Time to Baccalaureate Degree and Graduate School Enrollment

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Abstract

I study the relationship between the amount of time students take to complete a bachelor's degree and graduate school enrollment. Using nationally representative data from the Baccalaureate and Beyond survey and taking a selection on observables empirical approach, I find large disparities in graduate school enrollment and graduate degree attainment for delayed graduates compared to on-time graduates after controlling for a rich set of student characteristics. Importantly, I show that students with a different time to degree report having similar expectations for earning a graduate degree in the future when asked during their final year of their bachelor's degree, suggesting differential graduate school goals do not explain the results. Additional analyses find that these enrollment patterns are driven entirely by differences in full-time enrollment in graduate programs within the first year after completing the bachelor's degree. Delayed graduates are not more or less likely to enroll in part-time graduate degree programs or to initially enroll between one and ten years after completing their bachelor's degree.

JEL Codes: I21, I23, I24, I26

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1 Introduction

The opportunity to pursue a graduate degree is an important source of the private returns to completing a college degree (Altonji and Zhong, 2021a,b). There are also important social benefits of building a diverse stock of graduate school-educated labor since those who hold advanced degrees become doctors, lawyers, researchers, or otherwise key leaders and decision-makers (Posselt and Grodsky, 2017). Given existing racial and income disparities in graduate degree attainment rates, it is critical to understand where students may fall off the path to earning a graduate degree. One understudied point in this pipeline is the amount of time students take to complete a bachelor's degree. Nearly half of all bachelor's degree graduates take longer than four years to complete their degree—which is the standard for "on-time" graduation—and a longer time to degree is more common among populations that are typically underrepresented among those who hold a graduate degree.

In this paper, I study the question: Are students who take longer to complete a bachelor's degree less likely to later pursue a graduate degree? Taking more time to complete a bachelor's degree could be related to enrollment in graduate school through a possible effect it has on students. For instance, longer time to degree may be associated with higher student loan debt or a greater attachment to the labor force which could diminish interest in enrolling in graduate school. Or spending more time in college could induce a greater "educational fatigue" associated with being a full-time student, deterring students from continuing their education. Alternatively, a longer time to degree could be related to graduate school enrollment if graduate program admissions use time to degree to screen applicants and penalize students who have a longer time to degree with a lower admissions rate.

To study the relationship between time to bachelor's degree and graduate school enrollment outcomes, I use nationally representative data from the Baccalaureate and

Beyond survey which allows me to follow the long-run outcomes of multiple cohorts of bachelor's degree graduates in the United States. I take a selection-on-observables empirical approach, regressing graduate school outcomes on time to degree while controlling for a rich set of covariates including student demographics, SAT score, parent's education and income, college GPA and major, and college fixed effects.

I find that delayed graduates (those taking more than four years to complete their bachelor's degree) have graduate school enrollment rates that are roughly 7-10 percentage points (or about 12-17 percent) lower than on-time graduates (those graduating in four years or less) within ten years after students complete their bachelor's degree. Correspondingly, I also estimate significant differences in graduate degree attainment rates by time to degree. The enrollment rate disparities are even larger at earlier points in time relative to their bachelor's degree completion. My results are robust to alternative specification choices, additional control variables, and alternative samples. Moreover, tests that consider selection on observables as indicative of potential selection on unobservables suggest it is unlikely that selection bias fully explain these results (Oster, 2019).

According to data from the 2021 American Community Survey, about 16 percent of the White population aged 30–65 has an advanced degree, while these attainment rates are 11 and 7 percent for the Black and Hispanic populations, respectively (Ruggles et al., n.d.). I explore the heterogeneity of the relationship between time to degree and graduate school enrollment by student subgroups to assess its contribution to these existing disparities. I find somewhat larger graduate school enrollment disparities among Black or Hispanic students compared to White students. However, I find disparities of a similar magnitude between higher and lower income students. While both these between-student subgroup differences are not statistically significant at standard levels, these results suggest that the dynamics related to time to degree may exacerbate existing disparities in graduate degree attainment.

In an analysis of the potential mechanisms for the differences in graduate school enrollment by time to degree, I find little differences in expectations for earning a graduate degree when students are asked during their final year of their bachelor's degree. Yet, the differences again emerge when considering whether students had applied to a graduate degree program before completing their bachelor's degree. Moreover, I find that the differences in graduate school enrollment are entirely concentrated within the first year after bachelor's degree graduation, and completely driven by differences in full-time enrollment. Delayed graduates are not more or less likely to initially enroll in graduate school between one and ten years after their bachelor's degree, or enroll in a graduate program part time.

These results suggest an important role for a phenomena I describe as educational fatigue in explaining the main results. It seems that students who take extra time to complete a bachelor's degree have a greater distaste for continuing immediately into a graduate school program, particularly for full-time programs. Part-time graduate school enrollment appears to be more palatable for these students. Since delayed graduates do not have significantly lower expectations for earning a graduate degree, these students may have goals of eventually returning to graduate school, but seek to enter the labor market immediately after graduating to take a break from full-time schooling. Some do eventually return to school, but they do not make up for the initial enrollment disparities generated immediately after graduating.

My primary contribution is documenting the relationship between time to bachelor's degree and graduate school enrollment. Previous research has more frequently considered time to degree as an outcome (Denning et al., 2022; Bound et al., 2012; Kurlaender et al., 2014; Aina et al., 2011). I add to a smaller literature that studies the potential post-graduation consequences of a longer time to degree, which has so far focused exclusively on labor market outcomes. A few studies find some evidence for a negative relationship between time to degree and labor market outcomes (Fortin

and Ragued, 2017; Aina and Casalone, 2020; Witteveen and Attewell, 2021). Although, Bloem (2022) finds little signaling value in the labor market of on-time graduation relative to delayed graduation. A related but distinct literature considers the implications of time to high school degrees (e.g., Baert and Picchio (2021); ter Meulen (2023)). To my knowledge, this is the first paper studying the relationship between time to bachelor's degree and graduate school outcomes.

Finally, I contribute to a broader literature that documents determinants of graduate school enrollment. I add time to degree as a potential important determinant to this literature on graduate school enrollment which includes papers that study its relationship with economic conditions (Bedard and Herman, 2008; Kahn, 2010; Johnson, 2013; Altonji et al., 2016), undergraduate debt and student loan policies (Malcom and Dowd, 2012; Chakrabarti et al., 2020b; Chen and Bahr, 2021; Ortagus and II, 2022; Denning and Turner, 2023), undergraduate admissions policies (Garces, 2012; Bleemer, 2022), college quality and major choices (Eide et al., 1998; Zhang, 2005; Bleemer, 2021; Bleemer and Mehta, 2022; Ge et al., 2022), and funding for higher education (Chakrabarti et al., 2020a).

The remainder of the paper is organized as follows: In the next section, I describe the data sources I use in the empirical analysis in this paper, discuss summary statistics of the analytic sample, and detail my empirical approaches. The third section presents the core empirical results with an investigation of the heterogeneity and the robustness of the results. Section four conducts supplemental analyses that assesses the primary mechanisms driving the core results. Finally, section five concludes.

2 Data and Methodology

This section describes the data sources used in the subsequent analyses, discusses the summary statistics of the analytic sample, and details the empirical approach used in

this paper.

2.1 Data sources

I use data from the Baccalaureate and Beyond (B&B) surveys to study the relationship between time to bachelor's degree and long-run graduate school outcomes. These nationally representative surveys are administered by the National Center for Education Statistics of the United States Department of Education. Currently, the B&B data follows four cohorts of students who have received a bachelor's degree and gathers information about their subsequent outcomes after graduation. These four cohorts include students graduating during the 1993, 2000, 2008, and 2016 academic years. All students in the B&B data were initially interviewed as part of the National Postsecondary Student Aid Study (NPSAS).

For the 1993 and 2008 cohorts, the B&B data includes follow-up surveys one, four, and ten years after graduation. Meanwhile, the 2000 and 2016 cohorts have only a follow-up survey one year after graduation. The core analyses of this paper focus on the 1993 and 2008 B&B cohorts due to their ability to observe long-run outcomes. However, results using all four B&B cohorts where possible are included in the appendix. The B&B data also include some records from administrative data sources, including the Department of Education's Central Processing System and National Student Loan Data System. Finally, I link colleges in the B&B data to Barron's Admissions Competitiveness Index data files to characterize colleges as more or less selective.

2.2 Analytic sample and summary statistics

I make a few sample restrictions to the B&B data which are similar to those made by other studies of time to bachelor's degree (Bound et al., 2012; Denning et al., 2022). Specifically, I condition the sample to include first-time bachelor's degree graduating

students who went to college within two years of graduating high school and who received a bachelor's degree within eight years of graduating high school. My results are robust to relaxing these sample conditions (see Table A7). I calculate time to bachelor's degree (as well as time between high school graduation and college entry or college graduation) in years by converting the variables provided in terms of months.[1] I use the provided B&B survey weights throughout the analyses in this paper to yield nationally representative results.

Table 1 shows summary statistics of the analytic sample from the 1993 and 2008 cohorts of the B&B data. The top panel of the table highlights the wide distribution of time to degree in the United States. In the full sample, 48 percent of bachelor's degree graduates take longer than four years to complete their degree, with 29 percent taking five years, 12 percent taking six years, and 8 percent taking seven years or more. Table 1 also shows summary statistics for demographic, background, and academic variables for the full sample as well as separately by time to degree. Unconditionally, students with a longer time to degree are more likely to be male; less likely to be white; and have lower family incomes, SAT scores, and college grade point averages (GPAs) than students with shorter a time to degree.

Table A1 explores the conditional relationships between delayed graduation and student characteristics and college experiences by regressing an indicator for any delayed graduation (5 or more years to degree) on a set of demograhpic, background, and academic variables available in the B&B data. The table shows that several college experiences are strong predictors of delayed graduation, including (among others) working full-time during college, transferring credits between colleges, being placed on academic probation, and repeating a course for a higher grade. Meanwhile, SAT scores and family incomes are negatively related to delayed graduation. Finally, while female

[1]I calculate time to degree as 4 years or less if the difference between college entry and college graduation is less than or equal to 48 months; 5 years to degree is 49-60 months; 6 years to degree is 61-72 months; and 7 years or more is 73 or more months.

Table 1. Summary statistics.

		By time to degree			
	Full sample	4 years or less	5 years	6 years	7 years or more
Time to degree					
4 years to less	0.515				
5 years	0.289				
6 years	0.119				
7 years or more	0.078				
Demographics					
Female	0.561	0.615	0.509	0.507	0.484
White	0.792	0.820	0.787	0.733	0.717
Black	0.060	0.051	0.063	0.088	0.070
Hispanic	0.067	0.053	0.067	0.092	0.121
Asian	0.061	0.058	0.061	0.072	0.060
Other	0.020	0.019	0.021	0.014	0.032
Background and academics					
Parent has BA	0.594	0.663	0.546	0.487	0.470
Family income ($1,000s)	79.75	95.14	77.77	53.97	21.39
SAT score	1085	1134	1046	1008	997
College GPA	3.168	3.309	3.057	2.973	2.944
Graduate school outcomes					
Applied to grad school, in last year of BA	0.271	0.326	0.219	0.204	0.196
Enrolled in grad school, within 1 year of BA	0.221	0.287	0.152	0.148	0.144
Enrolled in grad school, within 4 years of BA	0.347	0.434	0.258	0.252	0.250
Enrolled in grad school, within 10 years of BA	0.478	0.570	0.386	0.364	0.373
Attained grad degree, within 10 years post BA	0.315	0.405	0.229	0.193	0.205
Attained master's degree, within 10 years post BA	0.227	0.279	0.179	0.153	0.168
Attained doctoral degree, within 10 years post BA	0.080	0.116	0.045	0.033	0.033
Observations (unweighted)	18,630	9,810	5,220	2,090	1,510

Notes: The table above reports means for key variables in the analytic sample. The sample includes first-time bachelors degree graduates from the 1993 and/or the 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The summary statistics were computed using the B&B's survey weights.

students are much less likely to be a delayed graduate, contrary to the unconditional summary statistics, race and ethnicity is only weakly correlated with delayed graduation once other background variables are accounted for. Some specifications reveal that black students are less likely to be a delayed graduate relative to white students when controlling for SAT score and parent's education and income.

Both Table 1 and Figure 1 show the unconditional relationship between time to

bachelor's degree and graduate school outcomes. Overall, about 48 percent of all bachelor's degree graduates later enroll in a graduate degree program within ten years of earning the bachelor's degree. Clear differences in graduate school enrollment emerge by how much time students took to complete their bachelor's degree. Among graduates taking four years or less, 57 percent enroll in graduate school within 10 years of earning their bachelor's degree. Meanwhile, graduates taking 5, 6, and 7 years or more have graduate school enrollment rates of 39, 36, and 37 percent, respectively. Disparities of similar magnitudes also exist by time to degree for other graduate school outcomes, including with enrollment rates within shorter time periods after their bachelor's degree, whether students applied to graduate school before their bachelor's degree graduation, and graduate degree attainment rates.

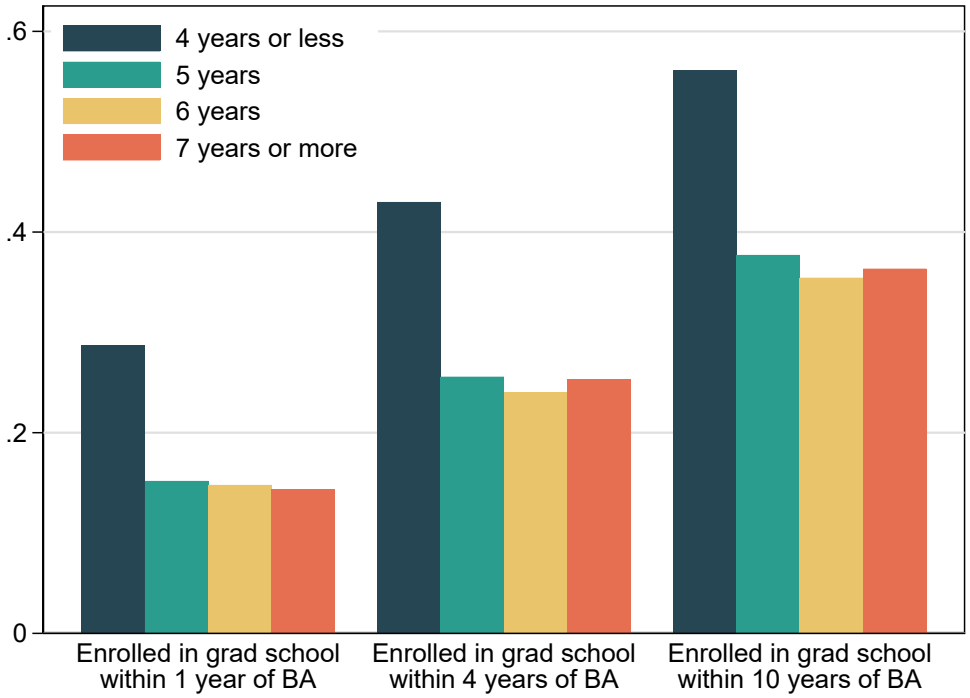
2.3 Empirical approach

My goal with the subsequent analyses is to determine to what extent the lower graduate school enrollment rates of delayed graduates can be attributed to the amount of time students took to complete their bachelor's degrees, independent of other factors. Since time to degree is not exogenously determined, this endogeneity must be accounted for in the empirical strategy. Since I lack an instrument that would affect a student's time to degree but not their graduate school outcomes, I adopt a selection-on-observables approach. I regress several graduate school outcomes on indicators for a student's time to degree, while controlling for a rich set of demographic, background, and academic variables that are available in the B&B data. Specifically, I estimate the following equation using ordinary least squares:

$$Y_i = \sum_{\tau} \beta_\tau \mathbb{1}(TTD_i = \tau) + \alpha X_i + \gamma_c + \delta_j + \epsilon_i \tag{1}$$

Where Y is a graduate school outcome for bachelor's degree graduate i. The term

Figure 1. Graduate school enrollment rates by time to bachelor's degree.



Notes: This figure shows means of graduate school outcomes by time to bachelor's degree. The sample includes first-time bachelor's degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelor's degree within eight years of graduating high school. The summary statistics were computed using the B&B's survey weights.

inside the summation is a vector of variables indicating student i's time to bachelor's degree in τ years, where $\tau \in \{4, 5, 6, 7\}$. Graduates in less than four years are coded as $\tau = 4$, and graduates in more than seven years are coded as $\tau = 7$. Typically, four-year graduates are the omitted reference group in the regressions. The vector X includes the set of controls for student characteristics and background variables, including sex, race/ethnicity, parent's education and income, SAT score, college GPA, and fixed effects for college major.[2] Finally, I include college graduation cohort fixed effects (γ_c) and college fixed effects (δ_j), and ϵ_i is the error term.

[2]The results shown in this paper include parent's income, SAT score, and college GPA as linear predictors in the regressions. Results are robust to more flexible approaches to controlling for these variables.

To interpret $\hat{\beta_\tau}$ as causal, the extensive set of controls for student background characteristics must be sufficient to control for the selection of students with a different time to bachelor's degree into different post-graduation outcomes. While I am able to include in my estimation a rich set of control variables that are correlated with both time to degree and graduation school enrollment outcomes, it is unlikely that I am able to fully account for the endogeneity of time to degree. Therefore, it would be appropriate to not necessarily consider the point estimates from Equation 1 as precisely identifying the causal effect of time to degree on a student's probability of enrolling in graduate school.

However, given that the controls I can include are quite detailed, and the fact that these relationships between time to degree and long-run graduate school outcomes have received little attention to date in the literature, I argue that my estimates are informative. Moreover, in section 4 I conduct supplemental analyses following the methods of Oster (2019) to assess the extent of unobserved selection in my setting. These results suggest that it is unlikely that controlling for all important unobserved and omitted variables would completely attenuate the estimates to zero. Thus, while I avoid making strong causal claims regarding my specific point estimates, I contend that my estimates suggest that a causal relationship exists between time to degree and graduate school outcomes. Assuming selection bias is positive, my estimates can be considered an upper bound on the causal effect of time to degree.

3 Time to Bachelor's Degree and Graduate School Enrollment

This section reports and discusses my core results. I begin by exploring the relationship between time to degree and students' later enrollment in graduate degree programs. I then present results on how these relationships differ across different types and fields of graduate programs and across different student groups. Finally, I assess the robustness

of my core results to additional control variables and alternative samples.

3.1 Main results

Table 2 presents the core results examining the relationship between time to bachelor's degree and whether the student ever enrolled in a graduate degree program within ten years of earning the bachelor's degree. Each column progressively includes additional controls to assess how the coefficients on time to degree respond. Column 1 begins with only graduating cohort fixed effects as controls. The coefficients show that, relative to on-time graduates, delayed graduates have lower graduate school enrollment rates of between 17.7 to 20.1 percentage points. After including controls for student demographics (column 2); parent's education, family income, and SAT score (column 3); college GPA and college major fixed effects (column 4); and college fixed effects (column 5), the coefficients on the time to degree indicators are more than halved. Yet, the estimates show that, even with the full set of controls, graduate school enrollment rates of delayed graduates are lower by 6.8 to 9.5 percentage points, or 12.1 to 16.9 percent differences relative to the enrollment rate of four-year graduates.

In Table A2 and Table A3 I report results from the same regressions but which instead use graduate school enrollment within four years and one year since earning the bachelor's degree, respectively. With the full set of controls, both tables show similar relationships between time to degree and graduate school enrollment that was seen in Table 2. Within four years of earning the bachelor's degree, delayed graduates have between 5.2 and 8.9 percentage points (11.9 to 20.5 percent) lower graduate school enrollment. Within one year of the bachelor's degree, delayed graduates have between 6.9 and 9.0 percentage points (23.9 to 31.3 percent) lower graduate school enrollment. The larger disparities in graduate school enrollment within a shorter time frame since earning a bachelor's degree suggests a relationship between time to degree and the

Table 2. Time to degree and enrollment in graduate school within 10 years of BA.

	(1)	(2)	(3)	(4)	(5)
Time to degree					
4 years or less (reference)	*Outcome mean for 4-year-grads = 0.561*				
5 years	-0.177***	-0.178***	-0.137***	-0.103***	-0.085***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
6 years	-0.201***	-0.205***	-0.147***	-0.116***	-0.094***
	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)
7 years or more	-0.196***	-0.200***	-0.137***	-0.093***	-0.068***
	(0.021)	(0.021)	(0.023)	(0.022)	(0.022)
Demographics					
Female		0.012	0.038***	-0.019*	-0.019*
		(0.011)	(0.011)	(0.012)	(0.012)
Black		0.078***	0.152***	0.181***	0.127***
		(0.023)	(0.023)	(0.023)	(0.027)
Hispanic		0.046**	0.081***	0.083***	0.066***
		(0.023)	(0.024)	(0.023)	(0.025)
Asian		0.050**	0.031	0.050**	0.029
		(0.025)	(0.025)	(0.022)	(0.023)
Background					
Parent with BA			0.027**	0.025**	0.031***
			(0.012)	(0.011)	(0.011)
Family income ($10,000s)			0.000	0.001*	0.001
			(0.001)	(0.001)	(0.001)
Academics					
SAT score (100s)			0.047***	0.029***	0.019***
			(0.003)	(0.003)	(0.004)
College GPA (0.1s)				0.015***	0.018***
				(0.001)	(0.001)
Observations	16,320	16,320	16,320	16,320	16,320
Additional controls:					
B&B cohort fixed effects	✓	✓	✓	✓	✓
College major fixed effects				✓	✓
College fixed effects					✓

Notes: The outcome in the regression results in the above table is whether the graduate ever enrolled in a graduate school program within ten years of earning a bachelors degree. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

timing of initial graduate school enrollment, which I examine more in section 4.

3.2 Robustness

In this subsection I assess the robustness of the main results to alternative specifications and samples. First, I show in Table A5 that I find similar results when using data from all four of the B&B graduating cohorts (including graduates from the 2000 and 2016 academic years) for outcomes that are observed during the baseline NPSAS survey or the follow-up survey one year after graduation. In particular, I estimate similar differences in graduate school enrollment by time to degree within one year of earning a bachelor's degree when using all four B&B cohorts (see column 3 of Table A5) compared to using only the 1993 and 2008 cohorts. I also find similar results in Table A7 which relaxes the main analytic sample restrictions that conditioned the sample on who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school.

I also explore alternative specifications in Table A6 that include additional controls, specifically regarding students' experiences during college. Column 1 repeats the main results from column 5 of Table 2. Column 2 includes additional covariates including the amount of loans students had upon completing college, whether the student worked part-time or full-time (relative to not working) in their last year of their bachelor's degree, and whether the student took remedial courses or transferred any credits. If the differences in graduate school enrollment by time to degree were primarily due to differences in these college experiences, including them as controls would attenuate the coefficients on the time to degree indicators. However, the estimates are similar to those in column 1.

Columns 3 and 4 of Table A6 run the same regressions separately for the 1993 and 2008 graduating cohorts. The estimates of the differences in graduate school enrollment by time to degree are remarkably consistent across these graduating cohorts. Finally, column 6 includes even more covariates for students academic experiences during

college that are only available in the data for the 2008 B&B cohort. These additional covariates include indicators for whether the student changed major during college, experienced a "stop out", was placed on academic probation, withdrew from a course or received an incomplete grade, and repeated a course to get a higher grade. While all these variables are related to the likelihood a student is a delayed graduate (see Table A1), including them in the regression makes very little difference for the estimates of the relationship between time to degree and graduate school enrollment.

Finally, following the insights from Altonji et al. (2005) and the methods of Oster (2019), I assess the extent to which selection bias may explain the main results. In essence, this method estimates how much unobservable heterogeneity would need to exist, relative to the observable heterogeneity included in the controls, to completely explain away the main results by comparing the results between a "short" regression with no controls and a "long" regression with the full set of controls. The key insight is that by comparing how the coefficient of interest and the R^2 changes between the "short" and "long" regressions provide information about the potential for unobserved and omitted covariates biasing the estimates. To carry out the analysis, I replace the indicators for specific years to degree in Equation 1 with a single variable indicating any delayed graduation (5 years to degree or more). Following the recommendations of Oster (2019), I make an assumption of the maximum possible R^2 calculated as 1.3 times the R^2 from the "long" regression.

Table 3 shows the results for both the "short" and "long" regressions for several graduate school outcomes, including the estimates on the indicator for delayed graduation, the R^2, and Oster's δ—which represents how much more meaningful unobservable and omitted covariates would need to be, relative to the observable and included covariates, to explain away the results. Oster (2019) argues that δ values greater than one are robust to potential unobservable selection. For the main outcome—enrollment in graduate school within 10 years of earning a bachelor's degree—the coefficient on

delayed graduation goes from -0.186 to -0.085 between the "short" and "long" regressions. Meanwhile, the R^2 increases from 0.040 to 0.258. This leads to an Oster's δ of 1.31, which implies that unobservable and omitted covariates would need to be 31 percent more meaningful than the observable covariates to explain away the finding that delayed graduates have lower graduate school enrollment rates. The values of Oster's δ are even larger for the other graduate school outcomes reported in the table.

In sum, these analyses suggest that it is unlikely that selection bias fully explains the differences I observe in graduate school enrollment by time to degree. While I refrain from claims that my main estimates have identified the true causal parameter, considering all the analyses above I argue that my estimates provide evidence that a causal effect of some magnitude does exist.

3.3 Types of graduate degree programs

In this subsection I assess whether the lower graduate school enrollment rates for delayed graduates are concentrated among particular types or fields of graduate school programs in Table 4.[3] Columns 1 and 2 show that the disparities in graduate school enrollment by time to degree are larger in percentage point terms for master's degree programs than doctoral degree programs. However, since enrollment rates in doctoral programs are lower overall, the enrollment disparities are actually larger in percent terms for doctoral degree programs than master's degree programs. Columns 3 through 7 show results for enrollment in particular graduate program fields. Enrollment disparities by time to degree are concentrated among STEM (especially in health fields) and humanities/social science fields, while little differences exist for enrollment in business or education graduate programs.

[3]The outcome in this table is enrollment in particular graduate program types and fields within four years of earning a bachelor's degree. Due to inconsistencies in variable availability across surveys for different B&B cohorts I am unable to produce a similar table for enrollment within ten years of earning a bachelor's degree.

Table 3. Unobservable selection and coefficient stability.

	Short (1)	Long (2)	Oster's δ (3)
Enrolled in graduate school within 10 years of BA	-0.186***	-0.085***	1.30
	(0.011)	(0.012)	
R^2	0.040	0.258	
Observations	16,320	16,320	
Enrolled in graduate school within 4 years of BA	-0.174***	-0.084***	1.41
	(0.010)	(0.012)	
R^2	0.038	0.249	
Observations	16,520	16,520	
Enrolled in graduate school within 1 year of BA	-0.130***	-0.081***	2.01
	(0.009)	(0.010)	
R^2	0.037	0.220	
Observations	17,890	17,890	
Applied to graduate school before completing BA	-0.118***	-0.067***	2.06
	(0.009)	(0.011)	
R^2	0.019	0.200	
Observations	17,900	17,900	
Attained graduate degree within 10 years of BA	-0.185***	-0.092***	1.48
	(0.010)	(0.011)	
R^2	0.043	0.242	
Observations	16,840	16,840	

Notes: The above table conducts an analysis of coefficient stability using the psacalc Stata command created by Oster (2019). The analysis calculates the proportional selection coefficient (Oster's δ in column 3) which represents how much more meaningful unobservable and omitted covariates would need to be, relative to the observable and included covariates, to explain away the results. Specifically, Oster's δ is calculated by comparing the results between the short regression in column 1 with no controls to the results in the long regression in column 2 with the full set of controls. For simplicity, I use a single indicator for any delayed graduation (5 or more years to degree) as the independent variable of interest instead of separate indicators for 5, 6, and 7 years to degree. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

4 Analysis of Mechanisms

This section aims to provide evidence towards why differences in graduate school enrollment exist between on-time and delayed graduates. At a high level I see three broad potential mechanisms. First, differences in graduate school enrollment by time to degree could result from an effect that spending longer in college has on students. For

Table 4. Program type and field of highest graduate school enrollment.

	Program type		Program field				
	Master's (1)	Doctoral (2)	STEM (3)	Health (4)	Business (5)	Education (6)	Hum. & Soc. Sci. (7)
Time to degree							
4 years or less (reference)							
5 years	-0.054***	-0.033***	-0.026***	-0.023***	-0.011*	-0.004	-0.031***
	(0.012)	(0.007)	(0.008)	(0.006)	(0.007)	(0.006)	(0.007)
6 years	-0.063***	-0.030***	-0.041***	-0.040***	-0.013	-0.009	-0.012
	(0.016)	(0.009)	(0.010)	(0.007)	(0.008)	(0.008)	(0.010)
7 years or more	-0.030	-0.027***	-0.016	-0.019*	0.000	-0.003	-0.026**
	(0.020)	(0.010)	(0.012)	(0.010)	(0.011)	(0.010)	(0.012)
Observations	16,520	16,520	16,520	16,520	16,520	16,520	16,520
Outcome mean for 4-year-grads	0.317	0.132	0.124	0.084	0.065	0.073	0.129

Notes: The outcome in the regression results in the above table is the graduate school program type or field of the highest program enrollment within four years of earning a bachelors degree. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

instance, taking more time to complete a degree could increase a student's "educational fatigue," where students become tired of being a student and opt to enter the labor market rather than pursuing further education. There could also be other factors that follow from a longer time to degree, such as larger student loan balances, that could deter students from considering graduate school. Second, differences in graduate school enrollment could result from colleges who penalize students with a longer time to degree with lower admissions rates to graduate degree programs. Finally, since my empirical approach does not exploit strictly exogenous variation in time to degree, the differences in graduate school enrollment could be partially or fully explained by selection bias: differences between students with a different time to degree that are correlated with graduate school enrollment and not accounted for in my full set of control variables.

To begin, there are some results that have already been discussed that are helpful to uncover the potential mechanisms at play. In Table A6, for example, I included in the regressions many additional covariates that describe students' experiences during college, including (among several others) the amount of loans students finished their degree with and their employment status during their last year of their degree. Including these additional variables had little effect on changing the estimated difference in graduate school enrollment rates by time to degree. These results suggest that the lower enrollment rates for delayed graduates are seemingly not explained by a larger amount of student debt or a greater attachment to the labor force among delayed graduates. Moreover, the results in Table 3 using the methods of Oster (2019) shows that it is unlikely that selection bias can fully explain the differences in graduate school enrollment that I observe by time to degree.

Next, I present results in Table 5 that largely use other outcome variables related to graduate school enrollment that are available in the B&B data using the same specification and full set of controls from the main results in Equation 1. Column 1 shows that upon graduating with their bachelor's degree, delayed graduates do not have large differences in their expectations for later earning a graduate degree compared to on-time graduates.[4] Yet, column 2 shows that delayed graduates are less likely to have applied to a graduate degree program during their last year of their bachelor's degree. The magnitude of these differences (17 to 25 percent) is similar to, although slightly larger than, the differences in graduate school enrollment. To reemphasize the takeaway from column 1, column 3 conditions the sample on students who indicated that they expected to someday earn a graduate degree. I still find lower application rates for delayed graduates, suggesting again that the main results do not appear to be explained by differential expectations or motivation to earn a graduate degree.

[4]The specific question wording is: "What is the highest level of education you ever expect to complete?" The response options are: bachelor's degree, post-BA or post-master certificate, master's degree, first-professional degree, or doctoral degree. The question is asked during the baseline NPSAS survey.

Table 5. Analysis of mechanisms.

Outcome variable:	Expect to earn grad degree	Applied to grad school	Applied to grad school	Enrolled in grad school
Sample condition:	None	None	Expect to earn grad degree	Applied to grad school
	(1)	(2)	(3)	(4)
Time to degree				
4 years or less (reference)				
5 years	-0.020*	-0.064***	-0.080***	-0.064**
	(0.012)	(0.012)	(0.015)	(0.025)
6 years	-0.021	-0.081***	-0.111***	-0.047
	(0.016)	(0.016)	(0.020)	(0.034)
7 years or more	0.032	-0.054***	-0.086***	
	(0.020)	(0.019)	(0.023)	
Observations	17,110	17,900	13,690	5,660
Outcome mean for 4-year-grads	0.807	0.326	0.381	0.660

Notes: The above table uses alternative outcomes and samples to explore potential mechanisms. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The outcome in column 1 is whether the student expected to earn a graduate degree when asked during the last year of their bachelor's degree. The outcome in columns 2 and 3 is whether the student had applied to a graduate degree program before completing their BA. Column 3 conditions the sample on those who expected to earn a graduate degree. The outcome in column 4 is whether the graduate ever enrolled in a graduate degree program within one year of earning the BA degree, while conditioning the sample on those who had applied to a program before completing their BA. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

The final column of Table 5 conditions the sample on students who applied to a graduate degree program during their final year of their bachelor's degree. In this specification I combine the "six years to degree" and "seven years or more" groups to compensate for the loss in statistical power for this smaller sample size. Among these students, I still find that delayed graduates have lower graduate school enrollment rates within one year of earning their bachelor's degree. This may indicate that delayed graduates are admitted to graduate programs at lower rates than on-time graduates even conditional on applying, which would offer some support for the role of graduate program admissions as a mechanism for the main results. However, the magnitude of the differences (7 to 10 percent) is smaller than for other results, suggesting this is likely

not a primary channel.

Overall, the analyses in Table 5 suggest an important role for how longer time to degree affects students in explaining the lower graduate school enrollment rates for delayed graduates. In particular, the results seem to fit with a story where longer time to degree generates greater educational fatigue. Despite not having significantly lower expectations for earning a graduate degree in the future, delayed graduates end up enrolling in graduate school at much lower rates. It appears that after spending extra time completing a bachelor's degree, delayed graduates are less willing to continue being a full-time student and instead are more likely to enter the labor market perhaps with goals of eventually returning to graduate school.

Further analyses in Table A8 and Table A9 support this story. Table A8 shows that the differences in enrollment come entirely within the first year after completing the bachelor's degree. Delayed graduates are not more or less likely to initially enroll in graduate school either between one and four years after graduation or between four and ten years after graduation. Meanwhile, Table A9 shows that the differences in enrollment are entirely driven by differences in full-time enrollment in graduate programs. Delayed graduates are not more or less likely to enroll part-time in a graduate school program. These results show that the main results are explained by an abrupt divergence in full-time enrollment in graduate school between on-time and delayed graduates immediately after finishing their bachelor's degrees.

5 Additional Results

This section presents additional results that explores the relationship between time to degree and graduate degree attainment, as well as the heterogeneity of the relationship between time to degree and graduate school enrollment.

5.1 Heterogeneity by student characteristics

Among adults between 30–65 years old, 16 percent of the White population in the United States have an advanced degree, while these attainment rates are 11 and 7 percent among the Black and Hispanic populations, respectively (Ruggles et al., n.d.).[5] Given these disparities in graduate degree attainment rates in the United States between certain student groups, it is important to examine whether time to degree plays any role in contributing to those disparities. In Table 6 I examine the heterogeneity in the relationship between time to degree and graduate school enrollment by student groups including race/ethnicity and parental income. For the latter, I use information on adjusted gross income that is reported in student's filings of the FAFSA (Free Application for Federal Student Aid) that is included in the B&B data.

Columns 1 and 2 show estimates separately for White students and for Black or Hispanic students. The results show that differences in graduate school enrollment rates between on-time and delayed graduates are generally larger for Black or Hispanic students compared to White students, although these between-race differences are not statistically significant.[6] Meanwhile, columns 3 and 4 show results separately for students with parental incomes that are above and below the median in the analytic sample. I find that there are fairly similar relationships between time to degree and graduate school enrollment for higher and lower income bachelor's degree graduates. Table A4 also explores heterogeneity by student's sex and the selectivity of the college they graduated from. I find similar differences by time to degree between male and female graduates but find somewhat larger enrollment disparities by time to degree for students graduating from a relatively less selective college, although differences across

[5] Advanced degree attainment rates are calculated using the 2021 American Community Survey, including the provided person weights as obtained from IPUMS USA.

[6] I test for statistically significant differences between student groups by estimating a single regression that uses a single indicator for any delayed graduation and the interaction of that delayed graduation indicator with an indicator variable for a specific student subgroup.

Table 6. Heterogeneity by race/ethnicity and parental income.

	Race/ethnicity		Parental income	
	White (1)	Black or Hispanic (2)	Above median (3)	Below median (4)
Time to degree				
4 years or less (reference)				
5 years	-0.082***	-0.114**	-0.105***	-0.057***
	(0.014)	(0.047)	(0.018)	(0.021)
6 years	-0.095***	-0.114*	-0.089***	-0.109***
	(0.021)	(0.061)	(0.030)	(0.026)
7 years or more	-0.050**	-0.202***	-0.064	-0.060**
	(0.026)	(0.073)	(0.071)	(0.028)
Observations	12,820	2,120	8,120	8,080
Outcome mean for 4-year-grads	0.543	0.624	0.575	0.531

Notes: The above table assesses the heterogeneity in the relationship between time to bachelor's degree and graduate school enrollment within 10 years of earning the BA by student characteristics. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

these groups are again not statistically significant.

5.2 Degree attainment

Finally, Table 7 shows that these differences in graduate school enrollment by time to degree also lead to differences in graduate degree attainment. Within four years of completing a bachelor's degree delayed graduates have about 9 percentage point (or 38 percent) lower graduate degree attainment rates, compared to on-time graduates. Within ten years of completing a bachelor's degree, these differences are between 8.6 to 10.4 percentage points (20 to 24 percent). In both cases, differences in attainment rates for doctoral degrees are slightly larger in percent terms than for master's degrees.

Table 7. Time to degree and graduate degree attainment.

	Within 4 years of BA			Within 10 years of BA		
	All	Master's degree	Doctoral degree	All	Master's degree	Doctoral degree
	(1)	(2)	(3)	(4)	(5)	(6)
Time to degree						
4 years or less (reference)						
5 years	-0.090***	-0.061***	-0.026***	-0.093***	-0.067***	-0.025***
	(0.010)	(0.009)	(0.005)	(0.012)	(0.012)	(0.007)
6 years	-0.094***	-0.069***	-0.022***	-0.112***	-0.083***	-0.029***
	(0.013)	(0.012)	(0.006)	(0.016)	(0.015)	(0.008)
7 years or more	-0.091***	-0.072***	-0.017***	-0.087***	-0.064***	-0.016
	(0.015)	(0.014)	(0.006)	(0.020)	(0.019)	(0.010)
Observations	16,520	16,520	16,520	16,360	16,360	16,360
Outcome mean for 4-year-grads	0.240	0.182	0.054	0.431	0.300	0.121

Notes: The outcome in the regression results in the above table is whether the graduate ever earned a graduate degree within four and ten years of earning a bachelors degree. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

6 Conclusion

In this paper, I study the relationship between time to bachelor's degree and long-run graduate school outcomes. I use nationally representative data from the Baccalaureate and Beyond surveys which allows me to follow the outcomes of multiple cohorts of bachelor's degree graduates up to ten years after completing their bachelor's degrees. I take a selection on observables empirical approach where I relate several graduate school outcomes to the number of years students take to complete their bachelor's degree while conditioning on a rich set of controls including student demographics, SAT scores, parent's education and income, college GPA, college major, and college fixed effects.

I consistently estimate large disparities in graduate school outcomes between on-time and delayed bachelor's degree graduates. Within ten years of earning a bachelor's

degree, delayed graduates have graduate school enrollment rates that are around 9 percentage points (or about 14 percent) lower than on-time graduates. Within this same time frame, I also find differences of a similar magnitude in percentage point terms for graduate degree attainment rates by time to degree, although these differences are larger in percent terms (about 21 percent). I also find somewhat larger graduate school enrollment differences between on-time and delayed graduates among Black or Hispanic students relative to White students. While these differences by race/ethnicity are not statistically significant, they suggest time to degree may contribute to disparities in graduate degree attainment rates by race.

The pattern of the results suggests an important role for how time to degree generates an educational fatigue where students with a longer time to degree are much less likely to continue being a full-time student immediately after finishing a bachelor's degree. In additional analyses, I show that while delayed graduates do not have large differences in their expectations for earning a graduate degree at the time of finishing their bachelor's degree, I do find large differences in application rates to graduate school programs in students' final year of their bachelor's degree. Moreover, I find that the differences in graduate school enrollment are entirely driven by differences in full-time enrollment within one year of earning their bachelor's degrees. Delayed graduates are not more or less likely to initially enroll in graduate school between one and ten years after earning the bachelor's degree, or to enroll part-time in a graduate program.

An important limitation of this paper is that my estimates are not based on variation in time to degree that is strictly exogenous with respect to graduate school outcomes. Thus, I withhold from making causal claims specific to my point estimates. I do contend, however, that my estimates are informative. First, the relationship between time to degree and graduate school enrollment has received little attention in the prior literature. Second, I am able to include a rich set of controls that seem to account for a significant amount of selection into a different time to degree, and my estimates are

remarkably insensitive to additional controls and alternative samples. Supplemental analyses also suggest that selection bias from unobserved and omitted variables are unlikely to completely attenuate my estimates to zero.

This paper uncovers a potential consequence of delayed graduation that has received little attention in the literature. Since nearly half of all bachelor's degree graduates in the United States are delayed graduates, my results highlight an important area for closer attention from policymakers and researchers. There is still much to learn about who enrolls in graduate school and why. Moreover, there is scope for policy interventions to support delayed graduates who would like to eventually enroll in graduate school, such as individualized counselling to promote seamless enrollment between undergraduate and graduate education, and active recruitment or tuition discounts in graduate admissions.

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A Appendix Tables and Figures

Table A1. Predictors of delayed graduation.

	(1)	(2)	(3)	(4)	(5)	(6)
Demographics						
Female	-0.114***		-0.143***	-0.140***	-0.138***	-0.119***
	(0.007)		(0.007)	(0.007)	(0.009)	(0.009)
Black	0.121***		-0.034**	0.003	-0.043**	-0.076***
	(0.016)		(0.015)	(0.016)	(0.020)	(0.020)
Hispanic	0.149***		0.043***	0.020	0.003	-0.017
	(0.015)		(0.014)	(0.015)	(0.018)	(0.018)
Asian	0.044***		0.037**	0.030**	0.030	0.011
	(0.016)		(0.015)	(0.015)	(0.018)	(0.018)
Background						
Parent with BA		-0.046***	-0.050***	-0.021***	-0.014	-0.017*
		(0.008)	(0.007)	(0.007)	(0.010)	(0.009)
Family income ($10,000s$)		-0.011***	-0.010***	-0.006***	-0.008***	-0.007***
		(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
SAT score (100s)		-0.063***	-0.068***	-0.044***	-0.046***	-0.040***
		(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
College experiences						
Had a part-time job in last year of BA				0.014*	-0.000	0.001
				(0.008)	(0.011)	(0.011)
Had a full-time job in last year of BA				0.142***	0.137***	0.113***
				(0.012)	(0.015)	(0.015)
Took remedial courses				0.050***	0.046***	0.031**
				(0.011)	(0.013)	(0.013)
Transferred any credits				0.120***	0.110***	0.094***
				(0.007)	(0.009)	(0.009)
Changed major						0.021**
						(0.009)
Stopped out						0.193***
						(0.013)
Placed on academic probation						0.126***
						(0.016)
Withdrew from course or incomplete grade						0.083***
						(0.010)
Repeated a course for higher grade						0.109***
						(0.011)
College fixed effects				✓	✓	✓
B&B cohort fixed effects	✓	✓	✓	✓	n/a	n/a
Included B&B cohorts	1993, 2008	1993, 2008	1993, 2008	1993, 2008	2008 only	2008 only
Observations	17,900	17,900	17,900	17,900	10,790	10,790

Notes: The table above regresses an indicator variable for whether students were a delayed graduate (5 years to degree or more) on student demographic, background, and college experience predictor variables. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A2. Time to degree and enrollment in graduate school within 4 years of BA.

	(1)	(2)	(3)	(4)	(5)
Time to degree					
4 years or less (reference)	*Outcome mean for 4-year-grads = 0.434*				
5 years	-0.169***	-0.171***	-0.132***	-0.102***	-0.087***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
6 years	-0.185***	-0.189***	-0.134***	-0.102***	-0.090***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)
7 years or more	-0.176***	-0.180***	-0.117***	-0.074***	-0.055***
	(0.019)	(0.019)	(0.020)	(0.020)	(0.021)
Demographics					
Female		0.005	0.029***	-0.021*	-0.020*
		(0.011)	(0.010)	(0.011)	(0.011)
Black		0.070***	0.136***	0.163***	0.105***
		(0.022)	(0.022)	(0.022)	(0.025)
Hispanic		0.040*	0.075***	0.075***	0.068***
		(0.022)	(0.021)	(0.021)	(0.023)
Asian		0.043*	0.028	0.040*	0.021
		(0.024)	(0.023)	(0.022)	(0.023)
Background					
Parent with BA			0.030***	0.027***	0.029***
			(0.011)	(0.011)	(0.011)
Family income ($10,000s$)			0.001	0.002***	0.002***
			(0.001)	(0.001)	(0.001)
Academics					
SAT score (100s)			0.041***	0.022***	0.017***
			(0.003)	(0.003)	(0.004)
College GPA (0.1s)				0.016***	0.018***
				(0.001)	(0.001)
Observations	16,520	16,520	16,520	16,520	16,520
Additional controls:					
B&B cohort fixed effects	✓	✓	✓	✓	✓
College major fixed effects				✓	✓
College fixed effects					✓

Notes: The outcome in the regression results in the above table is whether the graduate ever enrolled in a graduate school program within four years of earning a bachelors degree. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A3. Time to degree and enrollment in graduate school within 1 year of BA.

	(1)	(2)	(3)	(4)	(5)
Time to degree					
4 years or less (reference)	*Outcome mean for 4-year-grads = 0.288*				
5 years	-0.125***	-0.127***	-0.102***	-0.076***	-0.084***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
6 years	-0.133***	-0.135***	-0.099***	-0.071***	-0.079***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
7 years or more	-0.141***	-0.143***	-0.101***	-0.060***	-0.064***
	(0.015)	(0.015)	(0.016)	(0.015)	(0.016)
Demographics					
Female		-0.007	0.008	-0.027***	-0.032***
		(0.009)	(0.009)	(0.009)	(0.009)
Black		0.026	0.071***	0.088***	0.053***
		(0.018)	(0.019)	(0.018)	(0.020)
Hispanic		0.006	0.031*	0.034**	0.042**
		(0.018)	(0.018)	(0.017)	(0.020)
Asian		0.041**	0.036*	0.041**	0.045**
		(0.021)	(0.020)	(0.020)	(0.021)
Background					
Parent with BA			0.021**	0.018**	0.026***
			(0.009)	(0.009)	(0.009)
Family income ($10,000s$)			0.001	0.001**	0.002**
			(0.001)	(0.001)	(0.001)
Academics					
SAT score (100s)			0.026***	0.011***	0.014***
			(0.003)	(0.003)	(0.003)
College GPA (0.1s)				0.013***	0.014***
				(0.001)	(0.001)
Observations	17,890	17,890	17,890	17,890	17,890
Additional controls:					
B&B cohort fixed effects	✓	✓	✓	✓	✓
College major fixed effects				✓	✓
College fixed effects					✓

Notes: The outcome in the regression results in the above table is whether the graduate ever enrolled in a graduate school program within one year of earning a bachelors degree. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A4. Heterogeneity by sex and college selectivity.

	Sex		College selectivity	
	Male (1)	Female (2)	More selective (3)	Less selective (4)
Time to degree				
4 years or less (reference)				
5 years	-0.091***	-0.073***	-0.079***	-0.091***
	(0.022)	(0.018)	(0.021)	(0.018)
6 years	-0.092***	-0.093***	-0.065**	-0.125***
	(0.029)	(0.025)	(0.031)	(0.024)
7 years or more	-0.085**	-0.072**	-0.062	-0.081***
	(0.035)	(0.030)	(0.041)	(0.028)
Observations	6,860	9,440	7,110	8,210
Outcome mean for 4-year-grads	0.553	0.566	0.613	0.504

Notes: The above table assesses the heterogeneity in the relationship between time to bachelor's degree and graduate school enrollment within 10 years of earning the BA by student and college characteristics. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A5. Results using all four B&B graduating cohorts.

Outcome variable:	Expect to earn grad degree	Applied to grad school	Enrolled in grad school (1 yr post BA)	Enrolled in grad school (1 yr post BA)
Sample condition:	None	None	None	Applied to grad school
	(1)	(2)	(3)	(4)
Time to degree				
4 years or less (reference)				
5 years	-0.018**	-0.054***	-0.065***	-0.070***
	(0.008)	(0.008)	(0.007)	(0.019)
6 years	-0.005	-0.067***	-0.081***	-0.078***
	(0.012)	(0.011)	(0.009)	(0.025)
7 years or more	0.006	-0.054***	-0.060***	
	(0.014)	(0.013)	(0.010)	
Observations	34,250	34,890	35,980	9,680
Outcome mean for 4-year-grads	0.795	0.301	0.250	0.626

Notes: The above table shows results for which it is possible to use all four of the B&B's graduating cohorts: 1993, 2000, 2008, and 2016. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The outcome in column 1 is whether the student expected to earn a graduate degree when asked during the last year of their bachelor's degree. The outcome in columns 2 is whether the student had applied to a graduate degree program before completing their BA. The outcome in columns 3 and 4 is whether the graduate ever enrolled in a graduate degree program within one year of earning the BA degree. Column 4 conditions the sample on those who had applied to a program before completing their BA. The analysis sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A6. Robustness to additional controls and alternative samples.

	(1)	(2)	(3)	(4)	(5)
Time to degree					
4 years or less (reference)					
5 years	-0.085***	-0.093***	-0.078***	-0.097***	-0.098***
	(0.013)	(0.013)	(0.019)	(0.018)	(0.018)
6 years	-0.094***	-0.108***	-0.116***	-0.095***	-0.096***
	(0.019)	(0.019)	(0.026)	(0.027)	(0.027)
7 years or more	-0.068***	-0.086***	-0.089***	-0.084***	-0.083***
	(0.022)	(0.023)	(0.032)	(0.031)	(0.032)
College experiences					
Cumulative federal student loans ($10,000s)		0.016**	0.047***	0.009	0.008
		(0.007)	(0.014)	(0.007)	(0.007)
Had a part-time job in last year of BA		0.027**	0.005	0.043**	0.042**
		(0.013)	(0.018)	(0.018)	(0.018)
Had a full-time job in last year of BA		0.006	-0.044	0.037	0.036
		(0.018)	(0.028)	(0.024)	(0.024)
Took remedial courses		0.028*	0.008	0.030	0.030
		(0.016)	(0.028)	(0.021)	(0.021)
Transferred any credits		0.041***	0.040**	0.034**	0.034**
		(0.011)	(0.016)	(0.015)	(0.015)
Changed major					0.014
					(0.016)
Stopped out					-0.004
					(0.023)
Placed on academic probation					-0.020
					(0.030)
Withdrew from course or incomplete grade					0.015
					(0.017)
Repeated a course for higher grade					0.011
					(0.019)
Observations	16,320	16,320	6,010	10,310	10,310
Outcome mean for 4-year-grads	0.570	0.570	0.527	0.591	0.591
B&B cohorts included	1993, 2008	1993, 2008	1993 only	2008 only	2008 only

Notes: The outcome in the regression results in the above table is whether the graduate ever enrolled in a graduate school program within ten years of earning a bachelors degree. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The sample includes first-time bachelors degree graduates from the 1993 and/or the 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A7. Core results with relaxed sample conditions.

Outcome variable:	Enrolled in grad school	Enrolled in grad school	Enrolled in grad school	Applied to grad school	Earned grad degree
When outcome is observed:	10 years after BA	4 years after BA	1 year after BA	Last year of BA	10 years after BA
	(1)	(2)	(3)	(4)	(5)
Time to degree					
4 years or less (reference)					
5 years	-0.088***	-0.090***	-0.083***	-0.067***	-0.087***
	(0.012)	(0.012)	(0.010)	(0.011)	(0.011)
6 years	-0.102***	-0.086***	-0.079***	-0.086***	-0.113***
	(0.017)	(0.016)	(0.013)	(0.014)	(0.015)
7 years or more	-0.110***	-0.103***	-0.088***	-0.088***	-0.088***
	(0.015)	(0.014)	(0.011)	(0.013)	(0.013)
Observations	21,140	21,480	23,400	23,410	21,930
Outcome mean for 4-year-grads	0.557	0.428	0.286	0.325	0.400

Notes: The above table repeats the core results while eliminating the main sample conditions. The sample now includes all first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A8. Timing of first graduate school enrollment.

	Within 1 year after BA (1)	Between 1 and 4 years after BA (2)	Between 4 and 10 years after BA (3)
Time to degree			
4 years or less (reference)			
5 years	-0.084***	-0.001	0.005
	(0.010)	(0.009)	(0.010)
6 years	-0.079***	-0.006	-0.012
	(0.014)	(0.012)	(0.013)
7 years or more	-0.064***	0.014	-0.008
	(0.016)	(0.017)	(0.016)
Observations	17,890	15,790	15,640
Outcome mean for 4-year-grads	0.287	0.157	0.133

Notes: In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The outcome in column 1 is whether the student first enrolled in graduate school within one year of earning a bachelors degree. The outcome in column 2 is whether the student first enrolled in graduate school between one and four years of earning a bachelors degree. The outcome in column 2 is whether the student first enrolled in graduate school between four and ten years of earning a bachelors degree. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A9. Intensity of graduate school enrollment within 1 year of BA.

	Full-time (1)	Part-time (2)
Time to degree		
4 years or less (reference)		
5 years	-0.076***	-0.007
	(0.009)	(0.006)
6 years	-0.075***	-0.003
	(0.012)	(0.009)
7 years or more	-0.086***	0.023**
	(0.013)	(0.011)
Observations	17,890	17,890
Outcome mean for 4-year-grads	0.221	0.065

Notes: The outcome in the regression results in the above table is full-time or part-time enrollment in a graduate degree program within one year of earning a bachelors degree. In all columns, regressions include the full set of controls from column 5 of Table 2, including demographics, parent's education and income, SAT score, college GPA, and fixed effects for the student's college, college major, and B&B graduating cohort. The sample includes first-time bachelors degree graduates from the 1993 and 2008 B&B graduating cohorts who went to college within two years of graduating high school and who received a bachelors degree within eight years of graduating high school. The regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).