The Returns to a Master's Degree: Evidence from Recession-Induced Graduate Degree Enrollment

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Abstract

Unlucky college undergraduates entering the labor market in a recession suffer a persistent loss in their earnings in the medium- to long-term. Due to this "scarring effect," the opportunity cost for graduate school attendance decreases when an individual is exposed to a recession. This paper examines whether staying in school can help the unlucky cohort in terms of future labor market outcomes. There are two channels: delaying the time to enter the labor force and human capital accumulation. I find that graduating during a recession increases the probability of pursuing a graduate degree by 3 percentage points, and the return for the induced graduate degree is about 23% in future annual salary. At the same time, there is no statistically significant effect on the employment probability for those graduate degree holders induced by the recession. These findings provide evidence that the main benefit those induced graduate degree holders gain is from the additional accumulated human capital; the effect of delayed labor force entrance is negligible. I also find younger non-white females in non-STEM majors from non-research universities are more sensitive to the recession when making the graduate school decision.

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1 Introduction

The macroeconomic context in which students graduate and enter the labor market matters: college graduates face substantial and long-term adverse effects when graduating into a recession. Early-career recessions may have a permanent effect on earnings up to 10-15 years for new college graduates (Kahn, 2010; Oreopoulos et al., 2012; Schwandt and Von Wachter, 2019). This has been referred to as "scarring effect." At the same time, enrollment in a post-secondary degree has become more prevalent, especially in master's degrees. From 2001 to 2021, the number of individuals aged 25 and above holding a bachelor's degree has almost doubled, while the number of master's degree holders among the same age group has more than doubled. Indeed, there is anecdotal and empirical evidence that when facing adverse economic conditions at graduation, some college students take on post-graduate education to avoid entering a depressed labor market. Hence, enrollment in graduate programs is strongly counter-cyclical (Bedard and Herman, 2008; Johnson, 2013; Bogan and Wu, 2018).

Two groups of individuals are potentially induced to immediately enroll in a master's program when facing a recession at college graduation. The first are those who intertemporally substitute their graduate education. They change the timing of their graduate education but keep their lifetime human capital the same. The second are those who are induced to attain a master's degree that they otherwise would not have gotten. They accumulate human capital with an additional degree and postpone market entry until better economic conditions.

This paper estimates the return to a master's degree using 2010-2019 data from the National Survey of College Graduates (NSCG). I construct a pooled cross-section sample containing individuals who obtained their first bachelor's degree from 1995 to 2013 and are at least six years from college graduation when reporting their annual earnings. Thus, I focus on those who obtain a master's degree shortly after graduating from college. I analyze the labor supply and earnings responses from immediately obtaining a master's degree, defined as enrolling a master's within two years after college graduation. Based on a sample of 59,841 individuals with a bachelor's degree, the OLS estimate shows that immediately attaining a

master's degree increases earnings by 12%.

However, since unobserved ability may be correlated with whether and when to obtain graduate education, the OLS estimate might be biased. The previous literature has applied two strategies to overcome selection into graduate education: propensity score matching (Titus, 2007) and a fixed-effects strategy (Altonji and Zhong, 2021). Titus (2007) found a 20% return to a master's degree, while Altonji and Zhong (2021) found returns in the range of 10 to 27%. In contrast, I develop a different identification strategy by using the timing of recessions to form an instrumental variable (IV) for graduate education. Specifically, I use a recession indicator as an IV for the immediate master's degree attainment, as economic conditions at the time of graduation, which are plausibly exogenous to the individual, may affect the graduate school decision.

Indeed, my first-stage estimation indicates graduating during a recession increases the probability of pursuing a graduate degree right after college by 4 percentage points. Given that the average probability of graduate attendance is 0.12, this represents a 33% (i.e., $0.04/0.12 = 0.33$) increase in the probability of immediately obtaining a master's degree among full-time workers. The effect of the recession is heterogeneous between genders. For males, the increase in the probability of pursuing a graduate degree right after college is 0.03, and the average probability in the whole sample is 0.08, which is an overall 37% increase. For females, the increase in the probability of pursuing a graduate degree right after college is 0.03, and the average probability in the whole sample is 0.23, which is an overall 13% increase.

Controlling for a wide range of covariates, the IV parameter estimates are identified by comparing the wage outcomes across college-graduate cohorts who were differentially exposed to economic downturns. The IV estimates suggest a statistically significant return of 31% for the recession-induced master's degree holders for both genders pooled together. The 95% confidence interval does not include the OLS estimate.

An important concern is how to interpret these estimates. In particular, the attained

masters during a recession might be new human capital or just intertemporal substitution, i.e., shifts in the timing of master's degree attainment. To explore this, I estimate the effects on a second sample: including only those with a master's degree, comparing MA holders who attained the degrees immediately after graduation with those who attained them later in life. This sample contains 36,636 master's degree holders, and the OLS estimate shows no statistically significant difference in earnings for individuals who received a master's degree at different times. In contrast, IV estimates show a 22% return for those who obtained the master's degree immediately after graduation. Therefore, the estimates suggest that the estimated 31% return for the recession-induced master's degree holders contains both the human capital accumulation effect and the shifts in timing effect. Overall, the pooled results suggest substantial returns to a master's degree, in line with those by Titus (2007) and Altonji and Zhong (2021).

The second half of the empirical analysis focuses on the extent to which these returns are differential across subgroups of the college educated. A particular focus has been on STEM and non-STEM majors. For example, Bedard and Herman (2008) found that enrollment in master's degrees is procyclical for males in STEM majors. I also find evidence that individuals in STEM fields are less willing to obtain a master's degree immediately when graduating into a recession. For those in non-STEM curricula, I find that recessions induce them to obtain a master's degree.

Using the non-STEM subsample, with 37,325 individuals with a bachelor's degree, the OLS estimate suggests that immediately attaining a master's degree increases earnings by 12%. In contrast, the IV estimate suggests a statistically significant return of 23% on the recession-induced master's degree. The estimated effects on the sample of 20,244 master's degree holders show no statistically significant effect in both OLS and IV estimations. These results suggest that for individuals who are induced to obtain a master's degree by a recession in non-STEM fields, the changing of the timing for the labor market entry does not significantly affect earnings after (at least) six years of college graduation. The returns are

heterogeneous between genders: a recession-induced master's degree provides a 33% return for males, while only an 18% return for females. When comparing the average characteristics between those recession-induced master's degree holders (so-called compliers) and individuals who choose to immediately obtain a master degree after graduation regardless of a recession (so-called always takers), I find that the former are more likely to be younger females and new grads in non-Science and Engineering curricula. They are also more likely to obtain a bachelor's degree from less research-active institutions and have less-educated parents.

This paper provides several contributions to multiple streams of the literature. It is the first study to directly analyze the labor market outcomes for those induced to attend graduate school by a recession. This paper enriches the surprisingly understudied returns to an advanced degree, especially master's degrees (Titus, 2007; Altonji and Zhong, 2021). This paper contributes to the rich line of research on "scarring effects" (Kahn, 2010; Oreopoulos et al., 2012; Altonji et al., 2016; Liu et al., 2016; Schwandt and Von Wachter, 2019) by examining the outcomes of students who react to the labor market conditions by obtaining a master's degree right after college graduation. Finally, this paper complements the numerous studies on the relationship between post-graduate enrollment and recessions (Bedard and Herman, 2008; Johnson, 2013; Bogan and Wu, 2018).

The rest of the paper is organized as follows. Section 2 introduces the related literature, while Section 3 describes the data set and the construction of the sample. Section 4 develops the conceptual framework for the individual's graduate school decision right after college. Section 5 presents the identification strategy, and Section 6 shows the empirical strategy. Section 7 presents the key results. A brief conclusion follows.

2 Background and Related Literature

Previous research has shown that individuals who graduate during an economic downturn will suffer significant losses compared to their luckier counterparts who graduate before and

after an economic recession (Genda et al., 2010; Kahn, 2010; Oreopoulos et al., 2012; Altonji et al., 2016; Schwandt and Von Wachter, 2019). This persistent effect has been referred to as the scarring effect. According to the recent survey by Von Wachter (2020), college graduates entering a typical recessionary (a 4-5 point rise in unemployment rates) labor market, on average, experience about a 10% reduction in initial earnings. The reduction is typically larger for nonwhite individuals and those with less advantaged family backgrounds (Del Bono and Morando, 2022); and the effect could persist for ten years following graduation for graduates with degrees related to lower returns[1](Altonji et al., 2016). Researchers have also posited various explanations for this persistent negative effect. Graduating into a recession will likely be related to a low probability of employment or full-time employment (Forsythe, 2022), reduction in working time or hourly wage (Cockx and Ghirelli, 2016), a weak match of skills or interests (Modestino et al., 2016; Liu et al., 2016; Hershbein and Kahn, 2018), low-paying occupation or small firms (Altonji et al., 2016; Arellano-Bover, 2020) and fewer promotion opportunities and future employment (Oreopoulos et al., 2012). Nevertheless, the adverse effects of graduating into a recession are not limited to the labor market outcomes but also worse outcomes on health, family formation, fertility, and crime (Schwandt and von Wachter, 2020; Kawaguchi and Kondo, 2020).

Therefore, when facing depressed economic conditions at graduation, college students can postpone graduation or take on postgraduate education to avoid entering a depressed labor market. For students in better programs, higher-earnings majors, and from more advantaged backgrounds, the direct cost of education and the opportunity cost of delaying the labor market entrance is outweighed by the potential scarring effect of unemployment and a better match or job opportunities in a later labor market (Finamor (2022)). On the other hand, taking on postgraduate education can also benefit students, especially during a recession. Bičáková et al. (2021a) and Bičáková et al. (2021b) showed a positive association between entering college in bad economic conditions and a wage premium in the subsequent

[1]Lower returns majors are, for example, philosophy, religion, library science and etc.

labor market, and the effect is more significant for women. Hence, it is natural to think that those who do not postpone their college graduation would be inclined to enroll in a graduate program when facing a recession.

Figure 1 and Figure 2 display the relationship between aggregate graduate school enrollment and the unemployment rate.[2] The shaded area indicates recession periods. We can see from Figure 1 that overall graduate school enrollment has been steadily increasing in recent decades, rising from 1.65 million in 1995 to 3.14 million in 2020. The rate of increase also varies over time, as we can see more easily in Figure 2, which shows that the percentage change in aggregate graduate school enrollment is between -0.4% (in 2012) to 15% (in 2009). The correlation in Figure 2 is 0.32, indicating a positive association between changes in graduate school enrollment and the unemployment rate, especially during recessions.

One concern is that the enrollment for international graduate students has also increased dramatically during the same period. Hence, Figure 3 and Figure 4 display the Fall enrollment of domestic and international students separately from 2002 to 2020.[3] Figure 3 shows that there seems to be no positive correlation between the Fall enrollment of foreign graduates even during the recession. In contrast, we can see easily in Figure 4 that the percentage change in domestic Fall enrollment for graduate school is strongly correlated with the unemployment rate, especially during the recession, and the correlation in Figure 4 is 0.28. From looking at aggregate data, all of these graphs indicate a positive association between business cycle fluctuations and graduate school enrollment, especially among domestic students.

Indeed, Bedard and Herman (2008) found that an increase in unemployment is associated with increased enrollment in graduate school for males with higher undergraduate GPAs; the effect is more influential among those with social science majors during undergraduates. Johnson (2013) found that this effect is significant for women rather than men: one standard deviation increase in the unemployment rate is associated with a 4.3% increase

[2]The aggregate graduate school enrollment data are from the Integrated Postsecondary Education Data System school enrollment surveys.

[3]Fall enrollment data are from the Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Fall Enrollment Survey.

in female graduate school enrollment. Altonji et al. (2016) found that a significant recession is associated with a 0.0048 increase in the probability of holding an advanced degree among those with at least five years of potential experience.

Graduate program attendance can help an individual mitigate the "scarring effect" by accumulating additional formal education with an additional degree. There is a small but growing literature regarding the returns to a graduate degree, from focusing on a particular degree [e.g., MBA (Arcidiacono et al., 2008); medical degree (Ketel et al., 2016))] to a more general graduate degree (Titus, 2007; Altonji and Zhong, 2021). The latter found a positive and significant postgraduate wage premium, which rises over time (Lindley and Machin, 2016). Titus (2007) found a 20% private returns of a master's degree, while Altonji and Zhong (2021) found the returns for a master's or professional degree is in the range of 10-27%

Previous literature has adopted different strategies to overcome the selection on students' ability in the master's programs enrollment. Titus (2007) applied propensity score matching in estimating the average treatment effect of a master's degree. Arcidiacono et al. (2008) used the test scores required for MBA enrollment as controls, and Ketel et al. (2016) used admission lotteries to estimate the returns to medical school. Altonji and Zhong (2021) controled for experience-adjusted pre-graduate-school earning as a proxy for the potential earning. At the same time, they use person-specific fixed effects and college-graduate major combination fixed effects in their estimation of the returns to graduate school in a particular graduate field and given undergraduate major.

However, the return on education is heterogeneous, and we know little about the labor market outcomes for the new college graduates who are recession-induced master's degree holders. Building upon the existing literature, this study focuses on the returns of a master's degree for recession-induced degree holders. I focus on those who obtain a master's degree shortly after graduating from college and apply a different identification strategy by using the timing of recessions to form an instrumental variable (IV) for graduate education.

Specifically, I use a recession indicator as an IV for the immediate master's degree attainment, as economic conditions at the time of graduation, which are plausibly exogenous to the individual, may affect the graduate school decision.

3 Data

3.1 The National Survey of College Graduates

I employ data from the National Survey of College Graduates (NSCG 2010 - 2019). The NSCG is a repeated cross-sectional biennial survey. It is part of the Scientists and Statistical Data System (SESTAT) conducted by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation. The sample frame for all waves of the NSCG consists of people under age 76, living in the U.S., and having at least a bachelor's degree as the survey reference date. We only use data since the wave of 2010 because NSCG has employed a new rotating sampling strategy since the 2010 survey[4].

I append waves from 2010, 2013, 2015, 2017, and 2019 of the NSCG to build a pooled cross-sectional data focusing on individuals in the U.S. labor market with at least a bachelor's degree. The advantages of this dataset are the detailed information on postsecondary education, current and past employment, occupation, and essential demographic variables. The latter includes gender, race/Hispanic origin, and parental education level. The earnings data are based on the annualized salary at the principal employer referring to the survey date.

[4]The NSCG 2010 is drawn from respondents to the 2009 American Community Survey (ACS). The NSCG 2013 and 2015 surveys combine a subsample of the interviewees from the 2010 and 2013 waves of NSCG and a subsample of interviewees with postsecondary education from the 2011 and 2013 waves of the ACS. The NSCG 2017 and 2019 surveys combine a subsample of the interviewees from 2010, 2013, 2015, and 2017 NSCG and a subsample of interviewees with postsecondary education from the 2015 and 2017 waves of the ACS.

3.2 Sample Construction

The sample contains individuals who obtained their first bachelor's degree at age 20 - 24 from a US institution between 1995 and 2017. Those individuals are not currently in school either as part-time or full-time students. The rationale for the restriction on age to receive the first bachelor's degree is that older college graduates are less likely to seriously consider the decision to obtain a master's degree immediately. For a similar reason, I restrict the sample to individuals who obtained their master's degree no later than age 35. The analysis only focuses on individuals with a master's degree; therefore, individuals with a professional or Ph.D. degree are also excluded.

According to the survey, only the most recent two and the first bachelor's degrees are reported for individuals with more than three post-secondary degrees. Therefore, I exclude individuals with more than three post-secondary degrees to ensure we capture the exact education history. Individuals with previous retirement experiences are also excluded from the sample. I also drop individuals whose educational background implies an odd time order. For example, those who finished their advanced degree before they had a bachelor's degree or those who finished their bachelor's degree before they turned 18.

To make the labor market outcome comparable, I exclude individuals with a temporary residency visa and only include individuals who responded to the survey within the contiguous U.S. states. Retired individuals or individuals with any retirement history are not included in the sample. When analyzing the labor market earnings, I only focus on individuals who are full-time employed and not self-employed in the U.S., who have no missing annual salary, and who are at least two years after their most recent graduation.

Unfortunately, NSCG does not indicate full-time employment; therefore, I classify full-time employment based on individuals working at least 40 weeks per year and at least 35 hours per week (Altonji and Zhong, 2021). I also use 40 weeks to accommodate the employment arrangement for many teachers. The sample restriction to full-time workers and excluding currently enrolled students should help eliminate most problems of using

earnings measured while people are still attending graduate school.

Therefore, we can consistently capture the effect of recessions on graduate school attendance and have comparable annual earnings among the sample. All earning measures have been inflation-adjusted to 2010 dollars using the Consumer Price Index. In the analysis, the timing of recessions is used as an instrument for the graduate school decision. However, there is a concern about the violation of the exclusion restriction for the instrument. There is a potential direct effect of the recession an individual is exposed to at the time of college graduation on the observed earnings. Therefore, the analysis is restricted to individuals with at least six years of experience after college graduation. The rationale of this selection lies in findings that the negative effects of the adverse economic condition at gradation usually decrease after 4-5 years and virtually disappear after 6-7 years for college graduates (Genda et al., 2010; Altonji et al., 2016; Schwandt and Von Wachter, 2019).

As a result, we have 97,941 observations in the sample, with 54,674 individuals only holding a BA degree, 21,009 immediately going for a graduate degree, and 22,258 pursuing a graduate degree later[5].

3.3 Key Variables

3.3.1 The Timing of the Degree Completion

I am interested in the returns of a master's degree for individuals induced by the recession who immediately enroll in the program. Then it is crucial to capture those who attend graduate school with no work experience or a reasonably short gap between graduation from college and the start of graduate school. In this section, I provide detailed information about the timing of the BA completion and advanced degree completion.

Theoretically, there could be two potential scenarios during the recession where a student would like to apply for graduate school. On the one hand, during the graduate school application season, an individual was experiencing the prospects of a recessionary labor

[5]Detailed summary statistics are provided in Table A1 and Table A2 in the Appendix.

market, and they chose to apply for graduate school. On the other hand, at the time of graduation, an individual who experienced a recessionary labor market might decide to apply for graduate school for the next application season. In this case, individuals' decisions are conditional on the fact that they received an offer and the economic condition is still depressed [6]. For the latter case, we should allow for a one-year gap between graduate school attendance and college graduation.

Unfortunately, I do not observe individuals' start dates for each degree. Therefore, I do not know exactly whether an individual attended graduate school shortly after graduation from the survey. Consequently, I am forced to assume the start day of graduate school for the individual by subtracting an assumed average number of years required to obtain the degree for full-time students. The assumption is that it takes two years to finish a general Master's degree or an MBA and four years to finish a medical-related major[7].

Hence, "immediate graduate school attendees" are individuals whose gap between college graduation and graduate school graduation is within the average years of college degree attainment plus one year. In other words, an individual is an "immediate graduate school attendee" if she obtained a master's degree in general majors within three years, or in medical related majors within five years after her attainment of the first bachelor's degree.

3.3.2 Macroeconomic Conditions

I use a recession indicator variable to denote if an individual graduates from college into a severe recession. I consider the business cycle reference dates provided by the NBER "US Business Cycle Expansions and Contractions". An individual graduates into a recession if the year she obtained her first bachelor's degree is a recession year. According to the NBER classification, I borrow from Huckfeldt (2022) to define the recession year as a year of more

[6] If they get the offer from a master's program, the economy improves, and they reject it, we will not be able to identify those individuals from our sample as master's degree holders.

[7] Altonji and Zhong (2021) assumes the typical time to obtain the degree for a full-time student are four years for Medicine, three years for Law, two years for an MBA, and one year for all other Master's degrees. Schwandt and Von Wachter (2019), and Bičáková et al. (2021b) assume that individuals with a Master's or Professional degree enter the labor market six years after college enrollment.

than one quarter in recession. Hence, in my analysis, individuals who received their first bachelor's degree in 2001, 2008, and 2009 graduated into a recession.[8]

I control for the current economic conditions when an individual's earnings are observed. To do this, I use either the national unemployment rate or the census division unemployment rate based on an individual's region of employment. The unemployment rate data is obtained from the Bureau of Labor Statistics (BLS). The national annual unemployment rate is based on the average monthly seasonally unadjusted unemployment rate[9]. The BLS produces these monthly unemployment rates based on the Current Population Survey data. Annual unemployment rates at the census division level are obtained annually from the BLS's Local Area Unemployment Statistics program.

3.3.3 The First Graduate Degree

The raw data from the NSCG files organize the advanced degree by the level of the degrees: it includes the first BA, the most recent degree, and a list of degrees from the highest degree to the 3^{rd} highest degree. I rule out individuals whose most recent degree is inconsistent with the highest degree. Since in the sample we only have individuals with up to three bachelor's and above degrees, we have the following categories of individuals: (1) with only the first bachelor's degree, (2) receive bachelor's degree and master's degree separately (3) receive multiple Bachelor degrees at the same time, (4) receive Bachelor degree(s) at a different time from the first BA, (5) receive the graduate degree at the same time as the first bachelor degree, (6) receive multiple graduate degrees at the same time apart from the bachelor degree

For those with one degree, this is their first bachelor's degree. For individuals holding two degrees, the second highest degree is their first bachelor's degree. If their highest degree turns out to be an advanced degree, then this advanced degree is their first graduate degree.

[8]Previous literature has relied on the increase in unemployment as a measure of recession; a typical recession is a 4-5 point rise in the unemployment rate (e.g., Bedard and Herman (2008); Kahn (2010); Oreopoulos et al. (2012); Altonji et al. (2016); Von Wachter (2020); Bičáková et al. (2021b)).

[9]I follow Bičáková et al. (2021b), and use the series ID LNU0400000.

If their highest degree is a bachelor's degree, which means they do not have a record for an advanced degree, then their first graduate degree is missing. For individuals with three degrees, their third highest degree is their first bachelor's degree. If their second highest degree is a bachelor's degree and their highest degree is an advanced one, then their first graduate degree is their highest. However, when both their second highest and the highest degree are advanced degrees, they must be put in time order to decide which advanced degree is the first graduate degree for the individual. If an individual is reported to obtain two master's degrees simultaneously, we use the field of study information reported with their highest degree. For individuals with multiple master's degrees at different times, I consider them to have other preferences and exclude them from the analysis.

3.3.4 Other Related Controls

Unfortunately, direct ability measures are not available in the NSCG sample. I use parental education levels and the Carnegie Classification of Institutions to approximate the individual's ability.

Empirical evidence has shown that parents' educational levels are important predictors of children's educational outcomes and occupational outcomes (Davis-Kean, 2005). I control for both mother's and father's educational attainment as a proxy for an individual's ability when estimating the probability of attending graduate school facing a recessionary labor market and the effects on earnings from obtaining a master's degree during a recession[10]. In the sample, compared to those with only a bachelor's degree and those who got a graduate degree later in life, the proportion of immediate master's degree seekers with at least some college education parents is higher. A summary of statistics on the parental education level is presented in the appendix. Hersch (2019) found that the premium to an elite undergraduate degree remains large even with extensive controls for individual characteristics, family background, and employment characteristics. Therefore, I additionally control the Carnegie

[10]A detailed summary statistics for parental education level is provided in Table A3 in the Appendix

Classification of Institutions of Higher Education for the institution where the individual obtained the first bachelor's degree as another proxy for an individual's ability.

Since the returns from a master's degree are heterogeneous across different fields of study (Altonji and Zhong, 2021), I also control for each individual's aggregated field of study[11]. Since the full-time employment status varies over different employment sectors and regions of employment, I controlled for three major working sections (educational institution, government, and business) and nine census divisions as of the regions of employment. I also control the job code for an individual's principal job to circumvent the wage premium from high-paying occupations. The nine categories of job code correspond to the nine categories of the fields of study.

4 Conceptual Framework

Assume that after college gradation in period zero, individuals live for three periods denoted as $t = 1, 2, 3$, and that everyone works in the last period. Suppose at time $t = 1$ and $t = 2$, individuals can choose between working in the labor market or pursuing a master's degree. Each of those choices grants some utility to the individual in a particular period based on the individual's characteristics. The choice also has the potential to affect utility flows in future periods. Working grants individuals earnings and the experience gained while working can raise earnings in subsequent periods. Pursuing a master's degree is costly in three ways: (1) the direct cost associated with schooling (such as tuition, fees, books, etc.); (2) the foregone earnings due to not working, and (3) any non-pecuniary costs of schooling. However, additional education through a master's degree helps individuals accumulate human capital, increasing future earnings and other non-pecuniary benefits associated with a master's degree. An individual's optimal choice at time t is the one that grants the highest

[11] The nine groups for the field of study for the first bachelor's degree and the advanced degree are: Computer and Mathematical Sciences; Biological, Agricultural and Environmental Life Sciences; Physical and Related Sciences; Social and Related Sciences; Engineering; S&E-Related Fields and Non-S&E Fields S&E stands for Science and Engineering

expected utility. We assume that individuals are rational and seek to maximize their lifetime utility. New college graduates have the same level of education, no working experience, and are nearly the same age. Choices between working and pursuing a master's degree are determined the expected returns of the education and the returns to work, which includes both the initial wage offer and the returns to experience.

Therefore, in this three-period model, we will have three types of individuals: (1) those with only a Bachelor's Degree, (2) those who pursue a Master's degree right after college graduation (in period 1), and (3) those who pursue for a Master's degree later (in period 2). The types of individuals and their choices for each period are shown in Table 1.

Types	Period 1	Period 2	Period 3
Bachelor's Degree Only	Work	Work	Work
Immediately Obtained a Master's Degree	Master's	Work	Work
Obtained a Master's Degree Later	Work	Master's	Work

Table 1: The Different Types of Individuals and Choices

Suppose a recession occurs at time zero of college graduation, there is a negative labor demand shock, and wage offers are reduced. Suppose also that the negative impact on wages persists and reduces the accumulation of industry or occupation-specific capital due to the wage growth occurring from a smaller initial base. In that case, individuals graduating with a bachelor's degree will be more inclined to obtain a master's degree right after graduation. By doing so, they postpone their market entry and accumulate additional human capital through a master's degree. Therefore, they experience both the timing effect and the accumulation of human capital effect, and those two effects cannot be separated within this group.

On the other hand, for individuals who obtain a graduate degree later in life and who choose to work in $t = 1$, the recession will decrease their earnings as a new college graduate. With the additional assumption that the non-pecuniary costs or benefits would not change regardless of the recession, the expected returns for these individuals from working in period

$t = 1$ and then obtaining a master's degree in period $t = 2$ decrease. Therefore, some individuals in this category will switch their behavior to either a bachelor's degree or obtain a master's degree in period $t = 1$. Since they differ from those with a bachelor's degree in terms of the lifetime human-capital level, when facing a recession when graduating from college, some individuals under this scenario will benefit from switching to immediately obtaining a master's degree shortly after graduation. In this case, an individual does not change his/her lifetime human capital accumulation but intertemporally substitutes the master's degree attainment. Hence, for them, there is only the timing effect. If, in the long run, there is no earnings advantage by intertemporally substituting the attainment of the master's degree, then the returns from the recession-induced master's degree attainment are the returns for a master's degree.

5 Identification

Let D be the binary treatment indicating that an individual immediately enrolls in a master's program, defined as enrolled within two years after graduation. Let Y be the labor market outcome of interest. However, unobserved ability may be correlated with whether and when to obtain a master's degree. The decision to enroll immediately in a master's program is endogenous. This study adopts the instrumental variable (IV) approach to solve the selection to obtain a master's degree immediately after college. Suppose Z is a binary recession indicator plausibly exogenous, $Z = 1$ if an individual graduates into a recession; otherwise, $Z = 0$. Suppose X represents a vector of predetermined variables.

Following Rubin (1974, 1977) and Rubin (1977), I define Y_0 and Y_1 as the potential outcomes an individual would attain with and without exposure to the treatment, i.e, the potential labor market outcome for the individual with or without a immediately obtained master's degree. Let D_0 represents the potential treatment status (whether immediately enrolled in a master's program) when an individual graduates without exposure to a reces-

sion after college, and D_1 represents the potential treatment status for an individual when graduates into a recessionary economic condition. The treatment status indicator variable can then be expressed as $D = ZD_1 + (1 - Z)D_0$. We observe D and Z in the sample; therefore, we know D_z for individuals with $Z = z$, but we do not observe both potential treatment indicators simultaneously. Following the terminology of Angrist et al. (1996), the population is divided into groups defined by the potential treatment indicators D_0 and D_1. Theoretically, we can identify college graduates that are induced to attend graduate school apart from those who will attend graduate school regardless of the economic conditions at the time of graduation. Since attending graduate school is a binary decision, there are only four potential combinations of D_0 and D_1. These combinations are presented in Table 2.

	$D_0 = 0$	$D_0 = 1$
$D_1 = 0$	Never-takers	Defiers
$D_1 = 1$	Compliers	Always-takers

Table 2: Potential Combinations of Potential Treatment Indicators

In my analysis, always-takers ($D_0 = D_1 = 1$) will immediately enroll for a master's degree regardless of the economic condition at graduation. On the contrary, never-takers ($D_0 = D_1 = 0$) are individuals who will never choose to attend a master's program immediately regardless of whether exposure to a recession when they graduate. This paper pays primary interest for the third group: "compliers" ($D_0 = 0$ and $D_1 = 1$). Such individuals will attend graduate school if graduating into recession ($D_1 = 1$) but otherwise will not attend graduate school ($D_0 = 0$), i.e., those individuals are recession-induced master's degree holders. There is a fourth group called "defiers" ($D_0 = 1$ and $D_1 = 0$). "Defiers" are individuals who choose to attend graduate school when they do not face the recession at graduation ($D_0 = 1$) but would not attend graduate school when they graduate into a recession ($D_1 = 0$). However, since only one of the potential treatment indicators (D_0, D_1) is observed, we cannot identify which group any particular individual belongs to.

The parameter of interest is the local average treatment effect (LATE), which allows the heterogeneous effect of the treatment among the different populations. In this analysis, I allow the returns of a master's degree obtained immediately after college to differ among master's degree holders. Therefore, I am interested in the average treatment effect of a recession-induced master's degree, i.e., the returns from a master's degree for the compliers. Hence, the parameter of interests can be defined as:

$$\tau_{LATE} = E[Y_1 - Y_0 | D_1 > D_0] \tag{1}$$

By Angrist et al. (1996), the two-stage least square (2SLS) estimator can be interpreted as the local average treatment effect (LATE). In my context, the estimator of the regression uses Z (whether graduated into a recession) as an instrumental variable for the treatment D (whether immediately enrolled in a master's program after college). The outcome variable is Y (the labor market outcomes). The exclusion restriction underlying IV estimator may be more likely to be valid after conditioning on covariates X in my context. Therefore, To interpret the 2SLS estimate as the local average treatment effect, i.e., the returns to a master's degree immediately obtained after college, induced by the recession, we need to satisfy the following identification assumptions[12]:

A.1 Independence of the instrument: Conditional on X, the random vector (Y_{00}, Y_{01}, Y_{10}, Y_{11}, D_0, D_1) is independent of Z

A.2 Exclusion restriction: $P(Y_{1d} = Y_{0d}|X) = 1$ for $d \in 0, 1$

A.3 First Stage: $0 < P(Z = 1|X) < 1$ and $P(D_1 = 1|X) > P(D_0 = 1|X)$

[12]Since the exclusion restriction underlying IV estimator may be more likely to be valid after conditioning on covariates X, I assume that the assumptions of the LATE theorem in Angrist et al. (1996) hold conditional on X. If X is discrete with finite support, it is straightforward to produce estimators of $E[Y_1|X; D_1 > D0]$ and $E[Y_0|X; D_1 > D_0]$ (Abadie, 2003). The covariates are all (mostly) discrete and finite in this analysis; under $A1 - A4$, we can still interpret the 2SLS estimates with covariates as the LATE.

A.4 Monotonicity: $P(D_1 \geq D_0|X) = 1$

Assumption $A.1$ is also called "ignorability", meaning that Z is "as good as randomly" assigned once we condition on X. In this analysis, Z is the plausibly random recession indicator.

Assumption $A.2$ means that, once we condition on X, variation in the instrument does not change potential outcomes other than through the treatment D. Once the value of the treatment is fixed, the instrument has no direct effect on the outcome. Given this exclusion restriction, the potential outcomes for each treatment status only depend on the treatment, not the instrument, so we have $Y_0 = Y_{00} = Y_{10}$ and $Y_1 = Y_{01} = Y_{11}$. $A.1$ and $A.2$ together guarantee that the only effect of the instrument on the outcome is through variation in treatment status. In this analysis, this exclusion restriction requires that the recession at college graduation will not affect the future labor market outcome outside the effect on whether an individual immediately obtained a master's degree.

Assumption $A.3$ is related to the first stage, and it guarantees that Z and D are correlated conditional on X, and that the instrument affects the treatment. In addition, it implies that the support of X conditional on $Z = 1$ coincides with the support of X conditional on $Z = 0$. My analysis requires that graduating into a recession will affect the probability of graduate school attendance.

Monotonicity ($A.4$) is an assumption about the relationship between the instrument Z and treatment D to allow for heterogeneous effects. It states that no individuals would get the treatment when the instrument takes the value of zero but would not when the instrument takes the value of one, i.e., $D_1 - D_0 \geq 0$. In the present analysis, monotonicity means that those who attend post-graduate education when not graduating into a recession will also attend post-graduate education when graduating into a recession, holding everything else equal. Assumption $A.4$ rules out the existence of defiers, i.e., individuals whose graduate school decisions are procyclical. Hence, Assumption $A.4$ defines a population partition into always-takers (those with a master's degree regardless of whether they are caught by the

recession), compliers (those recession-induced master's degree holders), and never-takers (those who will not obtain a master's degree regardless of a recession). Therefore, we can identify individual i with $D_i = 1$ and $Z_i = 0$ as an "always-taker", and with $D_i = 0$ and $Z_i = 1$ as a "never-taker".

Under $A.1 - A.4$, the 2SLS estimand identifies the average treatment effect for the compliers, or the local average treatment effect (LATE). In this analysis, the LATE represents the economic returns for individuals induced to attend post-graduate education when graduating into a recession.

5.1 Average Characteristics for Recession-Induced Master's Degree Attendees Immediately after Graduation

In our analysis, always-takers are individuals who choose to attend a master's program immediately, regardless of the economic condition at the time of college graduation. On the contrary, never-takers will never immediately enroll in a master's program. Compliers are those recession-induced individuals who immediately obtain a master's degree. Since we never observe both potential treatment assignments for the same individual, we can not identify individual units as compliers, always-takers, or never-takers. However, under the assumptions A2 (exclusion restriction), A3 (first-stage), and A4 (monotonicity), it is easy to identify the proportion of compliers (π_c), always-takers (π_{at}), and never-takers (π_{nt}), respectively, in the population:

$$\pi_c : \quad P(D_1 > D_0|X) = E[D|X, Z = 1] - E[D|X, Z = 0] \tag{2}$$

$$\pi_{at} : \quad P(D_1 = D_0 = 1|X) = E[D|X, Z = 0] \tag{3}$$

$$\pi_{nt} : \quad P(D_1 = D_0 = 0|X) = 1 - E[D|X, Z = 1] \tag{4}$$

Similarly, the proportion of compliers (recession-induced individuals) among the treated

and the untreated can be identified. For example, the proportion of compliers among the treated would be as follows:

$$P(D_1 > D_0|X, D = 1) = \frac{P(Z = 1|X)(E[D|X, Z = 1] - E[D|X, Z = 0])}{P(D = 1|X)} \tag{5}$$

Therefore, the proportion of individuals in graduate school induced due to the recession is given by Equation (5) once the effect of a recession on the probability of graduate school attendance is identified.

Then, I can obtain the average pre-treatment characteristics of the always-takes, never-takers, and compliers. To obtain the average characteristics (or covariate means) of the always-takers and never-takers, we only need assumptions A.1 (the Independence of the instrument) and A.4 (Monotonicity). Assumption A.4 rules out defiers, and A.1 ensures that the characteristics we are looking at are independent of the instrument (graduate into a recession). Therefore, we can obtain the average characteristics of always-takers by looking at the observed always-takers who are not exposed to the treatment ($D = 1$, $Z = 0$). In our context, we are looking at individuals who immediately obtain a master's degree without graduating into a recession:

$$\mu_{at} = E[X|D_1 = D_0 = 1] = E[X|D = 1, Z = 0]. \tag{6}$$

The pre-treatment covariate means of the never-takers are based on the observed never-takers who do not immediately attend a master's program when graduating into a recession:

$$\mu_{nt} = E[X|D_1 = D_0 = 0] = E[X|D = 0, Z = 1]. \tag{7}$$

The intuition to obtain the average characteristics of the compliers is by subtracting the weighted mean of the observed always-takers and the observed never-takers from the mean

of the entire sample, from which I can back out the covariate mean for compliers. Hence, by the Law of Iterated Expectations (LIE), we can decompose the population means of X into a linear combination of the weighted means of sub-population:

$$\begin{aligned}\mu = E[X] = E[D_1 > D_0]P(D_1 > D_0) \\ + E[X|D_1 = D_0 = 1]P(D_1 = D_0 = 1) \\ + E[X|D_1 = D_0 = 0]P(D_1 = D_0 = 0).\end{aligned} \tag{8}$$

Under Assumptions A.1 and A.4, substitute Equation (6) and (7) into Equation (8), we can solve for the covariate means for the compliers:

$$\mu_c = E[X|D_1 > D_0] = \pi_c^{-1}(\mu - \mu_{at}\pi_{at} - \mu_{nt}\pi_{nt}), \tag{9}$$

since all terms on the right-hand-side are directly observed, the average characteristics of those recession-induced individuals are identified.

5.2 Assessment of Assumptions

In this subsection, I assess the assumptions in the context of analysing the returns of the master's degree induced by the recession.

Assumption A.1 is the random assignment of the instrument conditional on the covariates. In my context, this requires that the potential earnings with and without immediately attending a master's degree be independent of the recession at college graduation, conditional on individual characteristics. Since the macroeconomic condition is an exogenous shock for each individual, individual characteristics would not affect the instrument, which is "graduating into a recession". Therefore, the independence of the instrument assumption is plausible.

Assumption A.2 (exclusion restriction assumption) states that the recession at college

graduation affects the labor market outcomes exclusively through an indicator of enrollment in the master's degree. In our context, the assumptions could be violated if the earnings of an individual who graduated from college into a recession are still under the "scarring effect." The earnings will still be affected by the recession at college graduation if we observe the earnings close to the time of college graduation. Prior research provides evidence that finishing college and starting work in the middle of a weak economy will have a hard time finding full-time work and receive lower hourly wages for their work (Rodríguez et al., 2020). This disadvantage can last for years. Therefore, if we observe the earnings of individuals who graduated into a recession close to graduation, the observed earnings will contain a component affected by the recession. This component stays even after conditioning on the covariate such as gender, race, potential experience, and occupations, i.e., the exclusion restriction will not be satisfied.

However, studies suggest that the negative effect of graduating into a recession declines over time. For example, Altonji et al. (2016) found that the recession graduates reported about 11% less annual earnings in their first year; after three years of labor market experience, the difference was only about 4%, and by year seven, the effect was no longer observed. Similarly, Schwandt and Von Wachter (2019) found the negative wage effect from a one percent increase in unemployment at graduation virtually disappeared within 6-7 years. Genda et al. (2010) found no effect after 4-6 years for workers with at least some college education. Therefore, it is reasonable to assume that the recession has no direct effect on an individual's observed income after six years of college graduation if individual graduates into a recession from college, regardless of whether an individual obtained a master's degree or not.[13] Table 3 tabulates the year of the first graduate degree and the time for the wage

[13]However, Kahn (2010) found the negative effect can last for 17 years after graduation, and Oreopoulos et al. (2012) found young graduates entering the labor market in a recession suffer significant initial earnings losses that eventually fade after 8 to 10 years. On the one hand, Kahn (2010) examines the negative shock of the 1982 recession, and Oreopoulos et al. (2012) examines a similar issue using rich Canadian university–employer-employee matched data from 1982 to 1999. The 1982 recession might be particularly damaging and correlated with the recession after ten years, and it is reasonable to believe the scarring effect would be longer-lasting. Additionally, with the data constraint, I needed to track more individuals who had at least 17 years since graduation. Therefore, I rely on the analysis results based on the more

observation in our sample. It is clear that all the individuals in the sample are observed at least six years after college graduation, then the average number of years since graduation will surely be greater than six years. Therefore, conditional on the covariates, the exclusion restriction (A.2) are satisfied.

Assumption A.3 states that the instrument has a non-zero average effect on the treatment, i.e., graduating into recession has a non-zero average effect on the immediate obtainment of a master's degree. This is supported by Table 4. Two subgroups are used in the analysis: the first one contains those with only a bachelor's degree and those who immediately obtained a master's degree after graduation (shown in columns (2)-(4)); the second contains all those with a master's degree (shown in the last three columns). I use a univariate probit model to estimate the individual's probability of immediately attending a master's program shortly after the first bachelor's degree. I use two instrumental variables separately: the recession indicator and the annual national unemployment rate at the time of bachelor graduation. Estimation results in the tables present the average effects of graduating into a recession on the probability of immediately attending a master's program, or the marginal effects for the national unemployment rate at the time of college graduation. effect on the treatment, i.e., graduating into recession has a non-zero average effect on the immediate obtainment of a master's degree for both gender.

Overall, graduating during a recession increases the probability of pursuing a graduate degree right after college by 4.08 percentage points. Given that the average probability of graduate attendance is 0.12, this represents a 33% increase in the probability of immediately obtaining a master's degree among full-time workers. The effect of the recession is heterogeneous between genders as shown in Table 5. For males, the increase in the probability of pursuing a graduate degree right after college is 0.03, and the average probability in the whole sample is 0.08, which is an overall 37% increase. For females, the increase in the probability of pursuing a graduate degree right after college is 0.03, and the average probability

recent recessions and choose to use "at least six years from college graduation" as the criteria.

in the whole sample is 0.23, which is an overall 13% increase.

Individual-level weak monotonicity of the treatment in the instrument (Assumption A.4) is also needed. Although this is a conventional assumption of IV methods, it may be strong in my setting since the monotonicity is imposed at the individual level. Assumption A.4 requires that no individual enrolls in a master's program if not graduating into a recession but does not enroll if graduating into a recession. However, this assumption can be violated since some have found that the increase in the unemployment rate can affect graduate school enrollment in either way, depending on whether the budget constraint effect or the opportunity cost effect dominates. For example, Bedard and Herman (2008) found that enrollment in master's degrees is procyclical for males and that different majors diverge in response to the labor market condition. Therefore, I report the first stage analysis by the broad undergraduate majors in Table 6.

It is clear from Table 6 that for those with an undergraduate major in computer and mathematical sciences or in physical or related sciences, the probability for them to immediately attend a master's program statistically significantly decreases when graduating into a recession, and this is true for both males and females. Those in biology, agriculture, and environment life sciences also become more reluctant to immediately obtain a master's degree when facing a recession at the time of college graduation, even though the effect is not statistically significant. On the other hand, individuals in social sciences and non-S&E related fields are more willing to immediately attend the master's program when graduating from college into a recession. There is some evidence of a positive effect, but not statistically significant for those with an engineering or S&E-related major during college.

Therefore, for the rest of the paper, I only estimate the effect of graduating into a recession on the probability of an individual's attendance at a master's program right after college for a sub-sample. I exclude individuals who obtained their bachelor's degree in the computer and mathematical sciences, biology, agricultural and environment life sciences, and physical

or related sciences. I call from now on this sub-sample the "non-STEM" sample[14].

Table 7 presents the first-stage estimation results based on the "non-STEM " sample. In this sub-sample, overall, the probability of immediately attending the master's program after graduation increases by 3.59 percentage points if an individual graduates from college during a recession year. The estimation shows an increase of 3.77 percentage points if we only focus on the individuals who are not currently in school and an increase of 4.65 percentage points for those who are currently full-time employed. Therefore, within the "non-STEM" sample, it seems plausible to assume the weak monotonicity of the immediately attending a master's program in graduating into a recession.

6 Empirical Strategy

6.1 Probability of Employment and Full-time Employment

The analysis for the labor market outcome is based on individuals who are full-time employed and not self-employed. One concern is that the result might be biased due to the selection into employment and full-time employment. The selection into employment can vary depending on the sub-sample considered. Let us first consider the case by comparing those who are induced to immediately pursue a master's degree by the recession and those who graduate and enter the labor market without exposure to a recession and with only a bachelor's degree. Suppose individuals who are induced to obtain a master's degree immediately have higher underlying employment and full-time employment probabilities. In that case, it might be that the subset of full-time workers who directly entered the labor market without a recession is more positively selected than those recession-induced master's degree holders. On the other hand, suppose individuals who are induced to obtain a master's degree immediately have lower employment and full-time employment probabilities. In this

[14]Detailed summary statistics for the non-STEM sample are provided in Table A4 and Table A5 in the Appendix.

case, the subset of full-time workers from those recession-induced master's degree holders is more positively selected than those who obtained a master's degree later in life. I investigate whether the employment status will still be affected by the immediately obtained master's degree after at least six years of college graduation for those who are recession-induced to obtain a master's degree immediately after college. I apply the following analysis to check whether positive selection into employment exists:

$$P(emp_{it}) = \alpha + \beta G_i^{im} + \theta unemp_t + \eta FMAJ_i + \gamma x_{it} + \kappa_c + \tau_t + \epsilon_{it} \tag{10}$$

where emp_{it} is a dummy representing whether an individual i observed in year t is employed, and α is a constant term. G_i^{im} is a dummy representing whether an individual attending a master's program immediately after college. $unemp_t$ is the annual average unemployment rate at the time an individual's employment status is observed. $FMAJ_i$ is the field of study of individual i during the highest degree (either bachelor's or master's), x_{it} is a set of individual-specific characteristics, and κ_c captures the college graduate year c fixed effect. τ_t controls for the year fixed effect when observing the labor market outcome, and ϵ_{it} is the error term.

The estimation of the probability of full-time employment is conditional on employment, and the analysis is specified as follows:

$$P(fulltime_{it}) = \alpha + \beta G_i^{im} + \theta unemp_{jt} + \delta Occ_i + \gamma x_{it} + \eta_s + \tau_t + \epsilon_{it} \tag{11}$$

where $fulltime_{it}$ is a dummy representing whether an employed individual i observed in year t is full-time employed, and α is a constant term. G_i^{im} is a dummy representing whether an individual attending a master's program immediately after college. $unemp_{jt}$ is the annual unemployment rate in the employment location at the time an individual's full-time employment status is observed. Occ_i is the occupation an individual is employed in, x_{it} is a set of individual-specific characteristics, and η_s captures the employment sector s fixed effect. An

individual can belong to either an Education Institution, Government or Industry Sector. τ_t controls for the year fixed effect when observing the labor market outcome, and ϵ_{it} is the error term.

β in both equations is the coefficient of interest, which captures the effect of a master's degree obtained immediately after college on the full-time employment probability after at least six years past college graduation. Educational attainment is affected by labor market entry conditions because of the changes in the opportunity cost of remaining in school and seeking further education. Both the trigger of the treatment (whether an individual graduated into a recession from college), the treatment (whether immediately attending the master's program), and the outcome (whether employed/full-time employed) are binary.

6.2 Benchmark Analysis: Returns of the Master's Degree

In this paper, I am interested in the returns from the master's education for those who are induced to immediately attend the master's program by a recessionary labor market at the time of college graduation. Therefore, the analysis defines a cohort by the year of college graduation. The potential experience is defined as the years since college graduation. Therefore, I cannot simultaneously identify the graduation cohort effects and calendar year effects; instead, I can simultaneously identify the calendar year effects, potential experience, and tenure effects. This is because not all graduates start their current principal jobs simultaneously. Hence, among individuals of the same observed tenure at the observed principal jobs at time t, there is a variation in the college graduation cohorts they belong. The variation stemmed from the fact that people start their observed principal job at different times, i.e., there is variation in the potential experience for individuals with the same length of tenure in the same survey year. Using the NSCG data gives me the advantage of accessing accurate information on when each individual obtained each degree.

My benchmark estimation takes on the following form:

$$ln(w_{it}) = \alpha + \beta G_i^{im} + \delta exp_{it} + \theta unemp_{jt} + \gamma x_{it} + \kappa_j + \eta_s + \tau_t + \epsilon_{it} \tag{12}$$

where $ln(w_{it})$ is the log real annualized salary as the dependent variable for an individual i in full-time employment (excluding the self-employed) observed in year t, and α is a constant term. G_i^{im} is a dummy representing whether I observe an individual attend the master's program immediately after college. exp_{it} is a vector containing up to the quadratic term of tenure in the principal job and up to the quadratic term of potential experience of an individual i at the time t. $unemp_{jt}$ is the measure of the macroeconomic condition at the time the annual earnings of the individual employed in the census division j are observed, including the national unemployment rate and the unemployment rate in the census division of employment. x_{it} is a set of individual-specific characteristics, including race, gender, employed occupations, working time (weeks per year and hours per week), whether married or living in a marriage-like relationship, and the number of kids under age six living in the household. κ_j represents the employment location fixed effect, η_s represents the employment sector fixed effect, τ_t controls for the year fixed effect when observing the labor market outcome, and ϵ_{it} is the error term. In all the analyses, observations are weighted using person weights provided in the dataset.

β is the coefficient of interest, which captures returns from a master's degree that an individual obtained immediately after graduation. However, educational attainment is affected by labor market entry conditions. Since the opportunity cost of staying in school for further education decreases when an individual graduates into a recessionary labor market, this individual becomes more likely to enroll in a master's program immediately after graduation. I therefore have an endogenous dummy variable in my primary analysis.

I apply a two-step 2SLS method suggested by Wooldridge (2010). The first step is to estimate the binary response model $P(G^{im} = 1|x, z) = G(x, z)$ by the maximum likelihood

method and obtain the fitted probability $\hat{G}_i$. The second step is to estimate the benchmark equation using the fitted probability $\hat{G}_i$ as the IV for the actual immediate master program attendance G_i^{im}.

After controlling for the current economic condition, including the national unemployment rate and the unemployment rate in the census division of employment, the identification of β is driven solely by cross-cohort differences in outcomes that were systematically related by whether the immediate attendance of graduate school happened during a recession or not. One concern is that graduating into a recession might affect an individual's current labor market outcome through other channels outside the changes in the decision to attend a master's program immediately. The effect of graduating into a recession on one's labor market outcome could be long-lasting and potentially indirectly alter an individual's labor market choice. By including the current macroeconomic condition, the location of employment fixed effect, and the employed occupation, I would ideally capture all the potential variation that a recession at college graduation could cause. Hence, in my benchmark analysis, the identification of β is driven solely by cross-cohort differences in outcomes that were systematically related by whether the immediate attendance of graduate school happened during a recession or not.

6.3 The Average Characteristics for the Recession-Induced Individuals who Obtained a Master's Degree Immediately After College Graduation

As before, let D represent whether an individual immediately obtained a master's degree after the first bachelor's, and Z represent whether an individual graduated into a recession from college. Under Assumptions A.1 to A.4, I can identify the average characteristics for the different subpopulations of individuals defined by the potential treatment indicators given by the combination of $\{D, Z\}$. The average characteristics for each subpopulation can be iden-

tified from the observed mean of those characteristics for the four groups defined in Table 2. Each of them is a weighted average of the mean characteristics of different subpopulation as shown in Equation (2)-(4) in Section 5.1. Following Chen et al. (2018), let $\overline{x_k}$ denote the expectation of a scalar variable for a specific subpopulation k. Note that the assumptions used in Chen et al. (2018) are the random assignment of the instrument and weak monotonicity, where they assume the instrument is randomly assigned without conditioning on the covariates. In this analysis, the instrument is whether an individual graduated into a recession. Since I believe the macroeconomic condition is exogenous, it seems plausible to assume the random assignment of the instrument even without conditioning on the covariates, when estimating the average pre-treatment characteristics.

Therefore, I estimate the following moment function for the average characteristics:

$$g\left(\{\bar{x}_k\}\right) = \begin{bmatrix} \left(x - \bar{x}_{at}\right)(1-Z)D \\ \left(x - \bar{x}_{nt}\right)Z(1-D) \\ \left(x - \bar{x}_c\frac{\pi_c}{p_{1|1}} - \bar{x}_a\frac{\pi_{at}}{p_{1|1}}\right)ZD \\ \left(x - \bar{x}_c\frac{\pi_c}{p_{0|0}} - \bar{x}_n\frac{\pi_{nt}}{p_{0|}}\right)(1-Z)(1-D) \\ x - \sum_k \pi_k \bar{x}_k \end{bmatrix} \tag{13}$$

where $\{\bar{x}_k\} = \{\bar{x}_{at}, \bar{x}_{nt}, \bar{x}_c\}$. By Law of Iterated Expectations, $E[g\left(\{\bar{x}_k\}\right)] = 0$ when evaluated at the true value of $\{\bar{x}_k\}$. Therefore, I first estimate the proportions of all the subpopulations, and then estimate all the average characteristics given the estimated proportions. For each variable in $g\left(\{\bar{x}_k\}\right)$, there are five equations to identify three means, i.e. $\{\bar{x}_k\}$. Since the standard errors obtained from this GMM model do not take into account the fact that the proportions for each sub-population are also estimated, I employed a 100-repetition bootstrap to calculate the standard errors of the estimated average characteristics.

7 Results

7.1 Probability of Employment and Full-time Employment

In this study, the analysis of the returns from a master's degree obtained within a short time frame after college graduation is based on those who are full-time non-self-employed individuals. Hence, it is important first to understand whether the induced education will also increase the employment probability after at least six years after college graduation. Table 8 presents the estimation results for the effect on employment probability based on individuals who are not currently in school from the non-STEM sample. Panel A reports the estimation based on individuals who obtained a master's degree immediately after college or those with only a bachelor's degree. Panel B reports the estimation based on individuals with a master's degree. In Table 8, columns (1)-(4) report the estimation based on the whole sample. Column (1) reports the OLS estimation of the effect on employment probability from an immediately obtained master's degree, and column (2) reports the same estimation based on a probit model. Column (3) reports the estimation using the standard 2SLS model, while column (4) reports the result after implementing the two-step 2SLS method in Wooldridge (2010). Columns (5)-(8) report the corresponding set of estimations based on males, and the last three columns report the corresponding estimations for females.

Accompanying the 2SLS results, I also report the Cragg-Donald statistic (Cragg and Donald, 1993), which can be thought of as the matrix-analog of the first stage F-statistic. The critical value for the Cragg-Daniels statistic is based on Stock and Yogo (2002). The critical value is selected to represent the case when the bias from 2SLS is greater than 10% of the bias from OLS estimation. Then, if the Cragg-Donald statistic is less than the critical value, we cannot reject the null hypothesis that instruments are weak; on the other hand, if the statistic is higher than the critical value, we conclude that instruments are not weak. We have sufficient statistical evidence to reject the null hypothesis that instruments are weak as the F-statistics are significantly higher than the critical value in the 2SLS analysis in Table 8.

OLS and probit estimation show no statistically significant effect on the employment probability after at least six years post-graduation from an immediately-obtained master's degree both for the whole sample and for females. Neither do the 2SLS estimations find any statistically significant effect in either Panel A or B. However, there is evidence for a positive effect from the immediately obtained master's degree on the employment probability compared to individuals with only a bachelor's degree even after at least six years of college graduation for males by OLS and probit estimation (Table 8 Panel A column (5) and (6)). The increase in the employment probability is 2.99 - 4.41 percentage points. However, endogeneity exists in OLS and probit due to the selection in the unobserved ability. The estimated increase in the employment probability may be due to biases.

The 2SLS estimation implementing the two-step 2SLS method in Wooldridge (2010) also finds statistically significant evidence for a positive effect for 10.63 percentage points (Table 8 Panel A column (8)). Therefore, compared to their peers with only a bachelor's degree without exposure to a recession at college graduation, the recession-induced males who immediately obtained a master's degree have a higher employment probability at least six years after graduation. There is no evidence for a statistically significant effect compared to the peers who obtained a master's degree later in life without graduating into a recessionary labor market (Panel B).

Table 9 reports the corresponding estimations for the full-time employment probability based on employed individuals who are not currently in school from the non-STEM sample. OLS and probit estimations show statistically significant evidence for a positive effect of an immediately obtained master's degree. Compared to peers who obtained a master's degree later in life, an immediately obtained master's degree will increase the full-time employment probability by 4.86 percentage points (Panel B column(1)-(2)). For males, an immediately obtained master's degree will lead to an 8.32 - 9.36 percentage point increase in the full-time employment probability (Panel B column(5)-(6)) after at least six years since graduation. The 2SLS estimations find no such statistically significant evidence.

On the other hand, the 2SLS estimation implementing the two-step 2SLS method in Wooldridge (2010) finds statistically significant evidence for a negative effect in the whole sample (Table 9 Panel A column (4)). Compared to their peers with only a bachelor's degree and without being exposed to a recession at college graduation, the recession-induced individuals who immediately obtained a master's degree have a lower full-time employment probability at least six years after graduation, conditional on being employed. The immediately-obtained master's degree decreases the full-time employment probability by 8.08 percentage points. There is no such evidence separately for the sub-samples of males (Panel A column (8)) or females (Panel A column (12)).

To summarize, after at least six years past college graduation, there is some statistically significant evidence that the immediately-obtained master's degree will positively affect the employment probability for the recession-induced male degree holders. At the same time, there is no statistically significant effect on the full-time employment probability conditional on being employed. Therefore, those recession-induced male master's degree holders are more likely to be full-time employed than individuals who directly entered the labor market without a recession with only a bachelor's degree. Therefore, the estimated return from a recession-induced master's degree for males in the benchmark analysis provides a lower-bound estimate of the returns since individuals with only a bachelor's degree and without graduating into a recession from college are more positively selected in the sample of males.

7.2 Benchmark Results

The benchmark estimation uses log real annualized salary for the sample of individuals in full-time nonself-employed employment. Table 10 presents the estimated returns. Panel A reports the estimation based on individuals who obtained a master's degree immediately after college or those with only a bachelor's degree. Panel B reports the estimation based on individuals with a master's degree.

Columns (1), (3), and (5) report the OLS estimation for the whole sample, males and

for females, respectively. The OLS estimated coefficient on the immediate master's program enrollment is positive and statistically significant(12-14%) for the whole sample, males and females with only a bachelor's degree or who immediately attend the master's program. There are no statistically significant returns on earnings with samples including only individuals with a master's degree, except for females. The estimation show 4% annual earnings for those who immediately obtained the master's degree. However, unobserved ability may be correlated with whether and when to obtain graduate education, and the OLS estimate might be biased.

Columns (2), (4), and (6) report the estimated returns implementing the two-step 2SLS method from Wooldridge (2010) with the recession indicator as the IV. In Table 10, I also report the Cragg-Donald statistic (Cragg and Donald, 1993), which shows sufficient statistical evidence to reject the null hypothesis that instruments are weak for all the estimations of returns to a master's degree.

Column (2) of Table 10 reports the estimations based on the total population. The recession-induced master's degree holders are those who enroll in a master's program immediately after college when facing a recessionary labor market but otherwise would not enroll. The result in Panel A indicates that compared to peers who graduate without exposure to a recession and hold a bachelor's degree, the recession-induced master's degree holders, on average, have a master's degree earnings premium of 23.28% after college graduation for at least six years. The recession-induced substitutors are individuals who intertemporally substitute for their master's education. In other words, they change the timing for their education at the master's degree level by immediately pursuing the master's degree shortly after graduation; otherwise, they will pursue the master's degree later in life. Hence, for those individuals, their lifetime human capital accumulation does not change. The result in Panel B shows that compared to peers who graduate without exposure to a recession and gain a master's degree later in life, the recession-induced substitutors, on average, have no earnings benefit after graduating from college for at least six years. Therefore, the return

from a recession-induced master's degree can be interpreted as the return for a master's degree for the whole sample.

Columns (4) and (6) in Table 10 report the estimations based on males and females, respectively. The results in Panel A indicate that compared to peers who graduate without being exposed to a recession and hold a bachelor's degree, the recession-induced master's degree holders, on average, have a positive advantage in earnings at least six years after college graduation. The earnings premium is 33.34% for males and 17.59% for females. While compared to peers who graduate without being exposed to a recession and gain a master's degree later in life, the recession-induced substitutors, on average, have no earnings benefit at least six years after college graduation for either males or females (Panel B). Therefore, I can interpret the return from a recession-induced master's degree as the return for a master's degree for both genders.

In a nutshell, there is a statistically significant positive return from a recession-induced master's degree. The earnings advantages differ in magnitude between males and females after at least six years from college graduation.

7.3 Average Characteristics for Individuals who Induced to Obtain a Master's Degree Immediately by the Recession

Who are those individuals switching their master's degree decision when graduating into a recessionary labor market? This section characterizes those recession-induced master's degree holders and those who intertemporally substitute their master's education when graduating into a recession.

Recall that, in our analysis, always-takers are individuals who will attend graduate school immediately after college graduation regardless of the recession; never-takers are individuals who choose not to attend graduate school immediately regardless of exposure to the recession. "Compliers" are individuals who will not choose to attend a graduate school when the recession does not exist; however, when they graduate under exposure to the recession,

they will choose to attend graduate school. Table 11 displays the sample proportions of always-takers, compliers, and never-takers for each sub-sample. Among individuals who are either with only a bachelor's degree or immediately obtained a master's degree, the sample proportion of always-takers, compliers, and never-takers are 13.68%, 3.83%, and 82.49%; the corresponding estimated proportions are 36.59%, 10.05%, and 53.36% among all individuals with a master's degree. The estimated proportions for each sub-sample vary over gender. Among individuals with only a bachelor's degree or who immediately obtained a master's degree, the sample proportions of always-takers, compliers, and never-takers are 9.22%, 3.49%, and 78.25%. In contrast, the corresponding proportions for females are 17.32%, 4.43%, and 78.25%. On the other hand, for males with a master's degree, the sample proportions of always-takers, compliers, and never-takers are 32.64%, 9.42%, and 57.94%, while for females, the corresponding proportions are 38.61%, 20.81%, and 50.58%.

Given the estimated proportions for always-takers, compliers, and never-takers, I can now estimate all the average pre-treatment characteristics for each subpopulation. The baseline characteristics include gender, race, age when obtaining the first bachelor's degree, categories of the institution that received the first bachelor's degree,[15] parental education level, and the field of study for the first bachelor's degree.[16] Several relevant differences emerge.

Table 12 reports the average baseline characteristics and the corresponding 95% confidence intervals for always-takers, compliers, and never-takers based on the individuals who either with only a bachelor's degree or those who immediately obtained a master's degree after college graduation. In this case, the compliers are individuals who immediately enrolled in a master's program when graduating into a recessionary labor market and will not enroll

[15] Categories of the institution where individuals received the first bachelor degree are based on the Carnegie classifications (1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum (Hersch, 2019). Research Universities are those classified as Research I & II and Doctoral I & II universities.

[16] Four broad categories for the field of study are reported. BA Engineering is the engineering field. BA Social Sciences includes economics, political science, and other humanities majors. BA Other STEM fields include Architecture/Environmental Design. BA Other Majors include non-STEM fields such as English/Languages/Literature and Fine/Performing Arts.

otherwise. Never-takers are individuals who will not obtain a master's degree regardless of whether graduating into a recession. On the contrary, always-takers will immediately obtain a master's degree regardless of whether they are exposed to a recession when they graduate from college.

Results in Table 12 show that compared to never-takers, the recession-induced master's degree holders (compliers) are statistically significantly younger when they received their first bachelor's degree (21.37 vs. 21.76 years old). They also seem more likely to be non-white females from less research-active institutions for their bachelor's degrees and less likely to have parents with at least a bachelor's degree, but these differences are not statistically significant. When compared with always-takers, on the other hand, compliers are statistically significantly less likely to have a BA degree in "other STEM" field (2.8% vs. 16.8%) but more likely to be in "other majors" (59.8% vs. 32.8%) for the bachelor's degree. I do not find any statistically significant difference between compliers and always-takers, nor between compliers and never-takers for males (Tabel 13). However, I find that female compliers are statistically significantly younger than never-takers when they received their first bachelor's degree (21.44 vs. 22.07 years old), and they are less likely to have parents with a graduate degree (11.8% vs. 29.8%) than never-takers (Tabel 14).

Table 15 reports the average baseline characteristics and the corresponding 95% confidence intervals for always-takers, compliers, and never-takers based on the individuals with a master's degree. In this case, the compliers are individuals who immediately enrolled in a master's program when graduating into a recessionary labor market and will otherwise enroll in a master's degree later in life. Never-takers are individuals who will not immediately obtain a master's degree regardless of whether graduating into a recession. On the contrary, always-takers will immediately obtain a master's degree regardless of whether they are exposed to a recession when they graduate from college.

Among individuals with a master's degree, compared to never-takers, I find that compliers are statistically significantly younger when they receive their first bachelor's degree (21.44

vs. 21.99 years old). Compliers are more likely to come from a family where neither parent has a bachelor's degree (13.4% vs. 1.5%), and they are less likely to study in other-STEM fields (0.4% vs. 7.8%) but more likely to study in other Majors (56.5% vs. 37.6%) for their bachelor's degrees than the never-takers. Similarly, individuals who intertemporally substitute their master's education (compliers) are more likely to have parents whose highest educational attainment is at the high school level than always-takers (13.4% vs. 1.9%). Additionally, compliers are less likely to study in other-STEM fields (0.4% vs. 16.8%) but more likely to study in other Majors (56.5% vs. 32.9%) for their bachelor's degrees than the never-takers. I do not find any statistically significant difference between compliers and always-takers, nor between compliers and never-takers for males (Tabel 16). However, I find female compliers are statistically significantly younger when they received their first bachelor's degree (21.39 vs. 21.84 years old) than never-takers (Tabel 17).

Therefore, younger females are generally more sensitive to the master's education decision when graduating from college in a recessionary labor market. Specifically, those who changed their decision when facing a recession usually have a bachelor's degree in a major such as English. Additionally, those individuals are more likely to obtain their bachelor's degree from less research-active institutions, and they are more likely to have parents without a bachelor's degree. This finding is consistent with the previous literature that those who go directly to graduate school are academically and economically advantaged relative to those who do not (Altonji and Zhong, 2021).

8 Discussion and Conclusion

This paper estimates the labor market returns to a master's degree. To control for the selection of unobserved abilities and preferences in graduate education, I use whether an individual graduated into a recession from college as an instrumental variable (IV). Graduating during a recession increases the probability of pursuing a graduate degree right after

college by 4 percentage points. Given that the average probability of graduate attendance is 0.12, this represents an overall more than 30% increase in the probability of immediately obtaining a master's degree among full-time workers. The effect of the recession is heterogeneous between genders. For males, the increase in the probability of pursuing a graduate degree right after college is 0.03, and the average probability in the whole sample is 0.08, which is an overall 34% increase. Even though the percentage point increase is relatively the same but slightly higher for females, the average probability is 0.23 for females, which results in a 17% increase in the probability.

Individuals who intertemporally substitute their master's education when graduating in a recessionary labor market postpone their entrance to the labor market without changing their lifetime human capital accumulation.[17] They may benefit from the "timing effect" of attending the master's education immediately right after the college education. Those recession-induced master's holders benefit from both the "timing effect" and "human capital effect," which is the accumulation of additional human capital through a master's degree.

The estimated results suggest a 23.38% return for the pooled sample, 33.34% for males, and 17.59% for females from a recession-induced master's degree for full-time non-self-employed individuals after at least six years since graduation.

At the same time, the estimated results suggest no evidence of earning advantage for the master's education substitutors. This result suggests that the returns through the delayed entry into the labor market are negligible by analyzing the annual earnings after graduation for at least six years. These estimation results are consistent with the exclusion restriction assumption we imposed to identify the local average treatment effect for individuals induced to obtain a master's degree by the recession. Since after six years of graduating into a recession, there appears to be no effect for workers with at least a college education (Genda

[17]However, due to the construction of the sample, we could not compare the lifetime human capital for cohorts who graduated into the recession with those lucky cohorts. The longest span for the unlucky cohort is 18 years. Furthermore, for those who graduated during the 2008 - 2009 recession, the span is only 12 years. Even though it is less common for individuals to obtain a master's degree after age 30, this paper captures a short- to mid-term effect.

et al., 2010, Schwandt and Von Wachter, 2019 and Altonji et al., 2016), for individuals who were caught by the recession and college-graduates who are affected by the scarring effect, after at least six years of college graduation, they can go back to the "original" wage distribution as if they had never been affected by the negative shock from the economic condition at the time of college graduation. As a result, the shift in the wage distribution for those compliers is only the result of the additional human capital accumulation through a master's degree, which they would not obtain if graduating into a good economic condition from college. Therefore, the estimated returns for the recession-induced master's degree holders can be interpreted as the return of the master's degree.

The estimated returns for a master's degree are large in terms of returns from education; however, those estimates are still in line with the previous literature scrutinizing the returns for a graduate degree. For example, Titus (2007) found a 20% private returns of a master's degree, while Altonji and Zhong (2021) found the returns for a master's degree is in the range of 10 - 27%. One potential explanation is that I am looking at the economic returns for the marginal individuals induced to obtain a master's degree by the recession, and the returns for those types of individuals could be comparatively large. Therefore, this paper enriched the surprisingly understudied returns to a master's degree by providing a new estimation of the returns on the recession-induced master's degree holders.

In addition, this paper provides a complement to the finding that "more competitive students"[18] choose to delay the labor market entrance by staying in the undergraduate studies (Finamor, 2022). This paper provides a missing side of the story for the "less competitive students". This paper finds that the "less competitive students" would be more likely to delay the labor market entrance by obtaining a master's degree. Specifically, I find that younger females with a bachelor's education in "other majors" from less research-active universities and who come from families with neither parent holding a bachelor's degree are more sensitive to the master's education decision when graduating into a recession.

[18]The source of determining whether a student is competitive or not depending on gender, the major of study during undergrads, family background and types of school obtained the bachelor's degree.

Therefore, the marginal individuals in my sample are more likely to be from a non-Science or Engineering background. The economic returns of obtaining a master's degree for them appear to be relatively larger than for individuals from other educational backgrounds during college, regardless of their curriculum at the master's level (Altonji and Zhong, 2021).

This paper conveys important information about graduate school returns that individuals can rely on and insight for policymakers and universities interested in helping unlucky cohorts who faced adverse economic conditions during a recession. I find evidence for strong returns of a recession-induced master's degree, and this return diverges between males and females. For future studies, it would be interesting to use individual panel data to track the employment history to explore the mechanism of this divergence. Additionally, future research can go beyond identifying the local average treatment effects and estimate the marginal treatment effects (MTEs) to derive more relevant treatment parameters and explore the underlying self-selection into education behavior, especially for females.

Figures and Tables

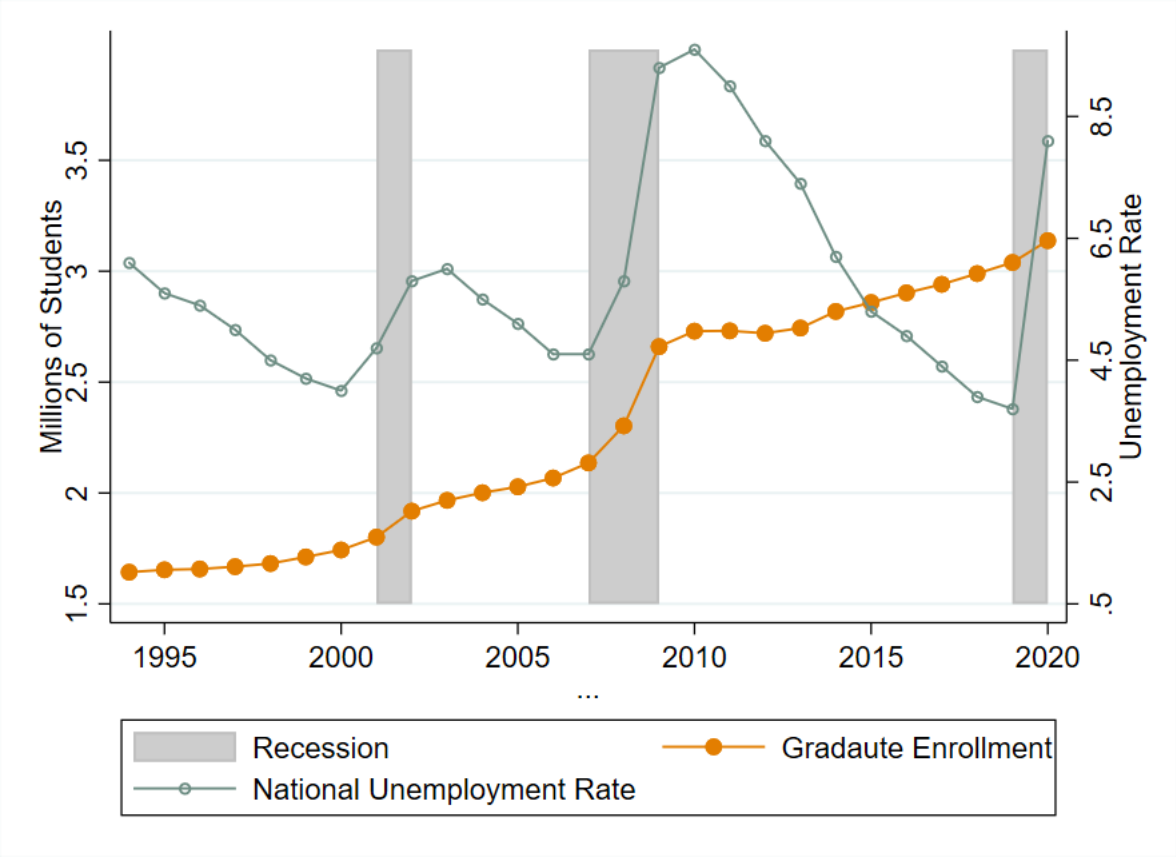

Figure 1: Graduate School Enrollment and National Unemployment Rate

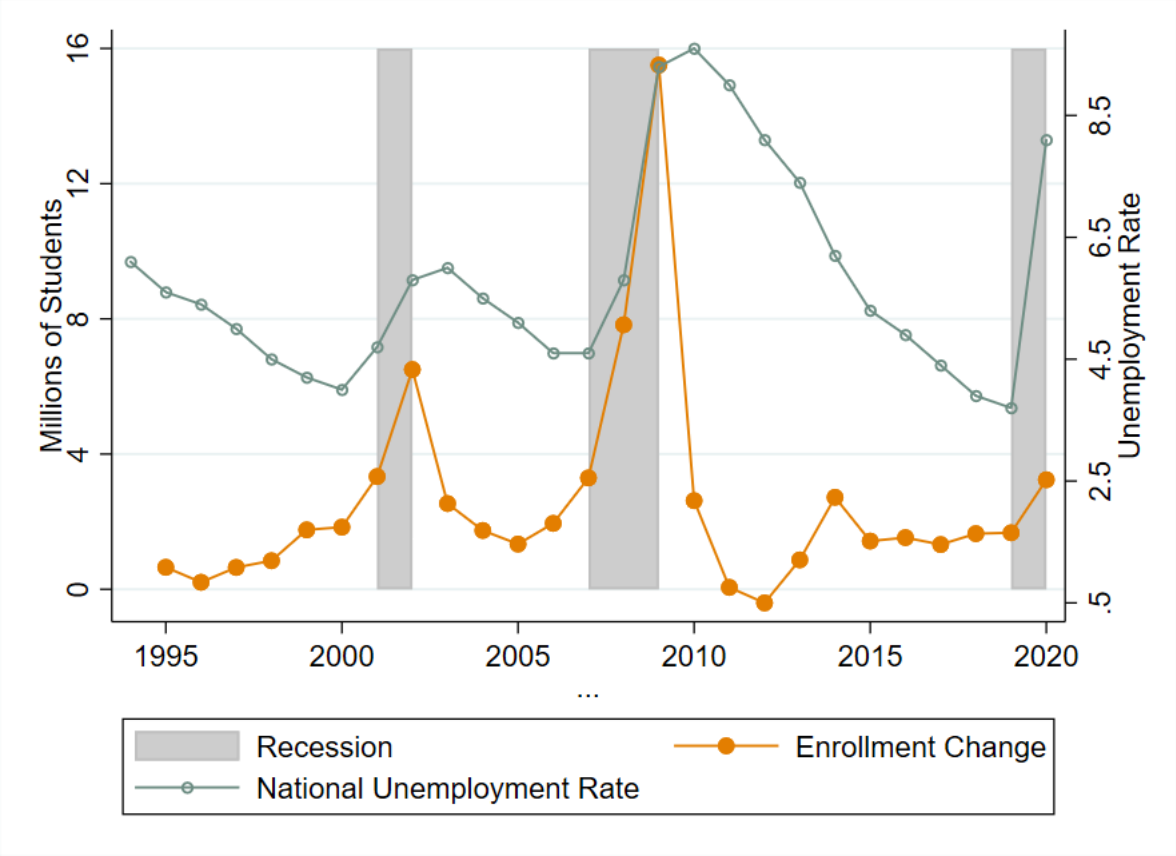

Figure 2: Percent Change in Graduate School Enrollment and National Unemployment Rate

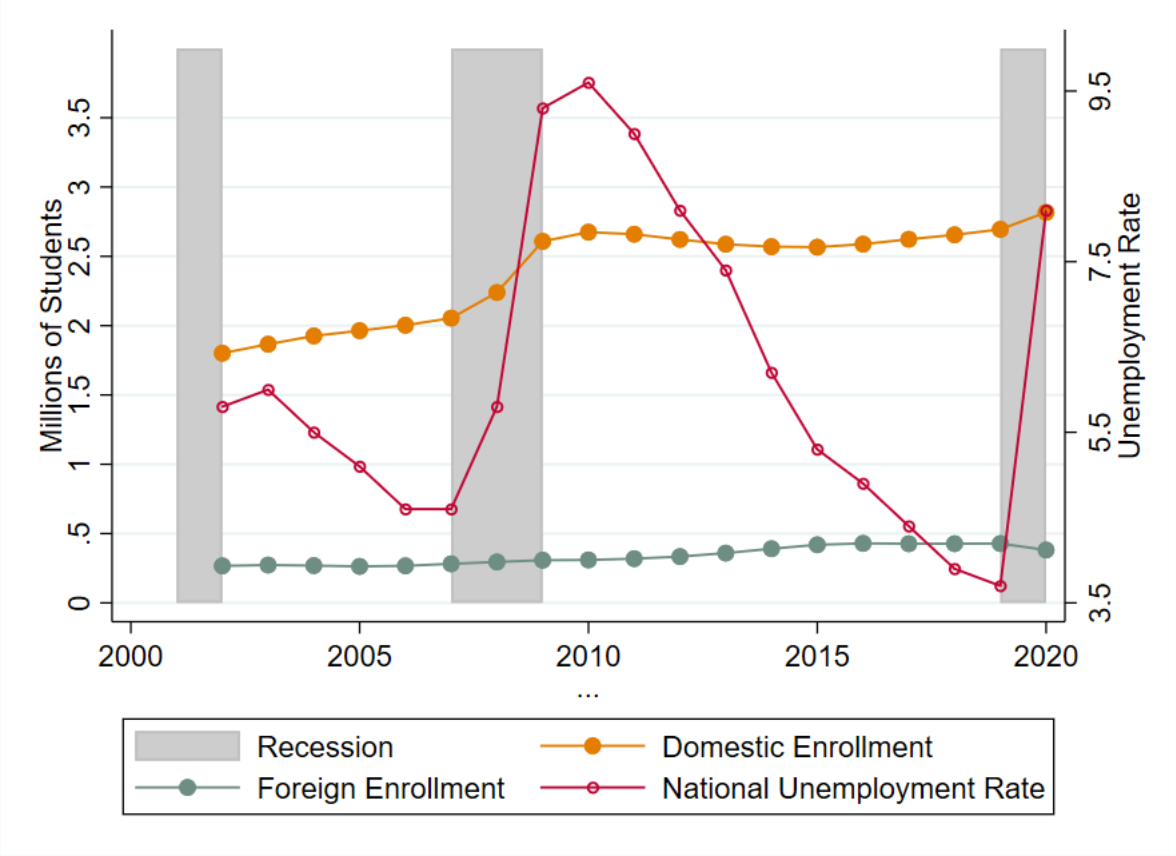

Figure 3: Graduate School Enrollment and National Unemployment Rate by Domestic or Foreign Students: 2002 - 2020

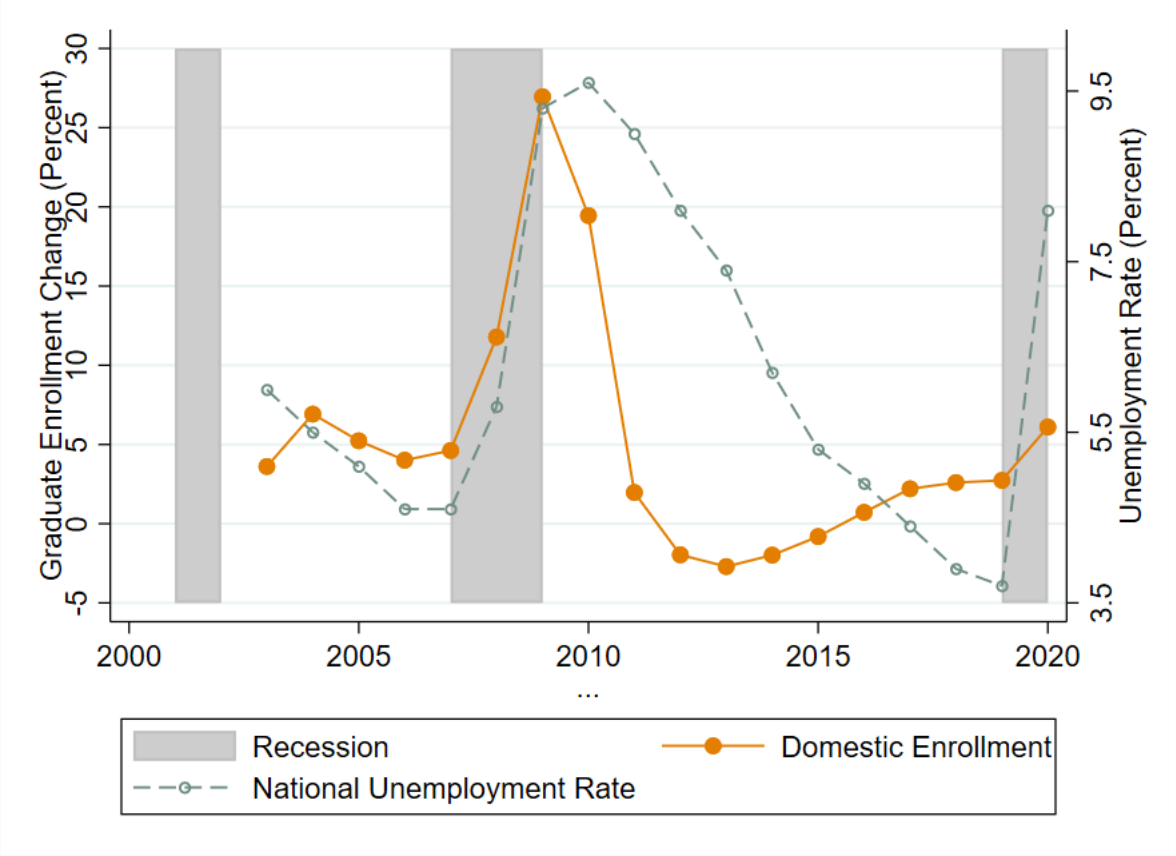

Figure 4: Percent Change Graduate School Enrollment for Domestic Students and National Unemployment Rate Foreign Students: 2003 - 2020

Table 3: Year of Wage Observation and College Graduation Year

BA Year	Survey Year				
	2010	2013	2015	2017	2019
1995	410	460	352	322	326
1996	414	471	354	333	321
1997	426	522	424	337	325
1998	408	487	375	309	296
1999	385	494	407	333	325
2000	460	579	470	403	395
2001	480	721	569	450	408
2002	491	802	688	525	466
2003	560	882	819	602	540
2004	572	997	893	696	668
2005		1216	1167	839	758
2006		1389	1271	886	859
2007		1501	1559	1000	1070
2008			1971	1105	1149
2009			1640	1207	1247
2010				1088	1334
2011				917	1329
2012					1289
2013					1087

Note: The sample contains full-time employed individuals who are not in school and not self-employed, who got their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24, and who graduated from college for at least six years. Each cell represents the number of individuals observed in a specific survey year who received a bachelor's degree in a particular BA year. Full-time employment is defined as working at least 40 weeks per year and at least 35 hours per week.

Table 4: First Stage: The Probability of Immediately Attending a Master's Program: (NSCG 10 - 19)

	All	BA and Im. Grad	Grad only
A. Not in School Sample			
Recession Indicator	0.0183***	0.0200***	0.0536***
	(0.0063)	(0.0075)	(0.0175)
Unemp Rate at BA graduation	0.0096***	0.0085***	0.0410***
	(0.0015)	(0.0018)	(0.0043)
Observations	97,939	75,683	43,265
B. Non-self Full-time Employed			
Recession Indicator	0.0408***	0.0476***	0.0938***
	(0.0081)	(0.0101)	(0.0203)
Unemp Rate at BA graduation	0.0117***	0.0101***	0.0442***
	(0.0020)	(0.0024)	(0.0051)
Observations	59,438	44,936	28,157

Note: Outcome: the probability of immediately obtaining a master's degree after graduation, which refers to enroll a master's program within two years of college graduation and obtaining the degree within the average time for full-time students. Coefficients are the average treatment effect for whether graduating into a recession.The controls include age, gender,race,age received the first bachelor's degree, the field of study for the bachelor's degree, the classification of the institution that received the first bachelor's degree, parental education level. The estimation is based on individuals who are not in school and who got their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$.

Table 5: First Stage: The Probability of Immediately Attending a Master's Program by Gender

	Males			Females		
	All	BA and Im. Grad	Grad only	All	BA and Im. Grad	Grad only
A. Not in School Sample						
Recession Indicator	0.0186**	0.0212***	0.0634**	0.0166*	0.0162	0.0470**
	(0.0083)	(0.0097)	(0.0275)	(0.0086)	(0.0104)	(0.021)
Unemp Rate at BA graduation	0.0092***	0.0096**	0.0370***	0.0097***	0.0072***	0.0426***
	(0.0021)	(0.0024)	(0.0068)	(0.0021)	(0.0025)	(0.0055)
Observations	47,544	37,776	17,563	50,395	37,907	25,702
B. Non-self Full-time Employed						
Recession Indicator	0.0345***	0.0410***	0.0975***	0.0420***	0.0468***	0.0878***
	(0.0110)	(0.0133)	(0.0330)	(0.0109)	(0.0137)	(0.0244)
Unemp Rate at BA graduation	0.0104***	0.0108***	0.0387***	0.0124***	0.0084**	0.0464***
	(0.0027)	(0.0033)	(0.0081)	(0.0027)	(0.0033)	(0.0065)
Observations	29,550	23,065	11,587	29,888	21,871	16,570

Note: Outcome: the probability of immediately obtaining a master's degree after graduation, which refers to enroll a master's program within two years of college graduation and obtaining the degree within the average time for full-time students. Coefficients are the average treatment effect for whether graduating into a recession.The controls include age, race,age received the first bachelor's degree, the field of study for the bachelor's degree, the classification of the institution that received the first bachelor's degree, parental education level. The estimation is based on individuals who are not in school and who got their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$.

Table 6: First Stage: The Probability of Immediately Attending a Master's Program by Filed of Study during Bachelor's Degree

	Pooled Sample	BA and Im. Grad			Grad only		
	All	All	Males	Female	All	Males	Female
Computer and	-0.0650***	-0.0711***	-0.0597***	-0.1070***	-0.1994***	-0.1633***	-0.2064***
Mathematical Sciences	(0.0128)	(0.0153)	(0.0154)	(0.0404)	(0.0414)	(0.0447)	(0.0661)
Obs	6,690	5,214	3,696	1,518	2,770	1,639	1,131
Bio,Agr,and Env	-0.0217	-0.0344	0.0246	-0.0686**	0.0124	0.1567**	-0.0346
Life Sciences	(0.0184)	(0.0225)	(0.0272)	(0.0322)	(0.0418)	(0.0696)	(0.0484)
Obs	8,831	6,762	2,796	3,966	4,023	1,302	2,721
Physical and	-0.0757**	-0.1288**	-0.1322***	-0.1138	-0.0146	-0.1229	0.0510
Related Sciences	(0.0383)	(0.0476)	(0.0450)	(0.0704)	(0.0694)	(0.0825)	(0.0765)
Obs	3,732	2,929	1,681	1,248	1,686	895	791
Social and	0.0314**	0.0359**	0.0001	0.0601***	0.0605**	0.0147	0.0854***
Related Sciences	(0.0123)	(0.0157)	(0.0176)	(0.0141)	(0.0254)	(0.0394)	(0.0313)
Obs	18,546	13,089	4,766	8,323	9,900	2,856	7,044
Engineering	0.0216**	0.0181	0.0309**	-0.0337	0.0932**	0.0949***	0.0934
	(0.0110)	(0.0135)	(0.0133)	(0.0362)	(0.0281)	(0.0296)	(0.0613)
Obs	18,923	15,047	11,829	3,218	8,041	5,849	2,192
S & E Related	0.0054	0.0137	0.0188	0.0074	-0.0334	0.0255	-0.0482
Fields	(0.0196)	(0.0198)	(0.0049)	(0.0284)	(0.0360)	(0.0557)	(0.0410)
Obs	7,822	6,406	1,787	4,619	3,972	787	3,185
Non - S & E	0.0507***	0.0601***	0.0493***	0.0573***	0.1250***	0.1188**	0.1161***
Related Fields	(0.0112)	(0.0138)	(0.0181)	(0.0186)	(0.0325)	(0.0536)	(0.0385)
Obs	14,147	10,394	4,683	5,711	6,244	2,095	4,149

Note: Outcome: the probability of immediately obtaining a master's degree after graduation, which refers to enroll a master's program within two years of college graduation and obtaining the degree within the average time for full-time students. Coefficients are the average treatment effect for whether graduating into a recession.The controls include age, gender,race,age received the first bachelor's degree, the classification of the institution that received the first bachelor's degree, parental education level. The estimation is based on individuals who are not in school and who got their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$.

Table 7: First Stage: The Probability of Immediately Attending a Master's Program Excluding by Gender(non-STEM)

	All	BA and Im. Grad	Grad only
A. Non-self Full-time Employed			
Recession Indicator	0.0310***	0.0355***	0.0752***
	(0.0074)	(0.0091)	(0.0184)
Unemp Rate at BA graduation	0.0115***	0.0098***	0.0443***
	(0.0018)	(0.0022)	(0.0045)
Observations	78,691	58,841	36,636
B. Males			
Recession Indicator	0.0261***	0.0310***	0.0762***
	(0.0098)	(0.0117)	(0.0291)
Unemp Rate at BA graduation	0.0100**	0.0103***	0.0386***
	(0.0024)	(0.0029)	(0.0070)
Observations	39,784	31,238	15,423
C. Females			
Recession Indicator	0.0316**	0.0337***	0.0712***
	(0.0100)	(0.0126)	(0.0223)
Unemp Rate at BA graduation	0.0124***	0.0086***	0.0468***
	(0.0024)	(0.0030)	(0.0058)
Observations	38,907	28,603	21,213

Note: Outcome: the probability of immediately obtaining a master's degree after graduation, which refers to enroll a master's program within two years of college graduation and obtaining the degree within the average time for full-time students. Coefficients are the average treatment effect for whether graduating into a recession.The controls include age, gender, race,age received the first bachelor's degree, the field of study for the bachelor's degree, the classification of the institution that received the first bachelor's degree, parental education level. The estimation is based on the non-STEM subsample with individuals who are not in school and who got their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$.

Table 8: The Effect of Immediately Obtained Master's Degree Induced by a Recession at College Graduation on the Probability of Employment (NSCG 10 - 19)

			Pr(Emp)				Pr(Emp)				Pr(Emp)	
	(1) OLS	(2) Probit	(3) 2SLS	(4) 2SLS	(5) OLS	(6) Probit	(7) 2SLS	(8) 2SLS	(9) OLS	(10) Probit	(11) 2SLS	(12) 2SLS
	For the Whole Sample				**Males**				**Females**			
A. BA vs Im. Grad												
	0.0243	0.0528	-0.0315	-0.0093	0.0299***	0.0441**	-0.0616	0.1063**	0.0352	0.0351	-0.1585	-0.0209
	(0.0202)	(0.0227)	(0.3073)	(0.0356)	(0.0099)	(0.0193)	(0.2735)	(0.0457)	(0.0290)	(0.0336)	(0.5421)	(0.0412)
CD Wald F-stat	——-	——-	50.397	3895.797	——-	——-	41.00	1361.745	——-	——-	17.58	2564.919
Stock-Yogo Critical Value	——-	——-	16.38	16.38	——-	——-	16.38	16.38	——-	——-	16.38	16.38
Observations	56,102				27,593				28,509			
B. Grads												
	-0.0176	-0.0152	0.0313	-0.0346	-0.0103	-0.0089	-0.0574	-0.0123	-0.0172	-0.0120	0.0568	-0.0630
	(0.0124)	(0.0127)	(0.1114)	(0.0392)	(0.0095)	(0.0096)	(0.1374)	(0.0193)	(0.0184)	(0.0185)	(0.1514)	(0.0520)
CD Wald F-stat	——-	——-	149.39	1209.13	——-	——-	60.96	584.38	——-	——-	92.33	928.24
Stock-Yogo Critical Value	——-	——-	16.38	16.38	——-	——-	16.38	16.38	——-	——-	16.38	16.38
Observations	29,992				11,734				18,258			

Note: The estimation is based on the non-STEM subsample with individuals who are not self-employed nor in school and who obtained their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. The controls include age, gender, race, years since graduation, and years since the most recent degree. The estimation also controls for the field of study for the most recent degree, the classification of the institution that received the first bachelor's degree, the current national unemployment rate, marital status, the number of kids under age six in the household, and the survey year fixed effect. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01, ^{**}p < 0.05, ^{*}p < 0.1$. Cragg-Donald statistics(Cragg and Donald, 1993) and the critical value(Stock and Yogo, 2002) for weak-iv testing are also reported along with the 2SLS results.

Table 9: The Effect of Immediately Obtained Master's Degree Induced by a Recession at College Graduation on the Probability of Full-Time Employment (NSCG 10 - 19)

			Pr(Full-time)				Pr(Full-time)				Pr(Full-time)	
	(1) OLS	(2) Probit	(3) 2SLS	(4) 2SLS	(5) OLS	(6) Probit	(7) 2SLS	(8) 2SLS	(9) OLS	(10) Probit	(11) 2SLS	(12) 2SLS
	For the Whole Sample				**Males**				**Females**			
A. BA vs Im. Grad												
	-0.0215	-0.0220	0.2373	-0.0808*	-0.0075	-0.0091	0.1477	0.0020	-0.0278	-0.0339	0.3277	-0.0572
	(0.0274)	(0.0229)	(0.1752)	(0.0454)	(0.0248)	(0.0226)	(0.2143)	(0.0477)	(0.0405)	(0.0359)	(0.2534)	(0.0560)
CD Wald F-stat	——-	——-	131.196	2134.77	——-	——-	54.24	843.30	——-	——-	68.62	1375.263
Stock-Yogo Critical Value	——-	——-	16.38	16.38	——-	——-	16.38	16.38	——-	——-	16.38	16.38
Observations	44,815				23,052				21,763			
B. Grads												
	0.0486**	0.0485**	0.0999	0.0347	0.0936***	0.0832***	0.0210	0.1121	0.0210	0.0191	0.1670	-0.024
	(0.0238)	(0.0233)	(0.1468)	(0.0705)	(0.0310)	(0.0269)	(0.1685)	(0.0749)	(0.0184)	(0.0324)	(0.2211)	(0.0964)
CD Wald F-stat	——-	——-	24.245	1137.366	——-	——-	98.27	483.363	——-	——-	103.175	670.405
Stock-Yogo Critical Value	——-	——-	16.38	16.38	——-	——-	16.38	16.38	——-	——-	16.38	16.38
Observations	25,603				11,734				18,258			

Note: The estimation is based on the non-STEM subsample with employed individuals who are not self-employed nor in school and who obtained their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. The controls include years since college graduation, the employment type, the size of the employer, the geographical region of the employer, unemployment rate at the employed region, occupation, race, gender, marital status, number of kids under age six in the household and the survey year fixed effect. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$. Cragg-Donald statistics(Cragg and Donald, 1993) and the critical value(Stock and Yogo, 2002) for weak-iv testing are also reported along with the 2SLS results.

Table 10: Main Results: The Returns in Annual Earning for Full-Time Workers who Immediately Obtained a Master's Degree Induced by a Recession at College Graduation (NSCG 10 - 19)

	All Sample		**Males**		**Females**	
	OLS	Use Rec Indicator	OLS	Use Rec Indicator	OLS	Use Rec Indicator
	(1)	(2)	(3)	(4)	(5)	(6)
A. BA only + Im Grad						
	0.1241***	0.2328***	0.1229***	0.3334**	0.1352***	0.1759*
	(0.0147)	(0.0792)	(0.0232)	(0.1514)	(0.0187)	(0.0958)
CD Wald F-stat	——-	1462.373	——-	593.914	——-	836.468
Stock-Yogo Critical Value	——-	16.38	——-	16.38	——-	16.38
Observations:		37,325		19,903		17,422
B. Grad only						
	-0.019	0.058	0.019	0.063	-0.043*	0.1103
	(0.017)	(0.083)	(0.026)	(0.100)	(0.0223)	(0.1028)
CD Wald F-stat	——-	834.279	——-	495.766	——-	541.51
Stock-Yogo Critical Value	——-	16.38	——-	16.38	——-	16.38
Observations:		20,244		9,167		11,077

Note: Earnings are measured in 2010 dollars. The estimation is based on the non-STEM subsample with non-schooler full-time non-self-employed individuals who obtained their first bachelor's degree from a US institution during 1995 - 2017 at age 20 - 24 and who graduated from college for at least six years. Full-time employment is defined as working at least 40 weeks per year and at least 35 hours per week. The controls include years since college graduation, the employment type, the size of the employer, the geographical region of the employer, unemployment rate at the employed region, occupation, race, gender, marital status, number of kids under age six in the household and the survey year fixed effect. NSCG individual weights are used. Standard errors that appear in the parentheses are the robust standard errors. $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$. Cragg-Donald statistics(Cragg and Donald, 1993) and the critical value(Stock and Yogo, 2002) for weak-iv testing are also reported along with the 2SLS results.

Table 11: Stratum Proportions (Under Assumption A1 and A4)

	BA only + $Grad^{IM}$			Grads		
	All	Males	Females	All	Males	Females
π_{at}	0.1368***	0.0922***	0.1732***	0.3659***	0.3264***	0.3861***
	(0.0037)	(0.0051)	(0.0042)	(0.0083)	(0.0141)	(0.0093)
π_c	0.0383***	0.0349**	0.0443***	0.1005***	0.0942**	0.1081***
	(0.0112)	(0.0140)	(0.0119)	(0.0228)	(0.0373)	(0.0275)
π_{nt}	0.8249***	0.8729***	0.7825***	0.5336***	0.5794***	0.5058***
	(0.0112)	(0.0129)	(0.0113)	(0.0188)	(0.0324)	(0.0245)

Note: BA only + $Grad^{IM}$ sample contains 37,325 individuals with a bachelor's degree. Grads sample has 20,244 master's degree holders. π_{at},π_c, and π_{nt} represent the proportion of always-takers, compliers, and never-takers, respectively. Always-takers are individuals who will attend graduate school regardless of the recession. Compliers are individuals who are induced to attend graduate school by recessions. "Compliers" are individuals who are induced to attend a graduate school by recessions. Never-takers choose not to attend graduate school regardless of exposure to economic downturns. Standard errors that appear in the parentheses are the bootstrapped standard errors.

Table 12: Average Characteristics for Subpopultions (BA only + Grad^{IM})

Variable	at	nt	c	nt - c	c-at	nt- at
Female	0.696***	0.521***	0.589***	-0.068	-0.107	-0.174***
	(0.013)	(0.007)	(0.116)	(0.119)	(0.123)	(0.013)
White	0.851***	0.852***	0.905***	-0.053	0.054	0.001
	(0.010)	(0.006)	(0.110)	(0.112)	(0.113)	(0.011)
Age Obtained BA	21.76***	22.21***	21.37***	0.840**	-0.397	0.443***
	(0.026)	(0.018)	(0.017)	(0.337)	(0.335)	(0.030)
BA in Research University	0.514***	0.487***	0.518***	0.005	-0.027	0.063*
	(0.013)	(0.007)	(0.154)	(0.157)	(0.015)	(0.040)
Tire 3 BA	0.240***	0.221***	0.382***	-0.161	0.142	-0.019
	(0.011)	(0.006)	(0.128)	(0.130)	(0.130)	(0.012)
Tire 4 BA	0.626***	0.648***	0.665***	-0.016	0.038	0.022
	(0.015)	(0.007)	(0.141)	(0.909)	(0.145)	(0.015)
Parents with Highest High School Degree	0.020***	0.020***	0.061	-0.041	0.041	0.000
	(0.004)	(0.002)	(0.040)	(0.041)	(0.041)	(0.004)
Either Parent with a Bachelor's Degree	0.676***	0.587***	0.517***	0.070	-0.159	-0.089***
	(0.012)	(0.008)	(0.017)	(0.179)	(0.179)	(0.011)
Either Parent with a Grad Degree	0.407***	0.300***	0.147	0.153	-0.259	-0.106***
	(0.011)	(0.008)	(0.172)	(0.177)	(0.176)	(0.012)
BA Engineering	0.090***	0.083***	0.040	0.043	-0.050	-0.007*
	(0.004)	(0.003)	(0.036)	(0.038)	(0.039)	(0.004)
BA Other STEM	0.168***	0.095***	0.028	0.067	-0.139**	-0.073***
	(0.008)	(0.003)	(0.062)	(0.063)	(0.064)	(0.007)
BA Social Sciences	0.422***	0.279***	0.330***	-0.051	-0.092	-0.143***
	(0.014)	(0.006)	(0.119)	(0.121)	(0.124)	(0.015)
BA Other Majors	0.328***	0.547***	0.598***	-0.051	0.270**	0.219***
	(0.016)	(0.007)	(0.104)	(0.105)	(0.108)	(0.016)

Note: This analysis is based on 37,325 individuals with a bachelor's degree.Averages are estimated with the overidentified nonparametric GMM procedure described in the Identification section. Computations use individual weights provided by NSCG. Numbers in parentheses are standard errors. $^{***}p < 0.01$,$^{**}p < 0.05$,$^{*}p < 0.1$. Categories of the institution that received the first Bachelor's degree are based on the Carnegie classifications(1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum. (Hersch, 2019) Research Universities are those classified as Research I & II and Doctoral I II universities. BA Other STEM fields include Architecture/environmental design etc. BA Other Majors include non-STEM fields such as English/Languages/Literature, Fine/Performing arts, etc.

Table 13: Average Characteristics for Subpopultions (BA only + Grad^{IM}, Males)

	at	nt	c	nt - c	c-at	nt- at
White	0.874***	0.869***	0.988	-0.119	0.114	-0.005
	(0.016)	(0.007)	(0.796)	(0.769)	(0.798)	(0.015)
Age Obtained BA	21.97***	22.36***	21.41***	0.949	-0.558	0.391***
	(0.064)	(0.028)	(0.921)	(0.925)	(0.938)	(0.067)
BA in Research University	0.602***	0.501***	0.518	-0.017	-0.085	-0.102***
	(0.027)	(0.012)	(0.477)	(0.482)	(0.488)	(0.024)
Tire 3 BA	0.297***	0.228***	0.446	-0.218	0.150	-0.068***
	(0.023)	(0.010)	(0.829)	(0.830)	(0.832)	(0.020)
Tire 4 BA	0.573***	0.642***	0.577	0.064	0.004	0.068***
	(0.023)	(0.010)	(0.433)	(0.436)	(0.441)	(0.022)
Parents with Highest High School Degree	0.021***	0.014***	0.003	0.010	-0.018	-0.007
	(0.007)	(0.002)	(0.066)	(0.067)	(0.068)	(0.007)
Either Parent with a Bachelor's Degree	0.674***	0.611***	0.520	0.091	-0.154	-0.063**
	(0.023)	(0.011)	(0.769)	(0.771)	(0.773)	(0.025)
Either Parent with a Grad Degree	0.394***	0.302***	0.192	0.110	-0.202	-0.092
	(0.022)	(0.010)	(0.874)	(0.876)	(0.887)	(0.023)
BA Engineering	0.214***	0.141***	0.119	0.022	-0.095	-0.073***
	(0.015)	(0.004)	(0.543)	(0.543)	(0.549)	(0.015)
BA Other STEM	0.109***	0.067***	0.046	0.021	-0.064	-0.042***
	(0.011)	(0.004)	(0.190)	(0.191)	(0.193)	(0.010)
BA Social Sciences	0.315***	0.236***	0.237	-0.001	-0.078	-0.079***
	(0.022)	(0.009)	(0.362)	(0.367)	(0.363)	(0.025)
BA Other Majors	0.365***	0.560***	0.609	-0.048	0.244	0.195***
	(0.027)	(0.011)	(0.437)	(0.439)	(0.443)	(0.031)

Note: This analysis is based on 19,903 individuals with a bachelor's degree.Averages are estimated with the overidentified nonparametric GMM procedure described in the Identification section. Computations use individual weights provided by NSCG. Numbers in parentheses are standard errors. $^{***}p < 0.01,^{**}p < 0.05,^{*}p < 0.1$. Categories of the institution that received the first Bachelor's degree are based on the Carnegie classifications(1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum. (Hersch, 2019) Research Universities are those classified as Research I & II and Doctoral I II universities. BA Other STEM fields include Architecture/environmental design etc. BA Other Majors include non-STEM fields such as English/Languages/Literature, Fine/Performing arts, etc.

Table 14: Average Characteristics for Subpopultions (BA only + Grad^{IM}, Females)

	at	nt	c	nt - c	c-at	nt- at
White	0.840***	0.838***	0.878***	0.041	-0.038	0.002
	(0.012)	(0.008)	(0.114)	(0.119)	(0.118)	(0.013)
Age Obtained BA	21.68***	22.07***	21.40***	0.676**	-0.282	0.394***
	(0.034)	(0.027)	(0.322)	(0.335)	(0.343)	(0.034)
BA in Research University	0.474***	0.473***	0.509	-0.036	0.035	-0.001
	(0.016)	(0.016)	(0.157)	(0.163)	(0.163)	(0.019)
Tire 3 BA	0.214***	0.213***	0.304**	-0.091	0.090	-0.001
	(0.013)	(0.010)	(0.120)	(0.126)	(0.125)	(0.014)
Tire 4 BA	0.652***	0.657***	0.732***	-0.075	0.080	0.005
	(0.014)	(0.012)	(0.135)	(0.143)	(0.139)	(0.017)
Parents with Highest High School Degree	0.017***	0.020***	0.085	-0.065	0.068	0.003
	(0.004)	(0.003)	(0.067)	(0.068)	(0.067)	(0.004)
Either Parent with a Bachelor's Degree	0.677***	0.566***	0.520***	0.045	-0.157	-0.112***
	(0.014)	(0.011)	(0.174)	(0.182)	(0.178)	(0.014)
Either Parent with a Grad Degree	0.412***	0.298***	0.118	0.179***	-0.293	-0.114***
	(0.016)	(0.011)	(0.181)	(0.188)	(0.187)	(0.019)
BA Other STEM	0.193***	0.120***	0.026	0.094	-0.168*	-0.073***
	(0.009)	(0.006)	(0.096)	(0.100)	(0.100)	(0.010)
BA Social Sciences	0.468***	0.316***	0.415***	-0.098	-0.054	-0.152***
	(0.015)	(0.010)	(0.156)	(0.161)	(0.161)	(0.018)
BA Other Majors	0.312***	0.536***	0.566***	-0.029	0.254*	0.224***
	(0.016)	(0.011)	(0.146)	(0.153)	(0.152)	(0.019)

Note: This analysis is based on 17,422 females with a bachelor's degree.Averages are estimated with the overidentified nonparametric GMM procedure described in the Identification section. Computations use individual weights provided by NSCG. Numbers in parentheses are standard errors. $^{***}p < 0.01$,$^{**}p < 0.05$,$^{*}p < 0.1$. Categories of the institution that received the first Bachelor's degree are based on the Carnegie classifications(1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum. (Hersch, 2019) Research Universities are those classified as Research I & II and Doctoral I II universities. BA Other STEM fields include Architecture/environmental design etc. BA Other Majors include non-STEM fields such as English/Languages/Literature, Fine/Performing arts, etc.

Table 15: Average Characteristics for Subpopultions (Grads)

Variable	at	nt	c	nt - c	c-at	nt- at
Female	0.693***	0.623***	0.689***	-0.066	-0.004	-0.070***
	(0.014)	(0.021)	(0.115)	(0.131)	(0.120)	(0.022)
White	0.853***	0.829***	0.855***	-0.027	0.002	-0.024
	(0.010)	(0.017)	(0.090)	(0.103)	(0.094)	(0.018)
Age Obtained BA	21.76***	21.99***	21.44***	0.544**	-0.323	0.221***
	(0.033)	(0.048)	(0.223)	(0.257)	(0.239)	(0.046)
BA in Research University	0.513***	0.476***	0.532***	-0.056	0.019	−0.037
	(0.012)	(0.021)	(0.119)	(0.137)	(0.121)	(0.023)
Tire 3 BA	0.242***	0.230***	0.296***	-0.067	0.054	-0.013
	(0.010)	(0.016)	(0.097)	(0.109)	(0.100)	(0.018)
Tire 4 BA	0.627***	0.572***	0.638***	-0.066	0.011	-0.055***
	(0.014)	(0.020)	(0.111)	(0.128)	(0.117)	(0.021)
Parents with Highest High School Degree	0.019***	0.015***	0.134***	-0.119**	0.115**	-0.004
	(0.004)	(0.006)	(0.049)	(0.053)	(0.050)	(0.006)
Either Parent with a Bachelor's Degree	0.673***	0.610***	0.606***	0.004	-0.067	-0.063***
	(0.014)	(0.023)	(0.126)	(0.145)	(0.134)	(0.023)
Either Parent with a Grad Degree	0.393***	0.327***	0.564***	-0.237	0.171	-0.066***
	(0.014)	(0.023)	(0.132)	(0.149)	(0.138)	(0.024)
BA Engineering	0.088***	0.081***	0.079***	0.002	-0.009	-0.007
	(0.004)	(0.005)	(0.027)	(0.031)	(0.028)	(0.005)
BA Other STEM	0.168***	0.078***	0.004	0.074*	-0.165***	-0.091***
	(0.008)	(0.007)	(0.034)	(0.038)	(0.027)	(0.010)
BA Social Sciences	0.422***	0.482***	0.344***	0.138	-0.077	0.060**
	(0.014)	(0.022)	(0.113)	(0.130)	(0.118)	(0.024)
BA Other Majors	0.329***	0.376***	0.565***	-0.189*	0.236**	0.047*
	(0.014)	(0.023)	(0.099)	(0.113)	(0.103)	(0.025)

Note: This analysis is based on 20,244 master's degree holders.Averages are estimated with the overidentified nonparametric GMM procedure described in the Identification section. Computations use individual weights provided by NSCG. Numbers in parentheses are standard errors. $^{***}p < 0.01$,$^{**}p < 0.05$,$^{*}p < 0.1$. Categories of the institution that received the first Bachelor's degree are based on the Carnegie classifications(1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum. (Hersch, 2019) Research Universities are those classified as Research I & II and Doctoral I II universities. BA Other STEM fields include Architecture/environmental design etc. BA Other Majors include non-STEM fields such as English/Languages/Literature, Fine/Performing arts, etc.

Table 16: Average Characteristics for Subpopultions (Grads, Males)

	at	nt	c	nt - c	c-at	nt- at
White	0.885***	0.875***	0.860*	0.015	- 0.024	-0.010
	(0.012)	(0.020)	(0.448)	(0.458)	(0.449)	(0.022)
Age Obtained BA	21.94***	22.21***	21.74***	0.469	-0.202	0.267***
	(0.078)	(0.090)	(0.919)	(0.967)	(0.955)	(0.088)
BA in Research University	0.589***	0.476***	0.926*	-0.450	0.337	-0.113***
	(0.026)	(0.035)	(0.500)	(0.502)	(0.503)	(0.043)
Tire 3 BA	0.292***	0.226***	0.697	-0.471	0.404	-0.067**
	(0.025)	(0.023)	(1.634)	(1.634)	(1.634)	(0.035)
Tire 4 BA	0.578***	0.560***	0.422	0.138	-0.156	-0.018
	(0.027)	(0.025)	(0.702)	(0.704)	(0.703)	(0.037)
Parents with Highest High School Degree	0.020***	0.010**	0.213	-0.203	-0.193	-0.009
	(0.006)	(0.004)	(0.371)	(0.372)	(0.371)	(0.008)
Either Parent with a Bachelor's Degree	0.668***	0.605***	0.705	-0.101	0.037	-0.063**
	(0.0234	(0.025)	(1.091)	(1.09)	(1.093)	(0.028)
Either Parent with a Grad Degree	0.378***	0.305***	0.758	-0.453	0.380	-0.073**
	(0.023)	(0.023)	(1.604)	(1.607)	(1.610)	(0.029)
BA Engineering	0.208***	0.162***	0.243	-0.080	0.035	-0.045**
	(0.015)	(0.014)	(0.663)	(0.666)	(0.666)	(0.019)
BA Other STEM	0.105***	0.063***	0.107	-0.044	0.002	-0.042**
	(0.012)	(0.011)	(0.378)	(0.382)	(0.378)	(0.017)
BA Social Sciences	0.316***	0.364***	0.177	0.187	-0.139	0.048
	(0.023)	(0.025)	(0.367)	(0.377)	(0.370)	(0.032)
BA Other Majors	0.369***	0.418***	0.538	-0.120	0.168	0.048
	(0.029)	(0.027)	(0.694)	(0.705)	(0.696)	(0.037)

Note: This analysis is based on 9,167 male master's degree holders.Averages are estimated with the overidentified nonparametric GMM procedure described in the Identification section. Computations use individual weights provided by NSCG. Numbers in parentheses are standard errors. $^{***}p < 0.01$,$^{**}p < 0.05$,$^{*}p < 0.1$. Categories of the institution that received the first Bachelor's degree are based on the Carnegie classifications(1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum. (Hersch, 2019) Research Universities are those classified as Research I & II and Doctoral I II universities. BA Other STEM fields include Architecture/environmental design etc. BA Other Majors include non-STEM fields such as English/Languages/Literature, Fine/Performing arts, etc.

Table 17: Average Characteristics for Subpopultions (Grads, Females)

	at	nt	c	nt - c	c-at	nt- at
White	0.841***	0.810***	0.839***	-0.029	-0.003	- 0.032
	(0.011)	(0.021)	(0.093)	(0.110)	(0.097)	(0.022)
Age Obtained BA	21.68***	21.84***	21.39***	0.441**	-0.286	0.155***
	(0.029)	(0.056)	(0.269)	(0.303)	(0.279)	(0.057)
BA in Research University	0.480***	0.480***	0.333**	0.147	-0.147	-0.000
	(0.016)	(0.023)	(0.149)	(0.167)	(0.152)	(0.026)
Tire 3 BA	0.221***	0.229***	0.127	-0.093	0.009	-0.201
	(0.012)	(0.020)	(0.089)	(0.089)	(0.024)	(0.155)
Tire 4 BA	0.650***	0.573***	0.774***	-0.201	0.124	-0.077**
	(0.013)	(0.030)	(0.132)	(0.155)	(0.135)	(0.031)
Parents with Highest High School Degree	0.018***	0.022***	0.064	-0.042	0.046	0.004
	(0.004)	(0.008)	(0.048)	(0.053)	(0.049)	(0.008)
Either Parent with a Bachelor's Degree	0.676***	0.613***	0.574***	0.039	-0.102	-0.063***
	(0.013)	(0.024)	(0.136)	(0.154)	(0.142)	(0.022)
Either Parent with a Grad Degree	0.399***	0.345***	0.443***	-0.097	0.044	-0.054*
	(0.015)	(0.028)	(0.146)	(0.168)	(0.154)	(0.028)
BA Engineering	0.033***	0.030***	0.010	0.021	-0.024	-0.003
	(0.003)	(0.004)	(0.019)	(0.023)	(0.020)	(0.004)
BA Social Sciences	0.468***	0.554***	0.421***	0.133	-0.048	0.086***
	(0.016)	(0.028)	(0.148)	(0.167)	(0.156)	(0.025)
BA Other Majors	0.311***	0.351***	0.570***	-0.219	0.258	0.039
	(0.017)	(0.029)	(0.1151)	(0.171)	(0.158)	(0.026)

Note: This analysis is based on 11,077 female master's degree holders.Averages are estimated with the overidentified nonparametric GMM procedure described in the Identification section. Computations use individual weights provided by NSCG. Numbers in parentheses are standard errors. $^{***}p < 0.01$,$^{**}p < 0.05$,$^{*}p < 0.1$. Categories of the institution that received the first Bachelor's degree are based on the Carnegie classifications(1994) and Barron's selectivity categories. Tier 1 includes Private Research I and II universities in Carnegie classification, Tier 2 includes Liberal Arts I college, Tier 3 includes Public Research I, and Tier 4 are the remaining 4-year colleges and universities excluding specialized institutions which focus on a narrow curriculum. (Hersch, 2019) Research Universities are those classified as Research I & II and Doctoral I II universities. BA Other Majors include non-STEM fields such as English/Languages/Literature, Fine/Performing arts, etc.

Appendix

Analyses in this paper rely on 2010 - 2019 sample from the National Survey of College Graduates(NSCG). NSCG is part of the Scientists and Statistical Data System (SESTAT), and it is conducted by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation (NSF). The NSCG has been a biannual- survey since 1993; however, unlike previous waves, from 2010 on, NSCG employs a new rotating sampling strategy. The NSCG 2010 is drawn from respondents to the 2009 American Community Survey (ACS).The sample for the NSCG 2013 and the 2015 surveys combine a subsample of the interviewees from the 2010 and 2013 waves of NSCG, and a subsample if interviewees with post secondary education from the 2011 and 2013 waves of the ACS. The NSCG 2017 and the 2019 survey sample combines a subsample of the interviewees from the 2010, 2013, 2015, 2017 NSCG, and a subsample of interviewees with post-secondary education from the 2015 and 2017 waves of the ACS.

Table A1 presents the summary statistics for the whole sample. Females are slightly more representative in the sample of people with a master's degree, either immediately obtained (70%) or obtained later in life (64%). Females only count 58% of individuals with only a bachelor's degree. The mean age for the individuals is 34.89. The group of people who immediately obtained a master's degree are, on average, slightly younger (33.81 years old) compared to those with only a bachelor's degree (34.92 years old) and those who obtained a master's degree later in life (35.48 years old) in the sample. Similarly, compared to those with only a bachelor's degree and those who obtained a master's degree later in life, those immediate-master-program-goers are, on average, younger when they obtained their first bachelor's degree at age 21.77, compared to age 22.19 for those only bachelor's degree holders and 21.92 for those obtained a master's degree later in life. The annual average national unemployment rate and the probability of graduating from college during a recession are slightly higher for those who attend the master's program immediately after the first bachelor's degree.

When compared to the field of major an individual studied for the bachelor's degree, the proportion of those who majored in computer and mathematical sciences or non-S&E related fields is lower among individuals who gained a master's degree compared to those with only a bachelor's degree. The proportion is higher for individuals who immediately enrolled in a master program for those with a bachelor's degree in Biological, agricultural and environmental life sciences; physical and related sciences and S&E-related fields. The proportion of individuals with a bachelor's degree in social science major is higher among individuals with a master's degree than those with only a bachelor's degree. However, the proportions among those who immediately attend the master's program or the master's program later in life are about the same, with the latter slightly higher.

Over 80% of the sample are white, 6.4% of those with a bachelor's degree are black, the black proportion is slightly higher among those with a master's program, which is 6.7% among those immediately attend the master's program, and 8.3% among those who attend the master's program later. About 5.7% of the individuals are Asian in the sample, and this number is 5.8%, 5.0%, and 5.8% among individuals with only a bachelor's degree, immediately attend the master's program and attend the master's program later in life respectively. In addition, the proportion of individuals with a family that both parents with a graduate degree is higher among individuals who go to the master's program immediately after the first bachelor's degree. To better understand an individual's educational background from the college, I classified all universities into five categories. Universities are grouped into tiers 1 - 4 by Carnegie classification, which is categorized by Barron's as most or highly competitive. Tier 1 institutions are private Research I and private Research II universities; tier 2 institutions are private Liberal Arts I colleges; tier 3 are public Research I universities; and tier 4 are the remaining four-year colleges and universities with Carnegie classification available,

excluding specialized institutions which focus on a narrow curriculum and professional schools (Hersch, 2019). Compared to individuals with only a bachelor's degree or those who obtained a master's degree later in life, individuals who went directly for a master's degree are more likely to have studied in more research-active institutions. On average, individuals who choose to attend a master's program immediately after graduating from college are more likely to be young white females who obtained an S& E major from a research university and who graduated into a relatively worse economic and whose parents with relatively higher education. Table A2 provide more detailed statistics for males and females separately. Table A4 and Table A5 provide the summary statistics for the "non- STEM" sample and by gender.

Table A1: Summary Statistics for Main Variables: NSCG 2010 - 19 Full

	A. All Samples	B. BA only	C.Grad$_{IM}$	D.Grads
Female	0.577	0.543	0.695	0.635
	(0.494)	(0.498)	(0.460)	(0.481)
Age	34.89	34.92	33.81	35.48
	(4.79)	(4.87)	(4.68)	(4.43)
Age obtained the first BA	22.10	22.19	21.77	21.92
	(1.15)	(1.17)	(1.04)	(1.10)
Unemployment Rate at graduation	5.613	5.625	5.862	5.406
	(1.506)	(1.518)	(1.675)	(1.304)
Graduated During a Recession	0.157	0.157	0.181	0.145
	(0.364)	(0.364)	(0.385	(0.352)
Stay in the Same Major	0.897		0.677	0.635
	(0.304)		(0.468)	(0.482)
Categories of the Institution Received the First Bachelor's Degree				
Tire1	0.054	0.049	0.060	0.073
	(0.049)	(0.215)	(0.237)	(0.260)
Tire2	0.051	0.042	0.061	0.080
	(0.220)	(0.201)	(0.240)	(0.271)
Tire3	0.235	0.232	0.250	0.238
	(0.424)	(0.422)	(0.433)	(0.426)
Tire4	0.628	0.642	0.614	0.581
	(0.483)	(0.479)	(0.487)	(0.493)
Tire_Specialized	0.032	0.036	0.015	0.029
	(0.176)	(0.186)	(0.122)	(0.168)
Field of Study for the first Bachelor's Degree				
Computer and Mathematical Sciences	0.047	0.048	0.038	0.047
	(0.211)	(0.214)	(0.190)	(0.211)
Bio, Agri and Env Sciences	0.061	0.060	0.076	0.058
	(0.240)	(0.237)	(0.265)	(0.234)
Physical and Related Sciences	0.014	0.012	0.022	0.017
	(0.119)	(0.110)	(0.146)	(0.130)
Social and Related Sciences	0.168	0.146	0.222	0.217
	(0.373)	(0.353)	(0.416)	(0.412)
Engineering	0.067	0.067	0.069	0.067
	(0.250)	(0.249)	(0.254)	(0.251)
S & E- Related Field	0.080	0.077	0.134	0.057
	(0.271)	(0.267)	(0.341)	(0.232)
Non S & E- Related Field	0.563	0.590	0.439	0.536
	(0.496)	(0.492)	(0.496)	(0.499)
White	0.839	0.841	0.845	0.823
	(0.368)	(0.362)	(0.362)	(0.382)
Black	0.067	0.064	0.067	0.083
	(0.251)	(0.244)	(0.250)	(0.275)
Asian	0.057	0.058	0.050	0.058
	(0.232)	(0.233)	(0.218)	(0.234)
Obtained the BA from a Research University	0.492	0.491	0.521	0.479
	(0.500)	(0.500)	(0.500)	(0.500)
Parent's Education				
at most High School	0.023	0.023	0.021	0.028
	(0.151)	(0.149)	(0.144)	(0.164)
either parent with a grad degree	0.318	0.292	0.395	0.371
	(0.466)	(0.455)	(0.489)	(0.483)
Employed	0.902	0.890	0.917	0.938
	(0.298)	(0.276)	(0.276)	(0.241)
Self-Employed	0.140	0.165	0.091	0.074
	(0.347)	(0.371)	(0.288)	(0.262)
Non-self Full-time Employed	0.753	0.764	0.827	0.663
	(0.431)	(0.424)	(0.378)	(0.473)
Observations	97,941	54,674	21,009	22,258

Table A2: Summary Statistics for Main Variables: NSCG 2010 - 19 Full by Gender

	Males			Females		
	A. BA only	B.Grad$_{IM}$	C.Grads	A. BA only	B.Grad$_{IM}$	C.Grads
Age	35.13	33.72	35.71	34.74	33.85	35.35
	(4.90)	(4.83)	(4.41)	(4.84)	(4.62)	(4.44)
Age obtained the first BA	22.36	21.96	22.18	22.06	21.69	21.78
	(1.18)	(1.19)	(1.15)	(1.15)	(0.96)	(1.05)
Unemployment Rate at graduation	5.625	5.956	5.470	5.625	5.820	5.369
	(1.533)	(1.766)	(1.379)	(1.505)	(1.632)	(1.258)
Graduated During a Recession	0.163	0.201	0.161	0.151	0.172	0.136
	(0.370)	(0.401)	(0.367)	(0.358)	(0.378)	(0.343)
Stay in the Same Major		0.720	0.592		0.658	0.660
		(0.449)	(0.492)		(0.474)	(0.474)
Categories of the Institution Received the First Bachelor's Degree						
Tire1	0.053	0.073	0.081	0.045	0.053	0.068
	(0.225)	(0.261)	(0.272)	(0.207)	(0.225)	(0.252)
Tire2	0.037	0.034	0.070	0.046	0.074	0.085
	(0.190)	(0.180)	(0.256)	(0.210)	(0.261)	(0.279)
Tire3	0.245	0.323	0.280	0.220	0.218	0.214
	(0.430)	(0.468)	(0.449)	(0.415)	(0.413)	(0.410)
Tire4	0.630	0.547	0.545	0.651	0.644	0.601
	(0.483)	(0.498)	(0.498)	(0.477)	(0.479)	(0.490)
Tire_Specialized	0.034	0.023	0.078	0.037	0.012	0.033
	(0.181)	(0.151)	(0.269)	(0.190)	(0.107)	(0.177)
Field of Study for the first Bachelor's Degree						
Computer and Mathematical Sciences	0.079	0.069	0.080	0.023	0.024	0.028
	(0.270)	(0.254)	(0.271)	(0.148)	(0.153)	(0.164)
Bio, Agri and Env Sciences	0.058	0.067	0.046	0.061	0.080	0.065
	(0.234)	(0.251)	(0.210)	(0.239)	(0.271)	(0.246)
Physical and Related Sciences	0.014	0.040	0.025	0.011	0.014	0.012
	(0.118)	(0.197)	(0.157)	(0.103)	(0.116)	(0.111)
Social and Related Sciences	0.131	0.167	0.187	0.158	0.246	0.235
	(0.337)	(0.373)	(0.390)	(0.365)	(0.431)	(0.424)
Engineering	0.117	0.166	0.142	0.024	0.027	0.025
	(0.321)	(0.372)	(0.349)	(0.154)	(0.162)	(0.155)
S & E- Related Field	0.053	0.086	0.055	0.097	0.155	0.059
	(0.223)	(0.281)	(0.228)	(0.296)	(0.362)	(0.235)
Non S & E- Related Field	0.548	0.404	0.465	0.625	0.454	0.578
	(0.498)	(0.491)	(0.499)	(0.484)	(0.498)	(0.494)
White	0.851	0.866	0.841	0.834	0.836	0.812
	(0.356)	(0.340)	(0.366)	(0.373)	(0.370)	(0.391)
Black	0.056	0.043	0.062	0.070	0.077	0.094
	(0.230)	(0.203)	(0.241)	(0.255)	(0.267)	(0.292)
Asian	0.060	0.062	0.067	0.056	0.045	0.053
	(0.237)	(0.241)	(0.250)	(0.230)	(0.207)	(0.224)
Obtained the BA from a Research University	0.510	0.598	0.523	0.476	0.487	0.453
	(0.500)	(0.490)	(0.499)	(0.499)	(0.500)	(0.498)
Parent's Education						
at most High School	0.020	0.031	0.028	0.025	0.017	0.028
	(0.139)	(0.174)	(0.165)	(0.157)	(0.128)	(0.164)
either parent with a grad degree	0.303	0.391	0.377	0.284	0.396	0.368
	(0.459)	(0.488)	(0.485)	(0.451)	(0.489)	(0.482)
Employed	0.959	0.981	0.981	0.832	0.888	0.913
	(0.198)	(0.135)	(0.135)	(0.374)	(0.315)	(0.282)
Self-Employed	0.179	0.095	0.088	0.153	0.089	0.066
	(0.384)	(0.294)	(0.283)	(0.360)	(0.285)	(0.249)
Non-self Full-time Employed	0.791	0.876	0.779	0.742	0.806	0.597
	(0.407)	(0.330)	(0.415)	(0.438)	(0.395)	(0.491)
Observations	29,981	7,795	9,768	24,693	13,214	12,490

Table A3: Parental Education Levels by Education

	All Sample			Full_time Employed		
	A.Bachelor's Only	B. Grad School Immediately	C.Grad School Later	A.Bachelor's Only	B. Grad School Immediately	C.Grad School Later
Mother's Educational Attainment						
Less than High School	0.047	0.037	0.053	0.045	0.042	0.050
	(0.212)	(0.190)	(0.224)	(0.208)	(0.201)	(0.219)
High School	0.263	0.213	0.218	0.267	0.208	0.231
	(0.440)	(0.410)	(0.413)	(0.442)	(0.406)	(0.422)
Some College	0.272	0.261	0.272	0.269	0.247	0.260
	(0.445)	(0.439)	(0.445)	(0.443)	(0.431)	(0.439)
College	0.266	0.267	0.234	0.263	0.268	0.241
	(0.442)	(0.443)	(0.423)	(0.440)	(0.443)	(0.428)
Graduate Degree	0.151	0.221	0.223	0.156	0.235	0.217
	(0.358)	(0.415)	(0.416)	(0.362)	(0.424)	(0.412)
Father's Educational Attainment						
Less than High School	0.049	0.044	0.062	0.046	0.049	0.060
	(0.216)	(0.205)	(0.241)	(0.209)	(0.216)	(0.237)
High School	0.245	0.188	0.183	0.252	0.193	0.196
	(0.430)	(0.391)	(0.387)	(0.434)	(0.395)	(0.397)
Some College	0.223	0.207	0.237	0.224	0.213	0.245
	(0.416)	(0.405)	(0.425)	(0.417)	(0.409)	(0.430)
College	0.267	0.285	0.247	0.264	0.281	0.234
	(0.442)	(0.451)	(0.431)	(0.441)	(0.450)	(0.424)
Graduate Degree	0.151	0.221	0.223	0.156	0.235	0.217
	(0.358)	(0.415)	(0.416	(0.362)	(0.424)	(0.412)
Observation	55,078	21,060	22,344	29,132	12,359	12,239

Table A4: Summary Statistics for Main Variables: NSCG 2010 - 19 (non-STEM)

	A. All Samples	B. BA only	C.Grad$_{IM}$	D.Grads
Female	0.592	0.559	0.710	0.647
	(0.492)	(0.497)	(0.454)	(0.478)
Age	34.89	34.93	33.76	35.45
	(4.80)	(4.88)	(4.66)	(4.42)
Age obtained the first BA	22.09	22.19	21.77	21.92
	(1.15)	(1.17)	(1.05)	(1.10)
Unemployment Rate at graduation	5.615	5.625	5.873	5.408
	(1.503)	(1.516)	(1.675)	(1.294)
Graduated During a Recession	0.154	0.152	0.187	0.141
	(0.361)	(0.359)	(0.390	(0.348)
Stay in the Same Major	0.911		0.721	0.681
	(0.285)		(0.449)	(0.466)
Categories of the Institution Received the First Bachelor's Degree				
Tire1	0.053	0.048	0.055	0.073
	(0.225)	(0.214)	(0.229)	(0.260)
Tire2	0.048	0.040	0.053	0.074
	(0.213)	(0.197)	(0.224)	(0.261)
Tire3	0.229	0.225	0.246	0.233
	(0.420)	(0.417)	(0.431)	(0.423)
Tire4	0.636	0.648	0.630	0.590
	(0.481)	(0.478)	(0.483)	(0.492)
Tire_Specialized	0.034	0.038	0.016	0.031
	(0.182)	(0.192)	(0.124)	(0.172)
Field of Study for the first Bachelor's Degree				
Social and Related Sciences	0.191	0.166	0.257	0.247
	(0.393)	(0.372)	(0.437)	(0.432)
Engineering	0.076	0.076	0.080	0.077
	(0.266)	(0.265)	(0.271)	(0.266)
S & E- Related Field	0.091	0.087	0.155	0.065
	(0.288)	(0.283)	(0.362)	(0.247)
Non S & E- Related Field	0.642	0.671	0.507	0.611
	(0.480)	(0.470)	(0.500)	(0.488)
White	0.845	0.848	0.852	0.828
	(0.362)	(0.359)	(0.355)	(0.377)
Black	0.068	0.064	0.070	0.082
	(0.251)	(0.244)	(0.255)	(0.275)
Asian	0.051	0.052	0.040	0.054
	(0.219)	(0.221)	(0.196)	(0.226)
Obtained the BA from a Research University	0.487	0.485	0.523	0.475
	(0.500)	(0.500)	(0.499)	(0.499)
Parent's Education				
at most High School	0.023	0.022	0.023	0.030
	(0.151)	(0.146)	(0.149)	(0.170)
either parent with a grad degree	0.315	0.291	0.392	0.363
	(0.465)	(0.454)	(0.488)	(0.481)
Employed	0.900	0.887	0.917	0.939
	(0.300)	(0.317)	(0.275)	(0.240)
Self-Employed	0.144	0.170	0.093	0.076
	(0.351)	(0.375)	(0.290)	(0.264)
Non-self Full-time Employed	0.750	0.757	0.826	0.655
	(0.435)	(0.429)	(0.380)	(0.475)
Observations	73,804	40,651	16,104	17,049

Table A5: Summary Statistics for Main Variables: NSCG 2010 - 19 by Gender (non-STEM)

	Males			Females		
	A. BA only	B.Grad$_{IM}$	C.Grads	A. BA only	B.Grad$_{IM}$	C.Grads
Age	35.16	33.66	35.68	34.75	33.80	35.33
	(4.91)	(4.83)	(4.40)	(4.84)	(4.59)	(4.43)
Age obtained the first BA	22.36	21.97	22.18	22.06	21.69	21.78
	(1.17)	(1.21)	(1.15)	(1.15)	(0.96)	(1.05)
Unemployment Rate at graduation	5.624	5.987	5.471	5.627	5.827	5.375
	(1.530)	(1.781)	(1.373)	(1.504)	(1.627)	(1.249)
Graduated During a Recession	0.159	0.210	0.157	0.146	0.178	0.132
	(0.366)	(0.407)	(0.364)	(0.353)	(0.383)	(0.338)
Stay in the Same Major		0.767	0.640		0.702	0.704
		(0.423)	(0.480)		(0.457)	(0.457)
Categories of the Institution Received the First Bachelor's Degree						
Tire1	0.052	0.072	0.081	0.045	0.049	0.069
	(0.222)	(0.259)	(0.272)	(0.207)	(0.215)	(0.253)
Tire2	0.036	0.023	0.065	0.044	0.066	0.078
	(0.186)	(0.149)	(0.247)	(0.205)	(0.247)	(0.268)
Tire3	0.236	0.315	0.278	0.220	0.218	0.208
	(0.425)	(0.465)	(0.448)	(0.412)	(0.413)	(0.406)
Tire4	0.639	0.565	0.552	0.655	0.656	0.611
	(0.480)	(0.496)	(0.497)	(0.475)	(0.475)	(0.487)
Tire_Specialized	0.037	0.025	0.024	0.040	0.012	0.034
	(0.188)	(0.155)	(0.154)	(0.195)	(0.109)	(0.181)
Field of Study for the first Bachelor's Degree						
Social and Related Sciences	0.154	0.203	0.221	0.175	0.279	0.262
	(0.361)	(0.403)	(0.415)	(0.380)	(0.449)	(0.440)
Engineering	0.138	0.201	0.167	0.027	0.031	0.028
	(0.344)	(0.401)	(0.373)	(0.162)	(0.172)	(0.164)
S & E- Related Field	0.062	0.105	0.065	0.108	0.176	0.065
	(0.241)	(0.306)	(0.247)	(0.310)	(0.381)	(0.247)
Non S & E- Related Field	0.646	0.491	0.548	0.691	0.514	0.645
	(0.478)	(0.500)	(0.498)	(0.462)	(0.500)	(0.479)
White	0.860	0.875	0.849	0.838	0.843	0.817
	(0.347)	(0.331)	(0.358)	(0.368)	(0.364)	(0.387)
Black	0.056	0.046	0.063	0.070	0.080	0.093
	(0.230)	(0.210)	(0.243)	(0.255)	(0.271)	(0.290)
Asian	0.052	0.053	0.061	0.052	0.035	0.050
	(0.221)	(0.223)	(0.239)	(0.221)	(0.183)	(0.218)
Obtained the BA from a Research University	0.501	0.601	0.523	0.472	0.491	0.449
	(0.500)	(0.490)	(0.500)	(0.499)	(0.500)	(0.497)
Parent's Education						
at most High School	0.018	0.036	0.031	0.025	0.018	0.029
	(0.133)	(0.185)	(0.174)	(0.156)	(0.132)	(0.168)
either parent with a grad degree	0.298	0.385	0.357	0.285	0.395	0.367
	(0.457)	(0.487)	(0.479)	(0.451)	(0.489)	(0.482)
Employed	0.959	0.980	0.983	0.830	0.892	0.915
	(0.198)	(0.139)	(0.129)	(0.376)	(0.311)	(0.279)
Self-Employed	0.187	0.096	0.093	0.156	0.091	0.066
	(0.390)	(0.294)	(0.290)	(0.363)	(0.288)	(0.249)
Non-self Full-time Employed	0.782	0.874	0.774	0.738	0.806	0.590
	(0.413)	(0.332)	(0.418)	(0.440)	(0.396)	(0.492)
Observations	22,106	5,751	7,381	18,545	10,353	9,668

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