Summer 8-8-2023

Time to Baccalaureate Degree and Post-Graduation Outcomes

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ABSTRACT

TIME TO BACCALAUREATE DEGREE AND POST-GRADUATION OUTCOMES

By

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August 2023

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About 48 percent of bachelor's degree graduates take longer than four years to complete their degree. While earning a college degree is associated with substantial labor market benefits, the diverse paths students take towards completing their degrees may be important determinants of outcomes after graduation. Since employers routinely make inferences about a worker's productivity based on observable characteristics such as on a resume, time to degree could be meaningful in the labor market if employers value it as a signal of an applicants' potential performance as an employee. Moreover, the opportunity to pursue a graduate degree is an important source of the private returns to completing a college degree. 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. Time to bachelor's degree is an understudied point in this pipeline.

In Chapter 1, I study whether the amount of time students take to complete their bachelor's degree affects labor market outcomes after graduation using a resume-based field experiment. I randomly assign a time to degree of either four or six years, as well as the selectivity of the public colleges where the degrees were received, to fictitious resumes of recent graduates where all other resume attributes are equivalent on average. I send over 7,000 resumes

to real job vacancy postings for entry-level business jobs on a large online job board and track employer response rates. In the full sample of jobs, resumes listing bachelor's degree completion in six years received about 3 percent fewer employer responses than resumes indicating graduation in four years, but this difference is not statistically significant. However, for jobs with relatively large applicant pools, resumes listing six years to degree receive 17 percent fewer responses. Meanwhile, I estimate that listing a relatively more selective college increases response rates by about 13 percent, and by about 33 percent among higher paying jobs.

Chapter 2 studies 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.

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A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree
of
Doctor of Philosophy
in the
Andrew Young School of Policy Studies
of
Georgia State University

GEORGIA STATE UNIVERSITY
2023

ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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August, 2023

DEDICATION

To Melissa, my wife, for being a consistent source of love, support, patience, sacrifice, and encouragement.

ACKNOWLEDGEMENTS

Many people are worthy of my gratitude for contributing to my graduate school experience. This list is my attempt to acknowledge as many as I can.

My dissertation committee: Thank you to Jon Smith, my advisor, for always providing clear, constructive, and timely feedback on everything related to my graduate studies. Thank you to Dan Kreisman and Dave Ribar for research guidance, support, and mentorship. Thank you to Raj Darolia for valuable feedback towards constructing my resume audit study.

My classmates and colleagues at Georgia State University: Although life as a graduate student can sometimes seem isolating, graduate school is really a group activity. I've been fortunate to have learned from gifted and dedicated researchers and teachers. Each of you have not only critically enabled my completion of this task but also made the entire experience fun.

My family: Thank you for always practicing patience and asking the right questions, for supporting me during the lows and celebrating with me during the highs, and for encouraging me every step of the way.

My friends outside of Georgia State University: Thank you for being a constant source of fun and friendship that has been critical to maintaining a healthy balance between my work and non-graduate school life.

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1.1. Introduction

The time between initial postsecondary enrollment and completion of a bachelor's degree is considered a key indicator of student success. While earning a college degree is associated with substantial labor market benefits, the diverse paths students take towards completing their degrees may be important determinants of labor market outcomes after graduation. Bachelor's degree graduates often take longer than four years to graduate, which is the standard "on-time" number of years. While 58 percent of graduates finish in four years, 26 percent finish in five years, and 16 percent finish in six or more years (Denning et al., 2022).

Conditional on students' college major and the college they graduated from, delayed graduates are more likely to have repeated or withdrawn from a course, received an incomplete grade, or have been placed on academic probation, in addition to having lower college GPAs and SAT scores (See Table A1). Thus, taking more time to complete a bachelor's degree may send a negative signal to potential employers even conditional on what they can observe from a resume. Since employers routinely make inferences about a worker's productivity based on observable characteristics such as on a resume (Altonji and Pierret, 2001), time to degree could be meaningful in the labor market if employers value it as a signal of an applicants' potential performance as an employee. Alternatively, conditional on college and major, students graduating in a different number of years have taken a similar set of courses and should not have large human capital differences.

Does time to bachelor's degree affect labor market outcomes after graduation? I study this question by conducting a resume audit experiment that is designed to examine employer

preferences for job applicants who completed a bachelor's degree in a different number of years. I include two educational treatments on the resumes: 1) time to degree, either four or six years, indicated by the range of years listed next to the college the applicant graduated from, and 2) college selectivity, indicated by listing names of public colleges with distinct average SAT scores. This generates four resume types defined by the interaction of the two educational treatments. Including college selectivity as a secondary treatment provides a benchmark to compare estimates of the effect of time to degree. It also provides the ability to test for differences in how employers value time to degree between graduates of more or less selective colleges and test the extent to which time to degree may be a mechanism for the labor market returns to college selectivity. All other information listed on the resumes is designed to be independent of the treatments.

To carry out the experiment, I submit about 7,500 resumes to about 2,000 entry-level business jobs posted on a large online job board in seven major US metropolitan areas beginning in January 2022. I apply to jobs in occupations such as accounting, finance, marketing, and sales that require (or at least prefer) a bachelor's degree with at most three years of experience. All applicants list bachelor's degree completion in 2022. I track employer responses to each resume from emails, phone calls, and text messages and compare response rates across the different educational treatment characteristics.

In the full sample of jobs, I find little evidence that employers place a high value on time to degree as a signal of an applicants' quality. Overall, resumes listing bachelor's degree completion in six years have a 3 percent (0.4 percentage points) lower response rate than resumes listing four years to degree, though this difference is not statistically significant.

Moreover, the difference in the estimated effect of time to degree between more and less selective colleges is negligible.

There is evidence, however, that among jobs with larger applicant pools, there is a large penalty for delayed graduation. Listing six years to degree on resumes decreases response rates by about 17 percent (2.8 percentage points) relative to listing four years to degree. I interpret these results to suggest that on-time bachelor's degree graduation is often no more valuable to employers than delayed graduation. But time to degree does seem to be more important in some situations. Specifically, it appears the competitive environment of the job vacancy is important. This is consistent with time to degree being relatively low on employers' list of important resume characteristics. When an employer has many applicants, it has the luxury to be more selective in its pursuit of potential employees and screen applicants based on less important characteristics like time to degree. Thus, on-time graduation becomes more important for applicants looking to stand out in a larger, more competitive applicant pool.

My results provide evidence that colleges and students should not have significant concerns about initial labor market consequences of delayed graduation. While employers may value time to degree on the margin when job openings are competitive, the skills and employment experiences graduates list on resumes are likely to carry more value. However, the tuition costs and opportunity costs associated with longer time to degree remain important issues worth considering and addressing with policy. An important caveat of this paper is that my analysis is conditional on college graduation. The true cost of extending enrollment beyond the standard on-time number of years may be on the graduation margin itself. Given the large labor market returns to having a degree relative to not having a degree (Zimmerman, 2014; Smith,

Goodman, and Hurwitz, 2020; Kozakowski, 2020), policy efforts should continue to focus on helping students graduate, regardless of how long it takes.

The first contribution of this paper is providing causal evidence on the labor market returns to time to bachelor's degree. A few papers have studied the heterogeneous labor market outcomes of graduates with different time to degree with observational data (Fortin and Ragued, 2017; Aina and Casalone, 2020; Witteveen and Attewell, 2021). Generally, these papers find a negative relationship between longer time to degree and labor market outcomes, at least in some capacity. However, research on this question is limited by a lack of credibly causal research designs. Observational studies are challenging since exogenous sources of variation in time to degree are scarce, and there are likely important differences between graduates with different time to degree that are also correlated with labor market outcomes that cannot be fully accounted for.

My research design avoids these problems by experimentally varying the information observed by employers. Since I randomly assign time to degree and college names to otherwise identical resumes, on average, differences in response rates represent a causal difference in how employers perceive applicants with a different educational history. My study follows a long tradition of resume audit experiments that study how employers respond to job seekers' characteristics.[1] This includes a set of papers that experimentally vary educational characteristics including the sector and selectivity of postsecondary institutions (Darolia et al., 2015; Deming et al., 2016), internships during college (Nunley et al., 2016; Baert et al., 2021), online degrees (Lennon, 2021), and college grades (Quadlin, 2018; Piopiunik et al., 2020).

[1] See for example, Riach and Rich (2002), Bertrand and Mullainathan (2004), Lahey (2008), Kroft et al. (2013), Eriksson and Rooth (2013), Agan and Starr (2018), Farber et al. (2019), and Neumark et al. (2019).

Another primary contribution of this paper is providing evidence on time to degree as a potential mechanism for the returns to college selectivity. There is a correlation between college selectivity and time to degree: more selective colleges have a lower time to degree on average. Meanwhile, a large literature generally documents positive labor market returns to college selectivity (or quality), but who accrues these returns and why is less understood (Lovenheim and Smith, 2022). Part of the returns to college selectivity could operate through time to degree if more selective colleges cause students to graduate in less time.

With my experimental design I can separately estimate the effect of time to degree and college selectivity, which is not possible in studies that use observational data, even those with exogenous variation in college selectivity. For example, I compare outcomes between graduates of more and less selective colleges that graduate in the same number of years. Nevertheless, since I do not estimate large effects of time to degree, I also do not find strong evidence that time to degree is a major channel through which the returns to college selectivity operate.

A final contribution of this paper is providing a current estimate of the returns to college selectivity that is not subject to bias from spillover effects between resumes sent to the same job posting. This contribution is twofold. First, while there is a large literature that tends to find positive returns to college selectivity, these studies generally exploit natural experiments using observational data, which typically implies that estimates come from graduating cohorts of at least several years ago where data can observe individual's educational history and post-graduation outcomes. An advantage of my experimental setting is that the results reflect how the labor market currently views new bachelor's degree graduates with different educational characteristics. My results show that resumes listing a more selective college receive about 13 percent (1.7 percentage points) more responses than resumes listing a less selective college (with

about 300 points lower average SAT scores). Although, with an estimated effect of about 33 percent, the return to a more selective college is much larger among higher quality jobs (using expected salary as a proxy for job quality).

Second, I assign treatment types to resumes using a non-stratified design where each resume has an equal probability of being each of the four treatment types, rather than a stratified design where exactly one of each resume treatment type is sent to each job. Consequently, my estimates avoid attenuation bias from spillover effects between resumes sent to the same job (Phillips, 2019), which has likely resulted in underestimating the return to college selectivity in previous resume audits. For example, Deming et al. (2016)—who randomizes postsecondary sector and selectivity to resumes using a stratified design within job vacancy—estimate a null effect of resumes listing a more selective public college relative to listing a less selective public college. Meanwhile, I estimate a positive return to listing a more selective college, and I also show evidence that while spillover effects exist in my context, the spillovers do not bias my estimates because they are differenced out in the non-stratified design.

1.2. Experimental Design

1.2.1. Educational Treatments

There are two educational treatments included in the experiment: time to degree (either four or six years) and the selectivity of the institution where the bachelor's degree was earned. I choose four years to degree since that is considered on-time graduation. I choose six years to degree as the delayed graduation comparison since it is distinct from four years to degree while still being relatively common. The interaction of the two educational treatments creates four resume types:

1. Four years to degree from a more selective public institution.
2. Four years to degree from a less selective public institution.
3. Six years to degree from a more selective public institution.
4. Six years to degree from a less selective public institution.

Time to bachelor's degree is signaled by the years listed next to the bachelor's degree granting institution indicated on the resume. This is a common revelation on resumes; exploring a sample of over 550,000 real resumes from an online job board reveals that 79 percent of resumes that indicate bachelor's degree completion include a year or range of years associated with that degree attainment, with about half of those listing a range of years. This is a similar signaling mechanism employed by resume audit experiments that are designed to test for age discrimination by listing different years in which applicants completed high school (e.g., Lahey, 2008; Neumark et al., 2019; Farber et al., 2019). Furthermore, evidence from resume audit experiments that study unemployment duration suggests that employers are capable of finely examining dates and date ranges on resumes (e.g., Kroft et al., 2013).

I focus on recent bachelor's degree recipients. Thus, all resumes list bachelor's degree completion in 2022, with time to degree indicated by the listed start year (i.e., 2018 or 2016). Thus, resumes sent before May will hypothetically be forthcoming graduates, while resumes sent after May would be very recent graduates. Focusing on recent graduates has the advantage that educational signals are likely the most valuable to employers early in a worker's career (Altonji and Pierret, 2001; Lange, 2007).

I carefully choose the institutions in which the fictitious job applicants received their bachelor's degree according to two criteria. First, the institutions are well known public colleges located near the metro area of the job search such that it is common that graduates of the college

to search for jobs in that labor market. Second, the colleges are clearly distinct in terms their selectivity. The college names of the more and less selective institutions listed on resumes in each labor market are shown in Table 1. Using data from Conzelmann et al. (2022), the corresponding labor market for each college is the most common labor market where graduates of that college work after graduation. Meanwhile, the average difference in SAT scores between the more and less selective college used across the seven labor markets is about 300 points.

Table 1. College Names Listed on Resumes

Labor market	College name	Selectivity
Atlanta	Georgia Gwinnett College	Less selective
Atlanta	University of Georgia	More selective
Chicago	Northeastern Illinois University	Less selective
Chicago	University of Illinois at Urbana-Champaign	More selective
Dallas	Tarleton State University	Less selective
Dallas	University of Texas at Dallas	More selective
Los Angeles	California State University, Northridge	Less selective
Los Angeles	University of California, Irvine	More selective
New York City	SUNY Farmingdale State College	Less selective
New York City	Stony Brook University	More selective
Philadelphia	Penn State Brandywine	Less selective
Philadelphia	Penn State University	More selective
San Francisco	California State University, East Bay	Less selective
San Francisco	University of California, Davis	More selective

I submit four resumes to each job opening, unless the job posting is removed before all four resumes can be submitted.[2] I use a non-stratified design when assigning resumes their treatment type within job vacancy. As opposed to sending exactly one of each resume type to each job vacancy, this means that each resume has an equal probability of being one of the four treatment types. Using a non-stratified design is important to avoid bias from spillover effects between resumes sent to the same job.

Phillips (2019) documents that resumes have positive within-vacancy spillover effects in audit studies that send multiple resumes to each job vacancy. These spillover effects will bias

[2] 95 percent of jobs received all four resumes.

treatment effect estimates in audit studies that send exactly one of each treatment type to each job vacancy. In these stratified designs, the average treatment statuses of the *other* resumes sent to the same job will be systematically different across the *own*-resume treatment types. Since the spillover effects tend to be positive, the bias results in underestimating differences in employer response rates across resume treatments.

By using a non-stratified design, I ensure that the treatment statuses of the other resumes sent to the same job will be balanced across the own-resume treatment types. Thus, the spillover effects will "net-out" and the treatment effect estimates will not be biased by the spillover effects. The cost of using a non-stratified design is that job vacancy fixed effects cannot be included in the estimation without reintroducing bias from spillover effects, since the other resume treatment statuses are not balanced within job after conditioning on the vacancy fixed effects by construction. While job vacancy fixed effects are not necessary for internal validity, they would improve precision of the estimates. However, an additional benefit of the non-stratified design is that it provides the means to test for the presence of spillovers ex-post. I report results of this test in Section 1.4.4 which confirm that spillovers exist in my setting but also that the spillovers do not bias my estimates of the effects of the educational treatments.

1.2.2. Study Setting, Labor Markets, and Occupations

I send resumes to openings for full-time, entry-level business jobs that require (or at least prefer) a bachelor's degree, with at most 3 years of experience required. The focus on business jobs simplifies the resume creation and the job search process. Specifically, I apply to jobs in the occupations of banking, finance, accounting, management, marketing, and sales. Business occupations are the largest employers of bachelor's degree holders and business-related fields are also by far the most common bachelor's degree in the U.S.

I send the resumes to job postings in seven large cities in the U.S.: Atlanta, Chicago, Dallas, Los Angeles, New York City, Philadelphia, and San Francisco. I study large cities to ensure a large stock of job postings to apply to and to increase the generalizability of the results across different regions of the country. The number of cities to include in the study is chosen to balance these benefits with the fixed costs of creating realistic educational and employment histories within each labor market.

I apply to jobs on Indeed.com, a large online job board in the U.S. Many jobs posted on Indeed require following a link to the employer's website to apply. To avoid the less efficient application processes that characterize those jobs, I only apply to jobs where the employer allows applying to jobs and submitting resumes directly through Indeed's website.

1.2.3. Employment Experience

Each resume includes a "Work Experience" section. These employment experiences are designed to be independent of the treatments such that work experience is similar between applicants with four and six years to degree. The work histories on my fictitious resumes are heavily influenced by real resumes posted online by job seekers. All resumes include two entries in their employment history section. The work experiences I list include various off-campus retail or food service jobs, such as "Customer Service Associate" at The Gap or Target or "Barista" at Starbucks, and on-campus jobs such as "Office Assistant" at the financial aid office, or "Food Service Worker" in the campus dining hall. The work experiences I list are likely relatively less valuable to employers than some work experiences typical of a top graduate (i.e., internships or other business industry experience) to mimic students that are more representative of students on the margin of longer time to degree.

Job titles and firm names are chosen based on commonly listed information on real resumes. All jobs indicate occurring within the past three years before graduation, to look like part-time work while enrolled in college, or potentially full-time summer work. Descriptions of work experiences are also based in part on actual job descriptions recorded on real resumes. However, to simplify resume creation and generate more generic work descriptions that can be used in many settings, I also use and adapt some descriptions from Nunley et al. (2016).

1.2.4. Other Resume Attributes

Names listed on resumes are chosen so that the job applicants would vary by gender and race. Although, following work by Gaddis (2017), names are chosen that are commonly given by mothers of relatively high education within race, to mitigate the socio-economic signal portrayed by the names. Resumes include contact information featuring email addresses and phone numbers corresponding to names that are generated through Google. To mimic a recent or forthcoming graduate, physical addresses are assigned to be in large apartment complexes with reasonable commutes to the institution in which the student earns their bachelor's degree.

Resumes are assigned one of seven business-related majors associated with their bachelor's degree: business, accounting, economics, finance, business management, marketing, or business economics. Resumes also list a high school name and graduation year. High schools were chosen to be a large and diverse public school located in the metropolitan area of the job search. High school graduation year is the same as the applicant's college start year, implying zero years between high school graduation and entry into college. I also include a high school start year, which always indicates four years spent in high school, to increase the salience of the range of years enrolled in college.

The final section of each resume is a "Skills" section. I create several skill "templates," based on resumes posted by real job seekers with bachelor's degrees in business fields. All templates list skills in "Microsoft Office" in some form since this is very common among real business job seekers. The templates also include some other technical skills such as "database management" or "Adobe software" and some templates may include some "soft" skills or general attributes, like "team player" or "detail-oriented". More details about the skills and work history templates I use to populate the resumes are included in Table A2.

1.2.5. Resume Creation

To create resumes I use the "resume randomizer" software developed by Lahey and Beasley (2009). The program allows complete control over all components of and information included on each resume, including how attributes are randomized both within and across job vacancies. Figure A1 shows an example of a resume used in the study. Each resume lists the sections in the same order, with name and contact information at the top, followed by the education section, the work experience section, and lastly, the skills section.

Resumes sent to the same job posting are designed to be visually distinct to mitigate the possibility that employers detect the experiment. Within job vacancy each resume uses a different font and distinct formatting features. Moreover, names, physical addresses, high school names, work histories, and skills templates are never repeated among resumes sent to the same job. To further limit the risk of employer detection, I wait at least three hours in between submitting resumes to the same job. Also, I only submit a set of four resumes to one job per firm, per labor market.

1.2.6. Data Collection

The outcome of interest is whether an employer responds positively to some applicants, typically a request for an interview, but not others. To track employer responses, I use the generated email addresses and phone numbers that correspond to applicant names. From these responses I create two outcomes: 1) any (non-perfunctory) positive response and 2) a request for an interview. In addition to tracking employer responses, I record information about the job posting itself such as the firm name, job title, the text of the job description summary, and if available, the number of expected hires.

I also collect data on the expected salary of each job, which comes from three sources. First, for roughly half of jobs the employer listed a salary or salary range on the job posting. Second, for about one-fourth of jobs, I use a salary range estimated by Indeed that the website sometimes lists on the job posting when an employer does not. Third, for the final one-fourth of jobs, I scrape median salaries from a separate tool on Indeed's website that allows one to search salaries based on job titles.

Additionally, after applying to a job Indeed displays how many people have applied to the job in a range of five applicants (i.e., 21-25, 26-30, 31-35, etc.). I record the number of applicants after waiting at least two weeks after applying to the job to allow others to submit applications.

1.3. Results

1.3.1. Summary Statistics

Table 2 and Table 3 present descriptive statistics for characteristics of jobs and applicants in the full experimental sample. I sent a total of 7,371 resumes and received a 13.6 percent response rate overall. This response rate is evidence of the validity of the resumes used in the

study and that employers considered them realistic. Other comforting evidence of the validity of the study is that response rates are higher for lower salary jobs and jobs hiring more than one candidate, while response rates are lower for higher salary jobs and jobs hiring only one candidate.

Table 2. Descriptive Statistics by Job Characteristics

	Response rate	Number of resumes
Total	0.136	7,371
Atlanta	0.137	1,382
Chicago	0.149	1,034
Dallas	0.175	764
Los Angeles	0.183	564
New York	0.107	1,582
Philadelphia	0.138	727
San Francisco	0.118	1,318
Sales	0.224	1,342
Marketing	0.092	728
Finance	0.102	1,789
Accounting	0.111	1,292
Business Administration	0.081	962
Other	0.125	558
Above median salary	0.088	3,464
Below median salary	0.181	3,816
Salary posted by employer	0.177	3,952
Salary estimated by Indeed	0.090	1,810
Salary scraped from Indeed	0.087	1,518
Hiring one candidate	0.092	2,763
Hiring multiple candidates	0.092	1,263
Number of hires not specified on job posting	0.109	3,345
Above median number of applicants	0.144	3,527
Below median number of applicants	0.129	3,844

Notes: This table shows the number of resumes and response rates by characteristics of the job posting. The response rate is the share of resumes that received a non-perfunctory response from a potential employer.

About 28 percent of jobs in the full sample are in sales or customer service related occupations. Meanwhile, 24 percent of jobs are in finance, 18 percent in accounting, 10 percent

in marketing, and 21 percent are in business administration or other business occupations. About 55 percent of job postings specified the number of applicants the employers are looking to hire, with about 17 percent of jobs overall indicating a desire to hire multiple candidates. The median number of people who applied to the jobs in the sample falls within a range of 26-30. Resumes sent with names typical of Black applicants received fewer responses than White applicants, and women applicants received fewer responses than men, but both differences are not statistically significant. At the intersection of race and gender, White men applicants have response rates 1.9 percentage points higher than Black women, which is statistically significant at the 10 percent level.

Table 3. Descriptive Statistics by Applicant Characteristics

	Response rate	Number of resumes
Total	0.136	7,371
White man	0.143	1,771
White woman	0.140	1,839
Black man	0.138	1,903
Black woman	0.124	1,858
Business major	0.135	1,026
Marketing major	0.111	1,061
Accounting major	0.160	1,118
Economics major	0.134	1,041
Finance major	0.146	1,054
Business Management major	0.133	1,043
Business Economics major	0.132	1,028
BA degree	0.134	3,703
BS degree	0.138	3,668
1st resume sent	0.142	1,957
2nd resume sent	0.137	1,873
3rd resume sent	0.135	1,792
4th resume sent	0.130	1,747

Notes: This table shows the number of resumes sent and response rates by characteristics of the fictitious applicants. The response rate is the share of resumes that received a non-perfunctory response from a potential employer.

I test for the balance of applicant characteristics across the four resume treatments by regressing each characteristic on indicators for the four treatments and running an F-test with a null hypothesis that the coefficients are jointly equal to zero. The results of these tests, presented in Table A3, show that randomization was successful. Out of the 40 characteristics tested, 2 characteristics reject the null hypothesis of the F-test at a 10 percent significance level, which is to be expected.

1.3.2. Main Estimates

Given the random assignment of the resume treatments, a simple regression of an employer response outcome on indicator variables for the treatment characteristics can capture the causal difference in the probability of an employer response between the educational treatments. The estimating equations take one of two general and related forms:

$$Response_{ij} = \alpha^k \cdot T^k + \mu_{ij} \quad (1.1)$$

$$Response_{ij} = \beta_0 + \beta_1 \cdot 1(Six\ years\ to\ degree_i) + \beta_2 \cdot 1(Selective\ college_i) + \varepsilon_{ij} \quad (1.2)$$

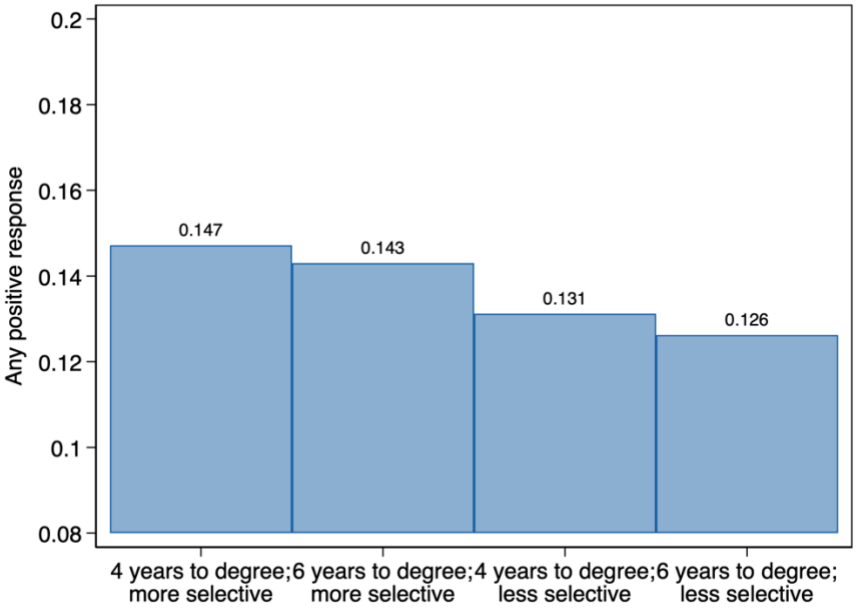
The outcome in both equations is an indicator variable that equals 1 if resume i gets an employer response for job vacancy$j$.[3] Equation 1.1 regresses this outcome on indicators for each of the four resume types (denoted by the k superscripts), while suppressing the constant term. Equation 1.2 pools the treatments into indicators for whether the resume lists six years to degree (relative to listing four years to degree) and whether the resume lists a selective college (relative to listing a less selective college). Occasionally, I add to Equation 1.2 the interaction between $1(Six\ years\ to\ degree_i)$ and $1(Selective\ college_i)$ to test for differences in the time to degree

[3] I estimate both equations with a linear probability model using ordinary least squares. Results are identical when estimating with a logistic model. The full sample estimates using a logistic model are shown in Appendix Table A6.

effect between more and less selective colleges. In all results I cluster standard errors at the job vacancy level.

In either equation I occasionally include a set of controls for other information listed on the resume including college major, the degree type (BA or BS), gender, race, the work experience and skill template, and formatting details. These controls are not necessary for internal validity, but they can slightly improve precision by reducing residual variance in the outcome.

Figure 1. Employer Response Rates by Resume Treatment



Notes: This figure shows coefficients from a regression of employer responses on indicators for the four resume treatment types (with the constant suppressed).

Figure 1 summarizes the results in the full sample. The figure presents response rates by the four resume treatments using Equation 1.1. Small differences exist between resumes listing six years to degree relative to listing four years to degree. For resumes listing a bachelor's degree from a more selective college, those that also list six years to degree have response rates 0.4 percentage points lower. For resumes indicating a less selective college, those listing six years to

degree receive response rates 0.4 percentage points lower. Meanwhile, regardless of time to degree, resumes listing a more selective college receive higher response rates than resumes listing a less selective college.

Column 1 of Table 4 presents the regression estimates from the pooled specification in Equation 1.2. Overall, resumes listing 6 years to degree have a response rate 0.4 percentage points lower than resumes listing 4 years to degree, though this is statistically insignificant. The standard errors allow me to rule out a time to degree effect larger in magnitude than -1.9 percentage points. Listing a more selective college, however, increases employer response rates by a statistically significant 1.7 percentage points, a 13 percent increase, relative to listing a less selective college. Column 2 shows that including resumes controls produces nearly identical results.

Table 4. Full Sample Estimates

	(1)	(2)	(3)	(4)
6 years to degree	-0.004	-0.005	-0.004	-0.004
	(0.008)	(0.008)	(0.011)	(0.011)
Selective college	0.017**	0.018**	0.017	0.019*
	(0.008)	(0.008)	(0.011)	(0.011)
6 years to degree × Selective college			0.000	-0.002
			(0.016)	(0.016)
Resume controls		X		X
Observations	7,371	7,371	7,371	7,371

Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer. Columns 2 and 4 include controls for other attributes of the resume including college major, the degree type (BA or BS), gender, race, city, the work experience and skill template, and formatting details. Standard errors are clustered at the job vacancy level and shown in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$). Estimates in terms of percent changes relative to the appropriate comparison response rate mean are shown in brackets.

Employers could interpret the time to degree signal differently between graduates of more or less selective colleges. For instance, the positive signal of attending a more selective

college could mitigate any delayed graduation penalty. On the other hand, since longer time to degree is less common at more selective colleges, delayed graduation could represent a particularly negative signal to employers. To test for these dynamics, column 3 of Table 4 adds the interaction term between the indicators for six years to degree and selective college. The time to degree effect implied by these estimates is -0.4 percentage points for resumes listing either less selective or more selective colleges, and the test of a different time to degree effect between more and less selective colleges is not statistically significant. Results are nearly identical when including resume controls in column 4.[4]

Finally, I test for differences in the effects of the educational treatments by the gender and race of the applicant which is signaled by the names listed on the resumes. Results for men and women applicants are reported in columns 1 and 2 of Table A5 and Figure A3, while results for White and Black applicants are reported in columns 3 and 4 of Table A5 and Figure A4. The point estimates for listing 6 years to degree and listing a selective college are both larger in magnitude for men applicants and for White applicants compared to women and Black applicants, respectively. Although, for both men and White applicants, the estimates of the time to degree effect are not statistically significant at conventional levels.

1.4. Interpretation

The main finding from the full sample analyses is that, while resumes listing a more selective college receive a response rate advantage, there is not a significant advantage for resumes listing graduation in four years relative to six years. A simple interpretation of this result is that, on average, many employers do not value time to degree as a signal of applicant quality. This section presents supplemental analyses to engage with alternative interpretations of the

[4] Appendix Table A4 shows the full sample estimates while also reporting the coefficients on the resume controls.

main results. First, I test whether estimates may be attenuated due to employers viewing applicants who graduated within four years as overqualified for the job and thus less likely to accept a job offer than those graduating in six years. Second, I assess whether employers simply did not notice the differences in time to degree indicated on the resumes. Third, I examine the robustness of the results to different subsamples of jobs. Lastly, I assess whether my estimates may be attenuated by bias from spillover effects between resumes sent to the same job.

1.4.1. Do estimates reflect employers' assessments of applicants with a different time to degree?

The results of the experiment broadly suggest that employers do screen resumes for signals of applicant quality, which is consistent with prior literature. For instance, I reject the hypothesis that employer response rates are equal across the work history templates listed on the resumes. Despite the resumes being designed to be similar to each other, employers are generally quite responsive to differences in resume attributes.

Since the full sample estimates find a small and statistically insignificant negative effect of a longer time to degree, does this imply that employers view the skills of applicants with different time to degree to be similar? An alternative explanation could be that resumes indicating degree completion in four years were viewed by employers as too highly qualified for the jobs in my sample. If this were the case, estimates of the effect of time to degree could be attenuated as response rates to resumes listing six years to degree are inflated because they are viewed to be more likely to accept a job offer. This phenomenon has been referred to as "reverse discrimination" in audit studies based on applicant characteristics like race and gender (Bertrand and Mullainathan, 2004).

To test for whether "reverse discrimination" explains the full sample results, I assess how the results differ by the quality of the job, using expected salary as a proxy for job quality. Specifically, I split the sample of resumes by whether the jobs they were sent to are above or below the median expected salary and run the analyses separately for each subsample. If "reverse discrimination" explains the small estimated effect of time to degree in the full sample, there would likely be a larger time to degree effect among higher salary jobs where there is less mismatch between applicant and job quality.

The results presented in Figure 2 and columns 1 and 2 of Table 5 shows little evidence of "reverse discrimination" based on time to degree, at least in the full sample. The estimated effect of listing six years to degree is actually larger in percentage point terms among lower salary jobs compared to higher salary jobs. But because overall response rates are much higher among lower salary jobs, these estimates are similar in magnitude when converted into percentages. Meanwhile, the effect of listing a more selective college is much higher among higher salary jobs, at about 33 percent (2.5 percentage points). This is consistent with higher salary jobs having higher standards for the quality of potential applicants and adds credibility to the conclusion that "reverse discrimination" does not contaminate the main estimates of the effect of time to degree.

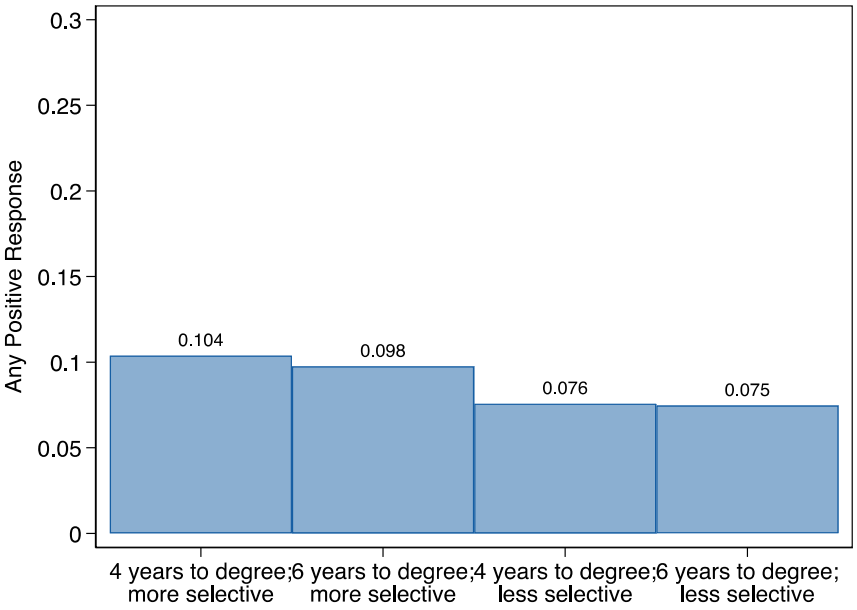
Table 5. Results by Job Characteristics

	Higher salary (1)	Lower salary (2)	More applicants (3)	Fewer applicants (4)
6 years to degree	-0.004	-0.007	-0.028**	0.016
	(0.010)	(0.012)	(0.012)	(0.011)
	[-4.5%]	[-3.8%]	[-17.2%]	[13.7%]
Selective college	0.025**	0.009	0.016	0.019
	(0.010)	(0.012)	(0.012)	(0.012)
	[33.2%]	[5.1%]	[11.3%]	[16.4%]
Observations	3,464	3,816	3,577	3,406

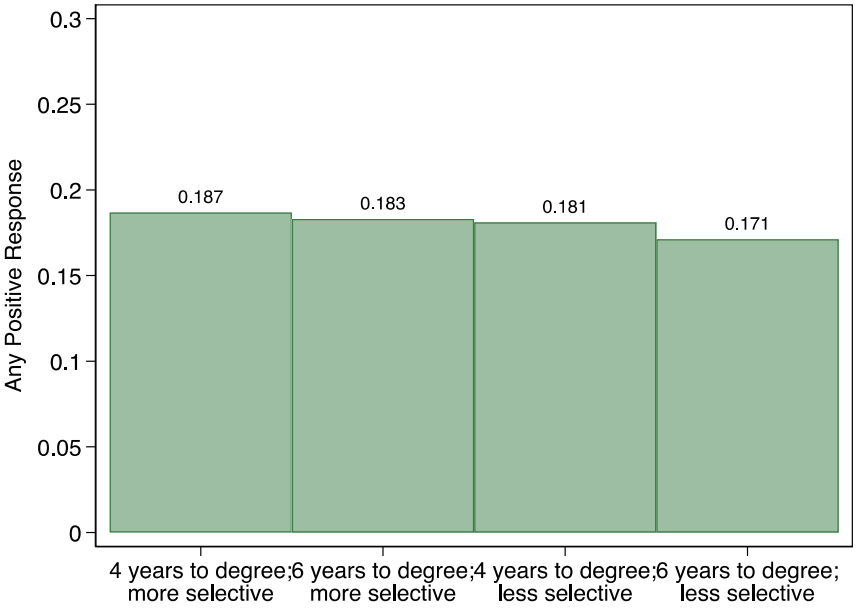
Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer. Columns 1 and 2 split the sample by whether the job was above or below the median expected salary. Columns 3 and 4 split the sample by whether the job posting had above or below the median number of applicants. Standard errors are clustered at the job vacancy level and shown in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$). Estimates in terms of percent changes relative to the appropriate comparison group's mean response rate are shown in brackets.

Figure 2. Results by Job Quality

(a) Higher salary jobs



(b) Lower salary jobs



Notes: This figure shows results from a regression of employer responses on indicators for the four resume treatment types separately by the expected salary of the job the resume was sent to. Panel (a) shows results for jobs above the median in expected salary, while panel (b) shows results for jobs below the median in expected salary.

1.4.2. Do employers notice time to degree on resumes?

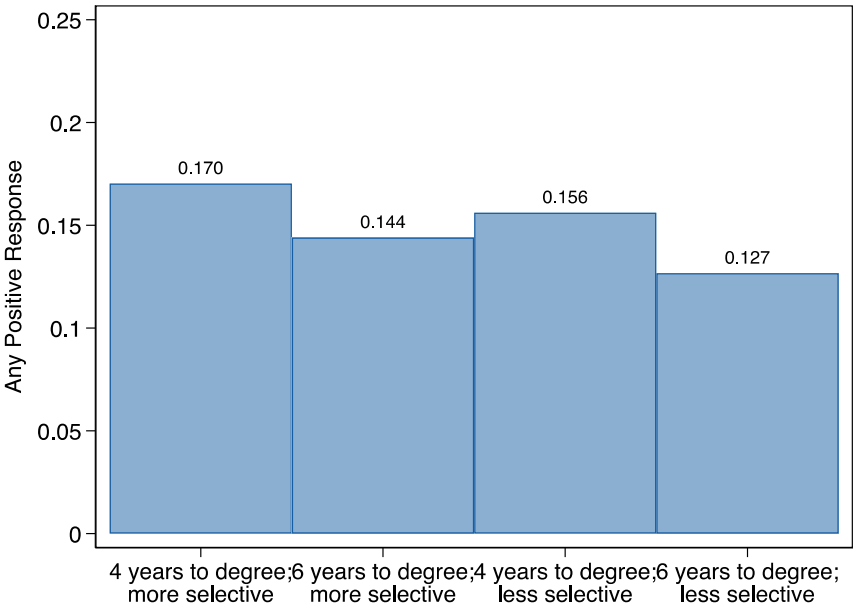
Another interpretation of the small (though not statistically significant) estimates of the effect of time to degree in the full sample is that employers simply do not notice differences in time to degree indicated on resumes. While there is evidence that employers can notice fine details on resumes such as the range of years enrolled in high school to indicate applicant age (Lahey, 2008) and date ranges to indicate unemployment duration (Kroft et al., 2013), there is no prior empirical evidence to suggest employers notice college enrollment year ranges to indicate time to degree.

To assess whether employers can notice time to degree indicated on resumes, I focus on a subset of jobs that have a larger applicant pool where competition among applicants is relatively high and employers can be more selective with which characteristics to use to screen applicants. Specifically, I split the sample at the median number of applicants and run the analyses separately for each subgroup. Figure 3 and columns 4 and 5 of Table 5 report the results.

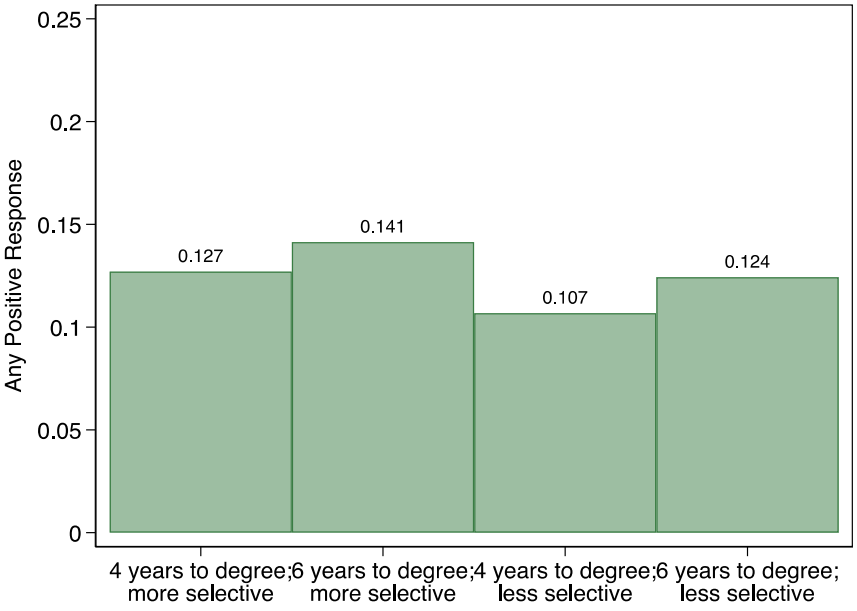
Among jobs with larger applicant pools, a response rate penalty emerges for resumes listing six years to degree. For resumes listing a more selective college, there is a response rate penalty of about 2.6 percentage points (p-value = 0.141) for listing six years to degree relative to four years to degree. Meanwhile, there is a 2.9 percentage point penalty (p-value = 0.078) for listing six years to degree among resumes also listing a less selective college. While these within-college selectivity estimates are not statistically significant at the 95 percent level, pooling across college types reveals a statistically significant 2.8 percentage point decrease in response rates for listing six years to degree.

Figure 3. Results by Number of Applicants

(a) More applicants



(b) Fewer applicants



Notes: This figure shows results from a regression of employer responses on indicators for the four resume treatment types separately by the number of applicants to the job posting. Panel (a) shows results for jobs above the median number of applicants, while panel (b) shows results for jobs below the median number of applicants.

For jobs with smaller applicant pools, there is actually some evidence of a positive effect of listing six years to degree. For instance, among resumes listing a more selective college, those

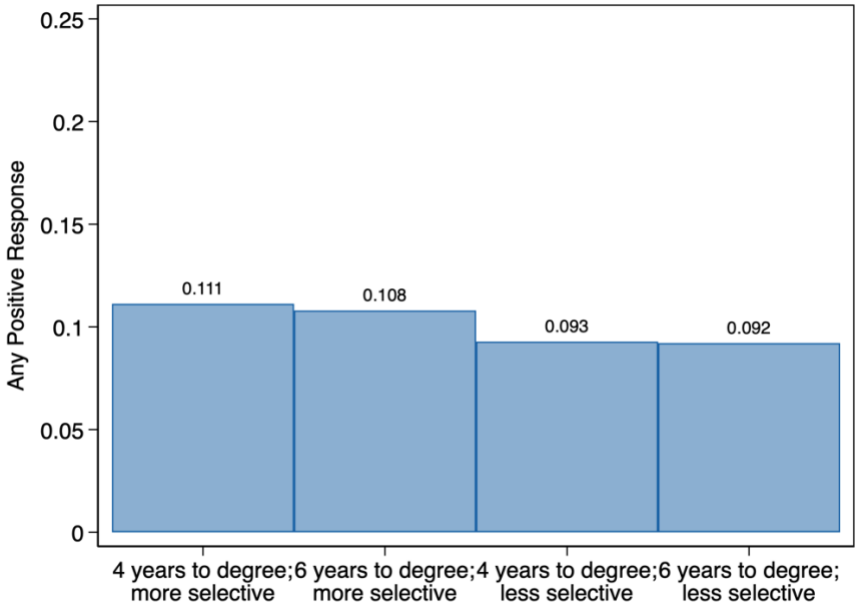
also listing six years to degree receive response rates 1.4 percentage points higher (p-value = 0.392) than those listing four years to degree. This delayed graduation penalty is 1.7 percentage points (p-value = 0.220) among resumes listing a less selective college. The pooled specification estimates a 1.6 percentage point effect (p-value = 0.152) of listing six years to degree.

These results suggest that employers do seem to recognize time to degree and some use it to screen applicants when the applicant pool is particularly competitive. The apparent positive effect of a longer time to degree among jobs with smaller applicant pools could be a case where employers are more aggressive in pursuing lower quality candidates who are perceived to be more likely to accept a job offer. Although, the data cannot rule out that employers of these jobs with small applicant pools could simply prefer the skills of candidates with longer time to degree.

1.4.3. Robustness to alternative subsamples

I also examine the robustness of the main results to excluding certain jobs from the sample. A potential concern with the study setting is that the full sample results are driven by jobs that are looking to hire multiple candidates for their open positions. If these jobs have relatively low standards for responding to applicants, it could be the case that characteristics like time to degree simply may not be important if hiring standards are lower than usual. In Figure 4 and column 1 of Table A7 I exclude job postings that indicate they are hiring multiple candidates to focus on jobs where resumes characteristics are plausibly considered with greater scrutiny. In this subset of jobs, the results look very similar to the full sample results.

Figure 4. Employer Response Rates Excluding Jobs Hiring Multiple Candidates



Notes: This figure shows coefficients from a regression of employer responses on indicators for the four resume treatment types excluding jobs that indicated that the employer was looking to hire multiple candidates for the position.

I also consider whether jobs of a single occupation solely drive the results. In columns 2 through 7 of Table A7 I report results from sequentially excluding a single occupation category from the sample. There is some variation in the coefficients across the samples for estimates of both time to degree and college selectivity, suggesting that the effects of the educational treatments are not homogeneous across occupations. However, the results are qualitatively similar across the samples and there is little evidence that results are driven by jobs in a single occupation.

1.4.4. Are estimates attenuated by bias from spillover effects between resumes?

Phillips (2019) shows that resumes have positive spillover effects on each other when multiple resumes are sent to the same job, which has the potential to introduce attenuation bias in the estimates of resume treatments. This section presents evidence that while spillover effects between resumes within job vacancies are present in my setting, my estimates are not subject to

bias from these spillovers due to the non-stratified setup of my experimental design. Column 1 of Table 6 reprints the main estimates while excluding a small number of observations where only one resume was submitted to a job, since those singleton observations will be dropped naturally in the specifications in subsequent columns of the table.

Table 6. Test of Within-vacancy Spillovers

	(1)	(2)	(3)
Own resume listing…			
6 years to degree	-0.003	-0.002	-0.003
	(0.008)	(0.006)	(0.008)
Selective college	0.017**	0.002	0.018**
	(0.008)	(0.006)	(0.008)
Share of other resumes to same job listing…			
6 years to degree			-0.007
			(0.020)
Selective college			0.044**
			(0.022)
Job vacancy fixed effects		X	
Observations	7,287	7,287	7,287

Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer. Column 2 includes fixed effects for the job vacancy. Column 3 includes variables that represent the share of other resumes sent to the same job that list the two educational treatments. Standard errors are clustered at the job vacancy level and shown in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

As described in Section 1.2.1, including job vacancy fixed effects in the estimating equations will reintroduce bias from spillover effects that the non-stratified design used in this study were intended to avoid. This is because the composition of the treatment types of the *other* resumes sent to the same job are, by construction in a non-stratified design, systematically different between the *own*-resume treatment types. For illustrative purposes, column 2 adds the job vacancy fixed effects. Comparing columns 1 and 2, the coefficient on 6 years to degree remains similar, but the coefficient on selective college changes dramatically, dropping close to

zero. This attenuation on the estimate of the effect of listing a selective college is consistent with bias from spillovers as documented by Phillips (2019).

The non-stratified design also provides the ability to test for spillovers directly by including the share of other resumes sent to the same job that list the educational treatment characteristics. This tests explicitly whether the treatment types of the *other* resumes sent to the same job influences the probability that the own-resumes get a response. The non-stratified design makes this test possible since these other resume treatment types are exogenous to the own-resume treatments.

Column 3 of Table 6 carries out the test for spillovers. Having all other resumes sent to the same job listing a selective college, relative to zero other resumes listing a selective college, increases the probability of the own resume getting a response from an employer by 4.4 percentage points. This is evidence of spillover effects in terms of college selectivity. The magnitude of these spillovers is consistent with the spillovers documented in Phillips (2019). Meanwhile, I estimate no significant spillovers coming from what other resumes list for time to degree. Finally, the estimates on the own-resume treatments remain identical to column 1 when including the other resume treatments, providing evidence that the spillovers do not bias my main estimates.

1.5. Conclusion

This paper asks how employers value otherwise-identical job seekers who completed bachelor's degrees in different amounts of time. I use a resume audit study in which resumes were sent to thousands of online job openings for entry-level business jobs to estimate the causal effect of indicating taking six years to complete a bachelor's degree on a resume relative to listing four years to degree on employer response rates.

In the full sample of jobs, I estimate small and statistically insignificant negative effects of listing six years to degree on resumes relative to listing four years to degree. Response rates differ by only 3-4 percent (0.4-0.5 percentage points). I also find no evidence in the full sample that the effect of time to degree differs by the selectivity of the college where the bachelor's degree was earned. I do find a 13 percent increase (1.7 percentage points) in response rates for resumes listing a more selective college, and this premium increases to 33 percent among jobs in the top half of the distribution of expected salary. There is evidence of some heterogeneous effects of time to degree based on characteristics of the job opening. In particular, there is a negative effect of time to degree among jobs with larger applicant pools.

Together, these results suggest that on-time graduation has relatively low value to employers as a signal of an applicant's quality. But, my evidence does not indicate that employers do not value on-time graduation at all. It is possible that employers simply see time to degree as a less important signal than the other information available to them. Thus, time to degree may become more important in certain situations. I find evidence consistent with time to degree being more important when there are more applicants to the job vacancy. When applicant pools are larger, applicants face more competition and employers can be more selective in who they respond to. In these more competitive environments employers may begin to weigh resumes characteristics like time to degree more heavily. Or, it is possible that employers that draw larger applicant pools for their open positions could have more sophisticated or simply different processes for screening applicants.

My results provide evidence that colleges and students should not have large99iii8 concerns about the initial labor market consequences of delayed graduation. Employers may only value time to degree on the margin when job openings are particularly competitive. Even so, the

skills and employment experiences that graduates are able to list on their resumes likely will be more valuable than time to degree. If students can afford it, extending college enrollment beyond the standard on-time amount of time may not have large private costs, especially if the extended enrollment allows a student to pursue a major in a more lucrative field. However, issues of the affordability of extended enrollment should not be minimized. The tuition costs and opportunity costs associated with extended enrollment are often large and worthy of consideration. Policy efforts should continue to focus attention on helping students to graduate, regardless of whether it takes an extra couple of years to do so. And given the continued labor market benefits, policies should also focus on guiding students toward higher quality colleges, if and where possible.

Finally, the experimental results warrant a few caveats. First, it should be noted that the context of this experimental study is fairly specific. Given the college enrollment ranges listed on the resumes, it is implied that the graduates in my study were enrolled in college during the Covid-19 pandemic. It is possible that employers are more lenient about delayed graduation after the onset of the pandemic than before. However, for similar reasons, graduating in four years may be viewed as more impressive now than before the pandemic. Also, the audit study occurred during a relatively tight labor market, and it also considered only jobs within business occupations. Results could conceivably be different in other labor market conditions and in other occupations, although business occupations are the most common jobs held by bachelor's degree graduates and I applied to jobs in a regionally diverse set of cities.

Second, while this paper provides evidence of only small labor market consequences of delayed graduation, more research is warranted to provide a comprehensive understanding of the possible dynamics. For instance, a limitation of the audit study method is that I only observe initial contacts from employers. While there is evidence that employer response rates are

informative about later hiring decisions (Lanning, 2013; Quillian et al., 2020), it is possible that larger effects of time to degree materialize in later stages of the hiring process. Also, my experimental design ensured that applicants with a different time to bachelor's degree the same (on average) across all other information on the resumes, and the reason for why applicants took more or less time to finish their degree was left ambiguous. The particular reasons for delayed graduation, some of which may end up on a resume while others may not, could be important in determining outcomes. Finally, my study naturally conditions the analysis on graduation. The true labor market costs of extending college enrollment beyond the standard on-time number of years may be at the graduation margin. In this indirect way, time to degree should remain an important area of study, especially given the evidence on the returns to having a college degree relative to not having a college degree.

CHAPTER 2: Time to Baccalaureate Degree and Graduate School Enrollment

2.1. Introduction

The opportunity to pursue a graduate degree is an important source of the private returns to completing a college degree (Altonji and Zhong, 2021; Altonji and Zhu, 2021). 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 point in this pathway 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 for several reasons. 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. By including college fixed effects, I compare students at the same college who completed their degree in a different number of years.

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 differences in enrollment rates are even larger within one and four years after 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., 2023). 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 that the differences in enrollment are not driven by 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 no 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 are consistent with a phenomenon I describe as educational fatigue. Students who take extra time to complete a bachelor's degree are much less likely to continue 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 force 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; terMeulen, 2023). To my knowledge, this is the first paper studying the relationship between time to bachelor's degree and graduate school outcomes.

I also 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 Kramer, 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 relationships I document between time to bachelor's degree and graduate school enrollment also has implications for economic inequality, since earning a graduate degree can be a pathway to reaching the right tail of the income distribution. Black and Hispanic bachelor's degree graduates are (unconditionally) more likely to take five or more years compared to White graduates. Delayed graduation is also more common among first generation and lower-income graduates. Closing gaps in graduate school enrollment by time to degree may also help to close income- and race/ethnicty-based gaps in graduate school attainment and reduce income inequality more broadly.

2.2. 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.

2.2.1. 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.

2.2.2. 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 B7). 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.[5] I use the provided B&B survey weights throughout the analyses in this paper to yield nationally representative results.

Table 7 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 7 also shows summary statistics for

[5] 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.

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 7. B&B Summary Statistics

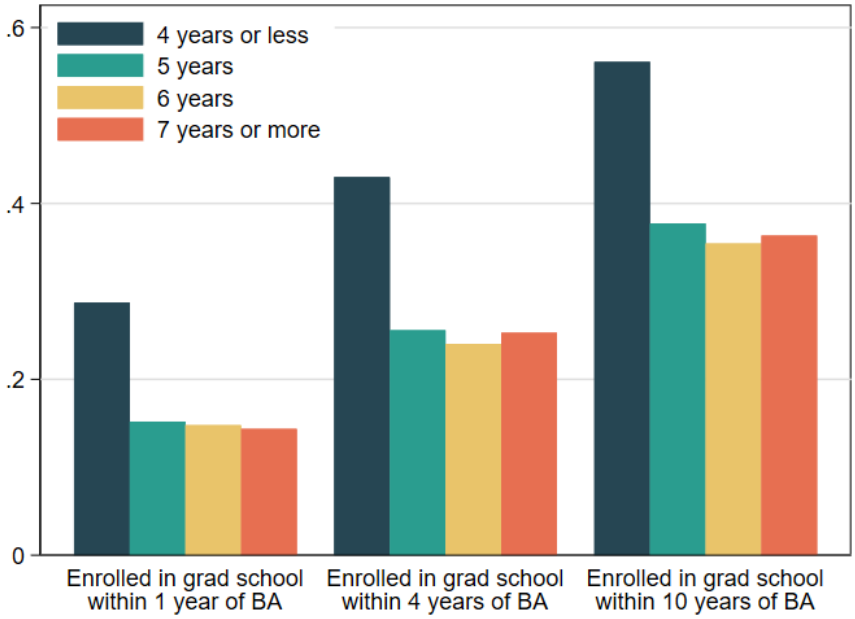
		By time to degree			
	Full sample	4 years or less	5 years	6 years	7 years or more
Time to degree					
4 years to degree	0.515				
5 years	0.289				
6 years	0.119				
7 years or more	0.078				
Demographics					
Female	0.561	0.615	0.509	0.507	0.484
White	0.792	0.820	0.787	0.733	0.717
Black	0.060	0.051	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 las year of BA	0.271	0.326	0.219	0.204	0.194
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 of BA	0.315	0.405	0.229	0.193	0.205
Attained master's degree, within 10 years of BA	0.227	0.279	0.179	0.153	0.168
Attained doctoral degree, within 10 years of 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 bachelor's 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 bachelor's degree within eight years of graduating high school. The summary statistics were computed using the B&B's survey weights.

Table B1 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 demographic, 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 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 7 and Figure 5 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.

Figure 5. 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.

2.2.3. 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:

$$Y_i = \sum_\tau \beta_\tau 1(TTD_i = \tau) + \alpha X_i + \gamma_c + \delta_j + \epsilon_i \quad (2.1)$$

Where Y is a graduate school outcome for bachelor's degree graduate i. The term 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.[6] Finally, I include college graduation cohort fixed effects (γ_c) and college fixed effects (δ_j), and ϵ_i is the error term.

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 2.1 as precisely identifying the causal effect of time to degree on a student's probability of enrolling in graduate school.

In Section 2.3.3 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

[6] 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.

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.

2.3. 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.

2.3.1. Main results

Table 8 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.

Table 8. 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***	-0.146***	-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	X	X	X	X	X
College major fixed effects				X	X
College fixed effects					X

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 (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

In Table B2 and Table B3 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 8. 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 timing of initial graduate school enrollment, which I examine more in Section 2.4.

2.3.2. Robustness

In this subsection I assess the robustness of the main results to alternative specifications and samples. First, I show in Table B5 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 B5) compared to using only the 1993 and 2008 cohorts. I also find similar results in Table B7 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 bachelor's degree within eight years of graduating high school.

I also explore alternative specifications in Table B6 that include additional controls, specifically regarding students' experiences during college. Column 1 repeats the main results from column 5 of Table 8. 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 B6 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 B1), 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. 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 2.1 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 9 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.

Table 9. 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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* p < 0.10, ** p < 0.05, *** p < 0.01).

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 negative effect of some magnitude does exist.

2.3.3. 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 10.[7] 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. I speculate that the differences in these enrollment patterns by time to degree across graduate program fields are partially explained by differing opportunities for part-time enrollment which are anecdotally more common in fields such as business and education. In the next section, I explore patterns with enrollment intensity and find that delayed graduates are not less likely to enroll in part-time programs compared to on-time graduates.

2.4. 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 instance, taking more

[7] 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.

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 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.

Table 10. Program Type and Field of Highest Graduate School Enrollment

	Program type		Program field				
	Master's	Doctoral	STEM	Health	Business	Educ.	Hum. & Soc. Sci
	(1)	(2)	(3)	(4)	(5)	(6)	(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 bachelor's 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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

To begin, there are some results that have already been discussed that are helpful to uncover the potential mechanisms at play. In Table B6, 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 9 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 11 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 2.1. 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.[8] 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

[8] 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.

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.

Table 11. Analysis of Mechanisms

Outcome:	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 to degree (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 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 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 11 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 11 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 B8 and Table B9 support this story. Table B8 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 B9 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.

2.5. 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.

2.5.1. 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., 2023).[9] 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 12, 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.[10] 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

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

[10] 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.

time to degree and graduate school enrollment for higher and lower income bachelor's degree graduates. Table B4 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 these groups are again not statistically significant.

Table 12. Heterogeneity by Race/Ethnicity and Parental Income

	Race/ethnicity		Parental income	
	White	Black or Hispanic	Above median	Below median
	(1)	(2)	(3)	(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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

2.5.2. Degree Attainment

Finally, Table 13 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 13. 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 bachelor's 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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

2.6. 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.

APPENDIX A: Appendix Tables and Figures for Chapter 1

Table A1. Correlates of Delayed Graduation

	(1)	(2)	(3)	(4)
Stopped out	0.251***	0.252***	0.188***	0.187***
	(0.014)	(0.013)	(0.013)	(0.013)
Placed on academic probation	0.168***	0.112***	0.099***	0.096***
	(0.019)	(0.019)	(0.018)	(0.018)
Withdrew from course or incomplete grade	0.090***	0.077***	0.066***	0.065***
	(0.010)	(0.010)	(0.010)	(0.010)
Repeated a course for higher grade	0.191***	0.129***	0.063***	0.065***
	(0.011)	(0.011)	(0.011)	(0.011)
Took remedial courses	0.119***	0.048***	-0.001	0.003
	(0.011)	(0.011)	(0.012)	(0.012)
Transferred any credits between colleges	0.133**	0.112***	0.108***	0.111***
	(0.009)	(0.009)	(0.009)	(0.008)
Changed major	0.028***	0.031**	0.023**	0.026**
	(0.010)	(0.010)	(0.009)	(0.009)
SAT score (100s)		-0.054***	-0.025***	-0.030***
		(0.003)	(0.003)	(0.003)
College GPA (0.1s)		-0.010***	-0.019***	-0.017***
		(0.001)	(0.001)	(0.001)
Female				-0.103***
				(0.009)
Black				-0.047**
				(0.018)
Hispanic				-0.010
				(0.017)
Asian				-0.030*
				(0.016)
College fixed effects			X	X
College major fixed effects			X	X
Observations	11,515	11,515	11,515	11,515

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. The data source is the 2008 bachelor's degree graduating cohort of the Baccalaureate and Beyond survey. The sample includes first-time bachelor's degree graduates 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A2. Descriptions of Work History and Skills Templates

Panel A: Work History Templates	Listed jobs
Template #1	Barista, Starbucks Customer Service Associate, [Target/Walmart]
Template #2	Sales Associate, [The GAP/Old Navy] Barista, [On-campus coffee shop]
Template #3	Student Tutor, [On-campus] Food Service Worker, [On-campus]
Template #4	Office Assistant and Peer Counselor, [On-campus] Customer Service Representative, [On-campus]
Panel B: Skills Templates	Listed skills
Template #1	Microsoft Office Database management Proficient in Spanish
Template #2	Microsoft Word, Excel, and Powerpoint Adobe InDesign and Illustrator Excellent written and verbal presentation skills Detail-oriented, team player
Template #3	Microsoft Office Salesforce CRM SQL Reliable, quick learner
Template #4	Microsoft Word, Excel, Powerpoint, and Outlook Proficient in Salesforce Intermediate skills in Adobe software suite
Template #5	Microsoft Office suite Proficient in Spanish Excellent Communicator Reliable, quick learner, hard worker
Template #6	Microsoft office Experienced in project management Organized problem solver

Notes: This table shows descriptions of the information for the templates that are used to populate the work experiences and skills sections on the resumes.

Table A3. Balance Tests

	More selective, TTD = 4	More selective, TTD = 6	Less selective, TTD = 4	Less selective, TTD = 6	F-test p-value
Woman	0.485	0.495	0.525	0.501	0.097
Black	0.510	0.515	0.502	0.514	0.859
BA degree	0.505	0.487	0.508	0.509	0.526
BS degree	0.495	0.513	0.492	0.491	0.526
Business major	0.144	0.138	0.141	0.134	0.809
Marketing major	0.141	0.156	0.139	0.140	0.395
Accounting major	0.151	0.144	0.150	0.161	0.560
Economics major	0.146	0.139	0.146	0.134	0.663
Finance major	0.135	0.142	0.148	0.146	0.649
Business Management major	0.135	0.153	0.138	0.140	0.427
Business Economics major	0.148	0.128	0.138	0.145	0.303
Work history template 1	0.253	0.245	0.251	0.246	0.928
Work history template 2	0.256	0.255	0.253	0.246	0.907
Work history template 3	0.251	0.250	0.239	0.260	0.518
Work history template 4	0.239	0.250	0.257	0.248	0.665
Skill template 1	0.183	0.168	0.165	0.154	0.119
Skill template 2	0.167	0.174	0.164	0.161	0.755
Skill template 3	0.171	0.166	0.164	0.171	0.905
Skill template 4	0.165	0.156	0.164	0.167	0.816
Skill template 5	0.155	0.162	0.167	0.175	0.426
Skill template 6	0.158	0.174	0.175	0.172	0.515
1st resume sent	0.262	0.260	0.265	0.275	0.722
2nd resume sent	0.258	0.254	0.263	0.241	0.442
3rd resume sent	0.231	0.261	0.238	0.244	0.173
4th resume sent	0.249	0.226	0.234	0.240	0.411
Atlanta	0.191	0.185	0.184	0.190	0.910
Chicago	0.137	0.134	0.143	0.146	0.718
Dallas	0.101	0.114	0.104	0.095	0.291
Los Angeles	0.065	0.079	0.084	0.078	0.166
New York City	0.224	0.201	0.217	0.216	0.364
Philadelphia	0.095	0.101	0.098	0.101	0.909
San Francisco	0.185	0.186	0.171	0.173	0.461
Tgbonum font	0.264	0.251	0.247	0.237	0.280
Lmodern font	0.239	0.255	0.252	0.256	0.632
Times font	0.255	0.240	0.242	0.255	0.602
Charter font	0.242	0.253	0.259	0.252	0.661
Format template 1	0.249	0.252	0.251	0.254	0.991
Format template 2	0.265	0.263	0.234	0.244	0.080
Format template 3	0.248	0.249	0.249	0.249	1.000
Format template 4	0.238	0.235	0.266	0.254	0.111

Table A4. Full Sample Estimates, with Coefficients on Resumes Controls

	(1)
6 years to degree	-0.005
	(0.008)
Selective college	0.018**
	(0.008)
White man	(reference)
White woman	-0.003
	(0.010)
Black man	-0.004
	(0.010)
Black woman	-0.018*
	(0.010)
Business major	(reference)
Marketing major	-0.026*
	(0.015)
Accounting major	0.023
	(0.016)
Economics major	-0.001
	(0.015)
Finance major	0.011
	(0.015)
Business Management major	-0.004
	(0.015)
Business Economics major	-0.003
	(0.014)
Work history template #1	(reference)
Work history template #2	0.018***
	(0.007)
Work history template #3	0.011*
	(0.007)
Work history template #4	0.025***
	(0.007)
Skills template #1	(reference)
Skills template #2	0.012
	(0.011)
Skills template #3	0.017
	(0.011)
Skills template #4	0.010
	(0.011)
Skills template #5	0.028***
	(0.011)
Skills template #6	0.020*
	(0.011)
Observations	7,371

Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer. Standard errors are clustered at the job vacancy level and shown in parentheses (* p < 0.10, ** p < 0.05, *** p < 0.01).

Table A5. Heterogeneity by Applicant Characteristics

	Men applicants (1)	Women applicants (2)	White applicants (3)	Black applicants (4)
6 years to degree	-0.012	0.005	-0.011	0.003
	(0.012)	(0.011)	(0.011)	(0.011)
Selective college	0.024**	0.010	0.020*	0.015
	(0.012)	(0.011)	(0.011)	(0.011)
Observations	3,674	3,697	3,610	3,761

Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer. Columns 1 and 2 split the sample by the gender of the applicant. Columns 3 and 4 split the sample by the race that is common among the names on the resumes. Standard errors are clustered at the job vacancy level and shown in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table A6. Full Sample Estimates Using a Logit Model

	(1)	(2)
6 years to degree	-0.004	-0.005
	(0.008)	(0.008)
Selective college	0.017**	0.018**
	(0.008)	(0.008)
Resume controls		X
Observations	7,371	7,371

Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer using a logistic model instead of a linear probability model.

Table A7. Results Using Alternative Samples

	Excluding jobs hiring multiple candidates (1)	Excluding sales jobs (2)	Excluding marketing jobs (3)	Excluding finance jobs (4)	Excluding accounting jobs (5)	Excluding business administration jobs (6)	Excluding customer service jobs (7)
6 years to degree	-0.002	-0.003	-0.003	-0.006	-0.001	-0.005	-0.008
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
Selective college	0.017**	0.013	0.021**	0.021**	0.015*	0.023***	0.011
	(0.008)	(0.008)	(0.009)	(0.010)	(0.009)	(0.009)	(0.008)
Observations	6,108	6,029	6,643	5,582	6,079	6,409	6,671

Notes: The dependent variable in the table above is an indicator variable for any non-perfunctory response from the potential employer. Each column excludes some type of jobs from the full sample. Column 1 excludes jobs the indicated the employers was hiring multiple candidates for the position. Columns 2 through 7 sequentially exclude jobs in a single occupation group. Standard errors are clustered at the job vacancy level and shown in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Figure A1. Example Resume

Emily Martin

1000 Redwood Ln
Athens, GA 30606
(385) 450-7351
emily.martin3421@gmail.com

Education

2018-2022 University of Georgia – Athens, GA
B.S. in Finance

2014-2018 Midtown High School – Atlanta, GA

Work Experience

Student Tutor
University of Georgia – Atlanta, GA
2021-2022

- Provided instruction to diverse groups of students
- Developed supplemental course materials, and helped to thoroughly explained assigned coursework
- Taught tailored large-group review sessions before exams

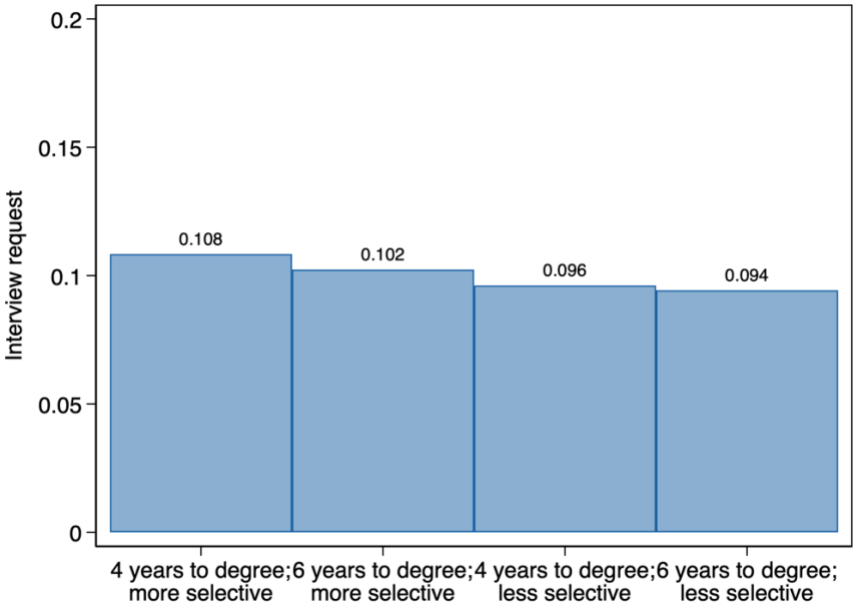
Food Service Worker
University of Georgia – Athens, GA
2019-2021

- Engaged in preparing foods, cleaning facilities and equipment, and preparing serving meal lines
- Responsible for the supervision and training of new food service employees on dining hall procedures
- Provided excellent customer service while handling varying sums of money as a cashier

Skills

- Microsoft Office suite
- Proficient in Spanish
- Excellent communicator
- Reliable, quick learner, hard worker

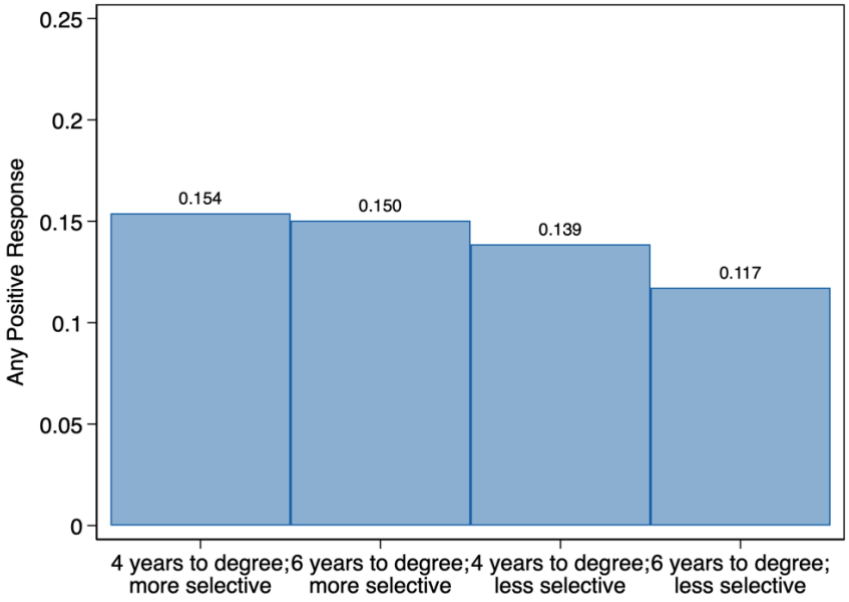
Figure A2. Interview Request Rates by Resume Treatment



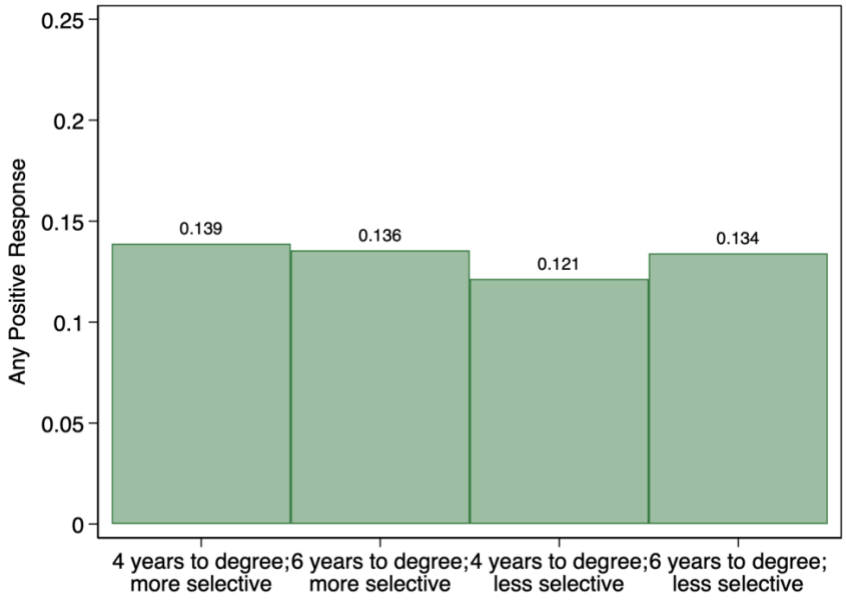
Notes: This figure shows coefficients from a regression of employer interview requests on indicators for the four resume treatment types.

Figure A3. Results by Gender of the Applicant

(a) Men



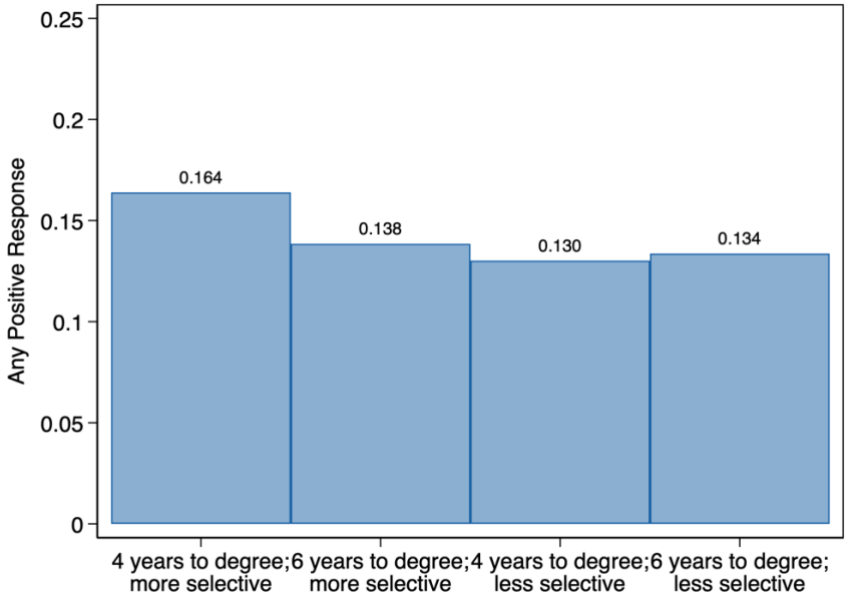
(b) Women



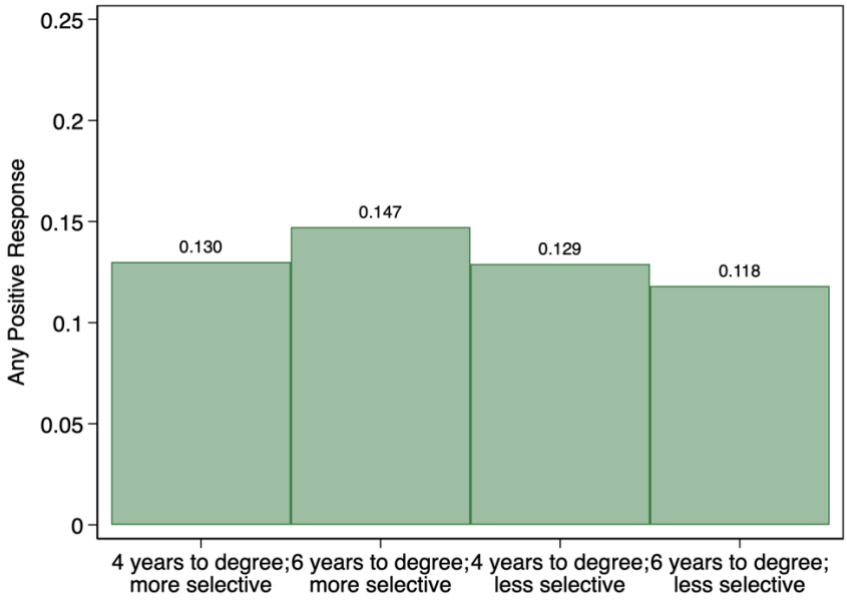
Notes: This figure shows results from a regression of employer responses on indicators for the four resume treatment types separately by the gender of the applicant. Panel (a) shows results for men applicants, while panel (b) shows results for women applicants.

Figure A4. Results by Race of the Applicant

(a) White applicants



(b) Black applicants



Notes: This figure shows results from a regression of employer responses on indicators for the four resume treatment types separately by the race of the applicant implied by the name on the resume. Panel (a) shows results for names common for White applicants, while panel (b) shows results for names common for Black applicants.

APPENDIX B: Appendix Tables and Figures for Chapter 2

Table B1. 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				X	X	X
B&B cohort fixed effects	X	X	X	X	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 B2. 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	X	X	X	X	X
College major fixed effects				X	X
College fixed effects					X

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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table B3. Time to Degree and Enrollment in Graduate School Within a 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	X	X	X	X	X
College major fixed effects				X	X
College fixed effects					X

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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table B4. Heterogeneity by Sex and College Selectivity

	Sex		College selectivity	
	Male	Female	More selective	Less selective
	(1)	(2)	(3)	(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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table B5. 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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table B6. 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 a 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 bachelor's 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 bachelor's 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 bachelor's 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 B7. 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 bachelor's 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 B8. 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 bachelor's degree. The outcome in column 2 is whether the student first enrolled in graduate school between one and four years of earning a bachelor's degree. The outcome in column 2 is whether the student first enrolled in graduate school between four and ten years of earning a 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

Table B9. Intensity of Graduate School Enrollment Within 1 Year of BA

	Full-time	Part-time
	(1)	(2)
Time to degree		
4 years to degree (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 bachelor's 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 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 regressions include survey weights. Robust standard errors are reported in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

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