DISCUSSION PAPER SERIES

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ABSTRACT

Why Have College Completion Rates Increased?*

College completion rates declined from the 1970s to the 1990s. We document that this trend has reversed - since the 1990s, college completion rates have increased. We investigate the reasons for the increase in college graduation rates. Collectively, student characteristics, institutional resources, and institution attended do not explain much of the change. However, we document that standards for degree receipt may explain some of the change in graduation rates.

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1. Introduction

Students who attend college enjoy many long run benefits (Oreopoulos and Petronijevic, 2013). Students who *complete* college have even better outcomes (Jaeger and Page, 1996; Ost, Pan, and Webber, 2018). Despite the large returns to college completion, many students who enroll in college do not graduate, leading to what some have described as a "college completion crisis" (Deming, 2017). In fact, in 2016, the six-year graduation rate for college completion at four-year schools was 67 percent (Shapiro et al., 2017).[1] Consequently, policy and research attention has increasingly focused on college completion.[2]

In influential work, Bound, Lovenheim, and Turner (2010) (hereafter BLT) showed that college completion rates declined from the 1970s to the 1990s. This fact added additional motivation for studying college completion. BLT showed that the overall decline was due to both changing student preparedness and institution-level factors. However, the institution, or supply-side, factors were relatively more important than student preparedness in explaining the decline in graduation rates.[3] BLT was highly influential in directing research over the next several years that considered the role institutions played on college completion.[4]

Our study asks what has happened to college completion rates after 1990. First, we document across three national data sources that aggregate trends have changed—college completion rates *increased* from 1990 to present. The increase in graduation rates occurred across institution types including public and private universities as well as elite and non-elite institutions. College graduation rates increased for both men and women which is notable because men drove the decline documented in BLT.

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[1] Hess and Hatalsky (2018) offer a nice summary of our understanding of the causes of college completion, policy tools, trends, etc.

[2] As examples see Scott-Clayton (2012), Castleman and Long (2016), Bettinger et al. (2019), Denning, Marx, Turner (Forthcoming), and Barr (2019).

[3] The decline in graduation rates in BLT was driven by males. The overall decline was largely due to the group of institutions that BLT refers to as public "non-top 50." Bound, Lovenheim, and Turner (2012) also document that time to degree has increased over a similar time frame.

[4] Many subsequent papers explored the causal effect of institution attended on graduation (Cohodes and Goodman, 2014; Zimmerman, 2014; Goodman, Hurwitz, and Smith, 2017).

Next, we investigate why college completion rates declined. We discuss relevant trends that could affect college graduation such as the college wage premium, enrollment, student preparation, study time, employment during college, price, state support for higher education, and initial college attended. The trends in these variables almost uniformly would predict declining college graduation rates. We use two nationally representative surveys from the National Center for Education Statistics (NCES): National Education Longitudinal Study of 1988 (NELS:88) and Education Longitudinal Study of 2002 (ELS:2002) to decompose the change in graduation rates into changes in student characteristics and institution-level factors.[5] These longitudinal student-level data sets have information on high school student background, academic preparation, college enrollment, and graduation outcomes. We find that student characteristics, institutional resources, and institution attended explain little of the change in graduation rates.

We then explore alternative hypotheses to explain the increase in graduation rates. We document that college student grade point averages are higher in the ELS:2002 than in NELS:88. This is true after accounting for math test scores, student demographics, and institution type attended. The increase in GPA happens across the distribution; importantly, 11 percent of all students move from being below a 2.0 GPA to above a 2.0. We add student first year GPA into our decomposition which accounts for most of the change in graduation rates. Our findings combined with trends in studying and labor force participation in college suggest standards for degree receipt have changed.

The rest of the paper proceeds as follows. Section 2 describes trends in college graduation rate and other related trends. Section 3 outlines potential explanations for the change in college graduation rates. Section 4 describes the data. Section 5 discusses the empirical strategy. Section 6 contains the results and Section 7 concludes.

2. Trends in College Graduation Rates

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[5] NELS:88 is the primary data set used for the later period in BLT.

We first establish that college graduation rates have increased since the 1990s. We use three data sources to document these trends. All three sources have limitations; however, the evidence is consistent across all sources we consider.

First, we use the decennial census to examine college graduation trends (Ruggles et al., 2019). Figure 1 shows the ratio of bachelor's recipients to those with some college among respondents who are 25 years old. If the college graduation rate increases, the ratio of bachelor's recipients to those who attended college but did not graduate would increase. The decline from 1970 to 1990 is visible and is the focus of BLT. However, from 1990 to 2010, the ratio of BA recipients to those with some college increased—especially for women.[6]

In the period that BLT studies, there were no nationwide institution-level graduation data available. However, NCES started publishing cohort graduation rates by college starting with the entering class of 1991. We summarize the trends in these graduation rates in Figure 2.[7] Integrated Postsecondary Education Data System (IPEDS) collects graduation rates for all schools who receive Title IV federal financial aid. However, the graduation rates are calculated only for first-time, full-time students who begin in the fall. These graduation rates will not capture students who do not fit this description.[8] We focus on the six-year graduation rate in Figure 2. Despite this limitation, the trends in the IPEDs data mirror the ratio of the number of bachelor's degrees to people with some college found in Figure 1. Terry Long (2018) notes similar trends in graduation rates using the same data starting in the entering class of 1998 and describes differences in graduation rates across institution type, student demographics, and the consequences of non-completion.

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[6] Archidald, Feldman, and McHenry (2015) document this fact using similar census data.

[7] For Figure 2, we exclude schools that were predominantly online because online schools are different in many ways. Online schools are concentrated at for-profit institutions and have lower graduation rates than traditional schools. Information on online enrollment is first available in 2012 in IPEDS. We follow the convention of Deming et al. (2015) and label institutions that were predominantly online in 2012 as online prior to 2012.

[8] For instance, this measure is likely to do a poor job measuring college completion at for-profit colleges where many students are "nontraditional."

We consider enrollment and graduation separately by institution type. We follow the convention of BLT with one notable difference--we separately consider for-profit institutions.[9] With that modification, we categorize schools as follows: Top 50 Public, Non-Top 50 Public, Highly Selective Non-Profit, Non-Selective Non-Profit, and For-Profit. We follow BLT in our definition of Top 50 and Selective for public schools and private schools respectively and provide complete descriptions of these groups in Section 4.[10]

Figure 2 shows there is substantial heterogeneity in the graduation rates across institution types. The graduation rates are highest for highly selective private universities and top 50 publics. The lowest graduation rates are for for-profit institutions. Setting aside for-profit schools, graduation rates continuously increase from 1991-2010. Not all school types had increases of the same size; public schools had larger increases than non-profit private schools at similar levels of selectivity. However, the direction of the graduation rates are surprisingly consistent across institution types. When combining all schools weighted by enrollment (the black dashed line), the graduation rate increases from 52.0 percent to 59.7 percent. For-profit schools notably exhibit a different pattern. Graduation rates decline for the 20 years we observe which coincides with the growth in the for-profit sector as seen in Figure A1. The growth in the for-profit sector suggests some of the decline may be due to changing composition of the sector's institutions or students.

We also show that the graduation rates for the two nationally representative samples followed a similar pattern. We define college graduation as graduation within 8 years of expected high school graduation following BLT.[11] In Table 1, we show the eight-year graduation rate for the two nationally representative surveys used in this paper, NELS:88 and ELS:2002. We show that the overall graduation rate increased by 3.76 percentage points. We find statistically significant increases in graduation rates for top 50 and non-top 50 public schools of 8.6 and 4.9

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[9] For-profit institutions have lower graduation rates and increased enrollments in the 2000s. Further, for-profits are different in many ways from nonprofit institutions (Deming et al. 2012).

[10] See Section 4 for a description of the criteria used to classify schools.

[11] We know when students actually graduate from high school but we use years from expected high school graduation to avoid conditioning our outcome on an endogenous variable (actual high school graduation)

percentage points respectively. We also see statistically significant increases at community colleges and all non-profit colleges. Less selective and highly selective private universities do not have a statistically significant change in their graduation rates across NELS:88 and ELS:2002. This contrasts with aggregate graduation trends in IPEDS but may be due to relatively small samples in the individual level surveys.

The remainder of the paper will use NELS:88 and ELS:2002 to analyze the change in graduation rates so we show that the change in graduation rates is comparable to the change in graduation rates in IPEDS. NELS:88 and ELS:2002 represent the high school graduating cohorts of 1992 and 2004, respectively. The change in overall graduation rates for the entering cohorts of 1992 to 2004 in IPEDS is 5.74 percentage points which is similar but somewhat larger to what is observed across NELS:88 and ELS:2002 at 3.76. Hence, using NELS:88 and ELS:2002 should yield useful insight because the change in graduation rates is similar to observed aggregate changes.

3.   Potential Explanations for Changes in Graduation Rate

We initially consider two types of explanations for changes in college graduation rates: student-level characteristics and institution-level characteristics. Student characteristics that may affect college graduation include student preparation, work during school, time spent studying, and choice of major. Institution characteristics that may explain changes in graduation rates include the quality of instruction, financial aid, student services, and standards for degree receipt.

In trying to explain the changes in college completion, several trends are worth noting. BLT notes that an increasing college wage premium would predict an increasing graduation rate. However, the college wage premium has flattened beginning for cohorts born around 1970 (Ashworth and Ransom 2019).[12] A stable college wage premium for young workers contrasts with earlier periods (including the period studied in BLT) where the college wage premium was

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[12] Valletta (2016) shows a similar trend starting slightly later with the wage premium flattening starting in 2000. Valletta (2016) considers workers age 25-64 whereas Ashworth and Ransom (2019) consider workers age 25-34 which may explain some of the discrepancy.

growing. Hence, in the period we study the college wage premium is unlikely to explain increasing graduation rates.

Appendix Figure A1 shows an increasing number of students enrolling in each institution type over time. Similarly, Figure 3 shows the fraction of recent high school graduates attending college. College enrollment steadily grew from 1975 starting at approximately 50 percent and rising to nearly 70 percent. Table 2 shows that college enrollment rose from 69.3 percent in NELS:88 to 78.3 percent in ELS:2002. With a larger fraction of students entering college, there may be more entrants who are relatively less prepared because as more students enter college, they likely come from farther down the distribution of student achievement.

Measuring student ability for the marginal college entrant could confound the increase in college attendance if the increase in college attendance coincided with an increase in performance. Performance of 17-year-old students on the math and reading portions of National Assessment of Educational Progress (NAEP) is essentially unchanged since the 1970s (National Center of Education Statistics 2013). Hence as college enrollment increases, the average preparation for college entrants would fall because the distribution of student ability is constant. We would expect college preparation would decrease in the time period studied given that college enrollment has increased and that performance on the NAEP is unchanged.[13] Trends in enrollment and student preparation would predict reduced college completion.[14]

Students are spending less time studying and more time employed over the time period we consider. Babcock and Marks (2011) show a drop in the number of hours studied from 1961 to 2003. Neither student demographics including race, gender, and parent education nor

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[13] Archibald, Feldman, and McHenry (2015) consider the change in preparation among college enrollees. They document decline in preparation as measured by math test scores and reading test scores. They find that student high school GPA matters for college enrollment. However, the increase in high school GPAs is difficult to interpret because GPAs are growing faster in affluent schools than in less affluent schools (Gershenson, 2018). They argue that students matched to schools on the basis of high school GPA reduce the impact of lower average math scores.

[14] We assign students their math percentile in the distribution of math test scores. We argue this represents student's absolute level of preparation because the overall distribution of student preparation is unchanged as discussed. In Table 3, college entrants' math percentile decreases from the 59th percentile to the 56th percentile. The decline in math percentile is also present among college graduates where it fell from the 71st percentile to the 68th percentile.

student SAT scores can explain much of the change in college study habits. Concurrently, college students increased their labor supply over this period. Scott-Clayton (2012) shows that average hours worked doubled from 1970 to 2000. However, student labor supply fell during the Great Recession. All else equal, we would expect declining graduation rates when students spend more time working for wages during college due to decreased study time, less full-time enrollment, etc. Trends in student labor supply and study time would predict declining college graduation rates, except perhaps during the Great Recession.

College has gotten more expensive since the 1990s. Inflation adjusted published tuition and fees have increased by over 300 percent since 1987. The net price of college accounting for financial aid has nearly doubled since 1997 for public four-year institutions (CollegeBoard, 2017). The price of college has been shown to affect college completion (Scott-Clayton, 2011; Castleman and Long, 2016; Bettinger et al., 2019; Denning, Forthcoming). Relatedly, state support for higher education per student has declined since 1985 (CollegeBoard, 2017), and state funding for higher education has been shown to affect enrollment and graduation rates (Deming and Walters, 2017).[15] In Appendix Table A1 we compare the student-faculty ratios for students attending college across NELS:88 and ELS:2002 to get a sense for how resources for students have changed. We find that the mean student-faculty ratio was nearly the same increasing from 39.4 to 40.4 while mean instructional expenditures per student fell somewhat from $4,581 to $4,287.[16] Overall, the rising price of college would predict declining graduation while instructional spending and student-faculty ratios are unlikely to explain much of the change.

Table 2 shows the changes in initial college attended across the NELS:88 and ELS:2002 cohorts. The share of students attending non-top 50 public and for-profit colleges increased. The share of students attending highly selective private, less selective private, top 50 public and community colleges decreased. The pattern of enrollment increases in non-top 50 public colleges balanced against the decrease in community college attendance and increased for-profit

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[15] Bailey and Dynarski (2011) document that there have been increases in the income gap in college graduation.

[16] We use the Higher Education Price Index to deflate spending.

attendance leads to an ambiguous prediction about the overall college completion rate if the average graduation rate of an institution causally affects college graduation.[17]

Changing college major choice could affect college completion. To explore the role of major choice, we explore what graduation rates would be if we changed the distribution of majors while holding fixed the graduation rates of any particular major. We find that students have not moved towards higher graduation rate majors over time.

Trends in the college wage premium, student enrollment, student preparation, student studying, labor supply in college, time spent studying, and the price of college would all predict *decreasing* college graduation rates. The patterns for enrollment by institution type yields an ambiguous prediction. Despite the bulk of the trends predicting decreasing graduation, we document that the college graduation rate is increasing. These trends foreshadow what we find in our analysis and present a puzzle. The trends in the variables that explained the decline documented in BLT will not be able to explain the increase in graduation rates observed from 1990 to 2010.

There has been increased policy attention on college completion during this period. Additionally, the number of state policies that tie appropriations for higher education to college completion via performance funding mechanisms has increased. The use of these mechanisms grew beginning in the 1990s. Evidence on the effect of these mechanisms is mixed with some studies finding that it affects degree production (Hillman, Tandberg, & Fryer, 2015; Tandberg & Hillman, 2014; Hillman, Fryar, & Crespín-Trujillo, 2017) and some finding that it does not (Hillman, Tandberg, & Gross, 2014). Increased attention to graduation and performance-based-funding gives schools incentive to increase graduation rates. However, even if performance funding affects graduation it would be an indirect mechanism. For performance funding to have an effect it must induce schools to change something about the degree production process.

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[17] This assumption has good empirical support (Cohodes and Goodman, 2014; Zimmerman, 2014; Goodman, Hurwitz, and Smith, 2017).

We propose, and test for, an additional channel that may change college completion rates—standards for degree receipt. If the standards for receiving a degree are relaxed, college completion rates would grow.[18]

4. Data

We use micro data to examine the reasons for the increase in college graduation rates. Specifically, we use two longitudinal surveys sponsored by the National Center for Education Statistics: the National Education Longitudinal Study of 1988 (NELS:88) and the Education Longitudinal Study of 2002 (ELS:2002). The NELS:88 and ELS:2002 capture college-going behavior of the high school classes of 1992 and 2004, respectively. The surveys provide information on whether a student attended college, the type of college attended, whether the student graduated from college, and the timing of college attendance and graduation.

The NELS:88 is a nationally representative, longitudinal study of 8th graders in the U.S. in 1988. The cohort was again surveyed in four follow-ups which occurred in 1990, 1992, 1994, and 2000. Postsecondary transcripts were also collected in 2000. The ELS:2002 is a nationally representative, longitudinal study of 10th graders in 2002. There were three follow up surveys which were administered in 2004, 2006, and 2012, with postsecondary transcripts collected in 2013. Importantly, both surveys include student assessments in math (and other areas) taken during high school, and we use the math assessments as a measure of student preparedness for college. Another advantage of these surveys is they contain a host of individual and family background variables. We use father's and mother's educational attainment (no high school diploma, high school diploma, some college, BA, graduate school), parental income (divided into income level categories), gender (male), and race/ethnicity (Asian, Hispanic, African American, White). Following BLT, we impute math test score, mother's education and father's

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[18] Evidence on patterns in "grade-inflation" is mixed with some studies finding support for grade inflation (Rojstaczer and Healy, 2012) and others finding none (Pattison, Grodsky, and Muller, 2013). We will discuss grade inflation in Section 6. Griffith and Sovero (2019) use administrative data from a public research university and find that grades have increased significantly since 1980. They hypothesize that an increasing number of instructors with job uncertainty may face pressures to increase grades, which is borne out empirically.

education for both surveys because these data are missing for many students. We also impute first-year college GPA for both surveys. For NELS, we also impute parental income.[19]

We follow BLT in how we define college attendance and college completion. We consider students who attend college within two years of when their high school cohort would be expected to graduate. The college completion rate is the proportion of students and obtain a BA within eight years of expected high school graduation.

We also follow BLT in assigning institutions to types which is primarily based on the 2005 U.S. News and World Report college rankings.[20] We assign the highest rated 50 public schools to "the top-50 public" category. The 65 highest rated private universities, the 50 highest rated liberal arts colleges, and the armed service academies are categorized as "highly selective private" category.[21] Other 4-year public schools are assigned to the "non-top 50 public" category, and other 4-year not-for-profit private schools were assigned to the "less selective private" category. Not-for-profit 2-year colleges are assigned to the "community college" category. Due to the recent rise in for-profit colleges, we created a new category, "for-profit colleges," and placed all for-profit colleges in this category.

Table 3 presents summary statistics for our two samples. From NELS:88 to ELS:2002 college enrollees had lower math percentiles moving from 58.88 to 55.92. Despite this decline in preparation, first-year college GPA increased from 2.44 to 2.65. Student-faculty ratios increased slightly 39.35 to 40.44. Parental education increased from NELS:88 to ELS:2002 where students whose mother had at least a bachelor's degree increased by 5 percentage points. Underrepresented minorities constituted a bit larger fraction of college enrollment in ELS:2002 than in NELS:88. Parental income shifted towards middle incomes. Lastly, the fraction of college students that are male declined from 49 percent to 46 percent.

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[19] We follow BLT's imputation strategy by using multiple imputation by chained equation (MICE) algorithm, implemented by the STATA module "ICE." See the data appendix for more information on imputation.
[20] We deviate from BLT's assignment due to a few cases, which are described in the appendix. We opted for using the same rankings to aid in comparability and because rankings are quite stable across years.
[21] We follow BLT in classifying armed services academies as private rather than public institutions. While they are publically funded, in many ways, e.g. academic ability of students, they are more similar to highly selective private institutions.

5. Empirical Strategy

We wish to decompose the increase in college graduation rates into student factors and institutional factors. In doing this, we closely follow the method used by BLT. The key challenge arises because we are interested in graduation, which is discrete. Throughout this section both institutional and student factors will be referred to as x_j.

First, we use a logit model to predict college completion in both the NELS:88 and ELS:2002 samples. This allows for nonlinear effects of any x_j which are likely to be important in describing changes in graduation rates. If we were using a linear framework, we could simply take the mean change in observable characteristics (x_j) across the two periods and multiply it by the estimated effect of the observable characteristic. However, a nonlinear framework does not allow this simple decomposition because the effect of changes in a given observable characteristic not only depends on the mean size of the change, but also where in the distribution of the characteristic that change occurs. To simulate the overall change in graduation rates, we use the estimates from the ELS:2002 and the covariates in the NELS:88 to generate a predicted probability of graduation. Generating how much of the overall change is due to changes in all characteristics simply compares the predicted graduation rates using NELS:88 covariates combined with the estimated coefficients from the ELS:2002 to the actual graduation rates in the ELS:2002.

However, we also wish to examine the effect of a particular x_j, which is not as straightforward. In principle, we would like to generate the distribution of a particular x_j from the ELS:2002 sample (i.e. the later cohort) in the NELS:88 sample (i.e. the early cohort) while holding all other variables constant. We follow BLT and do this by matching observations across samples. We will use an example to illustrate this point—math test score percentile. For all students in NELS:88 we assign each student a rank in the distribution of math test scores; we also do this for all students in ELS:2002. We then match each student in the ELS:2002 with the student who has the same rank in the NELS:88 and assign the test score percentile from the NELS:88. We break ties randomly. This process ensures that we do not assign students with

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high math scores with students who we would expect to go to have low math scores.[22] After matching, we then apply the estimates from the ELS:2002 model and see how predicted graduation probabilities change.[23]

   To interpret these changes causally, we must assume that the logit model of graduation on x_j accurately captures the causal effect and the relationship between the x_j and graduation is the same in both time periods. This is a strong assumption that may not hold. However, even if this strong assumption does not hold, this framework developed in BLT offers a consistent way to decompose the changes in the graduation rate into the changes in x_j.

   The coefficients from the logit for the whole sample and by school type are presented in Table A2 in the Appendix with ELS:2002 in Panel A and NELS:88 presented in Panel B. We do not discuss these in detail but do note that the coefficients have the expected sign. In particular, a higher student-faculty ratio, lower income, being male, and lower parental educational attainment are associated with reduced probability of graduation.

6. Results

We first start with our base specification which includes measures of student preparedness, the log of the student-faculty ratio and initial school type in Table 4. This is the same specification used in BLT for comparability. It decomposes the change in graduation rates into two main groups. First, we consider changes due to student characteristics (demand side) which include math percentile and other student characteristics such as parent education, income, and race. Second, we present changes due to institution-level factors (supply side) which includes student-faculty ratios and initial school types.

   Focusing on the full sample, there is a 3.76 percentage point increase in the probability of graduation from the NELS:88 cohort to the ELS:2002 cohort. The total explained by observable characteristics is -1.96. This suggests that covariates would predict that graduation rates would

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[22] We also reweight ELS:2002 and NELS:88 to have the same number of observations to facilitate matching. For initial college enrolled there is not a natural ranking of school types and so we use propensity score matching to predict which college a student would attend. Following BLT, we used propensity score matching implemented with the STATA module "psmatch2."

[23] Alternatively, we could use the estimates from NELS:88 and distribution of the covariates from ELS:2002. These results are very similar to those presented in the paper.

decrease by 1.96 percentage points. Hence, the residual or unexplained change is 5.73 percentage points or 152 percent of the change is unexplained by covariates. Student preparedness would predict a decline in graduation rates of 1.26 percentage points. Student-faculty ratios explain a 0.28 percentage point decline and initial school type explains a 0.01 percentage point increase in graduation rates.

Based on the full sample, Table 4 shows that the distribution of student characteristics and supply side factors cannot explain much of the increase in graduation rate—in fact, they predict graduation declines. This finding was previewed in Section 3 where many of the trends that may affect graduation went in the wrong direction to explain completion rate trends. Hence, we spend the rest of the paper exploring explanations not considered in BLT.

One reason that previous explanations no longer explain the change in graduation rates is that the covariates are no longer predictive of graduation. However, Appendix Table A2 reports the coefficients for various covariates. All have the expected sign and are statistically significant. Further, the coefficients are qualitatively similar across the samples.

6.1 Changing Standards for Degree Receipt

In section 3 we previewed a potential change that could explain increasing graduation rates despite the changes in student preparation and other covariates—standards for degree receipt. If degrees have less stringent requirements, graduation rates could increase in the face of declining student preparedness. Unfortunately, this mechanism is difficult to directly test. Ideally, there would be a panel containing a measure of the standards of degree receipt. Such a measure could include hours spent studying, content covered, measures of students learning, among other items. However, even if such a panel existed, each of these measures is less than ideal.

We develop an indirect measure for changing standards for degree receipt that focuses on GPA. We document several things about GPA. First, GPA predicts graduation. Second, GPAs are increasing over the time frame considered. Third, the growth in GPAs is not well explained by student observable characteristics. These facts combined with trends in student study time and employment suggest that standards for degree receipt have changed.

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GPA predicts graduation

First year college GPA is predictive of graduation. Table 5 presents the coefficients from a linear probability model where graduation is predicted using a linear effect of GPA. We run these regressions separately in NELS:88 and ELS:2002. The relationship between GPA and graduation rate is very similar so we focus on NELS:88 in our discussion. Without controlling for any other covariates, a one unit increase in GPA is associated with a 30 percentage point increase in the probability of graduation. After controlling for student characteristics, an increase in GPA of 1 point is associated with an approximately 24 percentage point increase in graduation (standard error 1 percentage point). We also control for the graduation rate of the major that students chose as well as major fixed effects and find that GPA is still highly predictive of college graduation and very statistically significant.

We show that this relationship is somewhat nonlinear in Figure A2. We regress graduation on bins of GPA while controlling for covariates including demographics, test scores, and institution type and plot the coefficients and 95% confidence intervals with GPAs larger than 3.5 being the excluded category. The change in the probability of graduation is largest for GPAs between 1.0 to 2.5. That is, improvements in GPAs in that range correlate with meaningful increases in graduation whereas GPAs above or below that range do not change the probability of graduation as much.

GPAs are increasing over time

Table 3 showed that average GPAs increased from 2.44 to 2.65 among college attendees. We explore this change in GPA in more detail—where did GPAs increase the most? Figure 4 shows that GPAs increased throughout the distribution for the full sample and when only considering four-year schools. This is true when considering school types separately as shown in Appendix Figure A3. Appendix Table A3 shows the cumulative density function of GPAs for the full sample and reveals that 11 percent more students have a GPA above a 2.0 in ELS:2002 than in NELS:88. This point is notable because many institutions have rules about academic

probation requiring GPAs of around 2.0 to continue enrollment.[24] Hence, the changes in GPA occurred where GPA is most predictive of changes in graduation.

Higher GPAs are not explained by changes in student characteristics

GPAs are increasing over time and are not well-explained by changes in student characteristics. We test this by regressing GPA on math score, demographic characteristics, initial school type, and an indicator for being in the later period (being in ELS:2002) in Table 6. If student characteristics changed in ways that predicted the change in GPA, the ELS:2002 indicator would become smaller with the additional controls. However, additional controls do not change the effect of GPA substantively and there is a meaningful and statistically significant coefficient on ELS ranging from 0.20 to 0.30 indicating that GPA is higher in ELS. We interpret this evidence as the increase in GPA being unexplained by demographics, preparation, or school type. Put another way, equally prepared students with the same family income, parental education, gender, and institution type have higher GPAs in ELS:2002 than their counterparts in NELS:88.

Interpreting these facts about GPA

We have documented that GPAs are higher at the end of our study period than they were at the beginning and that the increase is not explained by observable student characteristics. We interpret this evidence as consistent with decreasing standards for degree receipt. However, other explanations are consistent with higher GPAs. For instance, students could be studying more. Unfortunately, we do not observe student study time or effort in our data. However, the trends presented in Babcock and Marks (2011) suggest that time spent studying declined over this period. Another explanation is that perhaps students are more efficient at studying. This could be true but is hard to test absent measures of student study. The gains from efficiency would have to be large enough to exceed the decline in study time.

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[24] This can also be true for Satisfactory Academic Progress which is required to maintain financial aid eligibility (Schudde and Scott-Clayton, 2016). GPA can also act as a signal about a student's suitability for college (Arcidiacono et al., 2016).

Adding GPA to the decomposition

Given the evidence that GPA is changing over time and that GPA is predictive of graduation, we show how much of the change in graduation rates can be explained by changes in GPA. We add GPA to the decomposition exercise since it is increasing over time and predictive of graduation. We note that this is a "bad control" because it is endogenous to the type of college a student attends among other things. We include it in the decomposition analysis in the spirit of looking for a mediator rather than interpreting the effects of changing GPA causally. Table 7 presents the same decomposition exercise with one notable change to the specification used by BLT—the inclusion of first year GPA. The addition of GPA substantially increases the change in graduation rate due to observables. For the full sample, the change due to observables (including first year GPA) is 2.45 percentage points or 65 percent of the total change. The change explained by GPA alone is 3.57 or 95 percent of the observed change. The total change due to observables grows substantially with the inclusion of GPA at all schools. At public non-top 50s (the largest category) observables explain 56 percent of the change in graduation. First year GPA is an imperfect proxy for changing standards of degree receipt but still explains a substantial portion of the observed change.

6.3 Major Choice and Other Explanations

We also investigate changes in student's major. Trends in student's major choice could affect college graduation rates if students have moved to majors with higher graduation rates. To isolate the effect of major choice, we fix major graduation rates at what they were in NELS:88 and apply them to the actual major choices made in ELS:2002. We find that predicted graduation rates and actual graduation rates are very similar. In results not presented, we add a student's major graduation rate to the decomposition and we assign students the graduation rate for their chosen major in NELS:88.[25]

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[25] For students who start at two-year colleges we do not assign major-specific graduation rates for two reasons. First, there are not that many students and so calculation of graduation rates is noisy. Second, majors are sufficiently different across two- and four-year schools that we do not want to combine the graduation rates at these types of institutions. Hence, we do not consider two-year schools in this table.

Another potential explanation for our results is that colleges may have increased their focus on graduation rates by increasing programs and funding for student success initiatives. This is a difficult mechanism to test for, however we examine this hypothesis. First, we look at staff expenditures using data from IPEDS. Institutions report the spending of "other professional staff" "for the primary purpose of performing academic support, student service, and institutional support. This measure likely includes staff working on student success initiatives but also includes things that are unlikely to be related to student success. Trends in this variable can be seen in Appendix Table A1. Overall, spending on support programs cannot explain much of the increase in graduation rates because they are largely the same across cohorts.

7. Discussion and Conclusion

In this paper we carefully document that college graduation rates have increased from the 1990s to 2010. This represents a change in the pattern documented by BLT. In contrast to BLT, we do not find that traditional measures of student characteristics or colleges explain much of the change in graduation rates. Rather, we show that student GPAs increased over this time period and that this change can explain much of the increase in graduation rates.

We present evidence that the increase in GPA is not explained by observable student or institution characteristics. Combined with existing work on trends in student study, college preparation, labor supply, the price of college, and resources per student, our evidence suggests that standards for degree receipt have changed.

Why did standards for degrees change from the 1990s to 2010? It is hard to know for sure, but the recent policy focus on college completion rates seems a likely candidate. As schools face increased scrutiny and, in some cases, increased funding incentives, they may be responding by increasing graduation rates. The lowest cost way to increase graduation rates is through changing standards of degree receipt. In support of this interpretation, the increase in graduation rates is concentrated at public schools who have seen more of their funding tied to

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graduation. Further, spending per student declined suggesting that colleges did not increase spending to help students graduate.

Our findings have interesting implications for the returns to college degrees and the increasing college wage premium, as well as for models of human capital or signaling. In either a human capital or signaling model of education, declining standards of degree receipt would predict a declining college wage premium. Our work may explain some of the decline in the college wage premium that has been observed. In particular, this research suggests that concurrent with the decline in standards for degree receipt, there was a demand shock for college-educated labor that has been well documented in several places (Autor, Katz, and Kearney 2008).

Future work should consider the implications that changing standards for degree receipt has on other aspects of higher education such as choice of major, the skill composition of the workforce, and the decision to enroll in graduate school.

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Figures and Tables

Figure 1: Ratio of BA / Some College among 25 year-olds
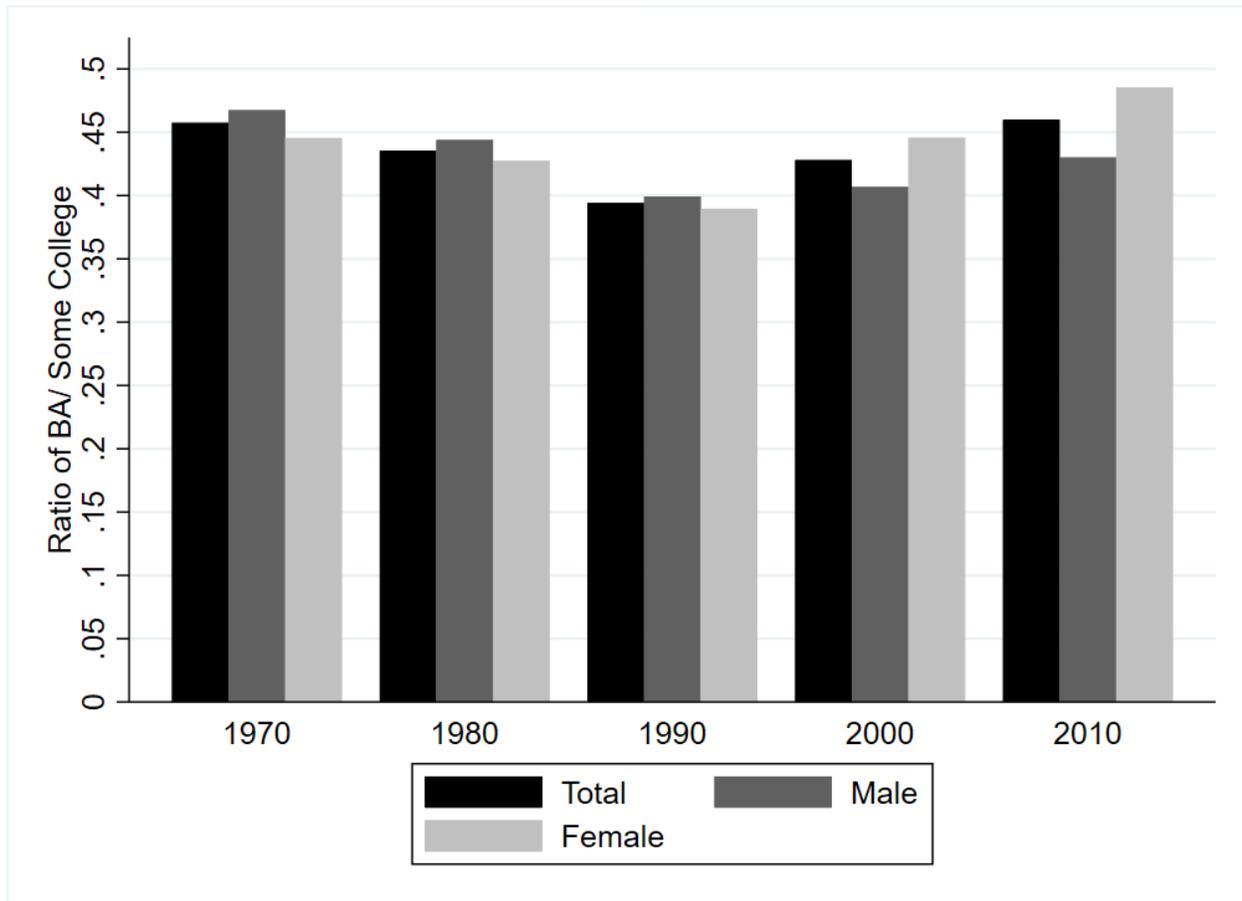
Notes: Data come from the decennial census downloaded from the Integrated Public Use Microdata series database at IPUMS USA. Following BLT, we calculated the ratio of 25-year-olds having a bachelor's degree to 25-year-olds with at least some college completed.

Figure 2 Graduate Rates by College Sector
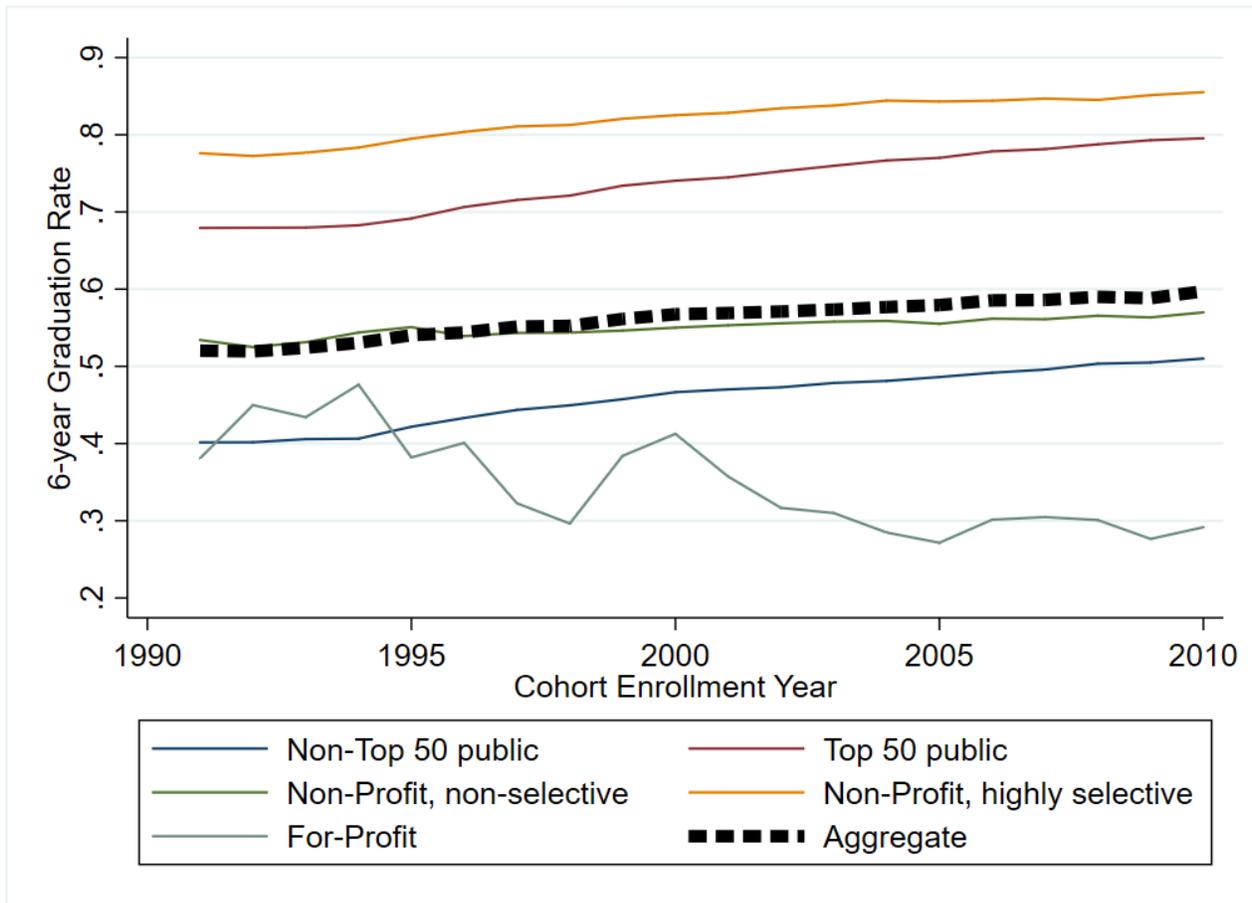
Note: Source: IPEDS. This figure plots the average six-year graduation rate for different institution types. Cohort enrollment year refers to the year that students were first enrolled. See Section 4 in the text for a detailed description of how institutions are assigned to a type. Schools that were predominantly online are excluded for all cohorts. These rates were calculated using only students who were full-time, first-time degree seekers in their respective entry years.

Figure 3: College Enrollment Rates, Recent High School Completers
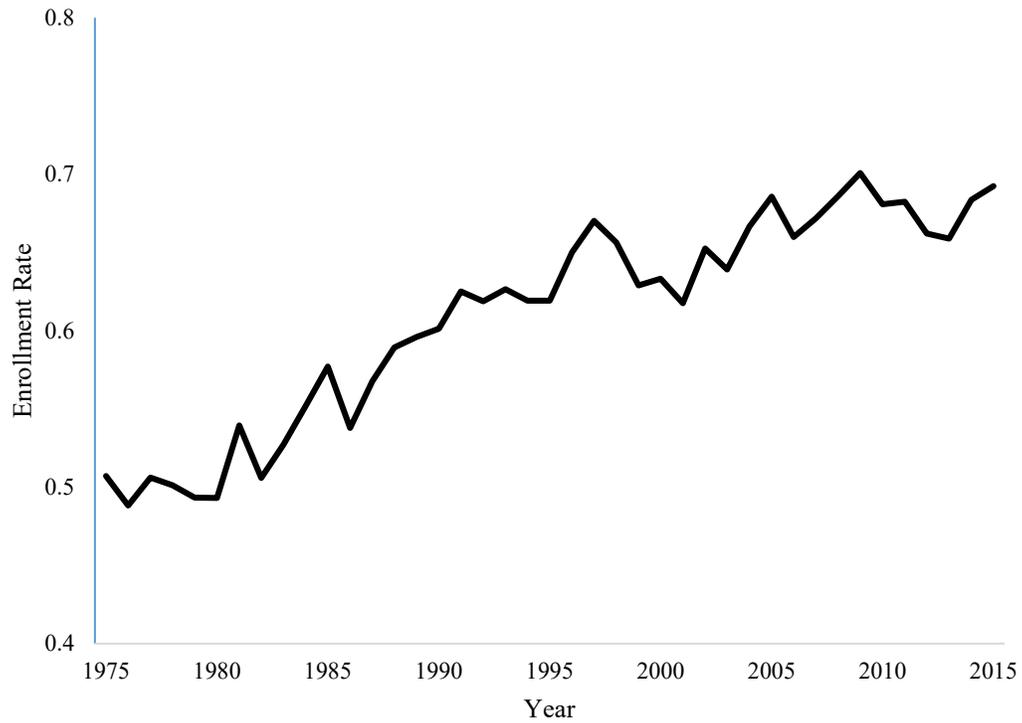
Note: The data comes from NCES Digest of Education Statistics Table 302.30 (National Center for Education Statistics 2018). This is the fraction of individuals age 16-24 enrolled in college as of October who recently graduated from high school or completed a GED. Enrollment is defined as enrollment in college as of October. Source: U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October, 1975 through 2015.

Figure 4: Distribution of GPA

A. Full Sample
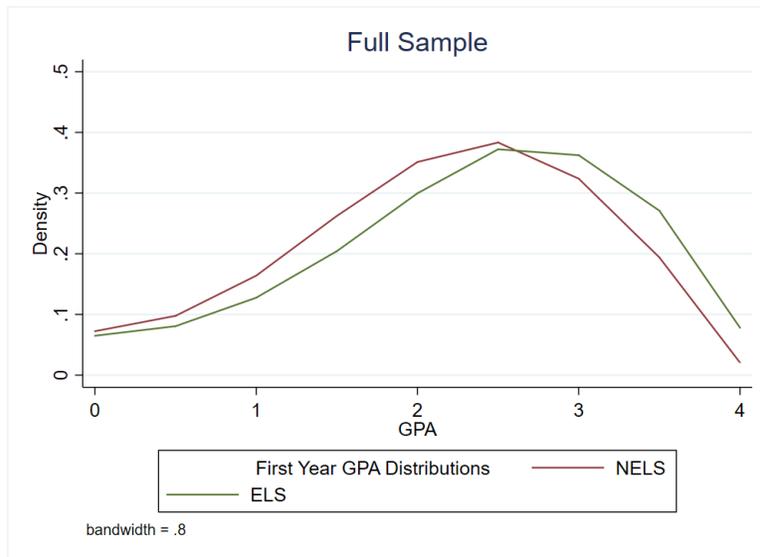
B. 4 Year Institutions
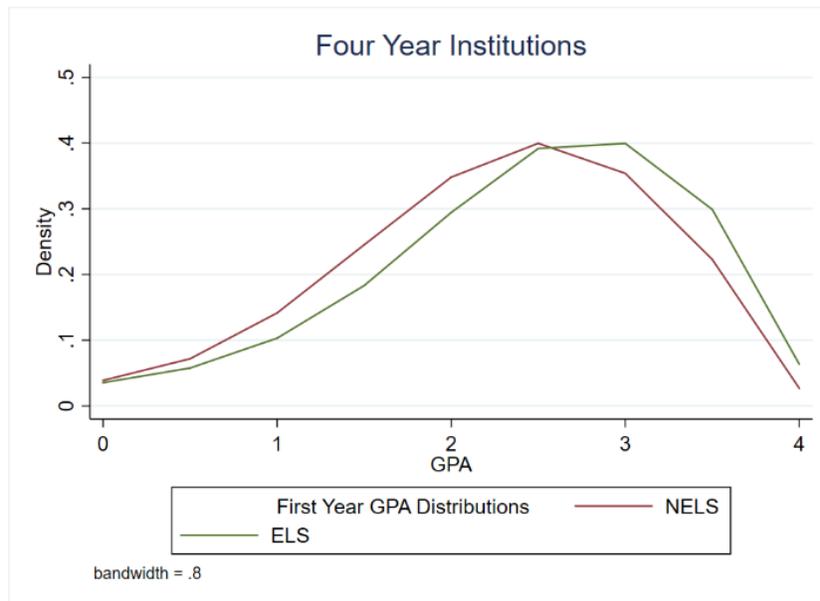
Notes: This plots a smoothed pdf of GPAs from NELS:88 and ELS:2002. Panel A Shows the full sample whereas Panel B only shows the distribution of GPA for four-year instiuttions

Table 1: Changes in College Graduation Rates

Sample	NELS:88	ELS:2002	Difference
Full Sample	48.7	52.5	3.76**
			(1.71)
Initial Institution Type			
Total Four-year Public	63.2	67.7	4.52*
			(2.38)
Non-top 50 Public	56.1	61.0	4.93*
			(2.59)
Top 50 Public	82.1	90.7	8.57***
			(2.57)
Total Four-year Private	78.4	77.2	-1.14
			(2.30)
Less Selective Private	72.3	71.2	-1.05
			(2.96)
Highly Selective Private	90.5	92.2	1.66
			(2.76)
Total Community College	19.5	24.3	4.81***
			(1.70)
For-Profit College	25.2	24.7	-0.42
			(8.92)
All Non-Profit Colleges	48.8	53.0	4.18**
			(1.72)
All Four-Year Colleges	68.3	70.6	2.33
			(1.85)

Note: This table describes the graduation rates for college enrollees by school types for the NELS:88 and ELS:2002.

Table 2: Changes in Initial College Attended

	NELS:88 Cohort			ELS:2002 Cohort		
	Total	Men	Women	Total	Men	Women
Percent of HS grads Attending College	69.3	66.9	71.8	78.3	74.2	84.1
Distribution of Enrollment by Type of Institution						
Total 4-year Public	39.9	39.7	40.1	42.2	42.7	41.7
Non-top 50 Public	28.9	28.3	29.6	32.6	33.2	32.1
Top 50 Public	10.9	11.4	10.5	9.6	9.4	9.6
Total 4-year Private	20.0	18.0	21.8	18.4	18.0	18.8
Less Selective Private	13.3	11.4	15.1	13.2	12.2	14.0
Highly Selective Private	6.7	6.7	6.7	5.2	5.8	4.7
Total Community College	39.8	41.8	37.9	37.2	36.6	37.6
For Profit Colleges	0.4	0.5	0.3	2.3	2.7	1.9

Note: This table describes the change in the fraction of students attending college within two years of expected high school graduation and initial college attended for the NELS:88 and ELS:2002.

Table 3: Summary Statistics NELS:88 and ELS:2002

Variable	All College Attendees		BA Recipients	
	NELS:88	ELS:2002	NELS:88	ELS:2002
Bottom Math Quartile	0.14	0.18	0.04	0.06
Second Math Quartile	0.23	0.24	0.16	0.18
Third Math Quartile	0.29	0.28	0.29	0.31
Top Math Quartile	0.33	0.30	0.51	0.45
Math Test Percentile	58.88	55.92	71.12	67.67
Student-Faculty Ratio	39.35	40.44	29.70	32.11
ln(S/F ratio)	3.52	3.55	3.28	3.55
Missing S/F Ratio	0.03	0.02	0.01	0.01
Student-Staff Ratio	199.55	197.22	105.70	120.12
First Year GPA	2.44	2.65	2.88	3.05
Major Graduation Rate (4-year schools)	0.76	0.76	0.77	0.77
Father's Education:				
No HS	0.11	0.10	0.06	0.06
HS Diploma	0.29	0.28	0.21	0.22
Some College	0.22	0.22	0.22	0.21
BA	0.20	0.23	0.25	0.28
Grad School	0.18	0.17	0.27	0.24
Mother's Education:				
No HS	0.10	0.09	0.05	0.05
HS Diploma	0.34	0.28	0.26	0.23
Some College	0.25	0.26	0.27	0.25
BA	0.18	0.23	0.25	0.28
Grad School	0.12	0.15	0.18	0.19

Parental Income:					
	<10000/15000	0.06	0.06	0.03	0.04
	<20000/25000	0.10	0.09	0.06	0.06
	<25000/35000	0.07	0.11	0.06	0.07
	<35000/50000	0.13	0.18	0.10	0.16
	<50000/75000	0.22	0.23	0.20	0.23
	>50000/75000	0.42	0.33	0.55	0.44
Race/Ethnicity:					
	Asian	0.05	0.04	0.06	0.06
	Hispanic	0.10	0.12	0.06	0.07
	African American	0.11	0.11	0.07	0.08
	White	0.75	0.73	0.81	0.79
Male		0.49	0.46	0.45	0.44
Number of Observations		7770	8650	4110	4970

Note: This table presents summary statistics from NELS:88 and ELS:2002 for college enrollees and graduates. The number of observations is rounded to the nearest 10 to comply with the data use agreement.

Table 4: Decomposition Exercise, Changes in College Graduation, BLT Specification

	Full Sample	Public non-top 50	Public top 50	Private Less Selective	Private Highly Selective	Community College	For-Profit Schools
NELS:88	48.71	56.08	82.15	72.26	90.50	19.53	25.15
ELS:2002	52.47	61.01	90.71	71.21	92.16	24.34	24.73
Total Change	3.76	4.93	8.57	-1.05	1.66	4.81	-0.42
Change due to Observables	-1.96	-4.43	-0.41	-0.64	3.73	-0.85	9.55
Change due to Student Characteristics	-1.69	-2.61	-0.42	-0.66	2.81	-0.88	9.55
Math Test Percentile	-1.26	-2.03	0.15	-0.78	0.26	-0.96	0.26
Other Student Characteristics	-0.43	-0.58	-0.56	0.13	2.55	0.08	9.28
Change due to Supply-Side Factors	-0.27	-1.82	0.00	0.02	0.92	0.03	0.00
Student/Faculty Ratios	-0.28	-1.82	0.00	0.02	0.92	0.03	0.00
Initial School Types	0.01						
Residual	5.73	9.36	8.98	-0.41	-2.07	5.66	-9.97

Notes: These differences were created by finding the difference between observed ELS:2002 graduation rates and simulated ELS:2002 graduation rates using distributions of NELS:88 variables. Change due to observables uses the NELS:88 distribution for all observable variables. Change due to math test percentile uses the NELS:88 distribution for only math test percentile, and observed ELS:2002 distributions for all other observable variables. Similarly, change due to student-faculty ratios and initial school types use the NELS:88 distribution for only student-faculty ratios and initial school types, respectively. The change due to supply-side factors is the sum of change due to student-faculty ratios and change due to initial school types. The change due to student characteristics is the difference between change due to observables and change due to supply side factors. The change due to other characteristics is the difference between change due to student characteristics and the change due to math test percentile. The residual is the difference between the total change and the difference due to observables.

Table 5: Relationship between Graduation and GPA

	NELS:88	ELS:2002	NELS:88	ELS:2002	NELS:88	ELS:2002	NELS:88	ELS:2002
GPA	0.30	0.27	0.24	0.22	0.24	0.22	0.23	0.20
	(0.009)	(0.007)	(0.0105)	(0.009)	(0.010)	(0.009)	(0.013)	(0.012)
Student Characteristics			X	X	X	X	X	X
Major Graduation Rates					X	X		
Major Fixed Effects							X	X
Means of Variables								
GPA	N/A	N/A	2.59	2.80	2.59	2.80	2.59	2.80
Predicted GPA	N/A	N/A	2.87	N/A	2.87	N/A	3.00	N/A
Residual	N/A	N/A	0.27	N/A	0.27	N/A	0.29	N/A

Note: This table reports the effect of an increase in first year GPA on graduation. Further, it describes the difference in actual GPA across the NELS:88 and ELS:2002. The regressions are run separately in NELS:88 and ELS:2002. Student characteristics include indicators for parent education, parent income, race, and gender as well as the percentile of math test scores. Graduation rates controls for the graduation rate of a student's major and major fixed effects are fixed effects for a student's choice of major.

Table 6: GPA Differences

|	First Year GPA			
Coefficient on ELS Indicator	0.20	0.28	0.28	0.30
	(0.024)	(0.020)	(0.021)	(0.021)
Student Characteristics		X	X	X
Major Graduation Rate			X	
Major Fixed Effects				X

Notes: This shows the coefficient on an indicator for an observation being ELS:2002. Student characteristics include indicators for parent education, parent income, race, and gender as well as the percentile of math test scores. Graduation rates controls for the graduation rate of a student's major and major fixed effects are fixed effects for a student's choice of major.

Table 7: Decomposition Exercise, Changes in College Graduation, BLT + First Year Grades

	Full Sample	Public non-top 50	Public top 50	Private Less selective	Private Highly Selective	Community College	For-Profit Schools
NELS:88	48.71	56.08	82.15	72.26	90.50	19.53	25.15
ELS:2002	52.47	61.01	90.71	71.21	92.16	24.34	24.73
Total Change	3.76	4.93	8.57	-1.05	1.66	4.81	-0.42
Change due to Observables	2.45	2.75	2.42	2.71	5.88	2.53	3.25
Change due to Student Characteristics	-0.96	-1.65	-0.87	-0.04	2.40	-0.44	7.09
Math Test Percentile	-0.75	-1.12	0.07	-0.30	0.06	-0.65	0.32
Other Student Characteristics	-0.21	-0.53	-0.94	0.26	2.33	0.21	6.77
Change due to Supply-Side Factors	-0.16	-1.68	0.00	0.00	0.69	0.09	-0.13
Student/Faculty Ratios	-0.20	-1.68	0.00	0.00	0.69	0.09	-0.13
Initial School Types	0.04						
Change due to GPA	3.57	6.08	3.28	2.75	2.79	2.88	-3.71
Residual	1.32	2.18	6.15	-3.76	-4.22	2.28	-3.67

Notes: These differences were found in the same way as the differences in Table 4, but adding another counterfactual ELS:2002 graduation rate using the NELS:88 distribution for GPA and using all other ELS:2002 observables. Furthermore, the change due to other characteristics is found by subtracting change due to GPA and change due to supply-side factors from change due to observables.

Appendix

Figure A1: Total Number of Enrollees by Sector
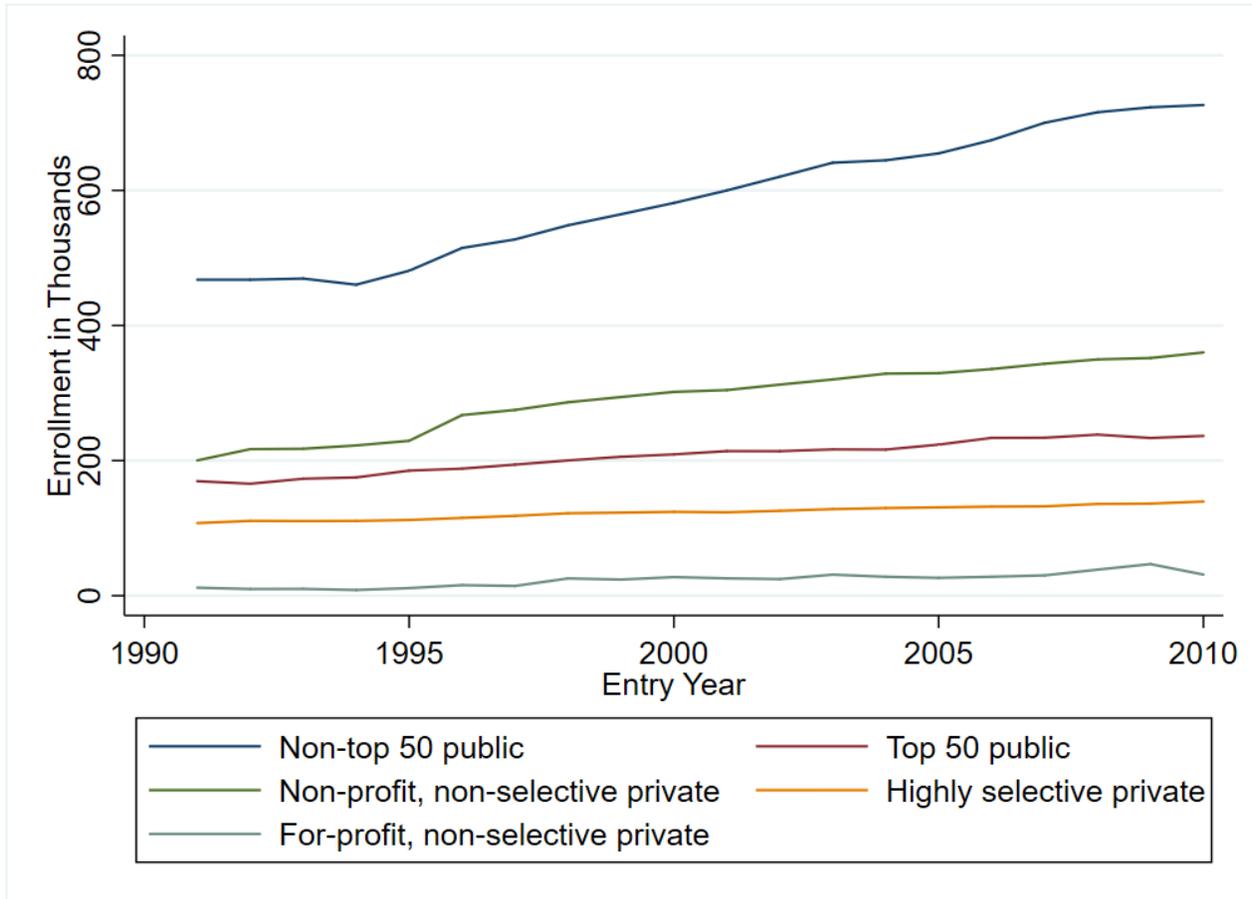
Source: IPEDS. This figure plots the total number of students enrolled by institution type. It shows the average six-year graduation rate for different institution types. Cohort enrollment year refers to the year that students were first enrolled. See Section 4 in the text for a detailed description of how institutions are assigned to a type. Schools that were predominantly online are excluded for all cohorts. These totals were calculated only using students who were first-time, full-time degree seeking students in their respective entry years.

Figure A2

A. Nonlinear relationship between GPA and graduation, ELS
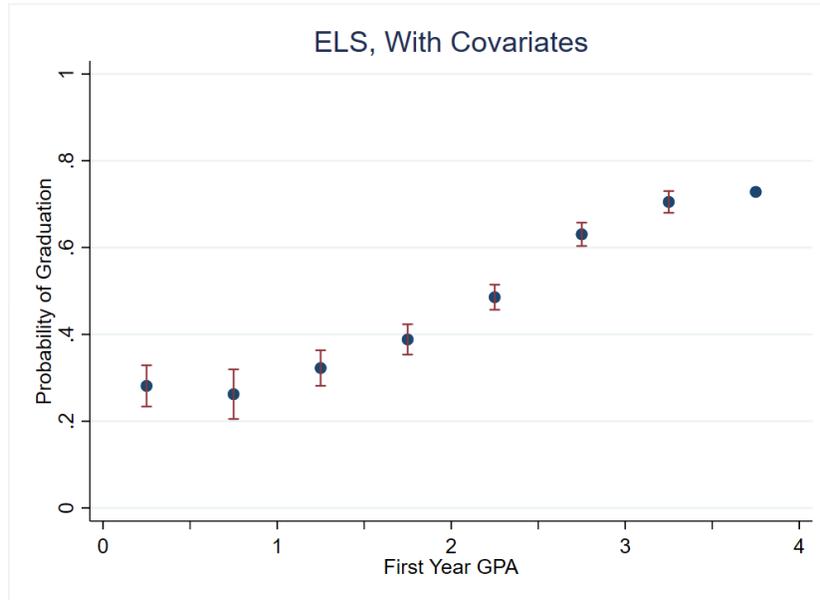
B. Nonlinear relationship between GPA and graduation, NELS
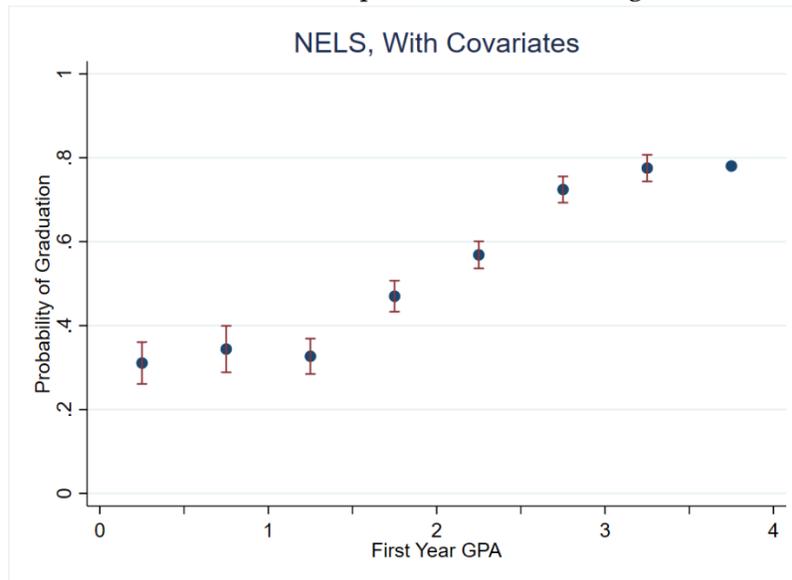
Note: This shows the relationship between GPA and graduation. Each of the point represents the coefficient on an indicator for GPA window (0 to .5, .5 to 1, …) The top bin is calculated using the constant in that regression. Student characteristics including gender, race, family income, and math test scores are controlled for in these regressions.

Figure A3

Notes: This plots a smoothed pdf of GPAs from NELS:88 and ELS:2002 separately by institution type.

A. Public Top 50
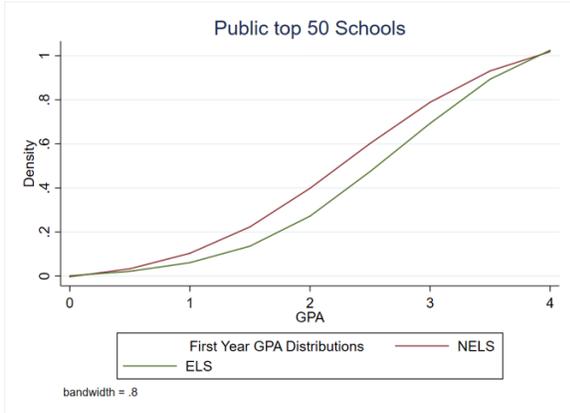
D. Private Less Selective
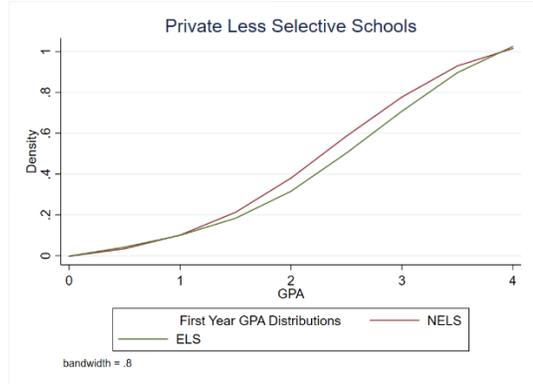
B. Public Non Top 50
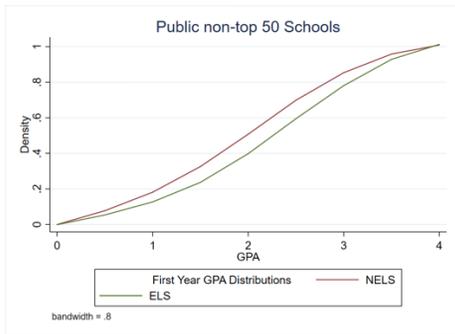
E. Community College
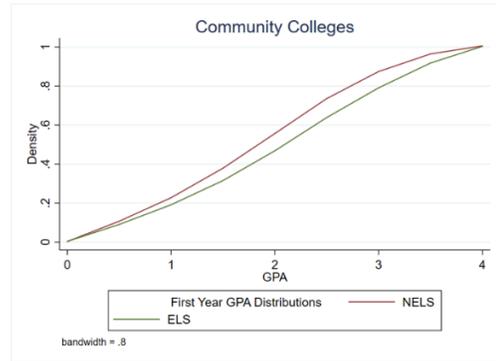
C. Private Selective
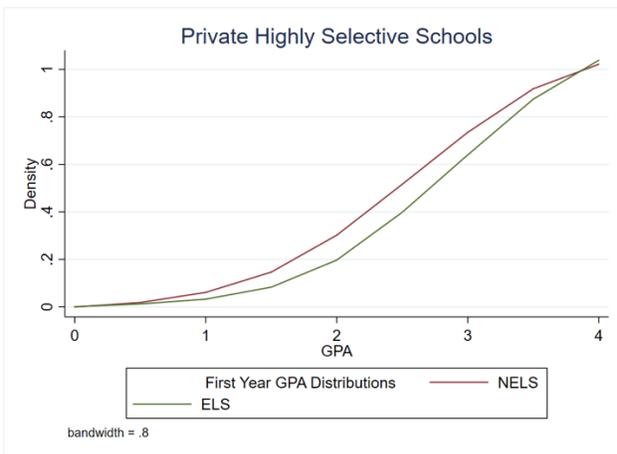
F. For Profit
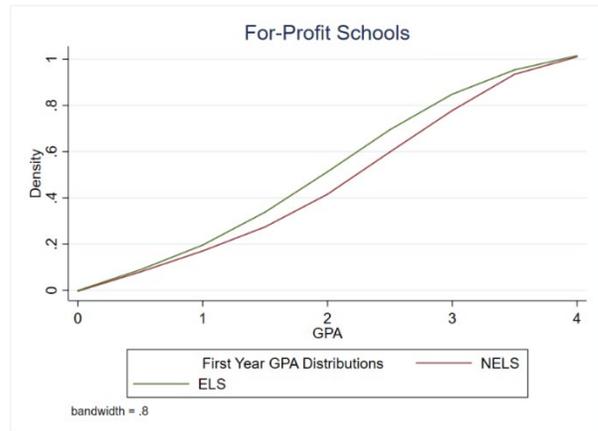
Table A1: College Resources

Panel A: Full Sample

Survey	Student-Faculty Ratios					Mean Instructional Expenditures per Student	Mean Service Expenditures per Student
	Mean	25th	50th	75th	90th		
			Percentile				
NELS:88	39.4	22.7	30.3	50.5	76.4	$4,581	$796
ELS:2002	40.4	23.6	31.7	52.6	77.8	$4,287	$806

Panel B: Public 4-Year Non-top 50

Survey	Student-Faculty Ratios					Mean Instructional Expenditures per Student	Mean Service Expenditures per Student
	Mean	25th	50th	75th	90th		
			Percentile				
NELS:88	29.0	24.1	27.9	33.2	38.7	$5,185	$828
ELS:2002	32.9	24.9	28.8	34.5	46.5	$4,728	$822

Panel C: Public 4-year Top 50

Survey	Student-Faculty Ratios					Mean Instructional Expenditures per Student	Mean Service Expenditures per Student
	Mean	25th	50th	75th	90th		
			Percentile				
NELS:88	22.7	20.7	22.2	25.2	26.3	$9,716	$922
ELS:2002	22.7	20.0	22.2	25.3	28.5	$9,681	$1,093

Panel D: Private 4-year Less Selective

| Survey	Student-Faculty Ratios					Mean Instructional Expenditures per Student	Mean Service Expenditures per Student
	Mean	25th	50th	75th	90th		
			Percentile				
NELS:88	24.0	17.1	20.7	26.5	35.6	$5,763	$1,820
ELS:2002	23.8	16.9	21.5	27.4	35.6	$6,681	$2,365

Panel E: Private 4-year Highly Selective

Survey	Student-Faculty Ratios					Mean Instructional Expenditures per Student	Mean Service Expenditures per Student
	Mean	25th	50th	75th	90th		
			Percentile				
NELS:88	19.6	13.8	19.1	23.6	27.3	$14,747	$2,245
ELS:2002	18.3	12.3	18.1	23.5	26.3	$15,900	$2,815

Panel F: 2-Year

Survey	Student-Faculty Ratios					Mean Instructional Expenditures per Student	Mean Service Expenditures per Student
	Mean	25th	50th	75th	90th		
			Percentile				
NELS:88	60.6	41.0	59.3	76.4	91.1	$2,683	$552
ELS:2002	60.9	43.5	59.4	76.3	90.1	$2,467	$555

	Panel G: For-Profit						
	Student-Faculty Ratios					**Mean Instructional Expenditures per Student**	**Mean Service Expenditures per Student**
			Percentile				
Survey	Mean	25th	50th	75th	90th		
NELS:88	42.0	31.6	42.2	44.4	62.2	$3,319	N/A
ELS:2002	43.9	31.3	36.7	59.1	74.8	$3,417	N/A

Note: This table describes the school resources by college type in the NELS:88 and ELS:2002.

Table A2: Predicting College Graduation

Panel A: ELS:2002

Panel A: NELS:88

	Full Sample	Public non-top 50	Public top 50	Private less selective	Private highly selective	Community College
First Year College GPA	1.080	1.255	1.435	1.441	1.813	0.800
	(0.06)	(0.09)	(0.27)	(0.17)	(0.43)	(0.08)
Ln(student/faculty)	-0.391	-1.122	0.026	-0.568	-1.776	0.270
	(0.12)	(0.21)	(0.93)	(0.38)	(0.81)	(0.18)
Missing(student/faculty)	-3.013	-3.248	0.000	-3.365	0.000	-1.295
	(0.78)	(1.73)	(.)	(1.73)	(.)	(1.30)
Math percentile	0.016	0.014	0.020	0.012	0.004	0.017
	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.00)
Missing(student/faculty)x(math percentile)	0.027	0.007	0.000	-0.001	0.000	0.047
	(0.01)	(0.04)	(.)	(0.02)	(.)	(0.02)
Income 20,000/25,000	0.114	0.146	-1.444	-0.621	0.309	0.434
	(0.18)	(0.31)	(0.79)	(0.58)	(1.76)	(0.29)
Income 25,000/35,000	-0.297	-0.231	-1.139	-0.725	1.199	-0.243
	(0.18)	(0.30)	(0.75)	(0.55)	(0.96)	(0.32)
Income 35,000/50,000	0.034	-0.022	-0.796	-0.569	0.961	0.303
	(0.17)	(0.28)	(0.60)	(0.52)	(1.00)	(0.28)
Income 50,000/75,000	0.114	0.091	-0.893	-0.929	0.229	0.505
	(0.17)	(0.28)	(0.77)	(0.53)	(0.65)	(0.28)
Income 50,000+/75,000+	0.448	0.487	-0.495	-0.096	N/A	0.612
	(0.17)	(0.27)	(0.71)	(0.53)	N/A	(0.28)

Father HS diploma	-0.014	0.064	0.138	-0.179	2.014	-0.082
	(0.16)	(0.27)	(1.05)	(0.47)	(2.25)	(0.29)
Father some college	0.133	0.045	0.533	0.402	1.798	0.049
	(0.16)	(0.29)	(1.09)	(0.47)	(2.70)	(0.26)
Father BA	0.338	0.410	0.987	0.211	2.839	0.187
	(0.18)	(0.27)	(1.20)	(0.53)	(2.42)	(0.29)
Father graduate school	0.434	0.264	1.258	0.475	2.814	0.383
	(0.18)	(0.32)	(1.19)	(0.55)	(2.45)	(0.28)
Mother HS diploma	0.229	0.051	-0.081	0.989	-0.669	0.211
	(0.17)	(0.28)	(0.86)	(0.50)	(2.36)	(0.27)
Mother some college	0.375	0.190	-0.525	0.854	-0.206	0.502
	(0.16)	(0.27)	(0.84)	(0.53)	(2.10)	(0.25)
Mother BA	0.466	0.180	-0.708	1.484	-0.997	0.622
	(0.18)	(0.29)	(1.06)	(0.54)	(2.11)	(0.29)
Mother graduate school	0.383	0.180	-1.384	1.411	-0.160	0.414
	(0.19)	(0.29)	(1.00)	(0.54)	(2.23)	(0.31)
Asian	0.633	0.713	-0.192	0.337	0.648	0.641
	(0.13)	(0.19)	(0.35)	(0.42)	(1.02)	(0.20)
Hispanic	-0.024	0.004	1.017	-0.043	1.511	-0.226
	(0.12)	(0.21)	(0.81)	(0.36)	(1.37)	(0.17)
Black	0.024	-0.033	1.508	-0.548	-1.668	0.153
	(0.12)	(0.18)	(0.49)	(0.31)	(0.81)	(0.22)
Male	-0.245	-0.122	-0.519	-0.341	-0.222	-0.258
	(0.08)	(0.13)	(0.46)	(0.25)	(0.48)	(0.12)
Public top 50	1.138					
	(0.20)					
Private less selective	0.089					
	(0.13)					

	Full Sample					
Private highly selective	0.846					
	(0.25)					
Community college	-1.222					
	(0.12)					
For-profit	-1.039					
	(0.27)					
Income <20,000/<25,000	N/A	N/A	N/A	N/A	0.000	N/A
	N/A	N/A	N/A	N/A	(.)	N/A
Constant	-2.486	-0.208	-2.177	-2.467	0.356	-5.806
	(0.50)	(0.85)	(3.09)	(1.63)	(2.86)	(0.80)

Panel B NELS:88

	Full Sample	Public non-top 50	Public top 50	Private less selective	Private highly selective	Community College
First Year College GPA	1.346	1.742	1.901	1.361	1.662	1.039
	(0.08)	(0.14)	(0.27)	(0.18)	(0.40)	(0.10)
Ln(student/faculty)	-0.571	-1.611	-1.977	-0.791	-0.129	-0.344
	(0.15)	(0.43)	(0.95)	(0.26)	(0.57)	(0.20)
Missing(student/faculty)	-3.941	-21.835	0.000	-5.859	0.000	-0.946
	(1.05)	(9.44)	(.)	(2.20)	(.)	(1.19)
Math percentile	0.013	0.005	0.018	0.010	0.005	0.020
	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.00)
Missing(student/faculty)x(math percentile)	0.010	0.188	0.000	0.047	0.000	-0.040
	(0.01)	(0.12)	(.)	(0.03)	(.)	(0.02)
Income 20,000/25,000	0.043	0.451	-0.616	-0.448	-0.994	-0.084

	(0.26)	(0.42)	(1.15)	(0.62)	(0.91)	(0.47)
Income 25,000/35,000	0.262	0.263	-0.644	-0.393	-1.049	0.648
	(0.33)	(0.44)	(0.97)	(0.70)	(1.24)	(0.61)
Income 35,000/50,000	0.271	0.501	-1.691	-0.043	-0.565	0.559
	(0.25)	(0.42)	(0.99)	(0.57)	(0.74)	(0.44)
Income 50,000/75,000	0.290	0.584	-0.551	0.032	-1.641	0.430
	(0.25)	(0.41)	(1.03)	(0.55)	(0.65)	(0.45)
Income 50,000+/75,000+	0.792	1.014	-0.763	0.402	N/A	1.030
	(0.24)	(0.41)	(0.94)	(0.56)	N/A	(0.43)
Father HS diploma	0.117	-0.028	0.435	0.313	-0.784	0.225
	(0.24)	(0.37)	(0.74)	(0.53)	(1.15)	(0.43)
Father some college	0.321	0.198	0.177	0.780	-1.329	0.373
	(0.22)	(0.38)	(0.71)	(0.64)	(1.30)	(0.38)
Father BA	0.449	0.607	0.483	0.430	-1.400	0.435
	(0.24)	(0.40)	(0.79)	(0.65)	(1.15)	(0.49)
Father graduate school	0.731	0.519	1.734	0.730	-1.547	1.010
	(0.25)	(0.40)	(0.84)	(0.71)	(1.21)	(0.43)
Mother HS diploma	0.014	0.143	-1.560	0.507	-0.157	-0.015
	(0.26)	(0.37)	(1.54)	(0.62)	(1.80)	(0.44)
Mother some college	0.193	0.338	-1.335	0.231	1.866	0.183
	(0.22)	(0.34)	(1.63)	(0.65)	(1.61)	(0.44)
Mother BA	0.217	0.256	-1.130	0.449	1.763	0.163
	(0.25)	(0.40)	(1.67)	(0.60)	(1.62)	(0.52)
Mother graduate school	0.153	0.137	-1.132	0.390	2.113	0.097
	(0.28)	(0.47)	(1.63)	(0.64)	(1.67)	(0.47)
Asian	0.461	0.005	0.379	-0.403	3.206	0.992
	(0.31)	(0.37)	(0.50)	(0.50)	(1.19)	(0.38)
Hispanic	-0.199	0.231	-0.370	-0.336	0.572	-0.407

	(0.17)	(0.33)	(0.51)	(0.54)	(0.95)	(0.25)
Black	0.018	-0.358	0.191	0.375	-0.758	0.224
	(0.22)	(0.29)	(0.46)	(0.35)	(1.00)	(0.46)
Male	-0.289	-0.514	-0.648	0.048	0.081	-0.191
	(0.10)	(0.16)	(0.30)	(0.22)	(0.53)	(0.16)
Public top 50	0.758					
	(0.15)					
Private less selective	0.322					
	(0.15)					
Private highly selective	0.876					
	(0.30)					
Community college	-1.208					
	(0.17)					
For-profit	-1.027					
	(0.57)					
Income <20,000/<25,000	N/A	N/A	N/A	N/A	1.248	N/A
	N/A	N/A	N/A	N/A	(1.42)	N/A
Constant	-2.593	0.362	3.613	-1.673	-1.887	-4.552
	(0.60)	(1.53)	(3.50)	(1.17)	(2.37)	(0.95)

Notes: This reports the coefficients on various predictors of college graduation for the entire sample and separately by school type. Panel A shows ELS:2002 and Panel B shows NELS:88

Table A3: CDF of GPA

Sample	GPA Thresholds							
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
NELS:88	0.07	0.14	0.25	0.47	0.70	0.89	0.99	1.00
ELS:2002	0.06	0.12	0.20	0.36	0.56	0.81	0.96	1.00

Notes: This shows the fraction of students with a GPA below each of the following thresholds separately by NELS:88 and ELS:2002.