Why Have College Completion Rates Increased?

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Abstract

In influential work, Bound, Lovenheim, and Turner (2010) showed that college completion rates declined from the 1970s to the 1990s and the majority of the decline was due to "supply side" reasons. We document that this trend has reversed--since the 1990s, college completion rates have increased. Next, we focus on 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 find support that standards for degree receipt may explain the change in graduation rates.

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, Forthcoming). Despite the large returns to college completion, many students who enroll in college do not graduate. In fact, in 2016, the six-year graduation rate for college completion at four-year schools was 67 percent. (Shapiro et al. 2017). Consequently, policy and research attention has increasingly focused on college completion (Scott-Clayton 2012; Castleman and Long 2016; Bettinger et al. 2016; Denning, Marx, Turner Forthcoming; Barr Forthcoming).

In influential work, Bound, Lovenheim, and Turner (2010) (hereafter BLT) showed that college completion rates declined from the 1970s to the 1990s. 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.[1]

BLT was highly influential in directing research over the next several years. First, researchers more readily acknowledged that most students attended colleges with low completion rates. Second, many papers explored the causal effect of institutions on completion (Cohodes and Goodman 2014; Zimmerman 2014; Goodman, Hurwitz, and Smith 2017). In a notable example, Cohodes and Goodman (2014) found a novel result—increased financial aid to public schools in Massachusetts *decreased* graduation rates. The authors concluded that the likely mechanism was that the scholarship increased enrollment at public schools in Massachusetts that had lower graduation rates than the schools that students would have otherwise attended. This negative result, as well as several positive results, highlight that college quality has a causal effect on student outcomes.

[1] The decline in graduation rates in BLT was driven by males. Further, the overall decline was largely due to the group of institutions that BLT refers to as public "non-top 50." We use their method of classifying institutions which we explain in Section 4. Bound, Lovenheim, and Turner (2012) also document that time to degree has increased over a similar time frame.

Our study asks what has happened to college completion rates in the 20 years after BLT's study period ends. First, we show in three data sets that aggregate trends have changed—college completion rates *increased* from 1990 to present. Completion rates also increased within school type (with one notable exception) and for men, who drove the decline documented in BLT.

Next, we investigate why college completion rates declined using 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). These data have information on student background, academic preparation, college enrollment, and graduation outcomes. We decompose the change in graduation rates into changes in student characteristics and institution-level factors. We find that student characteristics, institutional resources, and institution attended collectively explain little of the change in graduation rates.

We then explore alternative hypotheses to explain the increase in graduation rates. We document that student grade point averages are higher in the ELS:2002 than would be expected from the relationship between student characteristics and grades in NELS:88. We add student first year GPA into our decomposition which accounts for approximately sixty percent of the change in graduation rates. This fact combined with trends in studying, labor force participation in college, and financial aid 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

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

First, we use the decennial census to examine college graduation trends, following BLT. Figure 1 shows the ratio of bachelor's recipients to those with some college among respondents age 25. 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. Overall, the ratio changed from 0.407 to 0.460 with an increase of 0.084 for women and 0.018 for men.

In the period that BLT studies, there were no nation-wide 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. For Figure 2, we exclude schools that were predominantly online because online schools are different in many ways.[2] 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. 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.

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. 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). With that modification, we categorize schools as follows: Top 50 Public, Non-Top 50 Public,

[2] 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.

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.[3]

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 school types (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. This 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. 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 4.6 percentage points. We find statistically significant increases in graduation rates for top 50 and non-top 50 public schools of 8.6 and 5 percentage points respectively. We also see increases at community colleges and for-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 increase at for-profit colleges is also surprising given aggregate trends although there are again very few students attending for-profit colleges which may introduce sampling noise into the estimates from the NELS:88 and ELS:2002.

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

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 comparable to what is observed across NELS:88 and ELS:2002 at 4.61. We feel confident that using NELS:88 and ELS:2002 will yield useful insight because the change in graduation rates is similar in these data sets as compared to IPEDS data.

We show that graduation rates increased using three separate data sets: the decennial Census, IPEDS, and nationally representative, individual-level surveys. Having firmly established a positive trend in graduation rates since 1990, we next examine the reasons for this change.

3. Potential Explanations for Changes in Graduation Rate

Following BLT, 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, 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 2018). 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 (2018) consider workers age 25-34 which may explain some of the discrepancy. We interpret this evidence as showing a flat or slightly increasing college wage premium for young workers, which contrasts with earlier periods (including the period studied in BLT) where the college wage premium was growing.

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 70.7 percent in NELS to 78 percent in ELS:2002. With a larger fraction of students entering college, there may be more entrants who are relatively less prepared.

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. However, National Center of Education Statistics (2013) shows that average 17-year-old student performance on the National Assessment of Educational Progress (NAEP) is essentially unchanged since 1971. Hence, as college enrollment increases, the average preparation for college entrants would fall because the distribution of student ability is constant. Since the 1990s, we would expect college preparation would decrease given that college enrollment has increased and that performance on the NAEP is unchanged. Trends in enrollment would predict reduced college completion.

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 58th percentile to the 55th percentile. The decline in math percentile is also present among college graduates where it fell from the 72nd percentile to the 68th percentile.

Additionally, students are spending less time studying during college. Babcock and Marks (2011) show a drop in the number of hours studied from 1961 to 2003. The authors show that student demographics including race, gender, and parent education as well as student SAT scores cannot explain much of the change in college study habits. Trends in college study time would predict declining graduation rates.

Simultaneously, college students have increased labor supply. Scott-Clayton (2012) shows that average labor supply 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. Trends in student labor supply would predict declining college graduation rates, except 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 (2016); Denning (Forthcoming)). The rising price of college since the 1990s would predict lower graduation rates.

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 2018).[4] 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 decreased slightly overall from 38.2 to 36.6 while mean expenditures per student fell by $135, which is 3 percent relative to the level in NELS:88. The observed change in the student-faculty ratio would predict an increase in the probability of graduation while the change in mean expenditures would predict a decline in the probability of graduation.

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, less selective private, and for-profit colleges increased. The share of students attending highly selective private, top 50 public and community colleges decreased. The general pattern is a shifting of enrollment towards less selective schools with lower graduation rates, with the exception of community colleges where enrollment decreased. The pattern of enrollment increases in less selective four-year colleges balanced against the decrease in community college attendance leads to an ambiguous prediction about the overall college completion rate if the average quality of college where students graduate causally affects college graduation.[5]

Trends in time spent studying, labor supply in college, and the price of college would all predict *decreasing* college graduation rates. The patterns observed for student-faculty ratios would predict increasing graduation whereas spending per student would predict declining

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

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

graduation. The patterns for enrollment by institution type yields an ambiguous prediction. However, 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 in observed 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.

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.[6]

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.

[6] 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.

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 and 12th graders in 2004. 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 consider 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).[7]

We follow BLT in how we define college attendance and college completion. The college completion rate is the proportion of students who attend college within two years of when the high school cohort would be expected to graduate 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.[8] 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. 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

[7] Following BLT, we impute math test score, mother's education and father's 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. We again 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.

[8] We deviate from BLT's assignment due to a few cases of miscoding, which are described in the appendix.

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 58.0 to 55.9. Despite this decline in preparation, first-year college GPA increased from 2.54 to 2.66. Student-faculty ratios slightly declined from 38.2 to 36.6. Parental education increased from NELS:88 to ELS:2002 where students whose mother had at least a bachelor's degree increased by 6 percentage points. Underrepresented minorities constituted a larger fraction of college enrollment in ELS:2002 than in NELS:88. Parental income shifted towards middle incomes. Lastly, the fraction of male students in college declined from 48 percent to 46 percent.

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 difficulty 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. 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 generate predicted probabilities using the covariates in the NELS:88. 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 a particular example to illustrate this point—math test score percentile. We assign each student a rank in the distribution of math percentile separately in the NELS:88 and 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 ELS:2002. We break ties randomly. This process insures that we do not assign students with high math scores with students who we would expect to go to have low math scores.[9] After matching, we then apply the estimates from the ELS:2002 model and see how predicted graduation probabilities change.[10]

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

[9] 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."

[10] 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.

Table 4 mimics the main specification used in BLT. 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.

There is a 4.6 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 -0.27. This suggests that covariates would predict that graduation rates would *decrease* by 0.27 percentage points. Hence, the residual or unexplained change is 4.88 percentage points or 106 percent of the change is unexplained by covariates.

Student characteristics would predict a decline in graduation rates of 1.8 percentage points. This comes both from changes in math test percentiles (0.72 percentage points) and other student characteristics (1.09 percentage points). Student factors would therefore predict a declining graduation rate. In contrast, student-faculty ratios explain a 0.3 percentage point increase and initial school type explains 1.24 percentage points of the change in graduation rate, largely due to decreased enrollment in community colleges.

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. While some characteristics explain some of the increase, on net there are characteristics that point in the opposite direction. The explanations in BLT appear to explain essentially none of the increase in graduation rates from the early 1990s to the mid-2000s.

The story is consistent when considering the types of schools separately—the covariates used do not explain much of the change in graduation rate. The residuals are close to the total change for public non-top 50s, public top 50s, private less selective, and community colleges. This means that essentially none of the graduation rate change is explained, often with the covariates predicting a decline when there was an increase. For private highly selective colleges, the covariates predict a larger increase in graduation rates than occurred largely due to "other student characteristics." For-profit colleges have 65 percent of the total change explained by observable characteristics stemming largely from "other student characteristics."

Collectively, we find that student characteristics including math test percentiles, other student characteristics, and supply-side factors including student-faculty ratios and initial school type explain very little of the increase in graduation rates observed beginning in the 1990s. 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.

The explanations in BLT fail to predict changes in graduation rates suggesting something has changed since the early 1990s. One possibility 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.

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, among other measures. However, even if such a panel existed, each of these measures is less than ideal.

We develop an alternative test that we argue indirectly tests for standards of degree receipt. We first note in Table 3 that first year GPA increased from 2.54 to 2.66 from NELS:88 to ELS:2002. We also note that first year GPA is higher among students who graduate from college than among all college attendees meaning that first year GPA is predictive of graduation.

Table 5 further considers the change in student GPA. We first report the marginal effect of GPA on graduation from a logit model that predicts graduation using first year GPA, college characteristics, student math test percentile and student demographic characteristics. First year GPA is predictive of graduation with an increase of 0.1 GPA point predicting a 1.7 percentage point increase in the probability of student graduation.

To carry out our alternative test, we first predict a student's first year GPA using math percentile, student characteristics, and institution-type fixed effects in ELS:2002. Next, we take the estimated coefficients from ELS:2002 and generate predictions for all observations attending

college in NELS:88. We then compare the actual GPA to the predicted GPA. The predicted GPA is 0.166 higher than the actual GPA. This suggests that the relationship between GPA and student characteristics such as math scores, demographics, and parental education has changed. 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.

This is suggestive evidence that standards for degree receipt have changed. 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.

Alternatively, colleges may do a better job of helping students succeed by providing better services, or better targeting of services. Given that average expenditures per student has fallen, this increase in resources for students would have to be about efficiency gains or a reallocation of resources from students who do not benefit from additional resources to students whose college graduation rates are sensitive to student resources. Because overall funding per student has fallen, we think that colleges providing additional student services is unlikely to explain the change in GPA. We conclude that the increased GPA is likely a result of declining standards for degree receipt.

Given the evidence that GPA is changing over time and that GPA is predictive of graduation, we use this in the decomposition exercise. 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 6 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 2.73 percentage points or 59 percent of the total

change. The change explained by GPA alone is 2.32 or 50 percent of the observed changed. 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 77 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. However, there are still meaningful changes in graduation rates that are unexplained which could merit future work.

The exact mechanism for GPA to affect graduation is also unclear. It could be that there is a mechanical effect of higher GPAs. For instance, students could avoid academic probation or maintain satisfactory academic progress necessary for financial aid receipt (Schudde and Scott-Clayton 2016). It could also be that higher GPAs act as a signal to the student of their preparedness for college (Arcidiacono et al. 2016).

7. Discussion and Conclusion

In this paper we carefully document that college graduation rates have increased from the 1990 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 more than half of the increase in graduation rates.

We present evidence that the increase in GPA is not explained by observable student 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

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. 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.

Our findings present interesting implications for models of human capital or signaling. In either the human capital or signaling model of education, declining standards of degree receipt would predict a declining college wage premium. However, the college wage premium has been flat or grown slightly over this period. Our work suggests that concurrently 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). Our work suggests that if standards for degree receipt had remained the same, then the college wage premium would have been even higher than actually observed college wage premium.

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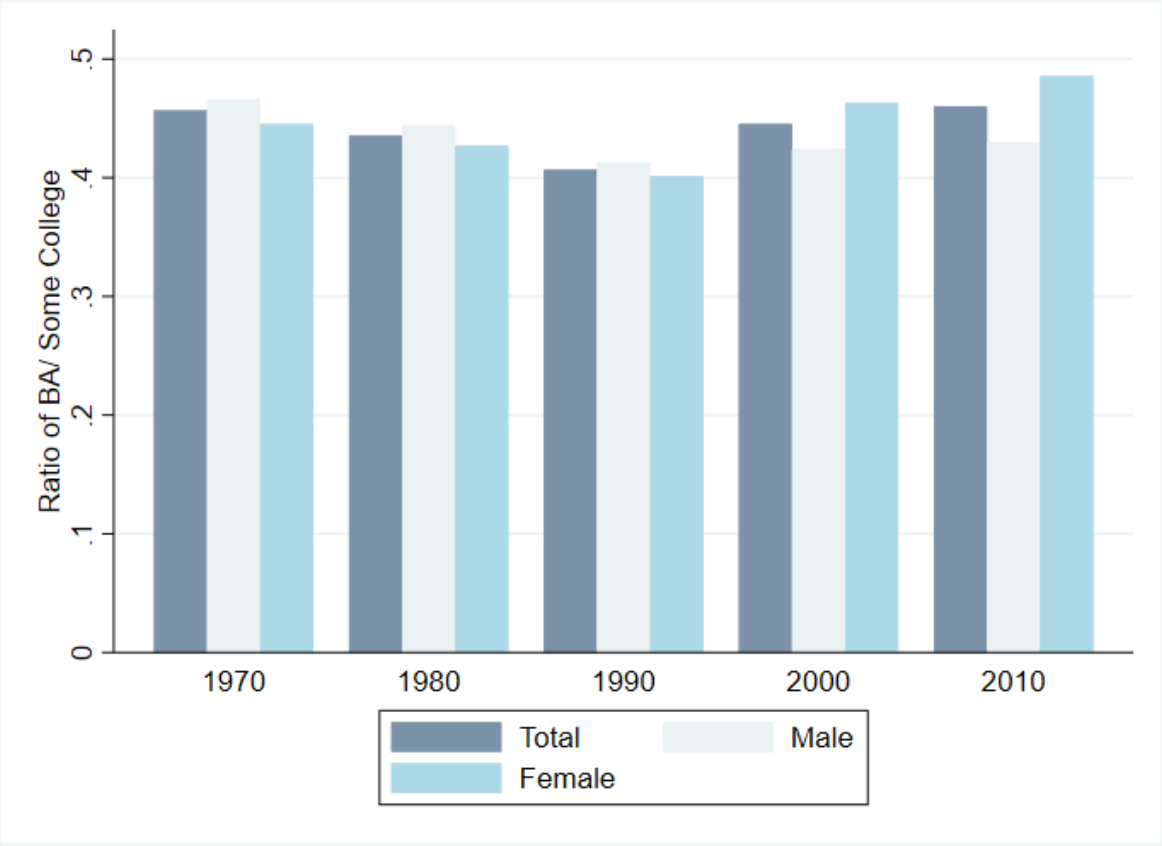
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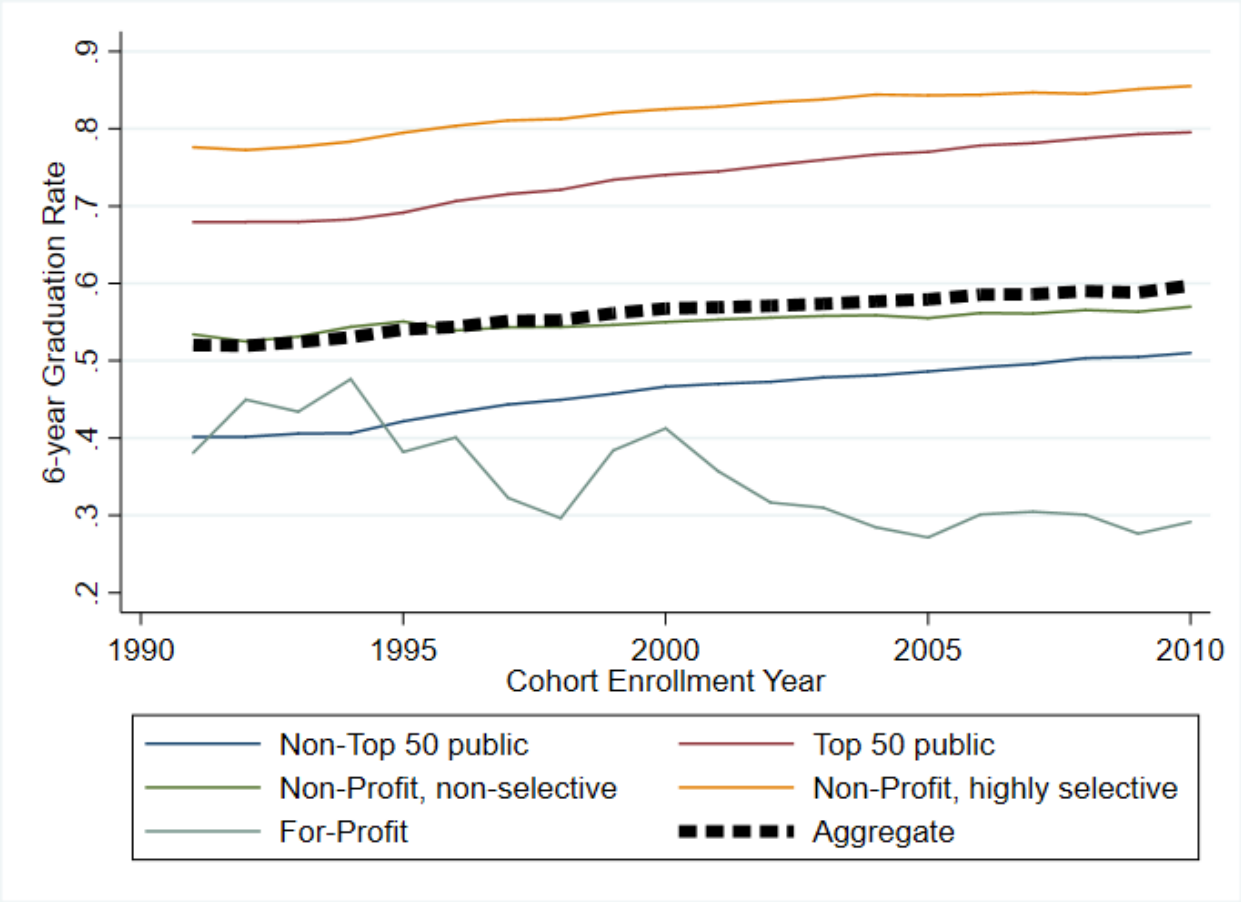
Figures and Tables

Figure 1: Ratio of BA / Some College among 25 year-olds



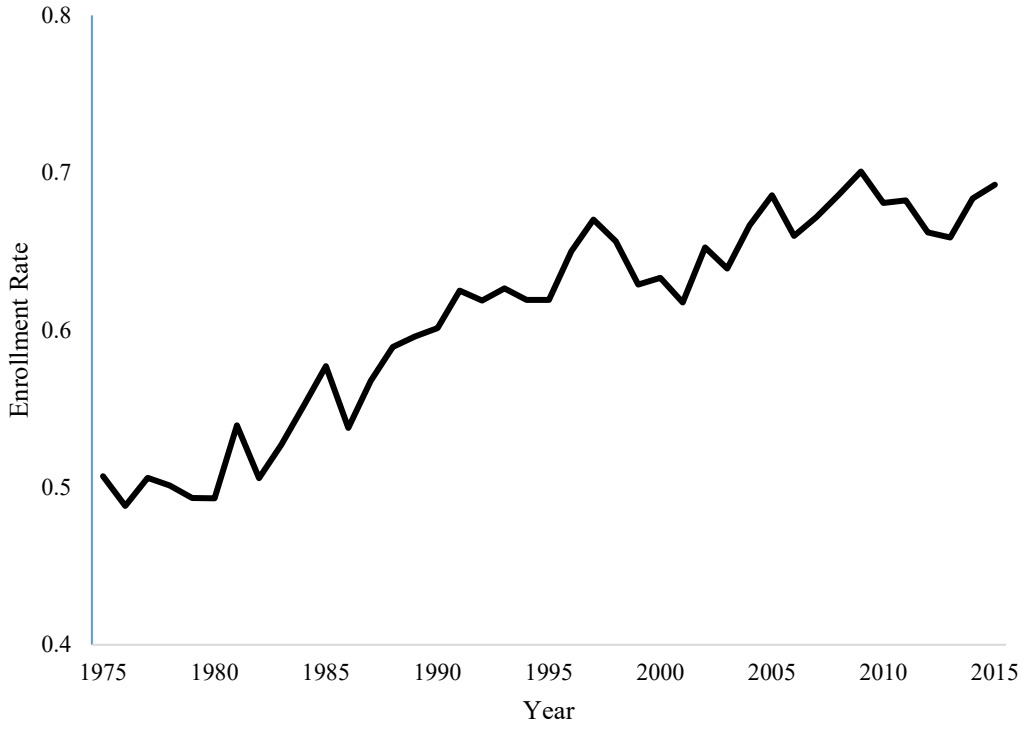
Notes: Data come from the decennial census downloaded from the Integrated Public Use Microdata series database at IPUMS USA. Following BLT, we calculated the ratio of 25-year-olds having a bachelor's degree to 25-year-olds with at least some college completed.

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.

Table 1: Changes in College Graduation Rates

Sample	Total NELS:88	ELS:2002	Difference
Full Sample	45.9	50.5	4.61**
			(1.64)
Initial Institution Type			
Total Four-year Public			
Non-top 50 Public	56.1	61.0	5.0*
			(2.59)
Top 50 Public	82.2	90.7	8.57**
			(2.57)
Total Four-Year Private			
Less Selective Private	72.5	71.2	-1.3
			(2.94)
Highly Selective Private	90.5	92.2	1.67
			(2.76)
Total Community College	19.2	24.1	4.91**
			(1.66)
For-Profit College	4.0	10.0	6**
			(2.14)

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	70.7	68.0	73.5	78.0	73.7	82.0
Distribution of Enrollment by Type of Institution						
Total 4-year Public	37.3	37.6	37.0	40.5	40.9	40.0
Non-top 50 Public	27.0	26.7	27.3	31.3	31.9	30.8
Top 50 Public	10.2	10.8	9.7	9.2	9.1	9.3
Total 4-year Private	18.5	17.0	19.9	17.7	17.3	18.0
Less Selective Private	12.2	10.6	13.8	12.7	11.7	13.5
Highly Selective Private	6.3	6.4	6.1	5.0	5.5	4.6
Total Community College	39.7	42.1	37.4	36.3	36.0	36.6
For Profit Colleges	4.6	3.4	5.8	5.5	5.8	5.3

Note: This table describes the change in initial college attended for the NELS:88 and ELS:2002.

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

	All College Attendees		College Graduates Who get a BA	
Variable	NELS:88	ELS:2002	NELS:88	ELS:2002
Bottom Math Quartile	0.16	0.18	0.04	0.06
Second Math Quartile	0.23	0.24	0.15	0.17
Third Math Quartile	0.28	0.27	0.29	0.31
Top Math Quartile	0.33	0.30	0.52	0.46
Math Test Percentile	58.01	55.93	71.66	68.53
First Year GPA	2.54	2.66	2.87	3.05
Student-Faculty Ratio	38.15	36.55	27.33	28.26
ln(S/F ratio)	3.43	3.40	3.14	3.16
Missing S/F Ratio	0.07	0.02	0.01	0.01
Father's Education				
No HS	0.11	0.10	0.05	0.06
HS Diploma	0.30	0.29	0.20	0.22
Some College	0.23	0.22	0.22	0.20
BA	0.19	0.22	0.25	0.28
Grad School	0.17	0.17	0.28	0.24
Mother's Education				
No HS	0.11	0.10	0.05	0.05
HS Diploma	0.35	0.28	0.27	0.23
Some College	0.25	0.26	0.26	0.25

BA	0.18	0.22	0.24	0.28
Grad School	0.12	0.14	0.18	0.20
Parental Income				
<10000/15000	0.07	0.07	0.03	0.04
20000/25000	0.11	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+	0.41	0.33	0.55	0.44
Race/Ethnicity				
Asian	0.05	0.04	0.06	0.06
Hispanic	0.10	0.12	0.06	0.08
African American	0.11	0.12	0.07	0.08
White	0.74	0.72	0.81	0.79
Male	0.48	0.46	0.45	0.44
Number of Observations	8290	8930	4140	4990

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
NELS:88	45.89	56.13	82.15	72.52	90.5	19.18	4
ELS:2002	50.5	61.01	90.71	71.21	92.16	24.09	10
Total Change	4.61	4.88	8.56	-1.31	1.66	4.91	6
Change Due to Observables	-0.27	-2.2	-0.49	-0.15	2.71	-0.39	3.9
Change due to Student Characteristics	-1.81	-2.46	-0.61	-0.6	2.45	-0.37	5.56
Math Test Percentile	-0.72	-1.87	-0.11	-0.26	0.35	-0.75	0.28
Other student characteristics	-1.09	-0.59	-0.5	-0.34	2.1	0.38	5.28
Change due to supply-side factors	1.54	0.26	0.12	0.45	0.26	-0.02	-1.66
Student-Faculty ratios	0.3	0.26	0.12	0.45	0.26	-0.02	-1.66
Initial School Types	1.24						
Residual	4.88	7.08	9.05	-1.16	-1.05	5.3	2.1

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 student 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: Predicted GPA

	NELS:88	ELS:2002
Effect of GPA on Graduation	0.174	0.151
Means of Variables		
GPA	2.538	2.652
Predicted GPA (using ELS coefficients on the NELS Xs)	2.704	N/A
Residual (predicted minus actual GPA)	0.166	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. It also outlines the differences in GPA not attributable to differences in student characteristics.

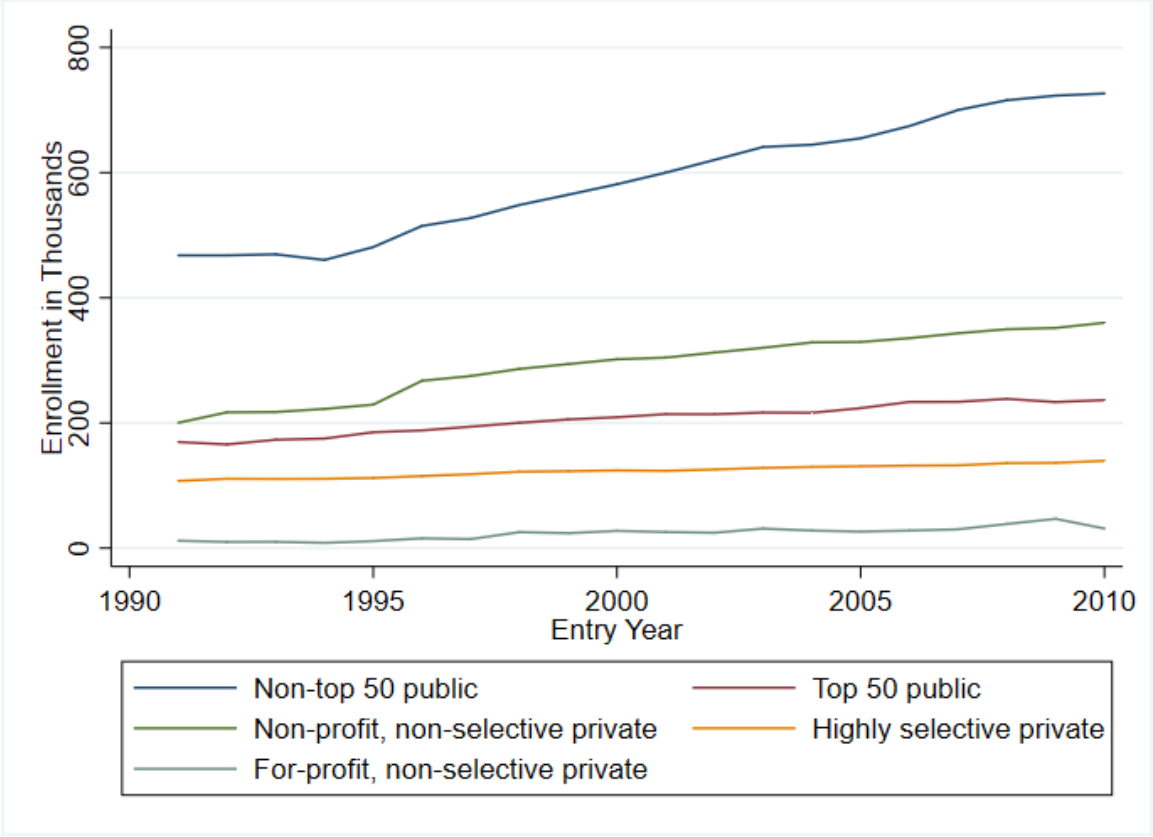
Table 6: Decomposition Exercise, Changes in College Graduation, BLT + First Year Grades

	Full Sample	Public non-top 50	Public top 50	Private less selective	Private Highly Selective	Community college	For-Profit
NELS:88	45.89	56.13	82.15	72.52	90.5	19.18	4
ELS:2002	50.5	61.01	90.71	71.21	92.16	24.09	10
Total Change	4.61	4.88	8.56	-1.31	1.66	4.91	6
Change Due to Observables	2.73	3.78	1.28	3.25	4.72	1.46	3.69
Change due to Student Characteristics	-1.1	-1.48	-1.37	-0.22	2.41	-5.17	7.33
math test percentile	-0.37	-1.03	-0.05	0.08	0.1	-0.49	0.38
Other student characteristics	-0.73	-0.45	-1.32	-0.3	2.31	-4.68	6.95
Change due to supply-side factors	1.51	0.25	0.1	0.43	0.16	5.09	-2.07
student-faculty ratios	0.25	0.25	0.1	0.43	0.16	5.09	-2.07
Initial School Types	1.26						
Change due to GPA							
GPA	2.32	5.01	2.55	3.04	2.15	1.54	-1.57
Residual	1.88	1.1	7.28	-4.56	-3.06	3.45	2.31

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 student 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 plot 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.

Table A1: College Resources

Panel A: Full Sample

Student-Faculty Ratios

		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	38.2	20.1	28.7	49.6	79.1	$4,328
ELS:2002	36.6	18.8	28.2	48.2	75.2	$4,193

Panel B: Public 4-Year Non-top 50

Student-Faculty Ratios

		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	27.22	22	26.3	32.3	37.7	$4,836
ELS:2002	28.3	19.6	25.1	31.2	42.8	$4,736

Panel C: Public 4-Year Top 50

Student-Faculty Ratios

		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	16.4	12.9	15.9	19.1	22.9	$9,496
ELS:2002	16	7.8	16.6	18.6	21.9	$9,564

Panel D: Private 4-Year Less Selective

Student-Faculty Ratios

		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	23.4	16.9	20.7	26.8	35.4	$5,370
ELS:2002	22.6	15.8	20.5	25.7	34.4	$6,583

Panel E: Private 4-Year Highly Selective

Student-Faculty Ratios

		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	15.4	9.9	14.2	19.4	23.5	$14,233
ELS:2002	13.9	9.2	12.3	19.9	21.7	$15,811

Panel F: 2-Year

Student-Faculty Ratios

		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	60.7	39.6	56.9	79.4	96.7	$2,431
ELS:2002	57.7	40.3	56.1	74.7	89.9	$2,533

Panel G: For-Profit

	Student-Faculty Ratios					
		percentile				Median Expenditures per
Survey	Mean	25th	50th	75th	90th	Student
NELS:88	39.9	26.6	37.6	50.5	55.1	$2,470
ELS:2002	31.6	17.9	27.6	38.6	60.8	$3,134

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

	Full Sample	Public non-top 50	Public top 50	Private less selective	Private highly selective	Community College	For-profit
Ln(student/faculty)	-0.215	-0.591	-0.693	-0.404	-0.182	0.136	0.668
	(0.09)	(0.15)	(0.68)	(0.27)	(0.25)	(0.15)	(0.41)
Missing(student/faculty)	-2.893	-5.748	0.000	-3.532	0.000	-2.095	-0.047
	(0.81)	(3.93)	(.)	(1.39)	(.)	(1.39)	(1.93)
Math percentile	0.024	0.022	0.029	0.024	0.016	0.024	0.026
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
Missing(student/faculty) x (math percentile)	0.033	0.058	0.000	0.021	0.000	0.047	0.041
	(0.02)	(0.05)	(.)	(0.02)	(.)	(0.02)	(0.02)
Income 20,000/25,000	0.034	0.142	-1.933	-0.683	-4.641	0.326	-1.531
	(0.16)	(0.28)	(0.78)	(0.51)	(0.60)	(0.27)	(1.01)
Income 25,000/35,000	-0.331	-0.272	-1.077	-0.733	-4.685	-0.278	-0.025
	(0.16)	(0.26)	(0.77)	(0.45)	(0.74)	(0.30)	(1.06)
Income 35,000/50,000	-0.010	-0.066	-0.773	-0.466		0.219	-0.219
	(0.15)	(0.24)	(0.65)	(0.43)		(0.26)	(0.95)
Income 50,000/75,000	0.025	-0.042	-0.935	-0.748	-4.474	0.393	-0.902
	(0.15)	(0.24)	(0.74)	(0.43)	(0.57)	(0.26)	(0.85)
Income 50,000+/75,000+	0.310	0.309	-0.510	-0.084	-4.767	0.455	0.537
	(0.15)	(0.24)	(0.70)	(0.43)	(0.54)	(0.26)	(0.83)
Father HS diploma	-0.082	-0.078	-0.312	-0.055	0.385	-0.063	-0.631

	(0.15)	(0.25)	(0.99)	(0.41)	(0.56)	(0.23)	(0.70)
Father some college	0.108	0.039	0.653	0.552	0.534	-0.004	0.271
	(0.17)	(0.26)	(0.78)	(0.45)	(0.59)	(0.25)	(0.69)
Father BA	0.337	0.356	0.710	0.449	0.822	0.254	0.062
	(0.18)	(0.26)	(0.86)	(0.47)	(0.62)	(0.28)	(0.90)
Father graduate school	0.411	0.269	1.237	0.648	1.044	0.275	0.869
	(0.16)	(0.26)	(0.95)	(0.44)	(0.63)	(0.27)	(0.82)
Mother HS diploma	0.205	0.042	1.108	0.526	-0.424	0.138	1.378
	(0.15)	(0.24)	(1.06)	(0.44)	(0.62)	(0.24)	(0.83)
Mother some college	0.291	0.089	-0.132	0.341	-0.203	0.478	1.591
	(0.16)	(0.24)	(0.92)	(0.47)	(0.61)	(0.24)	(0.90)
Mother BA	0.365	0.084	-0.147	0.936	-0.501	0.535	1.533
	(0.16)	(0.27)	(1.14)	(0.45)	(0.54)	(0.27)	(1.09)
Mother graduate school	0.466	0.147	-0.356	0.928	0.004	0.644	2.129
	(0.17)	(0.27)	(1.21)	(0.53)	(0.57)	(0.30)	(0.90)
Asian	0.554	0.527	-0.031	0.390	0.224	0.603	2.003
	(0.12)	(0.17)	(0.40)	(0.38)	(0.37)	(0.18)	(0.98)
Hispanic	-0.142	-0.195	1.370	-0.207	0.757	-0.331	1.053
	(0.11)	(0.19)	(0.91)	(0.33)	(0.47)	(0.16)	(0.62)
Black	-0.195	-0.229	0.974	-0.716	-0.898	-0.014	0.030
	(0.11)	(0.15)	(0.68)	(0.27)	(0.40)	(0.21)	(0.64)
Male	-0.497	-0.410	-0.725	-0.970	-0.497	-0.396	-0.151
	(0.07)	(0.11)	(0.42)	(0.20)	(0.20)	(0.11)	(0.43)
Public top 50	1.116						
	(0.21)						
Private less selective	0.300						
	(0.11)						
Private highly selective	1.070						

	(0.28)						
Community college	-1.113						
	(0.10)						
For-profit	-2.019						
	(0.21)						
Constant	-0.499	1.070	2.523	0.718	5.066	-3.262	-6.981
	(0.36)	(0.60)	(2.24)	(1.11)	(0.81)	(0.65)	(2.16)

Panel B NELS:88

	Full Sample	Public non-top 50	Public top 50	Private less selective	Private highly selective	Community College	For-profit
Ln(student/faculty)	-0.431	-1.006	-0.526	-0.708	-0.468	-0.239	1.115
	(0.16)	(0.30)	(0.48)	(0.27)	(0.53)	(0.21)	(0.64)
Missing(student/faculty)	-2.887	-7.987	0.000	-2.358	0.000	-1.210	0.750
	(0.84)	(3.19)	(.)	(1.38)	(.)	(1.07)	(2.96)
Math percentile	0.022	0.018	0.031	0.025	0.006	0.025	0.019
	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.00)	(0.02)
Missing(student/faculty) x (math percentile)	0.005	0.066	0.000	-0.004	0.000	-0.019	0.017
	(0.01)	(0.05)	(.)	(0.02)	(.)	(0.01)	(0.03)
Income 20,000/25,000	0.025	-0.079	-0.247	-0.167	-1.625	0.294	0.795

	(0.27)	(0.35)	(0.77)	(0.56)	(1.68)	(0.46)	(1.48)
Income 25,000/35,000	0.444	-0.001	0.001	0.293	-1.761	1.006	2.839
	(0.28)	(0.40)	(0.74)	(0.53)	(1.58)	(0.58)	(1.30)
Income 35,000/50,000	0.205	-0.003	-1.084	0.319		0.732	0.762
	(0.23)	(0.35)	(0.74)	(0.57)		(0.42)	(1.38)
Income 50,000/75,000	0.352	0.325	-0.337	0.324	-2.346	0.638	2.169
	(0.22)	(0.35)	(0.72)	(0.49)	(1.37)	(0.42)	(1.18)
Income 50,000+/75,000+	0.659	0.534	-0.550	0.613	-1.096	1.029	2.453
	(0.21)	(0.35)	(0.68)	(0.52)	(1.30)	(0.43)	(1.13)
Father HS diploma	0.022	-0.205	-0.054	0.530	-0.300	0.254	-1.587
	(0.22)	(0.37)	(0.75)	(0.55)	(1.69)	(0.42)	(1.44)
Father some college	0.387	0.198	0.312	0.968	-0.937	0.474	0.560
	(0.25)	(0.41)	(0.68)	(0.52)	(1.34)	(0.43)	(1.13)
Father BA	0.439	0.548	0.725	0.653	-0.482	0.330	0.708
	(0.25)	(0.45)	(0.62)	(0.59)	(1.34)	(0.48)	(1.53)
Father graduate school	0.804	0.508	1.705	0.989	-0.216	1.024	1.465
	(0.26)	(0.43)	(0.74)	(0.63)	(1.44)	(0.59)	(1.66)
Mother HS diploma	0.257	0.555	-1.067	0.699	-0.251	0.045	1.215
	(0.24)	(0.38)	(0.82)	(0.45)	(1.32)	(0.30)	(1.31)
Mother some college	0.422	0.782	-0.778	0.569	1.914	0.185	-0.646
	(0.25)	(0.39)	(0.88)	(0.51)	(1.22)	(0.35)	(1.25)
Mother BA	0.425	0.601	-0.881	0.750	1.386	0.288	1.481
	(0.23)	(0.37)	(0.85)	(0.53)	(1.19)	(0.45)	(1.22)
Mother graduate school	0.400	0.596	-0.734	0.747	1.522	0.141	1.556
	(0.33)	(0.53)	(0.93)	(0.61)	(1.37)	(0.47)	(1.65)
Asian	0.418	0.115	0.622	-0.312	3.233	0.717	0.943
	(0.25)	(0.33)	(0.60)	(0.58)	(1.17)	(0.35)	(1.20)
Hispanic	-0.252	0.164	-0.756	0.032	-0.375	-0.501	-0.145

	(0.17)	(0.29)	(0.52)	(0.47)	(1.00)	(0.25)	(1.01)
Black	-0.255	-0.669	-0.190	0.358	-0.705	0.099	0.746
	(0.20)	(0.24)	(0.42)	(0.41)	(0.99)	(0.42)	(0.88)
Male	-0.534	-0.701	-0.961	-0.267	-0.436	-0.420	0.660
	(0.09)	(0.14)	(0.34)	(0.20)	(0.45)	(0.15)	(0.61)
Public top 50	0.627						
	(0.16)						
Private less selective	0.648						
	(0.14)						
Private highly selective	1.069						
	(0.27)						
Community college	-0.977						
	(0.18)						
For-profit	-1.879						
	(0.36)						
Constant	-0.490	1.788	1.995	0.042	4.108	-2.751	-9.931
	(0.63)	(1.12)	(1.77)	(1.10)	(2.60)	(0.97)	(2.71)