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Highlights

- Enrolling in college during downturns associated with higher average earnings
- Not driven by selection or economic conditions at labor market entry
- Not explained by sorting into majors or post-graduate education
- Up to one third of the wage bonus accounted for by moving to higher paying states
- Consistent with increase in effort

Make Your Own Luck: The Wage Gains from Starting College in a Bad Economy*

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Abstract

Using data for nearly 40 cohorts of American college graduates and exploiting regional variation in economic conditions, we show robust evidence of a positive relationship between the unemployment rate at the time of college enrollment and subsequent annual earnings, particularly for women. This positive relationship is not driven by selection into employment or by economic conditions at the time of labor market entry. It also cannot be explained by differential sorting into college majors or post-graduate education. Up to one third of the effect is accounted for by sorting towards more remunerative locations. The results are consistent with a behavioral change that induces individuals who experience bad economic times at the beginning of their studies to exert more effort toward obtaining higher paying jobs.

JEL Codes: I23, J24, J31, E32

Keywords: Business Cycle, Higher Education, Cohort Effects

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1 Introduction

Adverse economic conditions have long-lasting impacts on individuals, especially when experienced during decisive moments in their lives. Individuals who lose a job or enter the labor market when unemployment is high experience persistent declines in earnings (e.g. Aslund and Rooth, 2007; Kahn, 2010; Davis and von Wachter, 2011; Oreopoulos et al., 2012; Altonji et al., 2016; Liu et al., 2016; Schwandt and von Wachter, 2019). Recessions also induce increases in human capital investments in the form of higher post-secondary enrollment (e.g. Betts and McFarland, 1995; Dellas and Sakellaris, 2003; Clark, 2011; Méndez and Sepúlveda, 2012; Johnson, 2013; Barr and Turner, 2013, 2015; Atkin, 2016; Sievertsen, 2016; Charles et al., 2018), and shifts in choices of college major towards higher-earning fields (Blom et al., 2021). Macroeconomic conditions experienced during early adulthood have also been shown to have a profound impact on people's risk aversion, expectations, and preferences (Malmendier and Nagel, 2011, 2016; Cotofan et al., 2023).

In this paper, we explore whether the labor market outcomes of college graduates vary systematically according to the economic conditions that they experienced during their late teenage years, around the time when they enrolled in college. We perform the analysis using data for U.S. college graduates from nearly 40 enrollment cohorts. Using an empirical strategy that flexibly controls for cross-cohort differences at the national level and exploits regional variation in economic conditions for identification, we find that individuals who enrolled in worse times have higher annual wage and salary earnings than those who enrolled in better times. For both men and women, this arises due to an increase in hourly wages, while women also experience an increase in labor market attachment. The positive impact that we identify is not driven by selection into employment or by economic conditions at the time of labor market entry. Differential sorting across fields of study or into post-graduate education also cannot explain the above-average earnings of those who enroll during periods of high unemployment. Up to one third of the documented effect is accounted for by sorting into higher paying states. We argue that the results are consistent with a behavioral change that leads to greater effort being exerted by people who experience bad economic times at the beginning of their studies.

Our analysis uses data for college graduates from the American Community Survey (Ruggles et al., 2020). Following previous literature (Schwandt and von Wachter, 2019; Blom et al., 2021), we proxy the economic conditions at the time of college enrollment using state-level unemployment rates at the time when individuals turned 18. To account for unobserved differences across cohorts, we identify the impact of economic conditions on future labor market outcomes by exploiting within-cohort variation in local economic conditions across U.S. states – a strategy that is similar to Oreopoulos et al. (2012). We focus on cohorts who enrolled in college between

1976 and 2014.

We find that U.S. college graduates who experience adverse economic conditions at the time of enrollment have higher earnings than those who enroll during expansionary periods. Specifically, our estimates imply that a 6 percentage point difference in the deviation from the long-run average state unemployment rate at the time of college enrollment – roughly the difference between the deviations in Louisiana and Michigan in 2009 at the peak of the Great Recession – increases annual earnings by about $1,100 for both women and men.

For men, the improvement in annual earnings is mainly due to a rise in hourly wages. For women, it is the result of higher hourly wages, more weekly working hours, and more weeks worked per year. Our results are not driven by selection into employment: graduates who enroll during bad times are more likely to be working later in life relative to those who enroll during good times. The pool of college graduates who enroll in bad times is larger, suggesting that it is unlikely that this group is more positively selected on ability. Moreover, this group is disproportionately composed of students from traditionally underrepresented groups, suggesting that it is unlikely that they are more positively selected in terms of socioeconomic background factors which could drive the higher earnings. Controlling for economic conditions at the time of labor market entry does not eliminate the positive relationship between future earnings and unemployment at the time of enrollment.

Previous evidence suggests that U.S. college students who experience economic downturns during their early college years tend to sort into higher-paying fields of study (Blom et al., 2021). We consider changes in the composition of fields of study and differential sorting into post-graduate education as candidate explanations for the wage differentials that we identify. We find that controlling for post-graduate education choice does not reduce the estimated effect of unemployment at college entry on earnings. Field of study choices, meanwhile, explain less than 10% of the estimated differentials conditional on educational attainment, implying that the overall earnings gains (conditional on educational attainment) experienced by people who enrolled during recessionary times are more than ten times greater than the wage bonus that can be attributed to the changes in the choice of major documented in Blom et al. (2021). The choice of state of residence, meanwhile, accounts for up to one third of the estimated effect on earnings.

We argue that our results are consistent with a behavioral change in terms of the effort exerted by students who experience bad economic times during their late teenage years when they begin their college studies. Increases in effort in response to adverse economic conditions have been identified in various contexts (e.g. Griffith et al., 2016; Lazear et al., 2016; Mukoyama et al., 2018). Furthermore, Cotofan et al. (2023) show that people who experience recessions during their teenage years give greater priority to income, relative to job meaning, for the rest of their lives. In

related work for the U.K., we find that students who enroll during downturns are not more positively selected at the time of college entry (in terms of their GCSE results, a measure of pre-enrollment ability), but perform better in terms of their college grades (Bičáková et al., 2021). All of this evidence suggests that an increase in effort is a very plausible candidate explanation for the pattern that we have documented. An increase in effort may enable individuals who enroll during downturns to obtain higher-earning jobs – in part by choosing more rewarding majors and by relocating to higher paying locations, but also conditional on these choices. It is also consistent with the documented increase in labor market attachment among female college graduates, and with the increased probability of obtaining a college degree among individuals who experience worse economic conditions at the age of 18.

Our paper provides several important contributions to the literature. We present new evidence for the U.S. on the long-term earnings consequences of entering college during a downturn. Despite the finding that enrollment in post-secondary education tends to increase during recessions, relatively little is known so far about how individuals who enroll during downturns ultimately perform in the labor market. The results are crucial to our understanding of the long-term impacts of recessions that operate through changes in human capital investment decisions. Our findings complement previous research on the effects of entering the labor market during a recession (or "scarring effects"; see von Wachter (2020) for a survey of this literature) by showing that economic conditions at the time of enrollment are also important in determining future earnings of college graduates, especially in the case of women. Our analysis also builds on the literature that highlights the important formative role of economic conditions experienced during early adulthood. Our results show that the impacts on preferences for monetary job attributes documented in Cotofan et al. (2023) are also reflected in labor market outcomes.

To our knowledge, this is the first paper to explore the influence that the economic cycle at the time of college enrollment exerts on future wages in the United States. The only other evidence for a similar nexus comes from our earlier work, which focuses on British college graduates (Bičáková et al., 2021), and from the work of Blom et al. (2021), which shows that cohorts exposed to higher unemployment during their school years tend to select majors that earn higher wages. Compared to Blom et al. (2021), we show that the earnings gains experienced by people who enroll during adverse economic times extend well beyond what is predicted by the change in major choices documented in their paper. The results are consistent with a behavioral adjustment in effort that induces individuals not only to choose higher-paying majors, but also to obtain higher-paying jobs conditional on their major choice. Relative to Bičáková et al. (2021), a key contribution of the analysis in this paper is to study the link between unemployment at enrollment and subsequent labor market outcomes using a much stricter identification strategy than what was feasible for the U.K. Specifi-

cally, we are able to flexibly control for unobserved differences between cohorts and exploit only within-cohort variation in local economic conditions for identification, while the analysis in Bičáková et al. (2021) relies primarily on between-cohort variation for identification. Using the within-cohort differences across regions of birth and simultaneously controlling for the current regions of residence allows us to assess the importance of geographic mobility, revealing that up to one third of the estimated earnings gap is driven by the fact that individuals exposed to worse economic conditions at the time of college enrollment tend to sort into states with higher-paying jobs after graduation. The U.S. data also allows us to study the impact of adverse economic conditions not only on hourly wages but also on labor market attachment (hours worked per week and weeks worked per year – two margins that turn out to be quantitatively important in the case of women). Finally, focusing on the U.S. context is also of interest given that there are key institutional differences between the U.S. and the U.K. For example, the choice of college majors is much more flexible in the U.S. than in the U.K., and there is also much stronger evidence of scarring effects in the U.S. context relative to what has been found for the U.K.

2 Data and Empirical Strategy

2.1 Data

We use individual-level data from the American Community Survey (ACS) for the years 2009–2019, obtained through IPUMS (Ruggles et al., 2020). As in Blom et al. (2021), we use data from 2009 onward because the field of study choices are not recorded in the earlier data. For most of the analysis, we restrict the sample to college graduates who were born in the US and who were at least 22 years old when surveyed. Nominal earnings are converted to real 2009 dollars using the Consumer Price Index from the Bureau of Labor Statistics. All analyses use the person weights provided in the data.

Following the literature (e.g. Schwandt and von Wachter, 2019; Blom et al., 2021), we assume that individuals enter college in the year in which they turn 18 – the typical college starting age in the US.[1] To impute the year of labor market entry, we follow Schwandt and von Wachter (2019) and assume that individuals with a bachelor's degree enter the labor market 4 years after college enrollment; individuals with a Master's or Professional degree 6 years after; and individuals with a Ph.D. 8 years after enrollment.[2] We drop observations for which the imputed year of entry into the

[1] We verify the sensitivity of our results to varying the imputed year of enrollment in Section 3.4.

[2] While this assumes very expeditious degree completion, we make these assumptions in order to be consistent with the specifications used in the existing literature on the negative effects of graduating

labor market is after the survey year.[3]

Our unemployment data is obtained from the Bureau of Labor Statistics (BLS). At the national level, we compute annual averages of the monthly non-seasonally adjusted unemployment rate (Series ID LNU04000000), which the BLS produces based on data from the Current Population Survey. State-level unemployment rates are obtained from the BLS's Local Area Unemployment Statistics program at the annual level.

State-level unemployment rates are only available from 1976 onward, so we restrict our analysis to cohorts enrolling in 1976 or later. To observe earnings in at least two years, the last cohort in our sample is the 2014 enrollment cohort, whose labor market outcomes are observed in 2018 and 2019.

To summarize, our core sample includes all US-born college graduates who turned 18 between 1976 and 2014, and who are observed in the ACS between 2009 and 2019 at age 22 or older.

2.2 Empirical Strategy

Our goal is to determine how the labor market outcomes of college graduates vary according to the business cycle conditions that prevailed at the time of their enrollment into college. Using variation in economic conditions at the national level makes it challenging to disentangle the effect of these conditions from other factors that vary across enrollment cohorts. Therefore, we follow the literature that investigates the impact of economic conditions at the time of labor market entry (e.g. Oreopoulos et al., 2012) and identify the impact of economic conditions at the time of enrollment relying on within-cohort variation in these conditions across U.S. states.

In particular, we assign individuals to states based on their state of birth and capture the economic conditions faced at the time of enrollment by individual i from enrollment cohort c and state s through the state-specific unemployment rate in the enrollment year, denoted U_{sc}. Our goal is to capture the local economic conditions experienced by individuals in the year leading up to their college enrollment. While admittedly the state in which individuals reside in the period leading up to enrollment may not be the same as their state of birth, it is a better proxy than individuals' cur-

during downturns (and specifically Schwandt and von Wachter, 2019). It is worth emphasizing that our focus is on the impact of economic conditions at the time of *enrollment*, and therefore our core results are not sensitive to the assumptions we make about the duration of studies for each degree level.

[3]Given that everyone in our sample is at least 22 years old, this restriction is never binding for individuals with an undergraduate degree. For individuals with a graduate degree, it only affects a small number of observations, namely 0.55% of individuals who report having a master's degree; 0.36% of individuals who report having a professional degree, and 1.44% of individuals who report having a PhD.

rent state of residence, which is influenced by their post-graduation location choices.

Our identifying equation is given by:

$$w_{it} = \alpha + \beta U_{sc} + \chi_{ct} + \theta_s + x'_{it}\gamma + \epsilon_{it}, \tag{1}$$

where w_{it} is the labor market outcome of individual i observed in year t, α is a constant term, U_{sc} is the unemployment rate experienced at the time of enrollment by individual i, which is computed based on their enrollment cohort c and state of birth s, χ_{ct} is a set of fully interacted cohort-year fixed effects, θ_s represent state of birth fixed effects, x_{it} is a vector of individual-specific characteristics (namely race/ethnicity dummies), with associated coefficients γ, and ϵ_{it} is a standard error term.

β is our coefficient of interest. It captures the impact of economic conditions at the time of enrollment on future labor market outcomes, after fully flexibly controlling for variation between cohorts and over time at the national level through χ_{ct}.[4] Identification is obtained solely from variation in outcomes at a given time between individuals from the same enrollment cohort who faced different local economic conditions at the time of enrollment, beyond the permanent local differences captured by the state fixed effects. The specification in Equation (1) cannot explicitly include controls for age profiles due to multicollinearity; however, given that age is perfectly predicted by cohort and time,[5] results are numerically identical if we replace the cohort-year fixed effects χ_{ct} with a set of fully interacted cohort-age fixed effects (given that all individuals in a given cohort are of the same age in a given year). Thus, the specification can be viewed as accounting for fully flexible cohort-specific life-cycle profiles at the national level.

Standard errors are clustered at the cohort-state level, which is the level of variation of our key variable of interest, the unemployment rate at college entry. The estimation thus allows for any correlation in the wage shocks among individuals from the same enrollment cohort and the same state of birth, who are observed at various ages across different survey years.

For comparison purposes, we also present results from specifications where we control separately for cohort and time, or cohort and age fixed effects (rather than the interaction of the two). These specifications impose different assumptions (they either assume that the impact of current economic conditions is the same across all cohorts, or that the life-cycle profile of earnings is the same across all cohorts) and

[4]Note that these fixed effects control not only for permanent differences across enrollment cohorts, but also for cohort-specific impacts of current economic conditions in the year in which labor market outcomes are observed.

[5]This follows from the fact that we assign individuals to enrollment cohorts based on the year in which they turned 18.

thus differ in terms of the source of variation used for identification. As we show below, they produce qualitatively and quantitatively similar results to our preferred estimates, thus confirming the robustness of our findings.

2.3 Descriptive Statistics

Panel (a) of Figure 1 plots the evolution of the state-specific unemployment rate, U_{sc}, over time. Recall that, although we observe earnings for 2009–2019 only, the variation in business cycle conditions at enrollment that we use for our analysis spans the entire 1976–2014 period. The figure shows that state-level unemployment rates tend to follow the aggregate business cycle. Note, however, that our empirical strategy controls for state and cohort fixed effects. Hence, the variation in U_{sc} which provides identification for our coefficient of interest β in Equation (1) is the residual variation of state-level unemployment conditional on these fixed effects.

Panel (b) of Figure 1 plots the residuals from a regression of the unemployment rate for each state on year and state fixed effects. It therefore reflects the year-specific deviations of the state-level unemployment rate relative to the overall average unemployment rate in the state, and captures the variation in economic conditions that underlies the identification of our coefficient of interest. As the figure shows, there is a lot of heterogeneity across states in this demeaned unemployment rate, and the state-specific deviations do not tend to follow a set business cycle length.

Table 1 provides summary statistics for our key variables of interest. Our sample comprises 1.7 million male college graduates and 1.9 million female college graduates. The main labor market outcome we focus on is individual's annual labor earnings (total wage and salary income), measured in real 2009 dollars. Men in our sample earn \$82,111 on average, while the corresponding figure for women is \$51,658. The average log income for men in our sample is 10.92, while the average log income for women is 10.47. The difference between the 75th and the 25th percentile of log annual income is 0.98 for men and 0.93 for women. State-level unemployment rates at enrollment are on average around 6.3% for individuals in our sample. Demeaned unemployment rates (as described above in the context of Panel (b) of Figure 1) are by construction mean zero, and have an inter-quartile range of approximately 1.2 percentage points. This is helpful in interpreting the magnitude of our estimated coefficient of interest below.

3 Results

3.1 Main Results

Table 2 presents our key results on the link between the economic conditions at enrollment and future earnings. The dependent variable is the logarithm of individuals' annual labor earnings (total wage and salary income), in real 2009 dollars. The top panel focuses on men; the bottom panel on women. All specifications control for state-of-birth fixed effects and include indicator variables for Black and Hispanic individuals.

For reference purposes, before implementing our preferred specification described in Section 2.2, in Columns (1) and (2) of Table 2 we begin by presenting results using the national unemployment rate as the measure of economic conditions at the time of enrollment. In these specifications, identification is achieved from cross-cohort variation in unemployment at the national level. Since we cannot control for cohort fixed effects (as these would absorb the effect of the economic conditions at enrollment), we restrict cohort effects to evolve smoothly along a cubic trend. We control for year fixed effects in Column (1), and age fixed effects in Column (2), and we cluster standard errors at the cohort level.

For both men and women, the estimated coefficients are positive and statistically significant when controlling for year fixed effects, but in both cases, they are statistically insignificant when controlling for age fixed effects. The coarseness of the national unemployment rate (which hides substantial heterogeneity at the state level), and the fact that we cannot fully flexibly control for cohort effects when considering economic conditions at the national level, justify our approach of measuring economic conditions using state-level unemployment rates in the remainder of the paper. As the results in the remaining Columns of Table 2 will show, our coefficient of interest is much less sensitive to whether we control for age or year fixed effects once we account fully flexibly for variation across cohorts using cohort fixed effects.

In Columns (3)-(5) we therefore use the unemployment rate in an individual's state of birth as the measure of economic conditions at enrollment. We cluster standard errors at the cohort-state level. Columns (3) and (4) control fully flexibly for cohort-level differences at the national level by including a full set of cohort fixed effects. Column (3) includes year fixed effects in addition to the cohort fixed effects, while Column (4) presents analogous results where year fixed effects are replaced with age fixed effects.[6] All of the coefficients in these specifications are positive and, in the

[6]Despite the fact that cohort, age, and calendar year are perfectly collinear, the two specifications yield different results because they make different assumptions. The model in Column (3) assumes that the impact of current macroeconomic shocks is the same across all cohorts, while the model in Column (4) assumes that the life-cycle age profile of wages is the same across all cohorts. Therefore,

case of women, strongly statistically significant. Whether we include year or age fixed effects does not dramatically alter the results.

Column (5) presents our preferred specification, which is the most restrictive. This specification controls for fully interacted cohort-year fixed effects, which, as discussed in Section 2.2, produces numerically identical results to a specification that controls for fully interacted cohort-age fixed effects. Therefore, it allows for flexible cross-cohort differences that can vary over time (or over the life cycle), thus controlling for unobservables that affect cohort outcomes at the national level not only in a static sense but also over time (or over their life cycle). Identification is achieved solely from regional variation in economic conditions at enrollment within cohort-year cells (beyond what is predicted by the state fixed effects). The results are nearly identical to those in Column (4). We estimate that a 1 percentage point increase in the local unemployment rate at enrollment is associated with an increase in women's earnings of almost 0.4%. The estimated effect for men is about half as large, around 0.2%.

To give an example in terms of magnitudes, our estimates imply that a 6 percentage point higher state unemployment rate at enrollment – roughly the difference between the demeaned unemployment rates in Louisiana and Michigan in 2009, at the peak of the Great Recession – increases earnings by about $1,100 per year for both women and men (in 2009 dollars).[7]

3.2 Selection into Employment

The positive relationship between the unemployment rate at enrollment and future earnings could be driven by lower employment rates among graduates who started college during downturns. If these individuals are less likely to find a job after graduation, then by focusing on those with positive earnings (as we have done in Table 2), we might be picking up a selection effect in terms of who can find work.

We rule out this possibility in Column (1) of Table 3. We report the coefficient for the effect of the local unemployment rate at the time of college enrollment on the probability of having any wage or salary income when observed in our survey, estimated through a linear probability model. Once again we include a set of fully interacted cohort-year fixed effects, as well as state fixed effects and controls for race/ethnicity.

The evidence emerging from this analysis is clear: higher local unemployment

the residual variation used for the identification of the coefficient of unemployment at enrollment is slightly different in the two cases.

[7] Although the estimated coefficient of interest is around half as large for men compared to women, average annual earnings among male graduates in our sample are much higher than among female graduates, and hence the gap in the estimated impact disappears when converted to dollar amounts.

in the year of college enrollment *increases* the probability of working (having labor income) later in life. The increase is large and significant for women, for whom a 1 percentage point increase in the unemployment rate at enrollment increases the probability of having any wage or salary income by 12 percentage points (relative to an average probability of 85%, as reported towards the bottom of the table). This indicates a higher degree of attachment to the labor market among women who enroll during downturns. For men, the effect is much smaller and statistically insignificant, probably reflecting the already high labor force attachment of male college graduates (which is on average 91% in our sample). In general, there is no evidence to indicate increased selectivity into employment among graduates who entered college during a bad economy.

3.3 The Extensive and Intensive Margins of Earnings Growth

Next, we decompose the positive earnings effect (conditional on working) into its intensive and extensive margins, i.e., we assess whether annual labor earnings increase as a consequence of higher per-hour wage rates or extended working hours.

The results are reported in the remaining columns of Table 3. For reference, in Column (2) we reproduce the benchmark results from our preferred specification with fully interacted cohort and year fixed effects. Column (3) estimates the same specification (Equation 1), but with the logarithm of weeks worked per year as the dependent variable.[8] In Column (4) we use the logarithm of the usual hours worked per week as the dependent variable, and in Column (5) we use the logarithm of hourly wages.

The table shows that partially different margins are at work for men and women. Men's annual earnings growth is primarily driven by an increase in hourly wages, whereas for women, hourly wages, hours worked per week, and weeks worked per year all expand. The results clearly show that adverse economic conditions lead to an increase in women's labor market attachment, both in terms of their probability of working (Column 1) and in their annual hours of work, conditional on working (Columns 3 and 4). The lack of a similar pattern for college-educated men is likely due to their already high and inelastic labor supply. Interestingly, the results in Column (5) show that the increase in hourly wage rates is of similar magnitude for both men and women.

[8]In some years, the ACS only reports weeks worked in intervals. In such cases, we take the midpoint of each interval.

3.4 Sensitivity to Different Choices for Enrollment Year

As mentioned above, our analysis assumes that college graduates enroll at the typical age of 18 (as commonly assumed in the literature). In Figure 2 we show that choosing years around the one in which individuals turn 18 as the year of enrollment would not substantially change our conclusion. In the figure, we plot our coefficient of interest from a model that is analogous to our benchmark specification in Equation (1), but where we vary the year for which the unemployment rate is measured. Each marker represents the coefficient for the unemployment rate from a separate regression; the lines represent 95% confidence intervals and the caps on each line represent 90% confidence intervals. The one labeled t_0 uses the year in which individuals turn 18 and therefore corresponds to the coefficient shown in Table 2, Column (5). The other markers correspond to separate regressions in which we vary the unemployment rate between the one experienced at age $t_0 - 5$ (13 years old) and the one experienced at age $t_0 + 5$ (23 years old).

For both men and women, the results are strongest when using the unemployment rate experienced at age 18. For men, the coefficients estimated between $t_0 - 1$ and $t_0 + 2$ are very similar. For women, all the coefficients between the year they turn 14 and the year they turn 19 are statistically significant, although slightly smaller than our benchmark. In general, Figure 2 shows that the unemployment rates that matter for future earnings are, in fact, around the age of 18, the typical age of college enrollment.

3.5 Additional Robustness Checks

As discussed in Section 2, our main sample includes all college graduates who turned 18 between 1976 and 2014, and who are observed in the ACS between 2009 and 2019 at age 22 or older. It is worth noting that not all cohorts are equally represented in this sample. Specifically, while individuals from the earlier cohorts are observed across all 11 waves of ACS data (with the earliest cohort – i.e. those who turned 18 in 1976 – being observed from age 51 in 2009 up to age 61 in 2019), this is not the case for the more recent cohorts (for example, individuals from the most recent cohort – i.e. those who turn 18 in 2014 – are only observed in the 2018 and 2019 waves, when they are aged 22 and 23 respectively).

As a robustness check of our analysis, we consider a set of specifications where we exclude individuals from cohorts that are not observed across all 11 ACS waves, i.e. we exclude individuals turning 18 in 2006 or later. This gives us a more balanced data structure, with all cohorts being observed at 11 points in time (though at different ages in each case).

We show the results for this sample in Table 4. For comparison purposes, in

Column (1) we reproduce our baseline results. Column (2) presents the analogous results for the restricted sample. The sample size is reduced by around 13% and the number of clusters by 23%. In this restricted sample, the coefficient of unemployment at enrollment is reduced for men and is no longer statistically significant at the 10% level. For women, however, the coefficient increases in magnitude and remains strongly significant.

In our individual-level regressions, the overall weight of each state-cohort cell is effectively equal to the (weighted) number of individuals from each state and each cohort in our sample (for each gender). Given that our key "treatment" variable (unemployment at enrollment) varies only at the state-cohort level, it is informative to also perform estimations that assign either equal weights to each cohort, or equal weights to each state-cohort cell.[9] We show the results of these estimations in Columns (3) and (4) of Table 4.

In Column (3), we adjust the sample weights so that every enrollment cohort in the restricted sample receives the same overall weight in the estimation (within each gender). The results from this regression are very similar to those in Column (2).

In Column (4), we adjust the sample weights so that each *state-cohort cell* receives the same overall weight in the estimation (within each gender). Although this approach gives equal weight at the level of observation where the treatment varies, it assigns the same weight to states with very different population levels and hence will not yield estimates that are representative at the national level for the U.S. This would particularly be the case in the presence of cross-state heterogeneity in the effect of economic conditions at college entry on future earnings.

Interestingly, the results in Column (4) show a larger coefficient estimate for men and a smaller one for women, compared to those in Column (2). This suggests that the impacts of unemployment at enrollment may indeed be heterogeneous across states, with larger states having a stronger relationship between unemployment at enrollment and earnings for women, but a weaker one for men.

[9]Solon et al. (2015) discusses the pros and cons of weighting in different settings. When treatment varies at the group level, as in our setting, they recommend weighting by the within-group sample size (which is effectively what our baseline regressions do) when the sample size varies substantially across groups, with some groups being only scarcely populated. This is the case in our setting, given that some states are much smaller than others, and hence some state-cohort cells are much more scarcely populated than others (and in our main sample, some cohorts are also much more scarcely populated than others). We therefore consider the weighting scheme used in our baseline specifications as preferable. An alternative approach would be to conduct the analysis at the state-cohort level, using aggregated data (see for example the two-step estimation approach in Altonji et al. (2016)). As discussed in their paper, the aggregation may lead to a substantial efficiency loss when outcomes that are precisely estimated for cells with many observations are given the same weight as much more noisy outcomes based on cells containing few observations.

4 Mechanisms

In this section, we explore a number of mechanisms that could potentially explain the higher annual earnings observed among graduates who enroll in college during periods of worse macroeconomic conditions.

4.1 Selection

One potential explanation for the positive relationship between the unemployment rate at the time of enrollment and future labor market outcomes of college graduates would be that individuals who enroll during downturns are more positively selected in terms of their underlying, pre-university ability. This explanation is somewhat contrary to economic intuition, given that previous evidence has shown that enrollment in post-secondary education tends to expand during economic downturns (see e.g. Betts and McFarland, 1995; Dellas and Sakellaris, 2003; Clark, 2011; Méndez and Sepúlveda, 2012; Johnson, 2013; Barr and Turner, 2013, 2015; Sievertsen, 2016; Alessandrini, 2018), and standard notions of selection would suggest that expansions of enrollment would be associated with the entry of marginal students with lower ability (see, e.g., Carneiro et al., 2011; Carneiro and Lee, 2011).

In order to verify the evidence that enrollment expands during downturns in our data, we estimate the relationship between economic conditions at the time when an individual is 18 years old and the probability of enrolling in college at any point up to the time in which the individual is observed in the ACS.[10] For this analysis, we consider all U.S.-born individuals aged 22 and above in the ACS, including those with no post-secondary education (and those with no wage and salary income), and thus our sample size increases to 6,208,917 observations for men, and 6,219,407 observations for women. We regress our outcome variable (an indicator equal to one for those who have at least some college education) on the unemployment rate at age 18, controls for race and ethnicity, as well as state and birth cohort fixed effects.

The results are in Column (1) of Table 5. The estimated coefficient on the unemployment rate at age 18 in the top panel is consistent with the findings from the previous literature, confirming that college enrollment expands for men during economic downturns. The bottom panel shows that, for women, there is no statistically significant relationship in our data between economic conditions at age 18 and the probability of ever enrolling into college.

Even if enrollment expands during downturns, the size of the corresponding *graduation* cohorts might not necessarily increase. In particular, if graduation rates are

[10] We measure this by whether the individual reports having any college education at the time of the survey.

lower among cohorts who enroll in worse economic times, due, for example, to a reduction in college resources (see e.g. Bound et al., 2010, 2019), then the pool of college graduates who enrolled during an economic downturn could be smaller and potentially more positively selected than the pool of college graduates who enrolled during better times.

To explore this possibility, in Column (2) of Table 5 we estimate the relationship between economic conditions at the time when an individual is 18 years old and the probability of completing a college degree. Here, the dependent variable is an indicator equal to one for individuals who are college graduates. This jointly captures the margin of selection in college enrollment and selection in college completion (and thus captures overall selection into our main analysis sample). As in Column (1), we control for race and ethnicity, as well as state and cohort fixed effects.

The coefficient on the unemployment rate at age 18 in Column (2) is positive and statistically significant at the 5% level for men, while it is positive but not statistically significant for women. These results show that, if anything, the pool of graduates is larger among cohorts that experienced worse economic conditions at the age of 18. Assuming that the marginal students that increase the size of the pool of college graduates are of lower ability than the infra-marginal ones, this suggests that the pool of college graduates who enroll in bad times is if anything more negatively selected in terms of ability compared to the pool of graduates who enroll in good times.[11]

Even if it is the case that graduates who enroll in bad times are more negatively selected in terms of ability, they could still be more positively selected in terms of other factors that influence earnings. For example, individuals from high socio-economic status (SES) backgrounds might be disproportionately able to afford to enroll into college during downturns. Given prior evidence that high SES students tend to have above-average earnings after graduation (Corak, 2013; Chetty et al., 2014), this could be a potential explanation for our main finding.

While we do not have any direct measure of SES in our data, we can provide suggestive evidence regarding changes in the composition of enrollment over the business cycle by exploring the extent to which enrollment and graduation rates vary for individuals from different racial and ethnic backgrounds. Columns (3) and (4) of Table 5 replicate the analysis from Columns (1) and (2) but allow for an interaction term between the unemployment rate at age 18 and our indicators for Black and Hispanic individuals.

Interestingly, we find that both men and women from traditionally underrepre-

[11] Consistent with the idea of negative marginal selection during downturns, in related work using data from the U.K. (Bičáková et al., 2021), we find that pre-university academic achievement indicators are similar or slightly worse for cohorts of graduates that enroll during worse economic conditions.

sented groups (Black or Hispanic) are substantially more likely to enroll in college when unemployment is high, and are also more likely to become graduates. Contrary to the selection rationale discussed above, we find that individuals from minority groups, who tend to disproportionately be drawn from more adverse SES backgrounds, are more, and not less represented among cohorts who enroll in bad times.[12]

Overall, while we cannot definitively rule out the role of selection in at least partially accounting for our results, the findings in Table 5 suggest that it is unlikely that the pool of college graduates who enroll in economic downturns in our data is more positively selected, given that this pool is larger, and disproportionately composed of individuals from traditionally disadvantaged minority groups. This makes our result about the positive relationship between unemployment at college entry and future earnings even more intriguing.

4.2 Post-Graduate Education Choices

Another reason why people who enroll in bad times have higher earnings than those who enroll in good times could be because they make different choices with regard to post-graduate education. In particular, if individuals enrolling in bad times are more likely to enroll in Master's, Professional or Doctoral programs, this could account for their higher levels of earnings when we observe them in the labor market.

To check whether this accounts for our result, in Table 6 we analyze how our benchmark coefficient changes when we add education level controls (a set of indicator variables for each of the degree levels above). For reference, Column (1) reproduces the results of our benchmark model, while Column (2) shows the estimated coefficients obtained when adding these fixed effects.

The estimated coefficient remains approximately the same for men and actually becomes larger in magnitude for women. This implies that our key result cannot be explained by this channel.

4.3 College Major Sorting

Using the same data as in this paper, Blom et al. (2021) show that college graduates who experience a higher unemployment rate at age 20 are more likely to select higher paying majors such as accounting and computer-related fields, particularly in the

[12]This evidence is consistent with Arenas and Malgouyres (2018), who find that experiencing economic downturns at the age of 16 induces children of blue-collar fathers to enroll into post-compulsory education more than children of white-collar fathers in France.

case of women.[13] This points towards a change in the composition of majors across individuals enrolling at different points in the business cycle as a potential explanation for the pattern that we have identified.

To check for this potential mechanism, in Column (3) of Table 6 we augment the specification in Column (2) by adding a full set of fixed effects for the undergraduate field of study of individuals. Interestingly, we find that sorting to different majors plays only a relatively limited role in accounting for the earnings gains enjoyed by individuals who enroll in a bad economy. Comparing the coefficients in Columns (2) and (3), we see that the inclusion of college major fixed effects reduces our coefficient of interest by less than 10% for both men and women. Therefore, there are important earnings gains for people who enroll during downturns that go well beyond any gains due to the changes in their field of study choices.

4.4 State of Residence Choices

Next, we explore the extent to which the wage gains that we identify are accounted for by individuals' state of residence choices. We do this by adding a full set of state of residence fixed effects to our baseline specification. The results are shown in Column (4).

Comparing Columns (1) and (4), we see that accounting for the state of residence choices reduces the estimated coefficient on unemployment at enrollment for men by around 30%, from 0.21 to 0.14. It also makes it statistically insignificant at standard levels. For women, the coefficient is reduced by less (around 22%) and remains statistically significant at the 5% level. Overall, these results imply that the earnings gains that we have identified for individuals who enroll during bad times are partially explained by their ex-post state of residence choices, though an important unexplained component still remains, particularly in the case of women.

4.5 Economic Conditions at the Time of Labor Market Entry

Relatively recent literature (Kahn, 2010; Oreopoulos et al., 2012; Schwandt and von Wachter, 2019; von Wachter, 2020) has shed light on the negative wage effect of entering the labor market during a recession for college graduates in particular. This literature highlights how entering the labor market during downturns leads to a "scarring effect" in the form of lower earnings for many years after graduation. In contrast, cohorts that are lucky enough to enter the labor market during an economic expansion enjoy relatively higher earnings. Given the cyclicality of the economy, it is natural to wonder whether the wage premia that we detect are the result of a favorable timing of

[13] In Bičáková et al. (2021), we find a similar pattern, though much more muted, using U.K. data.

labor market entry for affected cohorts. If the cohorts that enroll during downturns systematically graduate in boom periods, we might simply pick up the effect of this favorable timing of labor market entry.

The analysis presented in Columns (5) and (6) of Table 6 dissipates this concern. In Column (5) we first present a specification that reproduces the scarring result that has been identified in the literature. We do this by controlling for the unemployment rate in the year of labor market entry, but not the unemployment rate at enrollment. In line with the literature (Schwandt and von Wachter, 2019), we use the unemployment rate in the year of labor market entry in the individual's state of residence recorded at the time of the survey (which is a better proxy for the state of labor market entry compared to the state of birth), and we include a full set of state of residence fixed effects.[14] The results confirm that entering the labor market in a recession depresses earnings. We estimate that for each additional percentage point increase in the local unemployment rate at the time of entry into the labor market, average earnings drop by around 0.7% for men and 0.4% for women.

In Column (6) we include our variable of interest – the unemployment rate at the time of enrollment – along with the unemployment rate at the time of labor market entry. The estimated effect of the unemployment rate at enrollment for men remains positive, although still statistically insignificant at conventional levels. For women, the estimated coefficient on unemployment at enrollment remains significant at the 5% level and large in magnitude.

It is interesting to note that the estimated coefficients on the unemployment rate at enrollment for both men and women are larger in magnitude in Column (6) than in the analogous regression that does not control for unemployment at labor market entry in Column (4). In order to understand why this is the case, in Figure 3 we plot the demeaned state-level unemployment rate in year t (from Figure 1, Panel b) against the demeaned unemployment rate in the same state in year $t+4$. These two moments correspond to the (demeaned) unemployment rate at enrollment and the (demeaned) unemployment rate at labor market entry for individuals whose highest level of education is an undergraduate degree, and who live in their state of birth. The figure shows a moderate *positive* correlation between the two unemployment rates,[15] implying that, for this group of individuals, enrolling in a period of high unemployment is associated with graduating in a period in which unemployment is also relatively high. Overall in our sample, including individuals who live in a state other than their state of birth, as well as those who pursue post-graduate education, we obtain a slightly positive and statistically significant correlation of 0.02 between

[14] For consistency with our other specifications, we also continue to control for a full set of state of birth fixed effects.

[15] Weighting each state-cohort cell by the total number of individuals in the cell, we obtain a correlation coefficient of 0.14 which is highly statistically significant.

the (demeaned) unemployment rate at enrollment and the (demeaned) unemployment rate at labor market entry.

This evidence allows us to conclude that the positive earnings effect that we estimate cannot be explained by differences in the economic conditions experienced at the time of labor market entry by those who enroll in college during bad times. If anything, this group of individuals also tends to enter the labor market during relatively bad times. This implies that, if we do not control for economic conditions at the time of labor market entry, the positive effect of high unemployment at enrollment is underestimated, as confirmed by the relative magnitudes of the coefficients in Columns (4) and (6) of Table 6.

5 Discussion: Behavioral Change Leading to Increased Effort

Our findings show that graduates who enroll in college during bad economic times have higher average earnings than those who enroll during good times. As discussed in Section 4.1, it is unlikely that these cohorts are more positively selected in terms of their characteristics at the time of college entry. It is also unlikely that the quality of education is enhanced during downturns: Kane et al. (2005) and Barr and Turner (2013) show that public expenditures on education decline in the U.S. during downturns.

We argue that a plausible explanation for the patterns that we have documented is that individuals who enroll during downturns obtain higher paying jobs and increase their labor market attachment due to a behavioral change in effort. This seems particularly likely in light of the growing evidence that economic conditions experienced during early adulthood lead to long-lasting changes in preferences, values, and behavior, an idea known as the impressionable years hypothesis, first proposed by Krosnick and Alwin (1989).

The impressionable years hypothesis has proven to be useful in explaining differences between cohorts in preferences for redistribution, risk attitudes, and the formation of inflation expectations (Malmendier and Nagel, 2011, 2016; Shigeoka, 2019). Recently, Cotofan et al. (2023) have shown that "recessions create cohorts of workers who give higher priority to income, while booms make cohorts care more about job meaning for the rest of their lives." Our results are consistent with a preference shift that induces those who enroll during downturns to exert more effort toward obtaining higher-earning jobs (in part by choosing more rewarding majors and by relocating to higher-paying locations).[16] For women, we also document a positive impact of adverse

[16] An increase in human capital accumulation during students' college years could also arise as a

economic conditions at college entry on labor market attachment, another channel that is consistent with an increase in effort. The increase in the probability of college graduation among those who experience worse economic conditions at age 18, which we document in Table 5, can also be interpreted as being consistent with an increase in effort.

Increases in effort in response to adverse economic conditions have also been found in other contexts (e.g. Griffith et al., 2016; Lazear et al., 2016; Mukoyama et al., 2018). In Bičáková et al. (2021), we show that cohorts who enroll during adverse economic times in the U.K. perform better in terms of their college grades and also earn higher wages conditional on their college grade point average, compared to cohorts who enroll during good times.

A natural question to ask would be whether we observe evidence of a similar behavioral change when we consider the broader sample of individuals who ever enroll in post-secondary education, including those who do not complete an undergraduate degree. This is important given that the group of non-completers is comparable in size to the group of college graduates that we focus on. To shed some light on this, we re-estimate our main specifications using this expanded sample. The results are presented in Table 7. Column (1) presents a baseline specification that does not control for educational attainment; Column (2) adds controls for the highest level of education completed; Column (3) controls for both educational attainment and field of study;[17] and Column (4) adds controls for the unemployment rate at the time of labor market entry (as well as state of residence fixed effects).[18]

In this expanded sample, the positive impact of enrolling during economic downturns is smaller in magnitude than the corresponding estimates for college graduates presented in Table 6 (with the exception of the estimated coefficient for men in Column 4). This suggests that the wage gains associated with enrolling in downturns may be less pronounced among those who do not graduate. However, we are cautious about the interpretation of these results due to the correlation between unemployment rates at enrollment and unemployment rates at the time of labor market entry for non-graduates: For individuals who do not complete four years of college, the labor market conditions experienced at age 18 (which might influence their preferences and attitudes) are much closer to the conditions they experience at the time of labor

result of the potential lack of (part-time) job opportunities for those who enroll during downturns. If students have more limited opportunities to work while attending college, they might dedicate more time to their studies (see Darolia, 2014; Neyt et al., 2019, on the link between time use and educational outcomes).

[17]Since field of study is not available for individuals who do not complete an undergraduate degree, we group all of the non-completers as a separate category within the field of study variable.

[18]Individuals with "1 or more years of college credit, no degree" are assumed to enter the labor market at age 19, while those with an Associate's degree are assumed to enter the labor market at age 20.

market entry (which would affect their subsequent earnings), rendering it much more difficult to disentangle these effects.[19] In our sample, the correlation between the demeaned unemployment rate at age 18 and the demeaned unemployment rate at labor market entry is 0.023 for college graduates and as high as 0.466 for non-graduates. The results in Column (4) of Table 7 confirm that the estimated coefficient on the unemployment rate at enrollment is sensitive to controlling for conditions at the (imputed time of) labor market entry in this sample. The results for this expanded sample may therefore be less empirically credible than those of our main analysis focusing only on college graduates.

6 Conclusions

We explore the impact of adverse economic conditions at the time of college entry on future labor market outcomes for nearly 40 cohorts of U.S. college graduates. Using within-cohort variation in local economic conditions, we find a positive impact of higher unemployment rates at the time of college enrollment on the annual earnings of both female and male graduates. In particular, we find that a 1 p.p. higher unemployment rate at the time of college entry is associated with an increase in annual real earnings of around 0.35% for women and about 0.21% for men. While men and women experience similar increases in hourly wages, women experience a larger rise in annual earnings due to an increase in their labor market attachment in terms of their probability of working, as well as their weeks worked per year and hours worked per week, conditional on working.

The positive impact on earnings cannot be explained by selection into employment or by the economic conditions prevailing at the time of labor market entry. Changes in the choice of major among those who enroll in bad times account for about 10% of the observed earnings gains conditional on educational attainment, while sorting toward more remunerative locations after graduation explains up to one third of the estimated earnings gain.

Overall, our results show that economic downturns can have positive effects on future economic outcomes, at least for some individuals. This is consistent with existing evidence in the literature showing that economic shocks experienced during early adulthood lead to permanent changes in attitudes, values, and preferences, which can induce individuals to make important adjustments in terms of their human capital accumulation and job search behavior. Policymakers could take advantage of these behavioral changes by expanding college admissions during downturns when

[19] Conditions at the time of labor market entry are also subject to more measurement error in this sample, given that all individuals without a degree are grouped under a single category, regardless of how many years of college credit they completed.

demand is already high.

References

Alessandrini, Diana, "Is post-secondary education a safe port and for whom? Evidence from Canadian data," *Economics of Education Review*, 2018, *67*, 1–13.

Altonji, Joseph G., Lisa B. Kahn, and Jamin D. Speer, "Cashier or Consultant? Entry Labor Market Conditions, Field of Study, and Career Success," *Journal of Labor Economics*, 2016, *34* (S1), S361–S401.

Arenas, Andreu and Clément Malgouyres, "Countercyclical school attainment and intergenerational mobility," *Labour Economics*, 2018, *53* (C), 97–111.

Aslund, Olof and Dan-Olof Rooth, "Do When and Where Matter? Initial Labour Market Conditions and Immigrant Earnings," *The Economic Journal*, 2007, *117* (518), 422–448.

Atkin, David, "Endogenous Skill Acquisition and Export Manufacturing in Mexico," *American Economic Review*, August 2016, *106* (8), 2046–85.

Barr, Andrew and Sarah E Turner, "Expanding enrollments and contracting state budgets: The effect of the Great Recession on higher education," *The ANNALS of the American Academy of Political and Social Science*, 2013, *650* (1), 168–193.

_ **and Sarah Turner**, "Out of work and into school: Labor market policies and college enrollment during the Great Recession," *Journal of Public Economics*, 2015, *124*, 63–73.

Betts, Julian R. and Laurel L. McFarland, "Safe Port in a Storm: The Impact of Labor Market Conditions on Community College Enrollments," *The Journal of Human Resources*, 1995, *30* (4), 741–765.

Bičáková, Alena, Guido Matias Cortes, and Jacopo Mazza, "Caught in the Cycle: Economic Conditions at Enrolment and Labour Market Outcomes of College Graduates," *The Economic Journal*, 01 2021, *131* (638), 2383–2412.

Blom, Erica, Brian C. Cadena, and Benjamin J. Keys, "Investment over the Business Cycle: Insights from College Major Choice," *Journal of Labor Economics*, 2021, *39* (4), 1043–1082.

Bound, John, Breno Braga, Gaurav Khanna, and Sarah Turner, "Public Universities: The Supply Side of Building a Skilled Workforce," *RSF: The Russell Sage Foundation Journal of the Social Sciences*, 2019, *5* (5), 43–66.

_ , **Michael F Lovenheim, and Sarah Turner**, "Why have college completion rates declined? An analysis of changing student preparation and collegiate resources," *American Economic Journal: Applied Economics*, 2010, *2* (3), 129–57.

Carneiro, Pedro and Sokbae Lee, "Trends in quality-adjusted skill premia in the United States, 1960–2000," *The American Economic Review*, 2011, *101* (6), 2309–2349.

_ , **James J. Heckman, and Edward J. Vytlacil**, "Estimating Marginal Returns to Education," *American Economic Review*, October 2011, *101* (6), 2754–81.

Charles, Kerwin Kofi, Erik Hurst, and Matthew J. Notowidigdo, "Housing Booms and Busts, Labor Market Opportunities, and College Attendance," *American Economic Review*, October 2018, *108* (10), 2947–94.

Chetty, Raj, Nathaniel Hendren, Patrick Kline, and Emmanuel Saez, "Where is the land of Opportunity? The Geography of Intergenerational Mobility in the United States," *The Quarterly Journal of Economics*, September 2014, *129* (4), 1553–1623.

Clark, Damon, "Do Recessions Keep Students in School? The Impact of Youth Unemployment on Enrolment in Post-compulsory Education in England," *Economica*, 2011, *78* (311), 523–545.

Corak, Miles, "Income Inequality, Equality of Opportunity, and Intergenerational Mobility," *Journal of Economic Perspectives*, September 2013, *27* (3), 79–102.

Cotofan, Maria, Lea Cassar, Robert Dur, and Stephan Meier, "Macroeconomic Conditions When Young Shape Job Preferences for Life," *The Review of Economics and Statistics*, 01 2023, pp. 1–7.

Darolia, Rajeev, "Working (and studying) day and night: Heterogeneous effects of working on the academic performance of full-time and part-time students," *Economics of Education Review*, 2014, *38* (C), 38–50.

Davis, Steven J. and Till M. von Wachter, "Recessions and the Cost of Job Loss," *Brookings Papers on Economic Activity*, 2011, *43* (2 (Fall)), 1–72.

Dellas, Harris and Plutarchos Sakellaris, "On the cyclicality of schooling: Theory and evidence," *Oxford Economic Papers*, January 2003, *55* (1), 148–172.

Griffith, Rachel, Martin O'Connell, and Kate Smith, "Shopping Around: How Households Adjusted Food Spending Over the Great Recession," *Economica*, April 2016, *83* (330), 247–280.

Johnson, Matthew T., "The impact of business cycle fluctuations on graduate school enrollment," *Economics of Education Review*, 2013, *34* (C), 122–134.

Kahn, Lisa B., "The long-term labor market consequences of graduating from college in a bad economy," *Labour Economics*, 2010, *17* (2), 303 – 316.

Kane, Thomas J., Peter R. Orszag, and Emil Apostolov, "Higher Education Appropriations and Public Universities: Role of Medicaid and the Business Cycle," *Brookings-Wharton Papers on Urban Affairs*, 2005, pp. 99–146.

Krosnick, John A. and Duane E Alwin, "Aging and Susceptibility to Attitude Change," *Journal of Personality and Social Psychology*, 1989, (57), 416–425.

Lazear, Edward P., Kathryn L. Shaw, and Christopher Stanton, "Making Do with Less: Working Harder during Recessions," *Journal of Labor Economics*, 2016, *34* (S1), S333–S360.

Liu, Kai, Kjell G. Salvanes, and Erik Ø. Sørensen, "Good skills in bad times: Cyclical skill mismatch and the long-term effects of graduating in a recession," *European Economic Review*, 2016, *84*, 3 – 17.

Malmendier, Ulrike and Stefan Nagel, "Depression Babies: Do Macroeconomic Experiences Affect Risk Taking?," *The Quarterly Journal of Economics*, 2011, *126* (1), 373–416.

_ and _, "Learning from Inflation Experiences," *The Quarterly Journal of Economics*, 2016, *131* (1), 53–87.

Méndez, Fabio and Facundo Sepúlveda, "The Cyclicality of Skill Acquisition: Evidence from Panel Data," *American Economic Journal: Macroeconomics*, 2012, *4* (3), 128–152.

Mukoyama, Toshihiko, Christina Patterson, and Ayşegül Şahin, "Job Search Behavior over the Business Cycle," *American Economic Journal: Macroeconomics*, January 2018, *10* (1), 190–215.

Neyt, Brecht, Eddy Omey, Dieter Verhaest, and Stijn Baert, "Does Student Work Really Affect Educational Outcomes? A Review of the Literature," *Journal of Economic Surveys*, 2019, *33* (3), 896–921.

Oreopoulos, Philip, Till von Wachter, and Andrew Heisz, "The Short- and Long-Term Career Effects of Graduating in a Recession," *American Economic Journal: Applied Economics*, January 2012, *4* (1), 1–29.

Ruggles, Steven, Sarah Flood, Ronald Goeken, Josiah Grover, Erin Meyer, Jose Pacas, and Matthew Sobek, "Integrated Public Use Microdata Series (IPUMS) USA: Version 10.0 [dataset]," 2020.

Schwandt, Hannes and Till von Wachter, "Unlucky Cohorts: Estimating the Long-Term Effects of Entering the Labor Market in a Recession in Large Cross-Sectional Data Sets," *Journal of Labor Economics*, 2019, *37* (S1), S161–S198.

Shigeoka, Hitoshi, "Long-Term Consequences of Growing up in a Recession on Risk Preferences," *NBER Working Paper 26352*, October 2019.

Sievertsen, Hans Henrik, "Local unemployment and the timing of post-secondary schooling," *Economics of Education Review*, 2016, *50* (C), 17–28.

Solon, Gary, Steven J. Haider, and Jeffrey M. Wooldridge, "What Are We Weighting For?," *Journal of Human Resources*, 2015, *50* (2), 301–316.

von Wachter, Till, "The Persistent Effects of Initial Labor Market Conditions for Young Adults and Their Sources," *Journal of Economic Perspectives*, 2020, *34* (4), 168–94.

Table 1: Summary Statistics

	Men			*Women*		
	Mean	p25	p75	Mean	p25	p75
Annual Income	82,111	36,434	96,966	51,658	25,300	64,465
Log Annual Income	10.92	10.50	11.48	10.47	10.14	11.07
Unemp at enrol, state	0.0629	0.0490	0.0740	0.0625	0.0480	0.0730
Unemp, demeaned	0.0000	-0.0065	0.0056	0.0000	-0.0063	0.0055
Obs.	1,670,797			1,924,219		

Note: The sample includes all U.S. born college graduates who turned 18 between 1976 and 2014, and who are observed in the American Community Survey between 2009 and 2019 at age 22 or older. Nominal earnings are converted to real 2009 dollars using the Consumer Price Index from the Bureau of Labor Statistics (BLS). State-level unemployment rates are obtained from the BLS's Local Area Unemployment Statistics program. Demeaned unemployment rates are obtained by computing the residual of a regression of state-level unemployment rates on state and year fixed effects. Unemployment at enrollment is the unemployment rate in the individual's state of birth in the year in which they turned 18. The summary statistics for the state unemployment rates differ by gender, as female and male graduates are deferentially distributed across enrollment years and states of birth.

Table 2: Main Results: Relationship between Unemployment Rates at Enrollment and Earnings for College Graduates

Dependent Variable: Log annual wage and salary income					
	Men				
	(1)	(2)	(3)	(4)	(5)
U at enrol, nat'l	0.717**	0.168			
	(0.289)	(0.116)			
U at enrol, state			0.173	0.201*	0.205*
			(0.113)	(0.110)	(0.110)
Obs.	1,670,797	1,670,797	1,670,797	1,670,797	1,670,797
R^2	0.177	0.208	0.178	0.208	0.208
Nr. of Clusters	39	39	1,989	1,989	1,989
	Women				
	(1)	(2)	(3)	(4)	(5)
U at enrol, nat'l	0.656**	-0.050			
	(0.284)	(0.222)			
U at enrol, state			0.342***	0.347***	0.347***
			(0.110)	(0.113)	(0.113)
Obs.	1,924,219	1,924,219	1,924,219	1,924,219	1,924,219
R^2	0.077	0.102	0.077	0.103	0.103
Nr. of Clusters	39	39	1,989	1,989	1,989
State FE	✓	✓	✓	✓	✓
Year FE	✓		✓		
Age FE		✓		✓	
Cohort FE			✓	✓	
Cohort-Year FE					✓

Note: The dependent variable is the logarithm of individuals' annual labor earnings (total wage and salary income) in real 2009 dollars. The sample includes college graduates who are at least 22 years old and who enrolled in college between 1976 and 2014. The table shows the estimated coefficient for the unemployment rate at the time of college enrollment, measured either at the national or the state level. The table indicates the fixed effects included in each specification. The cohort trend included in Columns (1) and (2) is represented by a cubic term. All specifications include race/ethnicity controls. Standard errors are clustered at the cohort level in Columns (1) and (2) and at the cohort x state level in all other columns.
***, **, and * denote statistical significance at the one, five, and ten percent levels, respectively.

Table 3: Decomposing the Main Results

	Men				
	(1)	(2)	(3)	(4)	(5)
	Prob. Any Income	*Conditional on Working*			
		Annual Income	Weeks	Hours	Hourly Wage
U at enrol, state	0.044	0.205*	0.017	0.024	0.164**
	(0.029)	(0.110)	(0.032)	(0.033)	(0.084)
Obs.	1,835,246	1,670,797	1,670,797	1,670,797	1,670,797
R^2	0.014	0.208	0.066	0.053	0.173
Nr. of Clusters	1,989	1,989	1,989	1,989	1,989
Mean of Dep Var	0.910	10.919	3.847	3.755	3.317
	Women				
	(1)	(2)	(3)	(4)	(5)
	Prob. Any Income	*Conditional on Working*			
		Annual Income	Weeks	Hours	Hourly Wage
U at enrol, state	0.124***	0.347***	0.119***	0.093*	0.135*
	(0.035)	(0.113)	(0.038)	(0.050)	(0.077)
Obs.	2,269,728	1,924,219	1,924,219	1,924,219	1,924,219
R^2	0.020	0.103	0.030	0.018	0.117
Nr. of Clusters	1,989	1,989	1,989	1,989	1,989
Mean of Dep Var	0.852	10.472	3.803	3.611	3.059
State FE	✓	✓	✓	✓	✓
Cohort-Year FE	✓	✓	✓	✓	✓

Note: The sample includes college graduates who are at least 22 years old and who enrolled in college between 1976 and 2014. The dependent variables are: a dummy equal to one for individuals who report having non-zero wage or salary income in Column (1); the logarithm of individuals' annual labor earnings (total wage and salary income) in real 2009 dollars in Column (2); the logarithm of weeks worked per year in Column (3); the logarithm of usual hours worked per week in Column (4); and the logarithm of real hourly wages in Column (5). The table shows the estimated coefficient for the state-level unemployment rate at the time of college enrollment. All specifications include race/ethnicity controls. Standard errors are clustered at the cohort x state level.

***, ** and * denote statistical significance at the one, five and ten percent levels, respectively.

Table 4: Additional Robustness Checks

Dependent Variable: Log annual wage and salary income				
	Men			
	(1)	(2)	(3)	(4)
U at enrol, state	0.205*	0.157	0.168	0.341**
	(0.110)	(0.105)	(0.103)	(0.146)
Obs.	1,670,797	1,464,078	1,464,078	1,464,078
R^2	0.208	0.117	0.114	0.112
Nr. of Clusters	1,989	1,530	1,530	1,530
	Women			
	(1)	(2)	(3)	(4)
U at enrol, state	0.347***	0.535***	0.517***	0.384**
	(0.113)	(0.103)	(0.102)	(0.156)
Obs.	1,924,219	1,648,922	1,648,922	1,648,922
R^2	0.103	0.038	0.034	0.037
Nr. of Clusters	1,989	1,530	1,530	1,530
State FE	✓	✓	✓	✓
Cohort-Year FE	✓	✓	✓	✓
Sample:	Full	Restricted	Restricted	Restricted
Re-weighting:	None	None	Cohort	State-Cohort

Note: Column (1) reproduces our baseline specification using our main sample. Columns (2)-(4) restrict the sample to individuals observed across all 11 ACS waves, i.e. excluding individuals who turn 18 after 2005. Column (2) estimates the same specification as Column (1). Column (3) adjusts the weights so that each cohort receives the same weight in the regression. Column (4) adjusts the weights so that each state-cohort cell receives the same weight in the regression. All specifications include race/ethnicity controls. Standard errors are clustered at the cohort x state level.

***, ** and * denote statistical significance at the one, five and ten percent levels, respectively.

Table 5: Selection into Enrollment and Graduation

	Dependent Variable: Probability of...			
	Enrollment	Graduation	Enrollment	Graduation
	Men (Nr. of Obs.: 6,208,917)			
	(1)	(2)	(3)	(4)
U at age 18, state	0.198***	0.079**	0.113***	0.022
	(0.039)	(0.032)	(0.040)	(0.035)
Black	-0.149***	-0.171***	-0.177***	-0.193***
	(0.001)	(0.002)	(0.004)	(0.005)
Hispanic	-0.166***	-0.166***	-0.190***	-0.176***
	(0.003)	(0.002)	(0.010)	(0.009)
Black × U at age 18			0.417***	0.334***
			(0.064)	(0.066)
Hispanic × U at age 18			0.369**	0.145
			(0.148)	(0.122)
R^2	0.031	0.039	0.031	0.039
Mean of Dep Var	0.608	0.288	0.608	0.288
	Women (Nr. of Obs.: 6,291,407)			
	(1)	(2)	(3)	(4)
U at age 18, state	0.024	0.030	-0.085**	-0.098**
	(0.037)	(0.042)	(0.039)	(0.046)
Black	-0.093***	-0.157***	-0.127***	-0.203***
	(0.002)	(0.002)	(0.004)	(0.006)
Hispanic	-0.147***	-0.179***	-0.175***	-0.199***
	(0.003)	(0.003)	(0.008)	(0.010)
Black × U at age 18			0.517***	0.708***
			(0.067)	(0.087)
Hispanic × U at age 18			0.424***	0.303**
			(0.111)	(0.153)
R^2	0.027	0.040	0.027	0.040
Mean of Dep Var	0.700	0.347	0.700	0.347
State FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓

Note: The sample includes all U.S.-born individuals who are observed in the American Community Survey between 2009 and 2019 at age 22 or older. The dependent variable is an indicator equal to one for individuals with at least some college education in Columns (1) and (3); and an indicator for individuals with at least four years of college in Columns (2) and (4). Standard errors are clustered at the cohort x state level.
***, ** and * denote statistical significance at the one, five and ten percent levels, respectively.

Table 6: Mechanisms

Dependent Variable: Log annual wage and salary income						
	Men					
	(1)	(2)	(3)	(4)	(5)	(6)
U at enrol	0.205*	0.204*	0.195*	0.144		0.167
	(0.110)	(0.105)	(0.100)	(0.116)		(0.116)
U at LM entry					-0.693***	-0.697***
					(0.222)	(0.221)
Obs.	1,670,797	1,670,797	1,670,797	1,670,797	1,670,797	1,670,797
R^2	0.208	0.226	0.260	0.218	0.218	0.218
Nr. of Clusters	1,989	1,989	1,989	1,989	1,989	1,989
	Women					
	(1)	(2)	(3)	(4)	(5)	(6)
U at enrol	0.347***	0.381***	0.356***	0.270**		0.286**
	(0.113)	(0.109)	(0.113)	(0.117)		(0.117)
U at LM entry					-0.444*	-0.452*
					(0.261)	(0.261)
Obs.	1,924,219	1,924,219	1,924,219	1,924,219	1,924,219	1,924,219
R^2	0.103	0.127	0.149	0.113	0.113	0.113
Nr. of Clusters	1,989	1,989	1,989	1,989	1,989	1,989
Birth State FE	✓	✓	✓	✓	✓	✓
Cohort-Year FE	✓	✓	✓	✓	✓	✓
Educ Level FE		✓	✓			
Major FE			✓			
State of Resid FE				✓	✓	✓

Note: The dependent variable is the logarithm of individuals' annual labor earnings (total wage and salary income) in real 2009 dollars. The sample includes college graduates who are at least 22 years old and who enrolled in college between 1976 and 2014. The table shows the estimated coefficient for the state-level unemployment rate at the time of college enrollment and/or labor market (LM) entry. All specifications include race/ethnicity controls. Standard errors are clustered at the cohort x state of birth level.
***, ** and * denote statistical significance at the one, five and ten percent levels, respectively.

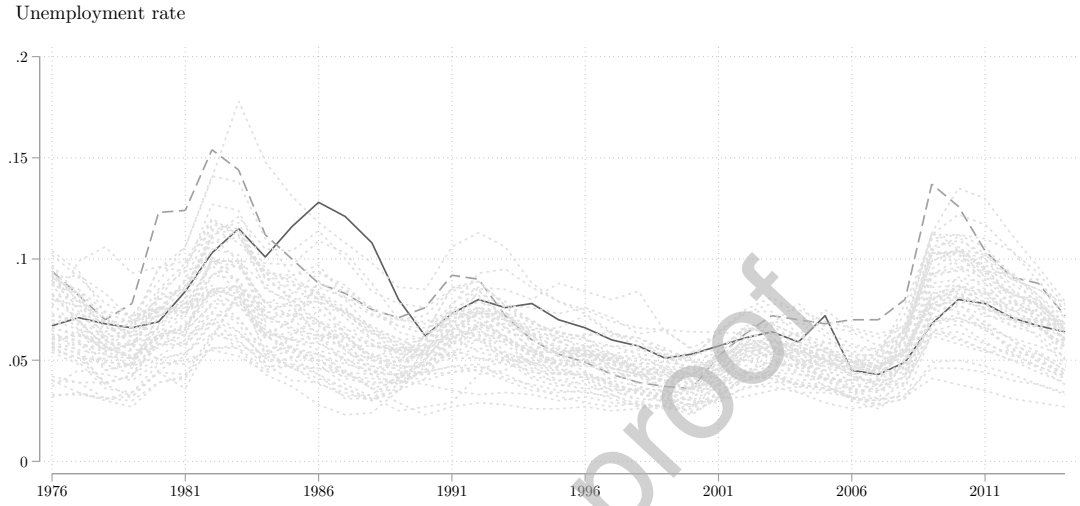
Table 7: Results Including Non-Graduates

Dependent Variable: Log annual wage and salary income				
	Men			
	(1)	(2)	(3)	(4)
U at enrol	0.170	0.158	0.149	0.218*
	(0.108)	(0.105)	(0.102)	(0.116)
U at LM entry				-0.452***
				(0.096)
Obs.	3,273,851	3,273,851	3,273,851	3,273,851
R^2	0.210	0.271	0.286	0.277
Nr. of Clusters	1,989	1,989	1,989	1,989
Mean of Dep Var	10.609	10.609	10.609	10.609
	Women			
	(1)	(2)	(3)	(4)
U at enrol	0.291***	0.255***	0.244***	0.175*
	(0.097)	(0.089)	(0.092)	(0.096)
U at LM entry				0.037
				(0.068)
Obs.	3,591,482	3,591,482	3,591,482	3,591,482
R^2	0.106	0.173	0.184	0.179
Nr. of Clusters	1,989	1,989	1,989	1,989
Mean of Dep Var	10.202	10.202	10.202	10.202
Birth State FE	✓	✓	✓	✓
Cohort-Year FE	✓	✓	✓	✓
Educ Level FE		✓	✓	✓
Major FE			✓	
State of Resid FE				✓

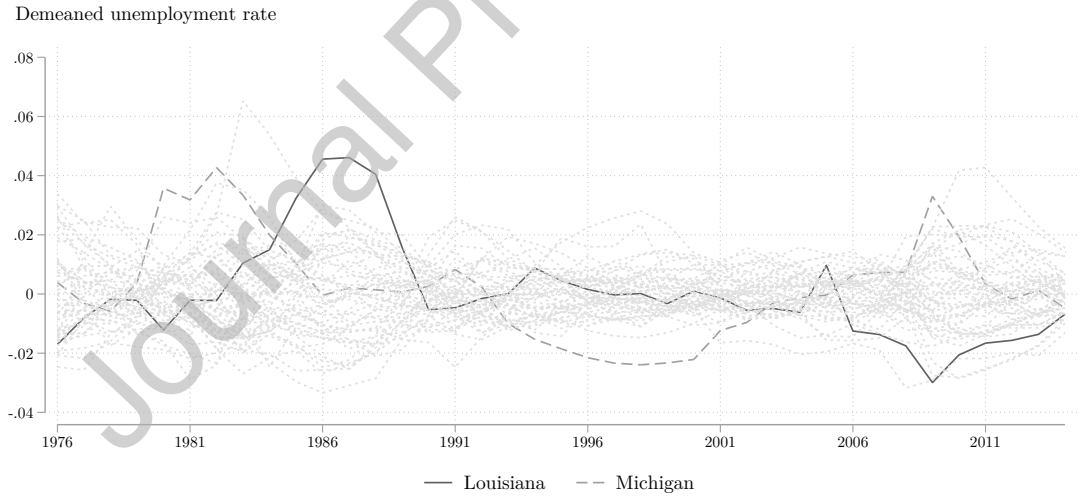
Note: The dependent variable is the logarithm of individuals' annual labor earnings (total wage and salary income) in real 2009 dollars. The sample includes all individuals with at least some college education who are at least 22 years old and who enrolled in college between 1976 and 2014. The table shows the estimated coefficient for the state-level unemployment rate at the time of college enrollment and/or labor market (LM) entry. All specifications include race/ethnicity controls. Standard errors are clustered at the cohort x state of birth level.
***, ** and * denote statistical significance at the one, five and ten percent levels, respectively.

Figure 1: Unemployment Rates by State, 1976–2014

(a) **Levels**

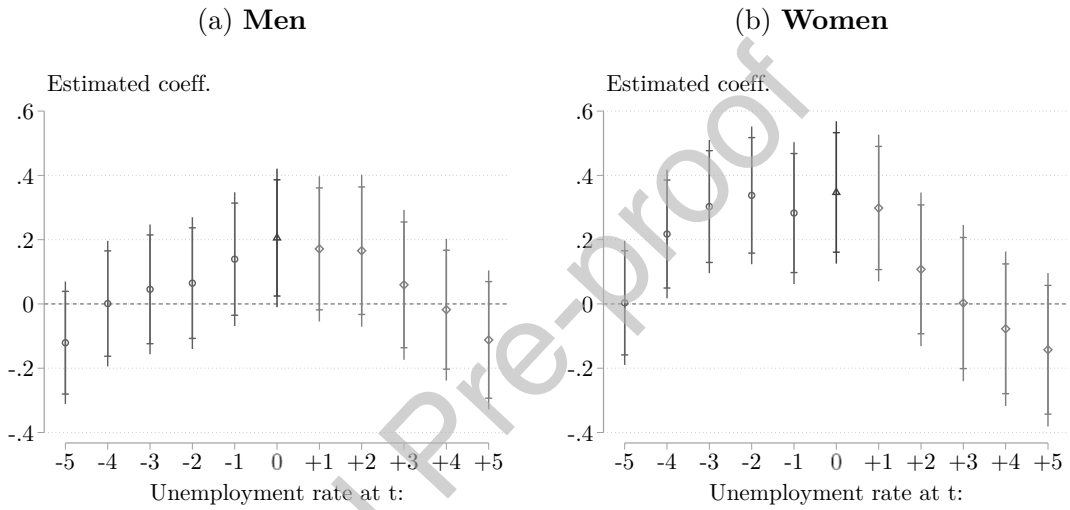


(b) **Demeaned**



Note: Panel 1a plots the unemployment rate for each U.S. state for the period 1976–2014. Panel 1b plots the residuals from a regression of the unemployment rate for each state on year and state fixed effects, thus capturing within-year deviations in unemployment from the state mean, which is the source of identifying variation for our empirical analysis. We have highlighted the two states with the highest and lowest demeaned unemployment rate in 2009: Louisiana and Michigan.

Figure 2: Relationship between the Unemployment Rate around the Year in which Individuals turn 18 and Future Earnings



Note: The markers represent the estimated effect of the state unemployment rate on the logarithm of real annual labor earnings (total wage and salary income). Each marker is obtained from a separate regression. The coefficient for $t = 0$ corresponds to our main result, which uses the unemployment rate in the year in which individuals turned 18 (the assumed year of enrollment). Other markers are obtained from regressions that use the unemployment rates in years before or after the individual turned 18. The lines represent 95% confidence intervals. The cap on each line represents the 90% confidence interval. The sample includes college graduates who are at least 22 years old and who enrolled in college between 1976 and 2014. All regressions include fully interacted cohort and calendar year fixed effects, as well as state of birth fixed effects, and race/ethnicity controls. Standard errors are clustered at the cohort x state level.

Figure 3: Demeaned Unemployment Rates in Years t and $t+4$ by State, 1976–2014

Note: The figure plots the residuals from a regression of the unemployment rate for each state for the period 1976–2014 on year and state fixed effects. Residuals from year $t+4$ are plotted against the residuals from year t. Each dot corresponds to a state-year combination. The correlation coefficient weighted by cohort-state cell size is 0.14 with a p-value below 0.001.