial institution is a two-year college, respectively. For the time to degree analysis, results are similar to those reported in Panel A. Changes in the characteristics of BA recipients explain none of the increase in time to degree across cohorts. While reweighting by individual characteristics explains none of the drop in completion rates for the public non-top 15 sample, it explains about 47% of the decrease in the completion rate for the two-year sample. These changes are reflected in the shifts in characteristics for individuals in these samples that are reported in Appendix D, Tables D-1 and D-2. There is substantial erosion in the characteristics of entering students at community colleges, with the share of entering students in the top math quartile falling from 0.26 to 0.14. At public institutions outside the top 15, the share of students from the top math quartile fell moderately, from 0.45 to 0.38, while this share rose slightly, from 0.74 to 0.76, among students attending top 15 public universities.

4.2. The Role of Institutional Type and Resources at Public Universities

4.2.1. Initial Institution Type Re-weighting Results

Whether college students at different points in time face the same options and levels of public support in the higher education market is a matter of considerable uncertainty. As discussed in Section 3, the supply-side of the market in higher education may contribute to the observed increased time to degree for students at public universities if there have been declines in resources per student that retard degree completion.

Suppose the class entering college from the high school class of 1992 was distributed among colleges in the same way as the class of 1972. How would this reweighting predict completion and time to degree? Results from reweighting by initial school type, both with and without additional controls for variation in individual characteristics, are shown in Table 6. With a predicted completion rate of 48.0% and 49.2% under the prior distribution of institutional type when individual covariates are included and excluded, respectively, the shift in type of institution – largely the shift toward entry at two-year schools – explains between 49.2% and 68.9% of the observed decline in completion rates. Because shifts in the type of institution that first time college students select reflect both individual characteristics and supply-side adjustments in the higher education market, these estimates likely over-estimate the causal effect of the shift on completion rates. However, as long as there is an effect on the probability of completing college of starting at a two-year school, these estimates suggest the shift towards two-year schools has contributed to declining completion rates.[25]

Yet, these shifts explain none of the change in the timing of college completion. In effect, type of initial collegiate institution captures considerable self-selection and, with low

[25] While it is possible that some students enter community colleges for sub-baccalaureate vocational training, the majority (64.12%) of community college entrants in the NELS:88 cohort intended to complete at least a BA degree.

completion rates among students starting at community colleges, there is little effect of increased enrollment in community colleges on the time to completion margin.

4.2.2. Institutional Crowding Estimates

The increase in time to degree among students attending public universities leads to the question of whether declines in resources within this sector over the period of observation might adversely affect the progression of students. We follow Bound and Turner (2007) and use the percentage change in the number of 18 year olds in each state between 1972 and 1992 as a determinant of exogenous changes in resources per student. Our analysis is thus at the state level, as this is the governmental level of control for public universities and, in turn, the division used in determining access for in-state tuition and fees. To investigate the role of school-level resources, we focus on each of seven different variables that measure time to degree and college completion: the eight-year college completion rate for all high school graduates; the eight-year college completion rate for all college attendees; the eight-year college completion rate for all college attendees who begin their postsecondary education at a public non-top 15 institution; the four-year completion rate for those who graduate within eight years; the four-year completion rate for those who graduate within eight years and whose initial institution is a public non-top 15 university; average time to degree, in years, truncated at eight years; and average time to degree for the public non-top 15 sample.[26]

A potential confounding factor in analyzing the relationship between the change in the time to degree measures and the 18-year old population is the role of changing demographic characteristics within each state. For example, if states that witness an increase in their 18 year old population also experience an increase in the number of students with low achievement or

[26] We lack sufficient observations of those who start at two-year institutions and eventually receive degrees within each state to separately identify crowding estimates for this group.

from groups with traditionally lower collegiate attainment, and if more high school students are pulled from this group, we should observe a time to degree increase regardless of the effect on resources per student.

Using a two-stage estimator, we first regress the dependent variable of interest on observable demographic characteristics (the same ones used in the multivariate reweighting analysis), a state specific indicator variable, a cohort specific dummy (NELS:88 =1), and state-cohort interaction terms at the individual level. In the cases where the dependent variable is binary, we use a logit to estimate the parameters of this regression, otherwise we use OLS.[27] Our goal is to compare the observed NLS72 outcome and the counterfactual outcome for NELS:88 if observable characteristics of students had remained unchanged over time. To obtain this counterfactual, we generate state and cohort level fitted values from each regression, and then, for the NLS72 observations, add in the cohort and relevant state x cohort fixed effect for each observation. When the regression is a logit, these variables are added into the logistic function. We then take state-level means of the observed outcomes and the counterfactual outcomes.

Taking the changes in these state-level estimates as our dependent variables, we run second stage regressions of the effect of the change in log population 18 in each state. Results are reported in Table 7. In the first column, the dependent variables are the change in actual state-level outcomes that are not regression-adjusted, NELS:88-NLS72. In the second column, the dependent variables are the difference between the NELS:88 counterfactual and the actual

[27] With the objective of estimating how state level variation in resources generated by changes in cohort size affects time to degree, we follow a two-step estimation process, first regressing individual educational outcomes on covariates and state effects: $\ln TTD_{ijt} = \alpha + \phi X_{ijt} + \gamma_j S_j + \lambda_j S_j D92 + \varepsilon_{ijt}$ and then recovering the year-state interactions to estimate the second stage: $\ln(TTD_{j72} - TTD^{92}_{j72}) = \alpha + \beta d \ln P_{jt} + \eta_{jt}$, where $TTD^{92}_{j72} = \alpha + \phi X_{ij72} + \gamma_j S_j + \lambda_j S_j$ is the predicted time to degree at the state level using the 1972 individual characteristics in addition to the 1992 state-specific effect. We lack sufficient observations within states to employ the non-parametric reweighting strategy within states.

NLS72 value of the outcome variable. This difference represents the average change within each state in the outcome variable that is not attributable to changes in observable background characteristics. Graphically, the same story is present in Figure 3, which shows the change in cohort size on the X axis and the change in time to degree on the Y axis.

Taken as a whole, the results are consistent with the hypothesis that time to degree has expanded the most in states where cohort size has increased, in turn reducing resources per student. For example, we find a 1 percent increase in a state's 18-year old population increases time to degree by 0.112 percent for the non-regression adjusted measure and by 0.094 for the regression adjusted measure.[28] These effects increase to 0.129 percent and 0.132 percent, respectively, when we restrict the sample to the public, non-top 15 sample. At the margin of college completion, there is also evidence that increases in the size of the college-age cohort lowers completion rates, particularly within four years.[29]

Our regression results support the hypothesis that shifts in the number of students attempting to enroll in public institutions within a state may reduce resources per student and, in turn, affect the pace at which students are able to complete their studies. The discussion of changes in resources over time requires particular attention to differences in changes across institutions. Taken as a whole, resources either increased or held constant on a number of widely reported scales. To illustrate, constant dollar current expenditures per student at public colleges and universities have risen from $14,610 in 1970-71, to $17,606 in 1990-91, to $22,559 in 2000-

[28] The results are substantively similar when the dependent variable is specified in levels rather than in logarithmic form, with estimated regression adjusted effects of 0.530 (0.200) for the full sample and 0.727 (0.265) for students at public institutions outside the top 15.

[29] Evidence of a link between eight-year completion rates and cohort size is appreciably weaker when we adjust for within-state changes in cohort characteristics. Changes in the representation of Hispanic students and parental education within states, variables also linked to student completion, are correlated with changes in cohort size. As a point of further consistency implicit in these results, we have estimated these models with the dependent variable expressed as a log differences; the elasticity of cohort size on eight-year completion with adjustment for demographic changes is 0.39 and close to the preferred estimate of 0.4 in Bound and Turner (2007).

01 (Snyder, Tan, and Hoffman, 2006, Table 339). Such measures miss two fundamental changes occurring over this period: first, the stratification in resources across institutions increased over this period, with dramatic increases in resources at private and selective public institutions combined with stagnation and decline in resources at other institutions; and secondly, changes in spending per student combine changes in the price of educational inputs with changes in quantities. While the employment of a price index specific to the overall mix of inputs employed by colleges and universities (e.g., HEPI) reduces the constant dollar growth in expenditures, it is likely faculty salaries and the cost of laboratory equipment at research universities have outpaced this general index.

When we use institutional level data from the HEGIS-IPEDS institutional surveys, we find real state appropriations per student declined by about 10% between 1976 and 1996 at public four-year institutions outside the most highly ranked institutions. Focusing on faculty inputs in Table 8, we present undergraduate student-faculty ratios at the BA-granting institution by initial school type weighted by student enrollment and find a pattern consistent with the hypothesis that resources outside the most selective public institutions were more thinly spread in the later period. While student-faculty ratios at the graduating institution actually fell somewhat for those starting at a top 15 public institution (declining by about 9%), student faculty ratios rose at other public institutions with a rise in the mean of about 15%, from 19.2 to 22.0 students per faculty member. Even larger relative increases occurred at below median institutions. Similarly, BA recipients beginning at a two-year school transferred into four-year schools that experienced a 31% increase in student-faculty ratios, from 18.8 to 24.5. Consistent with our results, smaller increases in student-faculty ratios occurred in the private sector of higher education.

These changes in student-faculty ratios reflect the differential increase in enrollment over time across institutions. For example, while undergraduate enrollment increased by 11% between 1972 and 1992 at public top 15 universities, enrollment increased by 29% in non-top 15 public institutions and by 116% in community colleges over this time period.[30] This differential increase in enrollment is consistent with the dilution of resources per student and the consequent increases in time to degree in the non-top 15 public and two-year colleges and universities found in the data.

Combined with the shift towards initial enrollment at two-year institutions, these results imply higher education has become increasingly stratified over time, with an increasingly smaller portion of the student body receiving an increasingly larger fraction of the resources. This stratification of resources in higher education is consistent with the sectors in which time to degree increases and completion rate decreases are localized.

We also considered the extent to which press accounts identify queuing and excess demand. These qualitative accounts provide unambiguous evidence that enrollment limitation occurs in higher education, even in those institutions such as community colleges purported to be "open access" (See Appendix A). In short, supply in higher education is not perfectly elastic. Within states, where the local market is likely to define collegiate options for the marginal college student, supply constraints appear to turn some students away from even community colleges, presumably limiting degree completion and slowing time to degree for those who do complete.

4.3. Increased Time Spent Working and Potential Credit Constraints

[30] Authors' calculations from the 1972-1992 HEGIS/IPEDS surveys.

There is no question that the number of hours worked by college students has increased in recent decades; what is at question is why this change has occurred and whether increased hours come at the expense of reductions in the rate of collegiate attainment. Between 1972 and 1992, average weekly hours worked (unconditional) among those enrolled in college increased by about 2.9 hours, from 9.5 to 12.4, as measured for 18-21 year old college students in the October CPS, with a further increase to 13.2 hours per week evident in 2005. Consistent with observations from the CPS, the comparison of the NLS72 and NELS:88 cohorts also show hours worked rose sharply for students in their first year of college.[31] For the full sample, average unconditional weekly hours worked increased from 7.1 to 14.9 and increased from 22.4 to 28.6 on the intensive margin. This increase in working behavior occurred differently across initial school types. For the public non-top 15 sample, average hours increased from 6.0 to 12.8 and from 11.0 to 21.0 hours for students in the sample entering two-year colleges. In the public top 15 and private sectors, the increases were more modest, from 4.9 to 9.3 and from 2.4 to 5.1 hours, respectively.

Figure 4 shows the distribution of work hours for those enrolled in college in the first year post high school cohort graduation by initial school type. As shown in the figure, there is a marked increase in the share of students enrolled in college who are also working (hours greater than zero) across all school types, though the increases are greatest among the two-year and non-top 15 public samples. Figure 5 contains similar employment information by school type from the CPS, which contains much better measures of hours worked than in the NCES surveys. Panel A of Figure 5 shows the steady rise in employment rates among 18-19 year old college students, particularly in the two-year and four-year public sectors. Panel B further explores these trends by

[31] The NELS:88 survey does not allow one to track work histories fully between the 1994 and 2000 follow-ups. Thus, we restrict the analysis of working hours in both surveys to those enrolled in college in the first year following high school cohort graduation.

presenting the share of enrolled students working more than 20 hours per week. The figure reinforces the distinct separation in employment behavior between students at two-year and four-year institutions, with the former group systematically more likely to be employed and working more than 20 hours per week. Focusing on differences among students at four-year institutions, students at public and private four-year institutions demonstrate similar employment behavior in the early 1970s yet, beginning in the 1980s, students at the public institutions are more likely to be both employed and work more than 20 hours per week relative to those at private institutions.

Estimating the effect of working while in school on the rate of collegiate attainment is difficult because the decision to work and the choice of hours of employment are endogenous. Indeed, to our knowledge, there is only one study that as credibly estimated the effect of time worked on any form of academic achievement in college. Stinebrickner and Stinebrickner (2003) use data from Berea College in Kentucky, where all students are expected to work and all admitted students have financial need. Random assignment of first year students to various jobs when they arrive at the college provides an instrument for hours worked, and their IV estimates imply a strong negative effect of hours worked on academic performance measured by GPA, suggesting the plausibility of a negative effect of hours employed on credit attainment.

To bound the potential effects of hours worked on time to degree, consider a student with a time budget of 60 hours per week available for course work and employment. With this fixed budget, increased hours worked necessarily reduce the time available for study. We measure the extent to which “effective time to degree,” measured as the amount of non-working time, in years, it takes each individual to obtain a baccalaureate degree out of high school, has changed over time. For example, if a student works twenty hours a week, he then will have only 2/3 of his time for study. If we observe it takes this student five years to graduate, then we calculate the effective time to degree as: 2/3 x 5 = 3 1/3. We make this calculation for each student in our sample and compare outcomes for the 1972 and 1992 high school cohorts. Assuming working hours fully crowd out time spent on academic pursuits, we estimate a decrease in "effective" time to degree from 4.25 to 4.15 years for the students starting at public non-top 15 colleges and from 4.34 to 4.05 years for students starting at two-year schools across the two cohorts. Our estimates imply the changes in working behavior between students in the NLS72 and NELS:88 cohorts are sufficiently large to explain fully the average time to degree increase observed in the data for these initial school types, assuming work hours fully crowd out time used for academic purposes.

Understanding why working while enrolled in college increased is central to interpreting the proximate effect of the increase in hours employed on time to degree. There are several compelling reasons for employment during college including credit constraints, which necessitate student income in order to pay tuition and living expenses, and economic gains afforded by work experience during the collegiate years. To contribute to the explanation of increased time to degree, such determinants must have increased over our period of observation and, to this end, the proposition that students face increased difficulty financing college has much more empirical support as an explanation for increased hours of work observed among college students than a case based on increased future labor market returns to employment during the college years.

During the 1980s and 1990s, the family incomes of those attending college increased less rapidly than the rise in college costs. Increases in tuition have been sizeable at all types of institutions, with real tuition costs rising by about 247% between academic year1976-77 and 2006-07 at four-year private institutions and by about 266% at four-year public institutions. Net costs faced by aid-eligible families likely increased at a greater rate as the real value of the Pell grant fell from $4952 in 1976 to $4050 in 2006 and family incomes – particularly below the median – increased much less rapidly than the rise in tuition. With tuition only a fraction of the total cost of full-time attendance (including room and board), it would seem plausible that an increasing fraction of students may be credit constrained.[32]

As discussed in Section 3.3, if families face significant liquidity constraints, we would expect real tuition increases to lead to a reduction in college enrollment among students from relatively low income families and an increase in the fraction of college costs paid by students relative to parents, with increased student employment resulting from limited credit markets. Indeed, as one would predict if a significant number of the families of college-going students were liquidity constrained, Belley and Lochner (2007) show evidence that, conditional on academic preparedness, the association between family income and school enrollment and attainment has increased along with student employment among high-achieving, low- and moderate-income youth, using data from the 1979 and 1997 cohorts of the National Longitudinal Survey of Youth (NLSY).

An alternative reason for students working while in school is that there is a potential post-graduation return to this employment experience (Light, 2001). Surely, there may be some returns to working while in college. For example, working for a professor may teach valuable skills or generate a strong and credible reference letter. However, the majority of jobs held by college students are in the trade and service sectors of the economy, such as working as a waiter

[32] Researchers have found evidence suggesting that credit constraints are relevant for a subset of the student population and that the resources available to students have important effects on behavior. For example, Kane (1996) finds high tuition at public colleges tends to induce students to postpone college, while Christian (2007) finds evidence that college enrollment tends to be pro-cyclical for students from low income families. The question of the size of the population constrained by access to credit in college enrollment and choice of college has been debated extensively in the literature (Carneiro and Heckman, 2002).

or waitress (Scott-Clayton, 2007). While such jobs may enhance soft skills, there are likely decreasing returns to work experience in these sectors. Moreover, hourly earnings of college students are substantially below the hourly earnings of recent college graduates, with this gap widening over the relevant time period.[33] Our conclusion is that, while theoretically possible, the empirical evidence does not favor explanations that connect increased collegiate employment to increased economic benefits of in-school employment.[34]

An alternative explanation for the increase in student employment and hours is that the mechanism of institutional crowding discussed in the prior section leaves students with more time for employment if they are limited in their access to courses for full-time continuous enrollment generated by institutional crowding.[35] In this context, we explore whether substantial growth in the college-age population corresponds with increased employment and hours among those enrolled. Results are reported in Table 9 and show within state changes in cohort size are strongly related to hours and employment. Further, the effects are most pronounced for students at public four-year colleges and universities. These estimates are consistent with the interpretation that the crowding mechanism is partly responsible for inducing students to work more while in school. Qualitative evidence makes the proximate connection among supply constraints, working, and degree completion. Responding to the overcrowding

[33] We use a combination of the May (1973-1978) and Outgoing Rotation Group Data (1979-2004) to compare hourly earnings of those ages 20-21 enrolled in college to those with BA degree in the 25-29 age range. We find that the hourly earnings premium -- which combines the returns to the degree, experience and full-time employment -- for the college graduates has risen to about 250% for men and about 230% for women, with the earnings of enrolled students falling in real terms by about 20% between the mid 1970s and mid 1990s, while earnings of recent college graduates remained stable.

[34] Scott-Clayton (2007) includes an extensive discussion of these issues and comes to conclusions similar to our own.

[35] It is also the case that more favorable macroeconomic conditions may improve employment opportunities for students, while cyclical downturns do reduce employment of college students. Still, the differences in macro economic conditions faced by the NLS72 and NELS:88 cohorts are sufficiently small to explain less than 15% of the observed increase in employment. Using the CPS and regressing hours employed among those enrolled in college on the state level unemployment rate from 1977 to 2006 yields a coefficient of -0.417 (0.049) with state fixed effects and -0.284 (0.043) with state fixed effects and a linear time trend.

and constraints at local community colleges in Riverside California, one high school counselor noted, "They [students] get jobs, they get apartments and then have bills to pay. It is easy for them to get off track, and hard to get back on" (Peoples, 1995).

Difficulties faced by individuals in financing college combined with institutional resource constraints are plausibly significant factors in the increased employment of students while in college and, in turn, we suspect both operate through increased employment to increase time to degree and reduce completion rates.

Section 5. Discussion

There is no ambiguity in the data with respect to the growth over the last three decades in the time elapsed for college graduates between high school completion and the receipt of the BA degree. While we focus our analysis on the inter-cohort comparison afforded by NLS72 (the high school class of 1972) and NELS:88 (the high school class of 1992), this finding is reiterated in other data sets including the CPS and the National Survey of College Graduates. By looking at the type of college at which individuals begin their postsecondary careers, it is clear the rise in time to degree is largely concentrated among students beginning at non-top 15 public universities and two-year colleges.

We find no evidence that changes in the characteristics of college entrants explain the drop in completion rates or outward shift in the time to degree distribution for the full sample or among students starting at four-year institutions. We do, however, find changes in background characteristics of students explain about half of the completion rate decline among those whose initial institution is a two-year school.

Our analysis emphasizes the increased stratification in resources among public colleges and universities in response to demand shocks, such as within-state changes in the college-age population, producing declines in resources per students and increased time to degree outside the very top tier where rationing occurs through selective admissions. Moreover, the shift toward initial enrollment at two-year institutions rather than four-year institutions accounts for some of the decline in completion rates. Thus, while "access" or initial college enrollment has increased dramatically over the past three decades, many of the new students drawn to higher education (likely to take advantage of the increased returns to a BA) are attending institutions with fewer resources and are not graduating. The mechanisms by which this is occurring, however, deserve more attention in future research.

Lastly, students in the more recent cohorts are working a significant number of hours while they are in school. For many students, family economic circumstances have eroded while college costs have increased, contributing to the need to increase employment to cover a greater share of college costs through wage earnings. While the magnitude of the effect of increased employment on degree progress is hard to ascertain with precision, the direction of the effect is unambiguous.

That increases in time to degree are not tied directly to declines in the pre-collegiate preparation of students suggests the underlying rate at which students complete college studies may be impeded by limited availability of courses and institutional resources more generally at public colleges as well as increased difficulties faced by individuals in financing full-time collegiate study. That increases in time to degree are concentrated among students attending public colleges and universities outside the most selective few suggests a need for more attention to how these institutions adjust to budget constraints and student demand and to how students at these colleges finance higher education.

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Appendix A: Press Accounts of Queuing and Enrollment Constraints

In addition to the quantitative work presented in the text linking expansions in cohort size to reductions in resources per student and, in turn, the outcomes of time to degree and college completion, we have explored press accounts over the past two decades to identify descriptions of cases in which it appears that resource constraints limit enrollment at public colleges and universities. Below, we present excerpts from a number of articles from *The Chronicle of Higher Education* and regional newspapers illustrating these conditions in three high-growth states: California, North Carolina and Utah. In addition to the cases noted below, we have employed a systematic Lexis-Nexis search for articles in the United States including "overcrowding" or "enrollment limit" in conjunction with "higher education", "college" or "university", which returned 375 citations.

A-1. California

> Under a law passed more than 30 years ago, qualified students in California are promised admission to the University of California, to California State University, or to a community college.
>
> The law remains in effect. But already this academic year, eight institutions in the state-university system have announced they will not accept any new applicants in the spring semester, and the president of the University of California has said that system may soon start rejecting qualified applicants.
>
> Community colleges have yet to turn students away, but a legislative staff member says the absence of formal enrollment caps is "just a facade."
>
> Students are being admitted, "but when they go to register for classes there just aren't any," says Ann Blackwood, who works for the Assembly Committee on Higher Education.
>
> Officials in all three of the California systems say the budget cuts brought on by the state's financial crisis are to blame. The heads of the three systems have publicly asked Gov. Pete Wilson to meet with them to discuss a solution.
>
> David Mertes, chancellor of the community colleges, has also asked each college for proposals that might become part of a new systemwide policy in January. Options under consideration include: limiting enrollment of out-of-state students, allowing students to take only a certain number of classes, and offering fewer basic-skills classes (Blumenstyk, 1991).

> In California, the state's master plan for higher-education prohibits community colleges from capping enrollment, but that hasn't stopped the Legislature from limiting the number of students they will reimburse the colleges for when dollars in the budget are tight. As a result, last year, there were more than 40,000 students at the state's 108 community colleges for which the institutions received no state money. Officials in the state system's office estimate that the colleges lost out on some $120.8-million in state funds.
>
> Some 17,000 of those students were in the Los Angeles Community College District, the state's largest district. Consequently, it lost out on more than

$46.6-million in state funds that the colleges had to make up on their own. And although California's public colleges enjoyed several years of robust state budgets in the late 1990s, officials say the few good years did not make up for the lean spending plans that lawmakers adopted when times were tough (Evelyn, 2002b).

Thousands of Riverside County high school graduates are being turned away every year from overcrowded community college classes, as a giant hole is ripped in the higher education 'safety net' for those with neither the money nor the grades for four-year schools.

Educators say many of the students who do not get in will never come back.

“They get jobs, they get apartments and then have bills to pay," said Billie Rogers, a veteran counselor at Corona High School. “It is easy for them to get off track, and hard to get back on.”

Community colleges statewide are limiting classes as a result of budget cuts and an enrollment cap that was imposed in 1981. But nowhere is the problem more acute than in Riverside County, where thousands of students are turned away from classes each year.

“A community college is supposed to accommodate the community,” said Salvatore Rotella, president of Riverside Community College. “But in this county, demand far outstrips the supply of seats at the college.”

All students over the age of 18 - and many who are still in high school with a counselor's permission - are “accepted” but may find it tough to get classes, he said.

That is especially true for general education courses - English, math and science - needed to transfer to a four-year college or university.

Twenty-year-old Andrew Shouse will start his third year at RCC in the fall. He has been trying since the fall of 1993 to complete enough general education requirements to transfer to UCR as a junior. His first semester, Shouse managed to get into one English class, but had to take a computer class and an art course. “Sometimes you have to take cheesey classes just to get credits,” he said….

Most classes have about 40 seats, and there are always about 20 people trying to talk instructors into letting them squeeze in, Shouse said.

“Usually you get to the teachers before the regular start of classes, or during the previous semester before classes are over,” he said. “If you keep pestering them, they might remember you and let you in.”

Rotella estimated RCC may be turning away as many as 10,000 students a year. Students may enroll by telephone or in person, but an unknown number never make it into classes.

As of June 21, RCC had about 20,000 applications on file for September classes. Rotella figured about half those students would get in (Peoples, 1995).

California's community colleges are bracing for a 25 percent enrollment increase in the next decade that will explode demand for teachers, classroom space, child care, financial aid and remedial education.

That explosion will rock a system already strained by waiting lists, crowding and tight budgets.

“We're pretty full,” said Bill Stewart, chancellor of the State Center Community College District, which includes Kings River Community College in Reedley as well as Fresno City College. “It's going to take a lot of creativity on our part” (Coleman, 1996).

It will take three years, but students at State Center Community College District's Clovis Center are relieved a new campus is going to be built.

They endure crowded classes, and many students who live in Clovis and northeast Fresno commute to Fresno City College for courses Clovis Center has no space to provide.

“The campus is too small for the amount of people who come here,” student Elie Lipson, 20, said while taking a moment away from a computer terminal before the start of a class (Benjamin, 2002).

CSU is becoming much harder to get into. The number of impacted campuses, those that receive more applications from qualified students than they can accept, has jumped from five to eight this year: Cal Poly Pomona, Cal State Fullerton, Cal State San Marcos, San Diego State, Cal State Long Beach, Cal Poly San Luis Obispo, Sonoma State and Chico State.

Already, 15 of the 23 campuses have closed their application period for the spring term for first-time freshmen, which is unusual.…

Now is the heart of college application season, with students taking SATs and writing essays. UC has an application deadline of Nov. 30. With CSU, it used to be that prospective students could sometimes wait until summer to apply to certain campuses. Those days are over.

“Many of our campuses will stop accepting applications earlier than ever before,” said CSU Assistant Vice Chancellor Allison Jones. “We just don't have the same degree of open access CSU has historically had” (Sturrock, 2003).

The state's community colleges are preparing for a crush of students who were turned away from the state's public universities because of state budget cuts.

More than 10,000 students who had the grades and SAT scores to enroll in the University of California or California State University systems are being told to apply instead to community colleges, then transfer to the campus of their choice in two years. That's further crowding a community college system that last year turned away tens of thousands of students due to overcrowding.

Enrollment opens Monday at some of the state's community colleges, and officials are worried about whether they'll be able to handle so many more applicants when they can't afford to add classes. They urged students to sign up quickly.

“If they wait, then there's nothing we can do for them. The classes will be gone,” said Darroch “Rocky” Young, acting senior vice chancellor for the nine-member Los Angeles Community College District. Last year lack of money forced the district to turn away 5,000 students and cut 1,000 classes (The Associated Press State & Local Wire, 2004).

A-2. North Carolina

In Florida and North Carolina, community colleges also have limited enrollment -- or are preparing to do so -- despite the “open admissions” principle under which they have long operated.….

Forsyth Technical Community College, in North Carolina, already has had to turn away about 100 students seeking remedial classes because the school had no money to hire the instructor. “That to me is pretty drastic in an urban community like ours,” says the president, Bob H. Greene.

Institutions with admissions requirements have other means to limit enrollment, and many are using them (Blumenstyk, 1991).

This year Cape Fear had to add more than 80 course sections more than the college had originally planned for, and Cape Fear still had to turn away students. For community colleges, selling out on courses sometimes means feeling like they are selling out on their open-admissions values. Campus administrators say it wasn't easy telling students they couldn't accommodate them. But with the state budget shortfall taking a 3-percent chunk out of the college's $25-million operating budget, officials here say they were hard pressed to come up with the resources to handle any more.

“It was just amazing to see the lines at registration come outside the buildings and wrap around campus blocks,” Mr. McKeithan says. “Many of those students waited in line for seven or eight hours only to find out that most of the classes they wanted were sold out. It really hurt to watch that happen” (Evelyn, 2002a).

When Tony Zeiss, the president of Central Piedmont Community College, heard about North Carolina's grim budget forecast for next year, he got on the phone. Not to legislators or his state's community-college system office. Instead, he called the Pepsi-Cola Bottling Company of Charlotte and other local businesses to ask them if they would be willing to donate $1,650 each to sponsor a course at the college.

Mr. Zeiss says his hands were tied. Because of a 5.5-percent reduction in his institution's budget last year, he had already canceled 110 courses -- out of some 2,400 courses that the college offered -- although enrollment had jumped 10 percent. He now faced cutting another 220 courses, even though projections for this fall's enrollment were already showing another 10-percent rise, as some politicians called for additional budget cuts of up to 15 percent. As a result, Mr. Zeiss is growing increasingly concerned about the extent to which he will have to do something that flies in the face of the historical mission of community colleges: Turn students away (Evelyn, 2002b).

A-3. Utah

Lynn Cundiff, the president of Salt Lake Community College, says that with state lawmakers weighing a 4-percent cut to the institution's budget, he is considering imposing admissions standards.

"If it gets much worse, something will have to give," Mr. Cundiff says.

He doesn't want a repeat of last year, when he estimates the college turned away 500 students after state officials reduced the institution's appropriation by some 4 percent.

Mr. Cundiff says that as it is, the college will likely turn away another 500 or so students this fall. If state revenues take another dive, he says, that number may increase. To stem growth, he is looking at his options: an official enrollment cap or even instituting admissions standards, two things almost unheard of in the community-college world (Evelyn, 2002b).

An unexpected "wave" of students enrolling at Salt Lake Community College is stretching the school's resources during its first week of school.

Enrollment, which was expected to hold steady this semester, is up about 700 FTE, the equivalent of full-time students, or by 1,400 actual students over the first day of classes last year.

"As of (Tuesday) night, 6,125 people were on wait lists trying to get into classes they need" -- a record number -- said Judd Morgan, vice president for student services.

"It's a zoo today," college spokesman Jay Williams added. As many as 800 students are trying to get into basic English classes (Titze, 2000).

Even universities experiencing manageable growth, such as the University of Utah, are concerned about future projections.

The U. is considering upping admissions standards to slow the flow of students.

Brigham Young University anticipates it will hit its enrollment cap of 30,000, and has no plans of opening up more seats.

The three schools hit the hardest also experienced dramatic growth last fall, and are projecting for it again this year.

Last year's dilemma was finding enough faculty members to open extra classes. This year, lack of space is the main constraint, said Lynn Cundiff, president of SLCC, which is reporting a 14 percent hike in the head count. Last year at this time, SLCC counted 19,759 students. This year, 22,533 have registered.

"We've got cars parked everywhere," even on the soccer field, said Cundiff. "We don't have classrooms to put [students] in."

The college is renting space from the LDS Institute on campus and even has held one class in an outdoor amphitheater -- a quick fix that works now, said Cundiff, "but not when winter rolls around" (Stewart, 2001).

Both the University of Utah and Utah State University are raising the bar for enrollments this fall. Other colleges and universities in the system have traditionally tried to take all comers, but they are warning ahead of time that budget cuts, coupled with unprecedented demand, may limit enrollment as classes fill and potential students are turned away.

With three weeks still to go in the registration process, Utah Valley State College already has 14 percent more enrollments than at the same time last fall, said registrar Luann Smith. The Orem college has been the fastest-growing among the state institutions for a number of years.

"We admit everyone, but if they come and find that the courses they want are already full, they may either look at other options or wait until the next semester," she said. Although "open enrollment" remains the objective, the availability of classes is a limiting factor, she said (Van Leer, 2002).

Salt Lake Community College expects about 3,000 additional students on its campuses for the fall 2003 semester due, in part, to the University of Utah's enrollment cap.

"We will have to do more with less," Interim President Judd Morgan told SLCC's board of trustees Wednesday. "We will see larger class sizes because we want to fill up those we already offer instead of creating new ones" (Sykes, 2003).

Appendix B: Data Appendix

B-1. Time To Degree and Degree Completion

Time to degree and degree completion are calculated using NLS72 and NELS:88 survey responses from the first through fifth follow-ups in NLS72 and the fourth follow-up in NELS:88. The NLS72 study participants were seniors in high school in the spring of 1972. Following the base year interview, participant follow-up surveys were administered in 1973, 1974, 1976, 1979, and 1986 (for a subsample), with questions covering collegiate participation and degree attainment. In addition, detailed high school records and postsecondary transcripts were collected by the Department of Education.

The NELS:88 survey started with students who were in the eighth grade in 1988 (high school class of 1992) and conducted follow-up surveys with participants in 1990, 1992, 1994, and 2000. Similar to the NLS72 survey, NELS:88 contains high school records and collegiate transcripts as well as a host of background information that may be relevant to time to degree.

Although degrees can be awarded throughout a year, we record the timing of degree receipt in discrete units of years since cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample. The cut-point in each survey that defines a new year is the end of August (and thus the start of the new academic year). For example, NLS72 respondents who received a degree in January and June of 1976 would both be classified as taking 4 years to obtain a BA. However, a student who received a degree in September 1976 would be classified as taking 5 years.

Because the NELS:88 survey is comprised of eighth graders from 1988 and the NLS72 survey follows 12th graders from the class of 1972, the NELS:88 survey contains more students who graduate high school after their cohort's high school graduation. In our base sample, 1.3% of respondents in NLS72 and 4.4% of respondents in NELS:88 finish high school after June of their respective cohort graduation year. However, looking only at eight-year BA recipients, 0.3% and 0.6%, respectively in NLS72 and NELS:88 did not finish high school on time. It is therefore unlikely the larger preponderance of late high school graduates in the NELS:88 survey biases our time to degree calculations.

Table B-1 contains variable names and definitions used to define the sample and to calculate time to degree and degree completion in both the NLS72 and NELS:88 surveys.

B-2. School Type and Collegiate Start Dates

Self-reported enrollment records from the first through fourth follow-up surveys for the NLS72 survey and from NCES-aggregated responses in the NELS:88 survey are used to define the type of institution of initial collegiate enrollment.

In the NLS72 survey, we first determine the year in which a student first enrolls in an academic post-secondary institution, where "academic" is defined as granting at least an associates degree or BA. In each follow-up, students were asked about schools they attended (up to three) in each year since the previous survey. The first school attended is defined as the first time a student reports attending an academic institution. Note that when we focus on those students who enroll in college, we restrict the sample to those who start at an academic institution within 2 years of cohort high school graduation. Identifying the first institution attended by FICE (Federal Interagency Committee on Education) code, we merge institutional-level information that contains public/private and 2-year/4-year identifiers and identify top 15 and top 50 public 4-year institutions by respondent's initial institution's FICE code.

In the NELS:88 survey, NCES has constructed variables that aggregate the individual reported enrollment histories in order to determine the type of first institution attended. These variables are f4efsect, psefirty, and levlcont. These variables are used in ascending order: information from f4efsect is used as the primary source, then information from psefirty, and then levlcont is used. Further, there are some individuals who have a start date prior to their high school graduation date as they take classes at community or local colleges and this is reflected in the above variables. [Note this is not a problem for the NLS72 measure because it incorporates only institutions attended after high school graduation.] For students with post-secondary experience preceding high school graduation, we use the first start date and institution after high school graduation taken from the post-secondary transcript files. For all other students in the NELS:88 survey, first start date is identified by f4efmy, which is the NCES-constructed date of first post-secondary attendance. In order to identify individuals whose first institution is a top 15 or top 50 public school, we use the first school attended post-high school cohort graduation listed in the post-secondary transcript files.

B-3. Background Characteristics

B-3.1. Math and Reading Tests

In both surveys, tests of academic achievement were administered to students in the senior year. The NLS72 exam was administered as a 69-minute test book with sections on vocabulary, picture numbers (associative memory), reading, letter groups, mathematics, and mosaic comparisons. Each section was 15 minutes (except for the mosaic comparison, which was 9 minutes). The math test included 25 items and the reading test included 20 items. While the reading test focused on analysis, interpretation and comprehension of short reading passages (100-200 words), the math test contained only quantitative comparisons in order to measure basic quantitative competence. We use the reported scaled math scores (scmatsc) and scaled reading scores (scrdsc) as our test score measures in NLS72.

The NELS:88 cognitive test batteries were administered in each of the first three waves, with sections on reading, math, science and social studies. The tests were 85 minutes and consisted of 116 questions, 40 of which were on math and 21 of which were on reading comprehension. Unlike the NLS72 exams, the NELS:88 tests covered more material and tested more skills. In reading comprehension, students were tested on word meaning, figures of speech, author's perspective, and comprehension. The math exam consisted of word problems, graphs, equations, quantitative comparisons, and geometric figures. Further, because the NELS:88 tests were given in subsequent waves, students were given harder or easier tests in the first and second follow-ups depending on their scores in the previous wave to guard against floor and ceiling effects. We use the math IRT theta score (f22xmth) and the reading IRT theta score (f22xrth) from the second follow-up as the base measure of test scores. These scores are psychometric evaluation scores of each student's ability that account for the difficulty of the exam.

Because the tests in NLS72 and NELS:88 covered different subject matter, were of different lengths, and were graded on different scales, the scores are not directly comparable across surveys. Instead, we construct the quartiles of the score distributions for each test type and for each survey. The comparison of students in the same test quartile across surveys is based on the assumption overall achievement did not change over this time period. This assumption is supported by the observation that there is little change in the overall level of test scores on the nationally-representative NAEP over our period of observation. Similarly, examination of time trends in standard college entrance exams such as the SAT provides little support for the proposition that achievement declined appreciable over the interval within test quartiles. For the SAT, the ratio of test takers to high school graduates increased from 33% to 42%, while mean math scores declined from 509 to 501 and mean verbal scores decline a bit more, from 530 to 500 over the 1972 to 1992 interval (*Digest of Education Statistics*, 2005, Table 129).

In the NLS72 survey, we use high school GPA as an imputation variable in order to measure pre-collegiate academic ability for students with missing test scores. The GPA measure we use is "imptaver" from the NLS72 survey. In the multiple imputation of missing variables in the NELS:88 survey, we use IRT theta test scores from the first follow-up for math (f12xmth) and reading (f12xrth) and from the base year for math (by2xmth) and reading (by2xrth). The IRT theta scores are scaled to a common metric across years by NCES. The imputed math and reading test scores from the senior year in each survey are used to construct the test quartiles used in the main analysis.

B-3.2. Parental Education

We obtain student reported measures of father's and mother's education separately. In the NLS72 survey, we have three different measures of this variable. For mother's education, we use the variables cmoed, bq90b, and fq78b. For father's education, we use the variables cfaed, bq90a, and fq78a. If there are disagreements across measures, fq78b and fq78a take precedence.

In the NELS:88 survey, we also use student reports of father's education (bys34a) and mother's education (bys34b). For the multiple imputation model, we include parent self-reports of their own education from the base year and second follow-up parental surveys. In the base year parent survey, we combine information on whether the respondent and his/her spouse is the father or mother (byp1a1 and byp1a2) with reported self (byp30) and spouse (byp31) educational attainment. A similar methodology is used for the second-follow up parent survey, using f2p1a and f2p1b to identify the gender of the respondent and the spouse, respectively, and f2p101a and f2p101b to identify educational attainment of the respondent and the spouse, respectively. The base year and second follow-up parental education information is aggregated into two variables, father's education and mother's education, used in the multiple imputation model.

B-3.3. Parental Income Levels

The parental income variables are bq93 for NLS72 and f2p74 for NELS:88. The former is reported by the student while the latter is reported by the parents. Unfortunately, NLS72 does not contain a parent-reported measure and the NELS:88 survey does not contain a student-reported measure, so these variables are the most closely aligned parental income measures across the two surveys.

Rather than asking directly for parental income levels, the NELS:88 and NLS72 surveys ask for income ranges from respondents. Because we are interested in measuring parents' ability to finance college, the variable of interest is the real income level, not one's place in the income distribution. We thus align the income blocks across the two surveys using the CPI. In NLS72, the measured income groups we construct are less than $3000, $3000-$6000, $6000-$7500, $7500-$10500, $10500-$15000, and greater than $15000. In NELS:88, the corresponding real income blocks we create are less than $10000, $10000-$20000, $20000-$25000, $25000-$35000, $35000-$50000, and greater than $50000. Across surveys, the six income groups are comparable in real terms.

B-3.4. Race

Race is measured in the NLS72 survey using "crace" and "race86." The latter is used if the former is blank due to non-response. In the NELS:88 survey, race is measured using the "race" variable available in the data files.

B-4. Multiple Imputation

There is a considerable amount of missing data in the NLS72 and NELS:88 surveys. Table B-2 presents the number of unweighted missing observations by variable and survey. These observations are not missing completely at random; respondents who have no math or reading test scores are less likely to finish college and less likely to finish in four years conditional on starting.

Casewise deletion of missing observations will therefore cause a bias in the calculation of the base trends we are seeking to explain in this analysis. To deal with this problem, we use the multiple imputation by chained equation (MICE) algorithm developed by Van Buuren, Boshuizen, and Knook (1999) that is implemented through the STATA module "ICE" (see Royston (2004) for a detailed discussion of ICE).

MICE is implemented by first defining the set of predictor variables ($x_1 \ldots x_k$) and the set of variables with missing values to be imputed: math test scores, reading test scores, father's education, mother's education, and parental income levels ($y_1 \ldots y_5$). The MICE algorithm implemented by ICE first randomly fills in all missing values from the posterior distribution of each variable. Then, for each variable with missing data, y_i, STATA runs a regression (or ordered logit) of y_i on $y_{\sim i}$ and $x_1 \ldots x_k$ and updates the randomly imputed missing values. A sequence of regressions for each y_i is a cycle, and this process is repeated for 10 cycles. In each cycle, the imputed values from the previous cycle are used in the regressions and updated. The imputed values after 10 cycles constitute 1 imputed data set, and this process is repeated 5 different times to generate 5 imputed data sets.

There are two important specifications in implementing MICE: determination of the predictor variables and determination of the imputation models. Because of the different structure of the two surveys, different variables are used in the imputation procedure across surveys. In both surveys, we include dummy variables for cumulative time to degree from four to eight years, dummy variables for initial school type, interactions between these variables, an indicator for college attendance within two years of cohort high school graduation, as well as race and gender indicators.

For imputations with the NLS72 sample, we include a measure of high school GPA in order to proxy for unobserved ability among those without test score information. Due to the structure of the NELS:88 survey, there is more background information with which to impute missing data. We utilize 8^{th} and 10^{th} grade math and reading test scores, parental reports of their education from the base year and second follow-up parent surveys, and parental reports of their income level from the base year parent survey. The definitions of the variables used in the imputation models are discussed in the preceding section.

Because the math and reading test scores are continuous variables, we use OLS regressions to impute these variables. Mother's and father's education and income, however, are categorical variables. Because of the ordered nature of these variables, we use ordered logits to impute the missing values of these variables. While these model choices are reasonably arbitrary, they are only used to draw ranges of plausible estimates of missing data.

B-5. Eighteen Year Old Population

For the crowding regressions, we calculate the number of eighteen-year olds in each state in 1972 and 1992, which are the cohort high school graduation years in NLS72 and NELS:88 respectively. To measure the population of eighteen year olds in each state, we use data on population by state and single year of age that are available through the Bureau of the Census website. Data for 1972 are available at: http://www.census.gov/popest/archives/pre-1980/e7080sta.txt and data for 1992 are available at: http://www.census.gov/popest/archives/1990s/st_age_sex.html. The change in the log of the eighteen year old population at the state-level constitutes the independent variable of interest in the crowding regressions.

B-6. Dropped Observations and Missing Transcript Data

The base sample in this analysis consists of all respondents who graduate high school and attend college within two years of their cohort's high school graduation. We further restrict the sample to exclude those whose only enrollment over this time period is at a private two-year institution as these schools are predominantly professional without a BA track. Table B-3 presents information on the number of observations that are dropped by survey and the reason for dropping the observation. For example, 168 respondents are dropped because they are not high school graduates in NLS72 whereas 722 are dropped in NELS:88 for this reason. The apparently higher dropout rate in NELS:88 is because the universe of students are all those enrolled in the 8^{th} grade in 1988, whereas the universe in NLS72 are all those enrolled in 12^{th} grade in 1972.

In the NLS72 survey, 99 observations are dropped because they report attending college but provide no information on either the type of institution or the date they first began attending this institution. In the NELS:88 survey, 195 observations were dropped because they were not in all four waves of the survey. In other words, they have a sample weight of zero.

Of potential concern in constructing our sample is the exclusion of those beginning college more than two years post-high school cohort graduation. We exclude these observations because we are interested in the truncated, eight-year time to degree distribution and the eight-year completion rate. These statistics have a different interpretation for a student who began college directly after high school than for a student who began college, for instance, five years after high school. While 613 and 795 respondents in NLS72 and NELS:88, respectively, attend college more than 2 years after their cohort's high school graduation, the eight year completion rates for these groups are 0.73% and 0.57%, respectively.

For the analysis of credit accumulation, we employ postsecondary transcript data from the postsecondary transcript studies in both the NLS72 and NELS:88 surveys. While the goal of these studies was to obtain all student transcripts, there are missing transcripts. Among all eight-year college graduates in the analysis sample, there are no transcripts for 454 respondents in the NLS72 sample nor for 182 respondents in the NELS:88 sample. Representing 10.6% and 4.4% percent of the relevant NLS72 and NELS:88 samples, respectively, these observations were dropped from the analysis of credit attainment.

With respect to collegiate outcomes, the observations with missing transcript data look similar to the observations without transcript data in NLS72. Average time to degree among the two groups is 4.68 and 4.67, respectively, while the four-year completion rate is 61% and 56%, respectively. Further, the initial school types for respondents with and without post-secondary transcripts are similar.

In contrast, the missing NELS:88 transcripts are not missing at random with respect to the outcome variables. Observations with missing transcript data have a higher time to degree (5.18 vs. 4.88), a lower four-year completion rate (30% vs. 44%) and are more likely to begin their postsecondary career at a two-year school. While these observations constitute a relatively small portion of total college graduates in NELS:88, the nature of the missing data suggests we overstate the rate of credit accumulation in NELS:88 and thus understate the reduction in the rate of credit attainment across the two surveys in our analysis.

Appendix C: Statistical Appendix

C-1. Calculation of P-Values Without Multivariate Reweighting

In order to test whether the NLS72 and NELS:88 distributions are different at a given point in the distribution, we calculate the difference and the standard error of this difference between the NLS72 and NELS:88 distributions at each year since high school cohort graduation in Tables 2 and 3. For each year since high school cohort graduation from 4-8, we regress a dummy variable equal to 1 if the respondent's time to degree is less than or equal to that number of years on a dummy variable for whether the respondent was in the NELS:88 survey as well as a constant term. We run a similar regression for the completion rate, where the dependent variable is an indicator equal to 1 if the respondent received a BA within 8 years of cohort high school graduation. All regressions are weighted by the sample weights used throughout and standard errors are clustered at the high school level. The standard errors are then converted into p-values of the probability one can reject the null hypothesis the difference is equal to zero. These p-values are reported in Tables 2 and 3.

C-2. Calculation of P-Values With Multivariate Reweighting

When we calculate P-values in the multivariate reweighting analysis, we bootstrap the difference in the distributions in order to take into account both the sampling variability of the weights as well as the fact the data from which the weights are calculated are from multiply imputed datasets.

We replicate the data across individuals, not across imputations, so each observation in each replication of the data contains all 5 imputed datasets. However, similar to the calculation of standard errors in the regressions discussed in the previous section, the bootstrap replications are clustered at the high school level. Clustering at the high school level amounts to replicating the data across high schools, not across individuals, with each observation within each cluster and replication containing all 5 imputed data sets.

For each replication and for each imputed data set, we generate the weights used for reweighting by running a logit of a dummy variable equal to 1 if the individual is in the NLS72 survey on the demographic characteristics described in the text and in Appendix B. The weights are the ratio of the predicted value to one minus the predicted value from each of these logits. We next calculate the difference between the NLS72 and reweighted NELS:88 distributions at each point in the distribution from four to eight (or similarly the difference in the 8-year completion rate) and take the average of these differences across imputations. Similarly, we calculate the difference between the NELS:88 reweighted distribution and the NELS:88 distribution for each year from 4 to 8 as well as for completion rates and take the average of these differences across the five imputations. We generate distributions of these various differences by bootstrapping this process using 5000 replications. The p-values of the test for statistical significance of the difference between the NLS72 and NELS:88 reweighted distributions are reported in Table 5 and Table 6. The p-values for statistical significance of the difference between the reweighted NELS:88 and actual NELS:88 distributions are available from the authors upon request.

C-3. Calculation of P-Values for Tests of First Order Stochastic Dominance

We limit our test of first order stochastic dominance to the range of completion in years 4, 5 and 6. The null hypothesis of the test for first order dominance is that for years 4, 5, or 6, the NLS72 and NELS:88 distributions cross (i.e., at some point in the distribution, the NLS72 distribution is less than the NELS:88 distribution). In order to test this null hypothesis, we bootstrap the cumulative time to degree distributions in the two surveys and calculate the percentage of times a "crossing" occurs. We define a "crossing" as any time the NLS72 distribution lies below the NELS:88 distribution.

The bootstrap process is similar to the one discussed above, however there is only one data set as the collegiate outcome variables were not imputed. For each replication, we calculate the proportion finishing in at least 4 years to at least 6 years for all those who complete within 8 years of cohort high school graduation separately for NLS72 and NELS:88. We then generate the distribution of these proportions by bootstrapping this process using 5000 replications. These bootstraps are clustered at the high school level. Finally, we count for how many replications there is a crossing of the time to degree distributions. The percentage of times a crossing occurs is the p-value reported in the tables and represents the probability the null hypothesis that the NLS72 distribution does not first order stochastically dominate the NELS:88 distribution is false. In other words, the p-value tells one with what certainty one can reject the null hypothesis of no first order stochastic dominance. Note this is a one-sided test as it tests whether the NLS72 distribution lies above the NELS:88 distribution, not whether one distribution lies above the other. In a case where the NELS:88 distribution first order dominates the NLS72 distribution, our test would fail to reject the null hypothesis.

Table 1. Changes Over Time Between First Institution and Graduating Institution Types For Those Obtaining a BA Within Eight Years of Cohort High School Graduation

Panel A: Full Sample

	NLS72 Cohort			**NELS:88 Cohort**		
	(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**	**(vi)**
Initial Institution Type	Enrollment Rate of High School Graduates	College Attendees	Eight Year BA	Enrollment Rate of High School Graduates	College Attendees	Eight Year BA
Four-Year Public	26.5%	51.2%	60.2%	33.8%	43.9%	54.9%
Four-Year Private	9.9%	20.0%	26.7%	13.1%	17.5%	30.3%
Two-Year	16.7%	28.8%	13.1%	33.9%	38.5%	14.8%
Total	53.1%	100%	100%	80.8%	100%	100%

Panel B: 8-Year College Graduates

	NLS72 Cohort			**NELS:88 Cohort**		
	(i)	**(ii)**	**(iii)**	**(iv)**	**(v)**	**(vi)**
		Institution of BA Receipt			**Institution of BA Receipt**	
Initial Institution Type	Completion Rate: 8 Year	Four-Year Public	Four-Year Private	Completion Rate: 8 Year	Four-Year Public	Four-Year Private
Four-Year Public	60.1%	65.0%	35.0%	56.7%	93.3%	6.7%
Four-Year Private	68.4%	12.9%	87.1%	78.2%	10.1%	89.9%
Two-Year	23.2%	64.5%	35.5%	17.4%	73.8%	26.2%
Total	51.1%			45.3%		

[1] Source: Authors' calculation from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

Table 2. Cumulative Time To Degree Distributions for College Graduates within 8 Years of Cohort High School Graduation for the Full Sample and by First Institution Attended

	Years out of High School							
Full Sample	**4**	**5**	**6**	**7**	**8**	**Completion Rate**	**Mean**	**Test For**
NLS72	56.8%	83.8%	92.4%	97.0%	100%	51.1%	4.67	**First Order**
NELS:88	43.6%	76.2%	89.6%	95.9%	100%	45.3%	4.93	**Dominance**
Difference	-13.2%	-7.6%	-2.8%	-1.1%	0.0%	-5.8%	0.26	
P-Value	0.000	0.000	0.001	0.059		0.000		0.000

Public 4-Year	**4**	**5**	**6**	**7**	**8**	**Completion Rate**	**Mean**	**Test For**
NLS72	54.6%	84.6%	92.9%	97.0%	100%	60.1%	4.68	**First Order**
NELS:88	37.1%	76.6%	90.3%	95.7%	100%	56.7%	4.99	**Dominance**
Difference	-17.5%	-8.0%	-2.6%	-1.3%	0.0%	-3.4%	0.31	
P-Value	0.000	0.000	0.020	0.117		0.122		0.015

Private 4-Year	**4**	**5**	**6**	**7**	**8**	**Completion Rate**	**Mean**	**Test For**
NLS72	71.7%	89.9%	94.9%	98.4%	100%	68.4%	4.42	**First Order**
NELS:88	66.4%	88.4%	95.4%	98.9%	100%	78.2%	4.47	**Dominance**
Difference	-5.3%	-1.5%	0.5%	0.5%	0.0%	9.8%	-0.05	
P-Value	0.040	0.388	0.688	0.368		0.000		1.000

2-Year	**4**	**5**	**6**	**7**	**8**	**Completion Rate**	**Mean**	**Test For**
NLS72	35.9%	67.7%	85.2%	93.8%	100%	23.2%	5.15	**First Order**
NELS:88	21.0%	49.8%	75.4%	90.3%	100%	17.4%	5.62	**Dominance**
Difference	-14.9%	-17.9%	-9.8%	-3.5%	0.0%	-5.8%	0.47	
P-Value	0.001	0.000	0.002	0.071		0.001		0.000

[1] Source: Authors' calculation from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] P-values in the table refer to tests for statistical significance of the differences. The p-values of the test for first-order dominance are based on 5000 bootstrap replications of the data, clustered at the high school level, and show the percentage of the replications for which the NLS72 distribution is less than the NELS:88 distribution for years 4, 5 or 6.

Table 3. Cumulative BA Distributions, Public Universities by Rank of First Institution Attended

Cohort	Years out of High School 4	5	6	7	8	Completion Rate	Mean	Test For First Order Dominance
Public 4-Year								
NLS72	54.6%	84.6%	92.9%	97.0%	100%	60.1%	4.68	
NELS:88	37.1%	76.6%	90.3%	95.7%	100%	56.7%	4.99	
Difference	-17.5%	-8.0%	-2.6%	-1.3%	0.0%	-3.4%	0.31	
P-Value	0.000	0.000	0.020	0.117		0.122		0.015

Top 15-Non-Top 15						Completion Rate	Mean	Test For First Order Dominance
Top 15 Public								
NLS72	53.8%	80.3%	90.9%	96.1%	100%	76.1%	4.77	
NELS:88	54.8%	90.1%	98.1%	98.9%	100%	90.6%	4.57	
Difference	1.0%	9.8%	7.2%	2.8%	0.0%	14.5%	-0.20	
P-Value	0.889	0.038	0.008	0.186		0.003		1.000
Non-Top 15 Public								
NLS72	54.7%	84.8%	93.0%	97.1%	100%	59.4%	4.68	
NELS:88	35.0%	75.1%	89.4%	95.3%	100%	54.3%	5.04	
Difference	-19.7%	-9.7%	-3.6%	-1.8%	0.0%	-5.1%	0.37	
P-Value	0.000	0.000	0.003	0.057		0.022		0.002

Top 50-Non-Top 50						Completion Rate	Mean	Test For First Order Dominance
Top 50 Public								
NLS72	54.3%	83.5%	92.7%	96.8%	100%	72.7%	4.70	
NELS:88	44.6%	84.3%	94.0%	96.5%	100%	83.7%	4.80	
Difference	-9.7%	0.8%	1.3%	-0.3%	0.0%	11.0%	0.10	
P-Value	0.014	0.766	0.438	0.838		0.000		1.000
Non-Top 50 Public								
NLS72	54.7%	84.9%	92.9%	97.1%	100%	57.4%	4.68	
NELS:88	34.0%	73.5%	88.8%	95.4%	100%	50.0%	5.07	
Difference	-20.7%	-11.4%	-4.1%	-1.7%	0.0%	-7.4%	0.39	
P-Value	0.000	0.000	0.003	0.102		0.002		0.000

[1] Source: Authors' calculation from the NLS72 and NELS:88 surveys. School rankings are taken from the 2005 US News and World Report top college and university rankings. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] P-values in the table refer to tests for statistical significance of the differences. The p-values of the test for first-order dominance are based on 5000 bootstrap replications of the data, clustered at the high school level, and show the percentage of the replications for which the NLS72 distribution is less than the NELS:88 distribution for years 4, 5 or 6.

Table 4. Means of Selected NLS72 and NELS:88 Variables

Variable	All College Attendees		College Graduates Who Obtain a BA With Eight Years of Cohort High School Graduation	
	NLS72	NELS:88	NLS72	NELS:88
Average Time to Degree	4.674 (1.040)	4.929 (1.114)	4.674 (1.040)	4.929 (1.114)
Lowest Reading Quartile	0.145 (0.352)	0.180 (0.384)	0.088 (0.284)	0.081 (0.272)
Second Reading Quartile	0.212 (0.409)	0.229 (0.420)	0.173 (0.378)	0.162 (0.369)
Third Reading Quartile	0.293 (0.455)	0.277 (0.447)	0.297 (0.457)	0.289 (0.453)
Highest Reading Quartile	0.350 (0.477)	0.314 (0.464)	0.441 (0.497)	0.468 (0.499)
Lowest Math Quartile	0.112 (0.316)	0.162 (0.368)	0.059 (0.235)	0.037 (0.189)
Second Math Quartile	0.216 (0.412)	0.233 (0.423)	0.149 (0.356)	0.152 (0.359)
Third Math Quartile	0.266 (0.442)	0.280 (0.449)	0.251 (0.434)	0.288 (0.453)
Highest Math Quartile	0.406 (0.491)	0.325 (0.468)	0.541 (0.498)	0.522 (0.500)
Father -- No HS Diploma	0.222 (0.415)	0.123 (0.328)	0.171 (0.377)	0.059 (0.235)
Father -- HS Diploma	0.262 (0.440)	0.307 (0.461)	0.222 (0.415)	0.207 (0.405)
Father – Some College	0.242 (0.428)	0.216 (0.412)	0.248 (0.432)	0.219 (0.413)
Father -- BA	0.162 (0.368)	0.187 (0.390)	0.200 (0.400)	0.251 (0.434)
Father -- Graduate School	0.112 (0.316)	0.168 (0.373)	0.159 (0.366)	0.264 (0.441)
Mother -- No HS Diploma	0.181 (0.385)	0.114 (0.318)	0.133 (0.339)	0.052 (0.222)
Mother -- HS Diploma	0.391 (0.488)	0.348 (0.476)	0.368 (0.482)	0.261 (0.439)
Mother – Some College	0.267 (0.443)	0.249 (0.432)	0.283 (0.450)	0.262 (0.440)
Mother -- BA	0.118 (0.322)	0.173 (0.378)	0.154 (0.361)	0.247 (0.431)
Mother -- Graduate School	0.043 (0.202)	0.117 (0.321)	0.063 (0.243)	0.178 (0.383)
Income <3000/<10000	0.040 (0.196)	0.067 (0.251)	0.024 (0.152)	0.031 (0.174)
Income 6000/20000	0.070 (0.256)	0.108 (0.310)	0.048 (0.214)	0.061 (0.239)
Income 7500/25000	0.070 (0.255)	0.077 (0.267)	0.067 (0.249)	0.062 (0.241)
Income 10500/35000	0.200 (0.400)	0.134 (0.341)	0.188 (0.391)	0.101 (0.302)

Income 15000/50000	0.270 (0.444)	0.213 (0.409)	0.267 (0.443)	0.200 (0.400)
Income 15000+/50000+	0.350 (0.477)	0.400 (0.490)	0.406 (0.491)	0.544 (0.498)
Asian	0.014 (0.116)	0.047 (0.212)	0.019 (0.135)	0.059 (0.235)
Hispanic	0.029 (0.168)	0.097 (0.296)	0.016 (0.124)	0.052 (0.223)
African American	0.093 (0.291)	0.109 (0.312)	0.073 (0.260)	0.073 (0.260)
White	0.858 (0.349)	0.738 (0.440)	0.890 (0.313)	0.812 (0.391)
Native American	0.006 (0.076)	0.008 (0.090)	0.003 (0.055)	0.003 (0.058)
Male	0.509 (0.500)	0.482 (0.500)	0.523 (0.500)	0.453 (0.498)
Number of Observations	7107	8417	4284	4179

[1] Source: Authors' tabulations from the NELS:88 and NLS72 surveys. Standard deviations are in parentheses. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] Parental income in NLS72 and NELS:88 are given in discrete ranges in both surveys. We group the income ranges into 6 income categories in each survey that correspond to the same real income across surveys using the CPI. In NLS72, the real income ranges are less than $3,000, $3000-$6000, $6001-$7500, $7501-$10500, $10501-$15000, and greater than $15000. In NELS:88, the real income ranges are less than $10,000, $10000-$20000, $20001-$25000, $25001-$35000, $35001-$50000, and greater than $50000.

Table 5. Cumulative BA Distribution, Multivariate Re-weighting NELS:88 using NLS72 Individual Background Characteristics

Panel A: Full Sample							
	Years out of High School					**Completion**	**P**
Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**	**Value**
NLS72	56.8%	83.8%	92.4%	97.0%	100%	51.1%	**of FOSD**
NELS:88	43.6%	76.2%	89.6%	95.9%	100%	45.3%	**Test**
NELS:88 Reweighted	39.6%	71.9%	87.1%	94.2%	100%	45.0%	
P-Value of NELS:88 Reweight – NLS72	0.000	0.000	0.000	0.000		0.000	0.000
Panel B: Public Four-Year Non-top 15 Sample							
	Years out of High School					**Completion**	**P**
Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**	**Value**
NLS72	54.7%	84.8%	93.0%	97.1%	100%	59.4%	**of FOSD**
NELS:88	35.0%	75.0%	89.4%	95.3%	100%	54.3%	**Test**
NELS:88 Reweighted	34.4%	73.3%	87.8%	93.8%	100%	52.0%	
P-Value of NELS:88 Reweight – NLS72	0.000	0.000	0.000	0.001		0.000	0.000
Panel C: Two-Year Sample							
	Years out of High School					**Completion**	**P**
Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**	**Value**
NLS72	35.9%	67.7%	85.2%	93.8%	100%	23.2%	**of FOSD**
NELS:88	21.0%	49.8%	75.4%	90.3%	100%	17.4%	**Test**
NELS:88 Reweighted	19.9%	47.8%	74.0%	87.6%	100%	20.1%	
P-Value of NELS:88 Reweight – NLS72	0.000	0.000	0.000	0.002		0.042	0.000

[1] Source: Authors' calculations as described in the text from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the regression.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] School type samples refer to first institution attended.

[4] All p-values in the table are based on 5000 bootstrap replications of the data, clustered at the high school level. The p-value for the test of first-order dominance shows the percentage of the replications for which the NLS72 distribution is less than the NELS:88 distribution for years 4, 5 or 6.

Table 6. Cumulative BA Distribution, Multivariate Re-weighting NELS:88 using NLS72 Initial School Type and Individual Background Characteristics

Cohort	Years out of High School: 4	5	6	7	8	Completion Rate	P Value of FOSD Test
NLS72	56.8%	83.8%	92.4%	97.0%	100%	51.1%	
NELS:88	43.6%	76.2%	89.6%	95.9%	100%	45.3%	
Initial School Type	42.2%	75.8%	89.4%	95.8%	100%	49.2%	
Initial School Type and Background Characteristics	39.9%	72.8%	87.6%	94.4%	100%	48.0%	
P-Value of NELS:88 Reweight with Initial School Type – NLS72	0.000	0.000	0.001	0.015		0.092	0.001
P-Value of NELS:88 Reweight with Initial School Type and Background Characteristics– NLS72	0.000	0.000	0.000	0.000		0.013	0.000

[1] Source: Authors' calculations as described in the text from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the regression.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] School types included in the weighting regressions are: public non-top 15, public top 15, private 4-year, and 2-year. School type indicators and samples refer to first institution attended.

[4] All p-values in the table are based on 5000 bootstrap replications of the data, clustered at the high school level. The p-value for the test of first-order dominance shows the percentage of the replications for which the NLS72 distribution is less than the NELS:88 distribution for years 4, 5 or 6.

Table 7. State-level Estimates of the Effect of Crowding on Multiple Time To Degree Measures

Independent Variable: Change in Log 18-Year Old Population (1992-1972)		
	2nd Stage	
Dependent Variable	Actual - Actual Coefficients	Counterfactual 92 - Actual 72 Coefficients
8 Year Completion Indicator – All HS Graduates	-0.348** (0.093)	-0.120* (0.071)
8 Year Completion Indicator	-0.264** (0.107)	-0.087 (0.100)
8 Year Completion Indicator – Public Non Top 15	-0.051 (0.138)	0.042 (0.128)
4 Year Completion Indicator	-0.181* (0.092)	-0.134 (0.097)
4 Year Completion Indicator – Public Non Top 15	-0.229** (0.103)	-0.261** (0.119)
Log Time to Degree	0.112** (0.041)	0.094** (0.043)
Log Time to Degree - Public Non Top 15	0.129** (0.048)	0.132** (0.053)

[1] Source: Authors' calculations as described in the text from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the regression.

[2] Robust standard errors are in parentheses: ** indicates significance at the 5 percent level and * indicates significance at the 10 percent level.

[3] The regressions using the four-year completion indicators as dependent variables include only those who obtain a BA within 8 years of cohort high school graduation. All samples include only those who begin college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample. The Public Non-top 15 samples refer to initial institution of the respondent.

Table 8. Undergraduate Student-Faculty Ratios at Graduating Institution by Initial School Type

Student-Faculty Ratios at Public Non-Top 15 Universities					
		Percentile			
Survey	**Mean**	**25th**	**50th**	**75th**	**90th**
NLS72	19.17	15.24	17.37	20.83	25.34
NELS:88	21.99	18.26	20.85	24.30	29.20

Student-Faculty Ratios at Public Top 15 Universities					
		Percentile			
Survey	**Mean**	**25th**	**50th**	**75th**	**90th**
NLS72	17.41	13.57	17.05	21.17	22.43
NELS:88	15.90	13.21	14.06	19.66	21.43

Student-Faculty Ratios at Private Universities					
		Percentile			
Survey	**Mean**	**25th**	**50th**	**75th**	**90th**
NLS72	16.62	13.20	15.69	18.78	23.02
NELS:88	18.63	13.06	16.50	20.68	26.73

Student-Faculty Ratios at Public Two-Year Universities					
		Percentile			
Survey	**Mean**	**25th**	**50th**	**75th**	**90th**
NLS72	18.76	15.81	18.16	21.34	22.67
NELS:88	24.53	18.45	21.41	25.42	35.32

Source: Authors' calculations as described in the text from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the regression. Data on faculty and enrollment are from the HEGIS/IPEDS surveys from the Department of Education.

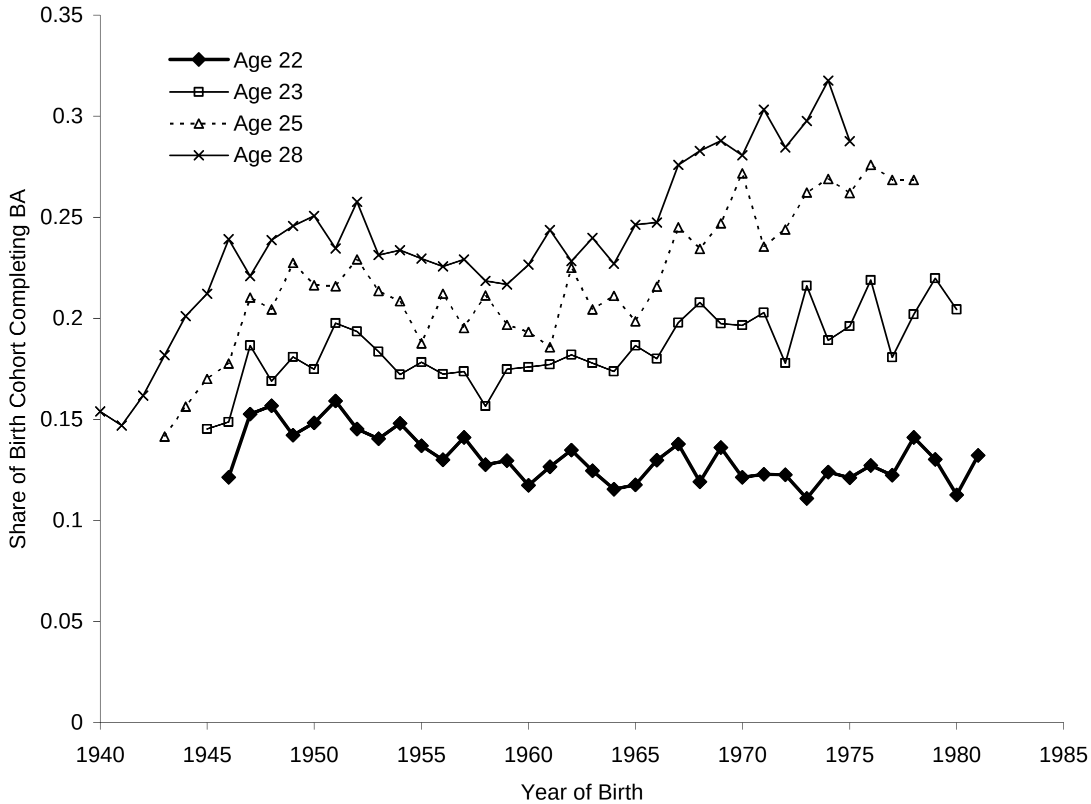
Table 9. Regressions of Hours and Employment on Cohort Size, by Type of Institution: 1976-2003

	Coefficient on Ln Pop 18		
Sample	**Hours (OLS)**	**Hours Tobit**	**Employment (OLS)**
All Enrollment	2.007**	3.417**	0.051*
	(0.845)	(1.595)	(0.031)
Public College	0.983	1.093	0.009
	(1.021)	(1.870)	(0.037)
Public 4-Year	4.150**	7.908**	0.101**
	(1.124)	(2.374)	(0.045)
Public 2-Year	0.111	0.405	-0.010
	(1.940)	(2.840)	(0.062)
State Fixed Effects	Y	Y	Y
Year Fixed Effects	Y	Y	Y
State Tuition	Y	Y	Y
Unemployment Rate	Y	Y	Y
Age Fixed Effects	Y	Y	Y

[1] Source: Authors' tabulations as described in the text using CPS data from 1977-2003 for the sample aged 18-20. Each cell represents a separate regression and includes CPS sample weights.

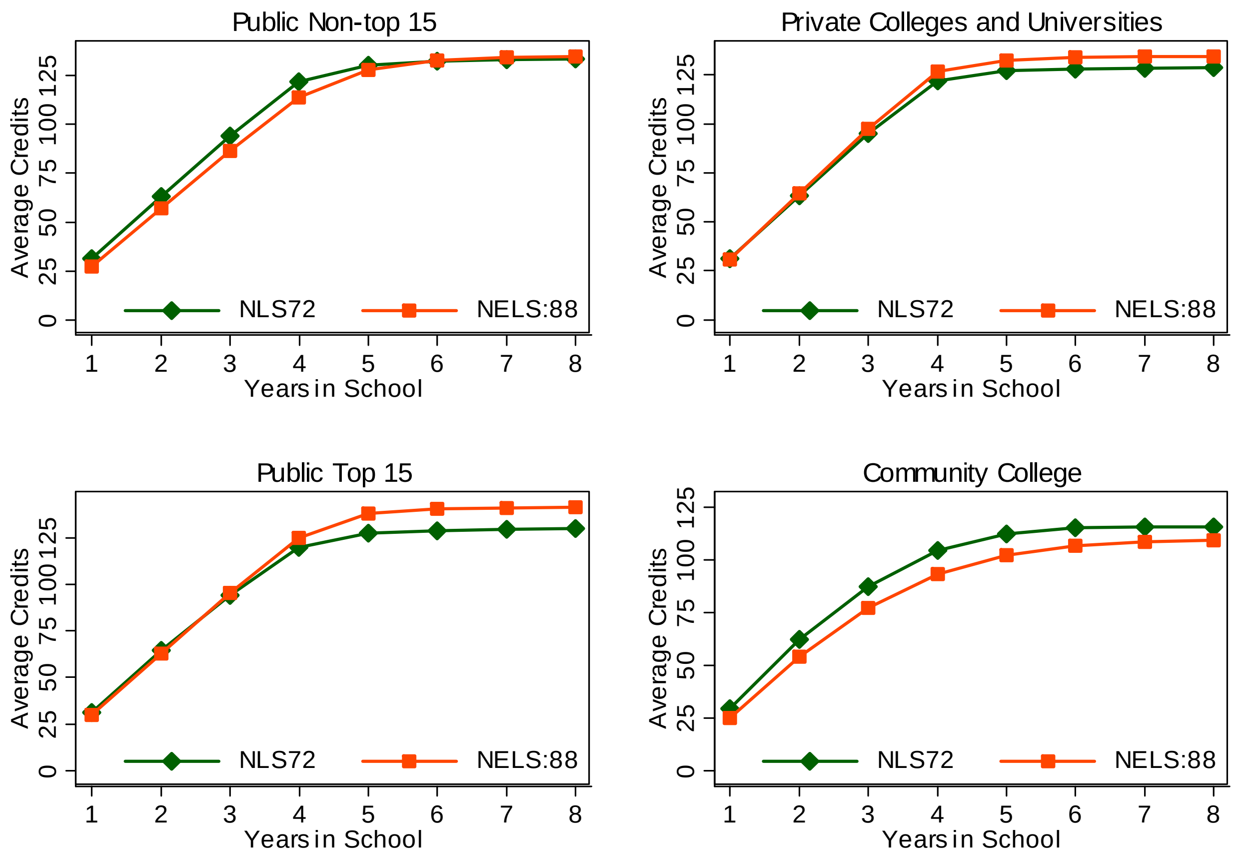
[2] Robust standard errors are in parentheses: ** indicates significance at the 5 percent level and * indicates significance at the 10 percent level.

Figure 1. College Completion Rates by Age, 1940-1980 Birth Cohorts



Source: Data are from authors' tabulations using the October CPS, 1968-2005. Individual weights are employed. See Turner (2005) for additional detail.

Figure 2. Credit Accumulation by Type of Initial Institution for Eight-Year BA Recipients

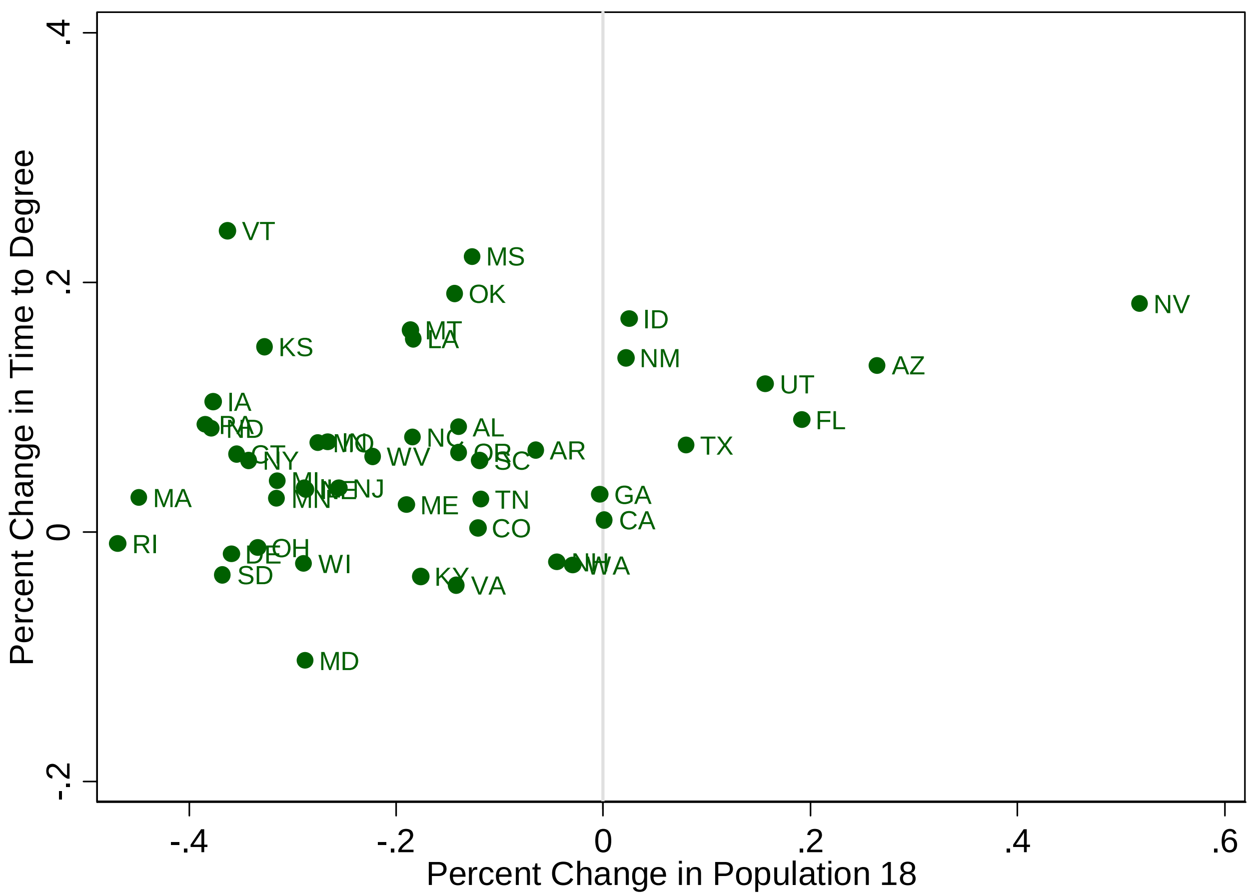


[1] Source: Authors' calculations from the NLS72 and NELS:88 transcript surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The credit accumulation schedules represent total average credits by years enrolled in college. For those who graduate in less than eight years, their number of credits are held constant for each subsequent year post graduation.

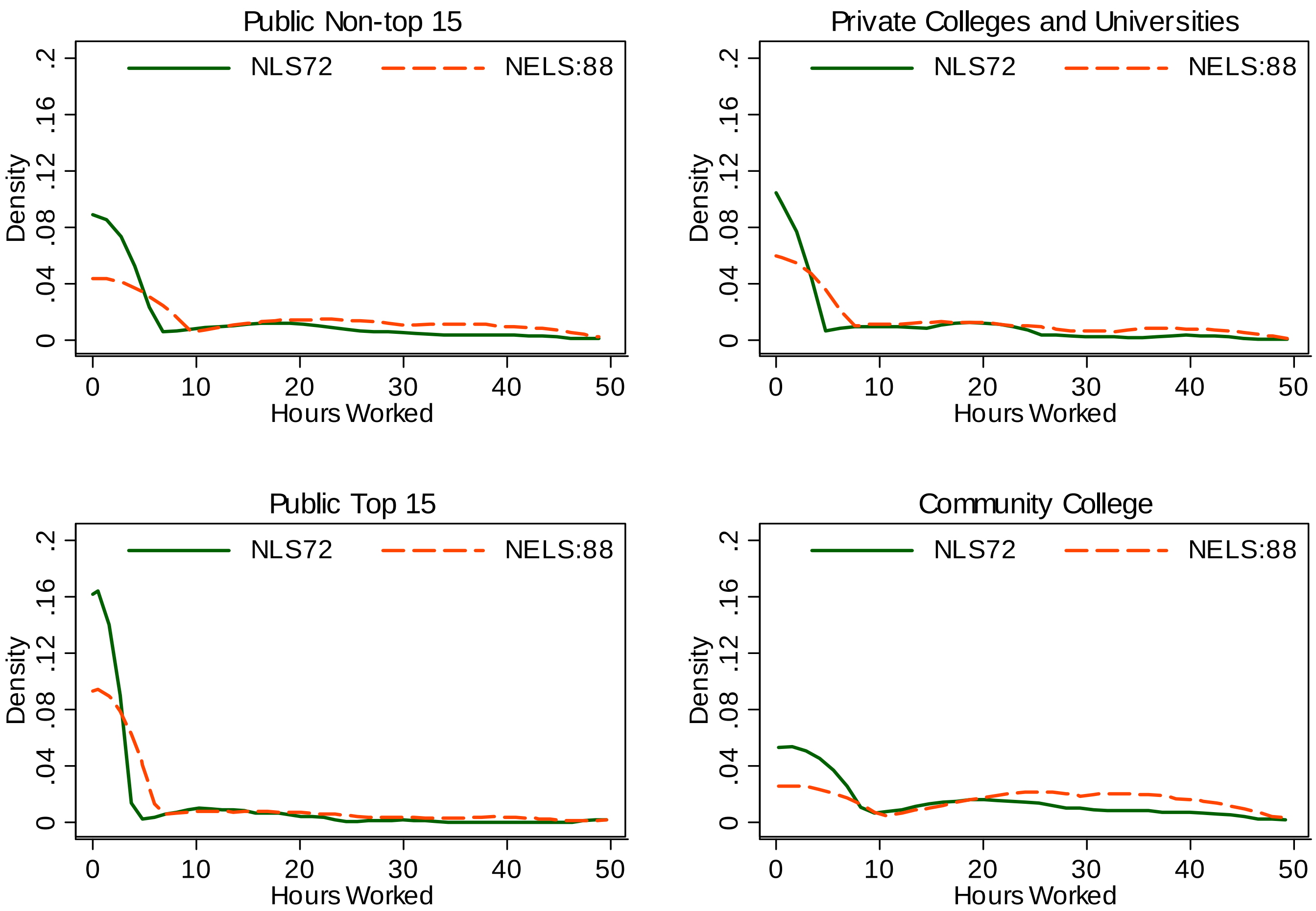
[3] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation and receive a BA within eight years. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample. The figure does not include outliers who accumulate more than 45 credits per year.

Figure 3: Percent Change in Time to Degree vs. Percent Change in 18-Year Old Population by State



Source: Authors' calculation from the NLS72 and NELS:88 surveys and the U.S. Census of population and Housing. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the figure.

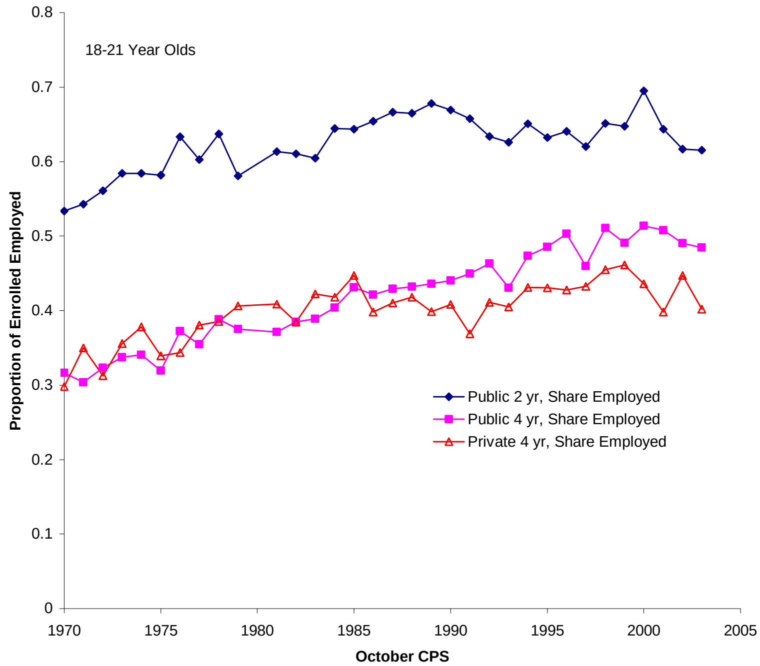
Figure 4. Distribution of Hours of Work Among Enrolled Students in the First Year after High School Cohort Graduation



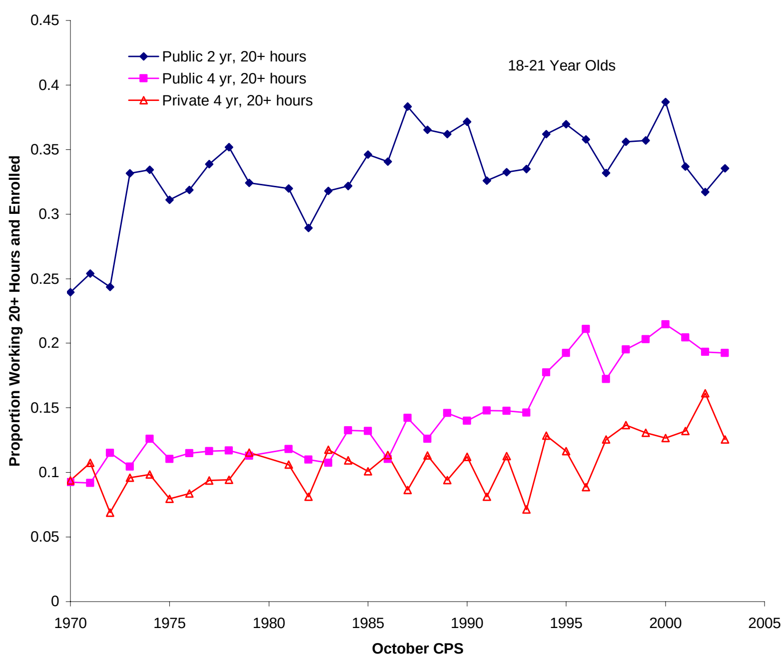
Source: Authors' calculations from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

Figure 5. Employment and Hours Worked Among Those Enrolled in College by Type of Institution, October CPS

Panel A. Proportion of Enrolled Students Employed



Panel B. Proportion of Students Working 20+ Hours Enrolled



Source: Data are from authors' tabulations using the October CPS. Individual weights are employed.

Table B-1. Variable Names and Definitions for Calculation of Time to Degree in NLS72 and NELS:88

	Panel A: NLS72	
Variable Name	**Variable Definition**	**Follow Up**
Fq2	High school completion dummy	2
Edatt86	Educational attainment as of 1986	1-5
Fq3b	High school graduation year	2
Fq3a	High school graduation month	2
Tq48ea	BA completion dummy as of 10/1/1976	3
Tq48eb	Month BA received as of third follow-up	3
Tq48ec	Year BA received as of third follow-up	4
Ft76ea	BA completion as of fourth follow-up	4
Ft76eb	Month BA received as of fourth follow-up	4
Ft76ec	Year BA received as of fourth follow-up	5
Fi19b1ey - Fi19b4ey	Year ended most recent school attended, first through fourth time	5
Fi19b1em – Fi19b4em	Month ended most recent school attended, first through fourth time	5
Fi19h	Course of study in most recent school attended	5
Fi19i	Completed requirements in most recent school attended	5
Fi20b1ey – Fi20b4ey	Year ended 2nd most recent school attended, first through fourth time	5
Fi20b1em – Fi20b4em	Month ended 2nd most recent school attended, first through fourth time	5
Fi19h	Course of study in 2nd most recent school attended	5
Fi19i	Completed requirements in 2nd most recent school attended	5
	Panel B: NELS:88	
Variable Name	**Variable Definition**	**Follow Up**
F4hsgradt	High school graduation date	4
F4ed1	Degree receipt date – first degree received	4
F4edgr1	Degree type received – first degree	4
F4ed2	Degree receipt date – second degree received	4
F4edgr2	Degree type received – second degree	4
F4ed3	Degree receipt date – third degree received	4
F4edgr3	Degree type received – third degree	4
F4ed4	Degree receipt date – fourth degree received	4
F4edgr4	Degree type received – fourth degree	4
F4ed5	Degree receipt date – fifth degree received	4
F4edgr5	Degree type received – fifth degree	4
F4ed6	Degree receipt date – sixth degree received	4
F4edgr6	Degree type received – sixth degree	4

Table B-2. Number of Imputed Observations by Survey and Variable (Unweighted)

	Number of Imputed Observations	
Variable	**NLS72**	**NELS:88**
Math Test Score	1,940	1,636
Reading Test Score	1,940	1,638
Mother's Education	46	1,231
Father's Education	45	1,445
Parent Income	1,612	1,193
Total	2,886	3,620

Observation counts include only those respondents who enroll in college within two years of cohort high school graduation at a four-year institution or a non-private two-year college.

Table B-3. Number of Dropped Observations by Category (Unweighted)

NLS72		
Sample Change	**Dropped Observations**	**Remaining Observations**
Original Base - 5th Follow Up Sample		12841
High School Dropouts	168	12673
Missing Initial School Information	99	12574
Never Attended College	4734	7840
Time between HS and College >2 Years	613	7227
1st School Type is 2 Year Private	120	**7107**
NELS:88		
Sample Change	**Dropped Observations**	**Remaining Observations**
Original Base-4th Follow Up Sample		12144
High School Dropouts	722	11422
Observations not in all 4 Waves	195	11227
Never Attended College	1918	9309
Time between HS and College >2 Years	795	8512
1st School Type is 2 Year Private	95	**8417**

Table D-1. Means of Selected NLS72 and NELS:88 Variables — Public Non-top 15 Sample

Variable	All College Attendees		College Graduates Who Obtain a BA With Eight Years of Cohort High School Graduation	
	NLS72	NELS:88	NLS72	NELS:88
Average Time to Degree	4.677	5.044	4.677	5.044
	(1.017)	(1.084)	(1.017)	(1.084)
Lowest Reading Quartile	0.126	0.146	0.093	0.078
	(0.332)	(0.353)	(0.290)	(0.268)
Second Reading Quartile	0.192	0.207	0.164	0.160
	(0.394)	(0.405)	(0.370)	(0.366)
Third Reading Quartile	0.299	0.302	0.310	0.316
	(0.458)	(0.459)	(0.462)	(0.465)
Highest Reading Quartile	0.383	0.345	0.433	0.446
	(0.486)	(0.479)	(0.496)	(0.497)
Lowest Math Quartile	0.096	0.122	0.067	0.033
	(0.295)	(0.327)	(0.249)	(0.179)
Second Math Quartile	0.196	0.203	0.146	0.153
	(0.397)	(0.403)	(0.353)	(0.360)
Third Math Quartile	0.259	0.298	0.246	0.304
	(0.438)	(0.458)	(0.431)	(0.460)
Highest Math Quartile	0.449	0.376	0.542	0.510
	(0.497)	(0.484)	(0.498)	(0.500)
Father -- No HS Diploma	0.220	0.107	0.190	0.056
	(0.414)	(0.309)	(0.392)	(0.231)
Father -- HS Diploma	0.256	0.294	0.222	0.215
	(0.437)	(0.455)	(0.416)	(0.411)
Father – Some College	0.242	0.224	0.246	0.235
	(0.429)	(0.417)	(0.431)	(0.424)
Father -- BA	0.170	0.200	0.201	0.255
	(0.375)	(0.400)	(0.401)	(0.436)
Father -- Graduate School	0.112	0.175	0.141	0.239
	(0.315)	(0.380)	(0.348)	(0.426)
Mother -- No HS Diploma	0.177	0.099	0.150	0.047
	(0.382)	(0.299)	(0.357)	(0.212)
Mother -- HS Diploma	0.394	0.330	0.383	0.278
	(0.489)	(0.470)	(0.486)	(0.448)
Mother – Some College	0.279	0.264	0.278	0.280
	(0.448)	(0.441)	(0.448)	(0.449)
Mother -- BA	0.110	0.183	0.135	0.230
	(0.312)	(0.387)	(0.341)	(0.421)
Mother -- Graduate School	0.041	0.124	0.054	0.165
	(0.197)	(0.330)	(0.226)	(0.371)
Income <3000/<10000	0.039	0.058	0.023	0.030
	(0.195)	(0.235)	(0.150)	(0.172)
Income 6000/20000	0.070	0.112	0.047	0.074
	(0.255)	(0.315)	(0.211)	(0.262)
Income 7500/25000	0.072	0.077	0.075	0.061
	(0.258)	(0.267)	(0.263)	(0.239)
Income 10500/35000	0.201	0.133	0.205	0.104
	(0.406)	(0.340)	(0.404)	(0.305)
Income 15000/50000	0.267	0.207	0.271	0.206

	(0.443)	(0.405)	(0.404)	(0.405)
Income 15000+/50000+	0.351	0.412	0.380	0.525
	(0.477)	(0.492)	(0.485)	(0.499)
Asian	0.009	0.039	0.012	0.044
	(0.095)	(0.193)	(0.111)	(0.205)
Hispanic	0.022	0.079	0.014	0.048
	(0.148)	(0.270)	(0.117)	(0.214)
African American	0.097	0.134	0.082	0.083
	(0.297)	(0.342)	(0.274)	(0.276)
White	0.866	0.741	0.889	0.819
	(0.341)	(0.438)	(0.314)	(0.385)
Native American	0.005	0.006	0.002	0.005
	(0.073)	(0.078)	(0.046)	(0.072)
Male	0.513	0.477	0.507	0.454
	(0.500)	(0.499)	(0.500)	(0.498)
Number of Observations	3570	3456	2418	1989

[1] Source: Authors' tabulations from the NELS:88 and NLS72 surveys. Standard deviations are in parentheses. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who initially attend a non-top 15 public college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] Parental income in NLS72 and NELS:88 are given in discrete ranges in both surveys. We group the income ranges into 6 income categories in each survey that correspond to the same real income across surveys using the CPI. In NLS72, the real income ranges are less than $3,000, $3000-$6000, $6001-$7500, $7501-$10500, $10501-$15000, and greater than $15000. In NELS:88, the real income ranges are less than $10,000, $10000-$20000, $20001-$25000, $25001-$35000, $35001-$50000, and greater than $50000.

Table D-2. Means of Selected NLS72 and NELS:88 Variables — Public Two-Year Sample

Variable	All College Attendees		College Graduates Who Obtain a BA With Eight Years of Cohort High School Graduation	
	NLS72	NELS:88	NLS72	NELS:88
Average Time to Degree	5.150 (1.221)	5.624 (1.259)	5.150 (1.221)	5.624 (1.259)
Lowest Reading Quartile	0.209 (0.407)	0.272 (0.445)	0.120 (0.325)	0.159 (0.366)
Second Reading Quartile	0.270 (0.444)	0.289 (0.453)	0.238 (0.426)	0.219 (0.413)
Third Reading Quartile	0.292 (0.455)	0.268 (0.443)	0.300 (0.458)	0.349 (0.477)
Highest Reading Quartile	0.228 (0.420)	0.171 (0.376)	0.343 (0.475)	0.273 (0.446)
Lowest Math Quartile	0.174 (0.379)	0.265 (0.441)	0.078 (0.269)	0.091 (0.288)
Second Math Quartile	0.301 (0.459)	0.312 (0.463)	0.220 (0.414)	0.229 (0.420)
Third Math Quartile	0.268 (0.443)	0.281 (0.449)	0.303 (0.459)	0.362 (0.481)
Highest Math Quartile	0.257 (0.437)	0.143 (0.350)	0.399 (0.490)	0.318 (0.466)
Father -- No HS Diploma	0.273 (0.445)	0.170 (0.376)	0.176 (0.380)	0.090 (0.286)
Father -- HS Diploma	0.307 (0.461)	0.385 (0.486)	0.273 (0.446)	0.313 (0.464)
Father – Some College	0.239 (0.427)	0.227 (0.419)	0.269 (0.443)	0.268 (0.443)
Father -- BA	0.110 (0.313)	0.131 (0.337)	0.155 (0.362)	0.172 (0.378)
Father -- Graduate School	0.070 (0.256)	0.087 (0.282)	0.128 (0.334)	0.157 (0.363)
Mother -- No HS Diploma	0.225 (0.418)	0.163 (0.370)	0.143 (0.350)	0.110 (0.313)
Mother -- HS Diploma	0.432 (0.495)	0.427 (0.495)	0.419 (0.494)	0.359 (0.480)
Mother – Some College	0.235 (0.424)	0.241 (0.427)	0.259 (0.438)	0.264 (0.441)
Mother -- BA	0.074 (0.261)	0.105 (0.307)	0.104 (0.306)	0.166 (0.373)
Mother -- Graduate School	0.034 (0.180)	0.064 (0.244)	0.074 (0.263)	0.100 (0.300)
Income <3000/<10000	0.040 (0.196)	0.092 (0.290)	0.030 (0.171)	0.044 (0.205)
Income 6000/20000	0.086 (0.281)	0.126 (0.332)	0.071 (0.257)	0.060 (0.237)
Income 7500/25000	0.076 (0.265)	0.086 (0.281)	0.057 (0.233)	0.074 (0.262)
Income 10500/35000	0.229 (0.420)	0.160 (0.366)	0.209 (0.407)	0.148 (0.355)
Income 15000/50000	0.287	0.233	0.277	0.234

	(0.452)	(0.423)	(0.447)	(0.424)
Income 15000+/50000+	0.281	0.302	0.355	0.440
	(0.450)	(0.459)	(0.479)	(0.496)
Asian	0.018	0.044	0.031	0.081
	(0.131)	(0.206)	(0.173)	(0.273)
Hispanic	0.053	0.131	0.031	0.071
	(0.223)	(0.338)	(0.174)	(0.257)
African American	0.089	0.093	0.052	0.043
	(0.284)	(0.290)	(0.222)	(0.202)
White	0.834	0.718	0.877	0.805
	(0.372)	(0.450)	(0.329)	(0.396)
Native American	0.007	0.014	0.009	0.000
	(0.086)	(0.116)	(0.095)	(0.000)
Male	0.496	0.505	0.554	0.467
	(0.500)	(0.500)	(0.497)	(0.499)
Number of Observations	1899	3020	582	591

[1] Source: Authors' tabulations from the NELS:88 and NLS72 surveys. Standard deviations are in parentheses. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who initially attend a two-year college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] Parental income in NLS72 and NELS:88 are given in discrete ranges in both surveys. We group the income ranges into 6 income categories in each survey that correspond to the same real income across surveys using the CPI. In NLS72, the real income ranges are less than $3,000, $3000-$6000, $6001-$7500, $7501-$10500, $10501-$15000, and greater than $15000. In NELS:88, the real income ranges are less than $10,000, $10000-$20000, $20001-$25000, $25001-$35000, $35001-$50000, and greater than $50000.

Table D-3. Cumulative BA Distribution, Univariate Re-weighting NELS:88 Using NLS72 Characteristics

Panel A: Full Sample						
	NLS72 and NELS:88 BA Distributions					Completion
Survey Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**
NLS72	56.8%	83.8%	92.4%	97.0%	100%	51.1%
NELS:88	43.6%	76.2%	89.6%	95.9%	100%	45.3%
Background Characteristic Reweighting Variable	**NELS:88 Distribution Reweighted by NLS72 Background Characteristics**					
Math Quartile	43.6%	75.9%	89.5%	95.8%	100%	49.5%
Reading Quartile	43.0%	75.9%	89.5%	95.8%	100%	47.3%
Father's Education Level	40.8%	73.1%	88.1%	95.1%	100%	41.8%
Mother's Education Level	40.3%	73.4%	87.7%	94.9%	100%	40.4%
Parent Income Level	42.2%	74.8%	89.0%	95.5%	100%	45.1%
Male	42.8%	75.8%	89.5%	95.8%	100%	45.2%
Racial Composition	44.2%	76.9%	90.1%	96.0%	100%	47.2%
Panel B: Public Non-top 15 Sample						
	NLS72 and NELS:88 BA Distributions					**Completion**
Survey Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**
NLS72	54.7%	84.8%	93.0%	97.1%	100%	59.4%
NELS:88	35.0%	75.0%	89.4%	95.3%	100%	54.3%
Background Characteristic Reweighting Variable	**NELS:88 Distribution Reweighted by NLS72 Background Characteristics**					
Math Quartile	35.0%	74.6%	89.3%	95.1%	100%	56.7%
Reading Quartile	34.8%	74.9%	89.3%	95.3%	100%	57.6%
Father's Education Level	33.8%	73.1%	88.2%	94.8%	100%	50.3%
Mother's Education Level	34.0%	73.2%	87.9%	94.3%	100%	49.1%
Parent Income Level	34.0%	73.5%	88.8%	94.8%	100%	53.9%
Male	34.4%	74.7%	89.3%	95.2%	100%	54.1%
Racial Composition	35.6%	75.8%	89.9%	95.6%	100%	56.8%
Panel C: Two-Year Sample						
	NLS72 and NELS:88 BA Distributions					**Completion**
Survey Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**
NLS72	35.9%	67.7%	85.2%	93.8%	100%	23.2%
NELS:88	21.0%	49.8%	75.4%	90.3%	100%	17.4%
Background Characteristic Reweighting Variable	**NELS:88 Distribution Reweighted by NLS72 Background Characteristics**					
Math Quartile	22.2%	51.1%	75.6%	90.2%	100%	20.8%
Reading Quartile	22.0%	50.5%	75.7%	90.4%	100%	18.7%

Father's Education Level	19.4%	47.5%	73.7%	89.2%	100%	16.5%
Mother's Education Level	20.9%	48.9%	74.7%	89.9%	100%	16.4%
Parent Income Level	20.5%	49.6%	75.1%	90.6%	100%	18.0%
Male	20.3%	49.1%	75.6%	90.5%	100%	17.4%
Racial Composition	20.9%	49.6%	75.1%	88.8%	100%	18.0%

[1] Source: Authors' calculation from the NELS:88 and NLS72 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the tabulations.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] School types refer to first institution attended.

Table D-4. Cumulative BA Distribution, Multivariate Re-weighting NLS72 using NELS:88 Individual Background Characteristics

Panel A: Full Sample							
	Years out of High School					Completion	P
Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**	**Value**
NLS72	56.8%	83.8%	92.4%	97.0%	100%	51.1%	**of FOSD**
NELS:88	43.6%	76.2%	89.6%	95.9%	100%	45.3%	**Test**
NLS72 Reweighted	59.7%	84.8%	93.5%	97.4%	100%	50.7%	
P-Value of NLS72 Reweight – NELS:88	0.000	0.000	0.000	0.006		0.000	0.000
Panel B: Public Four-Year Non-top 15 Sample							
	Years out of High School					**Completion**	**P**
Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**	**Value**
NLS72	54.7%	84.8%	93.0%	97.1%	100%	59.4%	**of FOSD**
NELS:88	35.0%	75.0%	89.4%	95.3%	100%	54.3%	**Test**
NELS:88 Reweighted	55.6%	85.5%	94.1%	97.6%	100%	59.9%	
P-Value of NLS72 Reweight – NELS:88	0.000	0.000	0.000	0.005		0.002	0.000
Panel C: Two-Year Sample							
	Years out of High School					**Completion**	**P**
Cohort	**4**	**5**	**6**	**7**	**8**	**Rate**	**Value**
NLS72	35.9%	67.7%	85.2%	93.8%	100%	23.2%	**of FOSD**
NELS:88	21.0%	49.8%	75.4%	90.3%	100%	17.4%	**Test**
NELS:88 Reweighted	38.3%	67.7%	85.2%	93.5%	100%	22.7%	
P-Value of NLS72 Reweight – NELS:88	0.000	0.000	0.001	0.070		0.002	0.001

[1] Source: Authors' calculations as described in the text from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the regression.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] School type samples refer to first institution attended.

[4] All p-values in the table are based on 5000 bootstrap replications of the data, clustered at the high school level. The p-value for the test of first-order dominance shows the percent of the replications for which the NLS72 distribution is less than the NELS:88 distribution for years 4, 5 or 6.

Table D-5. Cumulative BA Distribution, Multivariate Re-weighting NLS72 using NELS:88 Initial School Type and Individual Background Characteristics

Cohort	Years out of High School 4	5	6	7	8	Completion Rate	P Value of FOSD Test
NLS72	56.8%	83.8%	92.4%	97.0%	100%	51.1%	
NELS:88	43.6%	76.2%	89.6%	95.9%	100%	45.3%	
Initial School Type	57.0%	83.6%	92.3%	97.0%	100%	47.5%	
Initial School Type and Background Characteristics	59.4%	84.3%	93.3%	97.2%	100%	48.0%	
P-Value of NLS72 Reweight with Initial School Type – NELS:88	0.000	0.000	0.001	0.031		0.055	0.001
P-Value of NLS72 Reweight with Initial School Type and Background Characteristics– NELS:88	0.000	0.000	0.000	0.013		0.024	0.000

[1] Source: Authors' calculations as described in the text from the NLS72 and NELS:88 surveys. NLS72 calculations were made using the fifth follow-up weights included in the survey. Fourth follow-up weights were used for the NELS:88 survey calculations. Only those participating in these follow-ups are included in the regression.

[2] The NLS72 and NELS:88 samples are restricted to those who attend college within 2 years of cohort high school graduation. Cohort high school graduation is defined as June 1972 for the NLS72 sample and June 1992 for the NELS:88 sample.

[3] School types included in the weighting regressions are: public non-top 15, public top 15, private 4-year, and public 2-year. School type indicators and samples refer to first institution attended.

[4] All p-values in the table are based on 5000 bootstrap replications of the data, clustered at the high school level. The p-value for the test of first-order dominance shows the percent of the replications for which the NLS72 distribution is less than the NELS:88 distribution for years 4, 5 or 6.