Strategic or scarred? Disparities in college enrollment and dropout response to macroeconomic conditions*

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Abstract

Recessions create enduring effects, or scars, on young individuals' careers, notably when they occur around critical periods such as high school graduation and college enrollment. I investigate how educational choices amplify or mitigate these scarring effects across income levels. Low-income young people face dual scarring effects: increased likelihood of dropping out of college and enduring negative labor market entry effects. High-income young people strategically evade these repercussions, delaying labor market entry through timely college enrollment during economic downturns. I quantify the lifetime repercussions of experiencing a recession during these critical phases. The poorest individuals endure a 40% reduction in lifetime consumption if a recession occurs while they are enrolled in college. A recession that occurs around the time of high school graduation hinders the college attendance of the middle-to-low-income group, causing a 24% lifetime consumption loss.

***JEL Codes**: E24, E32, E61, I23, I24.*
***Keywords**: Business cycles, unemployment, college, dropout, scarring.*

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1 Introduction

Macroeconomic conditions are well-known to affect young people's schooling choices, but less is understood about how these impacts vary by students' socioeconomic backgrounds. Poor labor market conditions pose a difficult tradeoff for recent high school graduates and enrolled college students. First, high unemployment rates increase the likelihood of family financial distress, potentially making it difficult for students to pay tuition, thereby increasing the likelihood of dropping out of college or not enrolling at all. Second, a weak labor market reduces the opportunity cost of college attendance by lowering foregone wages. I focus on how the relative significance of these mechanisms correlates with family income. Given the distinct patterns of college enrollment and completion in response to macroeconomic conditions, I quantify the lifetime impacts of experiencing a rise in the unemployment rate, similar to the 2009 economic recession, during critical times—around high school graduation and during college attendance—across different family income levels.

I reveal novel findings regarding the distinct responses to macroeconomic conditions in college decisions across family income groups. Low-income students are more likely to drop out of college during periods of high unemployment rates while high-income students tend to stay and earn their degree. Further, high-income individuals who suffered high unemployment rates around their high school graduation are more likely to have attended college and earned a degree years after. Building on these empirical insights, I introduce a theoretical model aimed at estimating the lifetime impacts of recession experiences. The model incorporates two main rigidities that could potentially rationalize the aforementioned findings: liquidity constraints and persistent effects of labor market entry conditions on current wages. The model successfully replicates key empirical findings and reproduces large losses incurred by low-income individuals when a recession strikes during these pivotal periods, leaving lasting scars. In contrast, it highlights the strategic college decisions of high-income individuals as a means to mitigate such long-term effects.

I use CPS micro data to explore the key mechanisms driving the disparities in college decisions as a response to macro conditions by income levels. I find that low-income individuals are disproportionately susceptible to the enduring adverse effects of high unemployment rate periods during two pivotal time periods. When unemployment increases while enrolled in college, they are more likely to drop out without earning a degree. In addition, if unemployment rate goes up around the time they graduate from high school, they become less likely to pursue higher education, relative to their higher-income counterparts. High unemployment rate periods scar low-income individuals in two ways. First, a subset of low-income individuals is forced to drop out from college. Second, low-income individuals tend to stay

in the labor force even when the labor market is weak, resulting in comparatively milder but persistent repercussions stemming from unfavorable labor market entry conditions. These wage losses amount to a real loss of approximately 16%, lasting for a decade following the initial entry into the labor force, for individuals entering during periods of unemployment rates similar to those experienced during the 2009 crisis, in contrast to those initiating their careers during pre-recession unemployment rate levels.[1] By contrast, high-income individuals strategically evade these scarring effects. When periods of high unemployment coincide with their college enrollment, they are more inclined to complete their college degree, and when such economic downturns coincide with their high school graduation, they exhibit an increased propensity to enroll in college.

For low-income individuals, an increase in state's unemployment rate equivalent to that experienced during the 2009 crisis correlates with an increase in the likelihood of dropping out of college by a factor of 1.07 and an insignificant change in the probability of transitioning from the labor force to college.[2] In contrast, the same rise in state's unemployment is associated with a reduction in the probability of dropping out by a factor of 0.95 (or a 5% reduction) of college and a substantial rise in the likelihood of transitioning from the labor force to college by a factor of 1.2 for high-income individuals.

For high school graduates, a rise in the state-level unemployment rate comparable to the 2009 crisis is linked to an increase in college enrollment disparity between high and low-income groups by a factor of 1.10.[3] The ratio of college attendees to high school graduates rises 10% more for richer young adults compared to their less privileged counterparts following such a macroeconomic shock. Further, the same size shock is associated with an average widening in the disparity of college degree holders between individuals from higher and lower-income backgrounds by a factor of 1.32.

The substantial increase in college enrollment among high-income individuals after a rise in state's unemployment rates around their high school graduation does not fully translate into the same rise in future college degree holders within this income bracket. This spike in college enrollment is accompanied by an increase in college dropouts among high-income individuals as economic conditions rebound post-recession. For those belonging to the high-income group, who remain relatively resilient to the financial constraints, the diminished opportunity cost incentivizes even individuals who might be a worse fit for college to enroll.

[1] I calculate these results in Section 3.2 using a similar method and obtaining similar results as Schwandt & Von Wachter (2019).

[2] The probability of dropping out rises by 0.6 p.p. which corresponds to a rise in this likelihood by a factor of 1.07 or 7%.

[3] In section 3.2 I explain how I measure these disparities in more detail. I take the ratio of people who has attended college over people with high school only for young adults with high family income and for young adults with low-income family. The ratio between high and low-income is the college enrollment disparity.

Relying solely on empirical analysis renders it challenging to quantify recessions' disparate impacts on young people's lifetime earnings. I therefore supplement my empirical analysis with a model that incorporates the key mechanisms driving young people's schooling decisions in the face of an economic downturn.

I present a dynamic individual decision-making model aimed at quantifying the lifetime impacts of experiencing a recession during these two pivotal time periods for young individuals: high school graduation and while being enrolled in college. The model incorporates endogenous choices regarding college enrollment, completion, and dropout, as well as decisions regarding consumption and savings, all starting from different initial asset levels characteristic of low and high-income individuals. The "business cycles" within this framework are generated by a productivity variable subject to a stochastic process. Individuals' wages depend both on current productivity states and the productivity state at labor market entry, effectively capturing the scarring effects resulting from unfavorable entry conditions. Additionally, the model features liquidity constraints that affect individuals' ability to borrow to pay tuition and living expenses during college enrollment. I estimate the three key parameters of the model—the college wage premium, the influence of labor market entry conditions on current wages, and tuition fees—with key moments of the data.

I estimate that experiencing a rise in state's unemployment rate similar to the one experienced in the 2009 recession while enrolled in college carries substantial adverse implications for the expected lifetime utility of the most economically disadvantaged. Within this group, the repercussions manifest as a 40% reduction in expected lifetime consumption (in present value terms), stemming from the increase in college dropout rates following a recession. Next, I find that experiencing the same rise in state's unemployment rate around high school graduation has almost no impact on high-income individuals, given their strategic response of college enrollment during economic downturns. The poorest individuals experience a 9% reduction in expected lifetime consumption following a recession around high school graduation date stemming from the negative labor market entry effects. The most severe impact is borne by the second-poorest, or middle-to-low-income group. Economic conditions around the time of high school graduation significantly sway this group's decisions regarding college enrollment. A recession at this time reduces expected lifetime consumption by 24% for this income group.

College enrollment and completion decisions magnify recessions' scarring effects for financially constrained individuals but mitigate them for financially unconstrained individuals. The model in this paper suggests that liquidity constraints and the enduring impacts of labor market entry conditions are fundamental mechanisms driving these outcomes. Notably, the influence of these two types of rigidities is negligible for middle and high-income groups,

implying that the low-income group bears the burden of their implications. Policies aimed at reducing the impact of these types of rigidities would therefore potentially benefit the lowest-income young individuals.

This paper is structured as follows: in Section 2 I provide an overview of the data set employed in the empirical analysis and I present preliminary statistics for the key variables of interest. Using the longitudinal data, in Section 3.1 I show the first empirical finding which focuses on the disparities in the probability of leaving college and transitioning from the labor force to college during periods of high unemployment rates for varying income levels. Building on the cross-sectional data, in Section 3.2 I show the second main empirical finding, which illustrates the differential sensitivity of educational choices to changes in unemployment rates around high school graduation dates across distinct income groups. To ensure the robustness of these empirical findings, in Section 3.3 I conduct sensitivity analyses with alternative specifications. Additionally, in Section 3.4, I carefully discuss the central identifying assumptions underpinning the empirical section of the paper. Subsequently, in Section 4, I introduce a dynamic individual decision-making model designed to capture the dynamics of college decisions amid changing macroeconomic conditions. In Section 5 I present the core outcomes of the model and I compare them with the empirical findings. In Section 6 I present the two main counterfactuals of the paper which quantify the lifetime impacts of experiencing a rise in state's unemployment rates similar to the ones experienced in the 2009 recession while enrolled in college or around high school graduation date. Finally, in Section 7 I present the conclusions of the paper as well as policy relevant suggestions derived from the paper.

Related Literature

This paper is related to three branches of the literature. First, it follows recent empirical literature regarding the negative and persistent effects of entering the labor market during economic crises. Second, it shows the counter-cyclicality of college enrollment, with a novel finding regarding the distinct elasticities across income levels. I also distinguish between people who finish the degree and those who drop out from college. Third, it contributes to the literature regarding the effects of recessions on income mobility with a new mechanism, the heterogeneity in the cyclicality of college enrollment decisions and consequently the endogenous labor market entry choice.

I contribute to the empirical literature that finds negative and persistent effects of starting a career during periods of high unemployment rates. Kahn (2010), Speer (2016) and Schwandt & Von Wachter (2019) find that entering the labor market during a time of high

unemployment rate impacts negatively entrants' wages significantly for more than a decade. Stevens (2008) documents these negative and (less) persistent effects in Germany. This finding is consistent with Beaudry & DiNardo (1991)'s contract model in which macroeconomic conditions at the time of the labor contract predicts better the evolution of wages than current macroeconomic conditions. These effects are also well-documented for other countries besides the US, such as for Germany (Bachmann et al. (2010)), Japan (Genda et al. (2010)), Canada (Oreopoulos et al. (2012)), Austria (Brunner & Kuhn (2014)), Spain (Fernández-Kranz & Rodríguez-Planas (2018) and Escalonilla et al. (2021)) or the Netherlands (Van den Berge (2018)). Oyer (2006) finds the same entry effects for Ph.D. graduates who enter the job market during a recession not only through lower wages but also with lower probabilities to get positions in top-50 schools and lower overall productivity levels, measured in terms of publications and research citations. Kondo (2015) focuses on the heterogeneity in these effects across gender and race. Choi et al. (2020) shows the same effects for South Korean college graduates during the Asian financial crisis. They also found that the negative effects expand to other welfare relevant variables such as marriage, fertility and asset building beyond earnings and employment.

This paper contributes to this first branch of the literature by replicating this empirical fact using CPS data and exhibiting that economic downturns around high school graduation dates matter only for people who do not go to college, and therefore, actually enter the labor market. In the model I will also allow the labor market entry decision to be endogenous for an individual that can use college enrollment to postpone it and avoid these negative entry effects. I find empirical evidence suggesting that this labor market entry postponement is coming from middle and high-income groups and it is economically significant.

The theoretical reasons behind these persistent effects of entering the labor market during a crisis have been recently explored using macroeconomic directed search models. Guo (2018) builds a dynamic directed search model to show the effect of experiencing a recession while young on lifetime welfare. She shows that early career recessions impact welfare especially through the loss from job mobility and professional experience which both effects happen to be quite persistent. Acabbi et al. (2020) propose a model where on-the-job human capital accumulation is affected by the business cycle and the quality of the firm workers get matched with. Workers value better quality firms which offer not only higher wages but also higher human capital accumulation, however, these matches become less likely, especially during tight times like recessions, so workers tend to direct their job search towards lower quality firms sacrificing future dynamic payoffs in terms of human capital. Another similar branch of the literature focused on trying to explain theoretical reasons behind the *scarring effects* of job losses, that is, the persistent negative effects of being unemployed. Jarosch (2021)

shows that the main reason for the observed negative persistent scarring effects generated by unemployment is the interaction of human capital and job security loss. That is because of the serial correlation of unemployment spells among displaced workers over their lifetime and its negative impact on their own cumulative experience gained on the job. Huckfeldt (2022) also finds that these scarring effects are explained by the directed search of relatively skilled workers who focus their search into less skilled submarkets during recessions in order to increase their likelihood of matching with a firm.

I contribute to the second branch of the literature that finds a negative relationship between labor market conditions and school enrollment due to the reduction in the opportunity cost of education (Gustman & Steinmeier (1981), Betts & McFarland (1995), Sakellaris & Spilimbergo (2000), Dellas & Koubi (2003), Johnson (2013), Boffy-Ramirez et al. (2013), Cajner et al. (2021), Schanzenbach et al. (2023)). This paper contributes to this branch of the literature in two main ways. First, I show that the counter-cyclicality in college enrollment is heterogeneous at the income level. More specifically, for low-income levels, college enrollment is a-cyclical, whereas for high-income levels is strongly counter-cyclical. Second, within individuals who have gone to college, I distinguish those who graduate from those who drop out from college which have significant economic and policy implications.

I also contribute to the branch of literature focused on the effects of recessions on income inequality. Meyer & Sullivan (2013) show that income inequality, measured as the 90 to 10 percentile ratio, increases significantly after the Great Depression of 2009. Heathcote et al. (2020) find that the main driver of income inequality is the decline in number of hours worked, which fall sharply during economic crises. They develop a structural model with skill-biased technical change in which low-skilled individuals suffer job losses during recessions during which their human capital depreciates capturing the *scarring effects*. The contribution in this particular branch of the literature is that I provide a novel channel for which recessions might have an impact on income inequality. This channel is the different level of counter-cyclicality of college enrollment and completion decisions which can potentially impact future labor inequalities in two ways. First, a recession could expand the educational composition disparities between rich and poor individuals. Second, rich individuals have the opportunity to enter the labor force during better macroeconomic conditions compared to poorer individuals which also impacts earnings significantly and quite persistently.

2 Data

I introduce the data employed in the subsequent analysis to unveil the primary empirical findings of this study. First, I use yearly aggregate data from the US Census to present foun-

dational stylized facts pertaining to educational choices and their relationship with business cycles. I show that college enrollment has been counter-cyclical since 1970.

Second, I turn the attention to the CPS IPUMS monthly micro data spanning from January 1992 to December 2022, which constitutes the focal dataset for the main empirical facts in Section 3.[4] This dataset is divided into two distinct subgroups: longitudinal and cross-sectional data. I use the longitudinal data to unveil the first empirical finding, highlighting the differential responses of income groups to economic downturns while enrolled in college or in the labor force. Specifically, low-income individuals are more likely to drop out of college during high unemployment rate periods, while middle and high-income individuals are more likely to persist in college amid challenging macroeconomic conditions. Furthermore, I observe that middle and high-income individuals are also more inclined to transition from the labor force to college during high unemployment rate periods.

Meanwhile, the cross-sectional data proves instrumental in unveiling the second empirical finding, wherein high unemployment rates at the time of high school graduation exert varying effects on future college enrollment decisions across different income strata. Notably, it leads to an increased likelihood of college enrollment for middle and high-income individuals, while showing relatively insignificant changes in the probability of college attendance for their low-income counterparts.

2.1 Aggregate yearly data

I use historical yearly data from the CPS (Current Population Survey) to examine school enrollment trends in the United States.[5] The main dependent variable encompasses annual college enrollment of students under 35 years old relative to the entire student age population deviations from the trend.[6] To construct this variable, I aggregate the counts of undergraduates, graduate students, and two-year college students under 35 years old and express it as a percentage of the total student age population in the US. I also apply a HP filter to account for the linear trend of this variable.

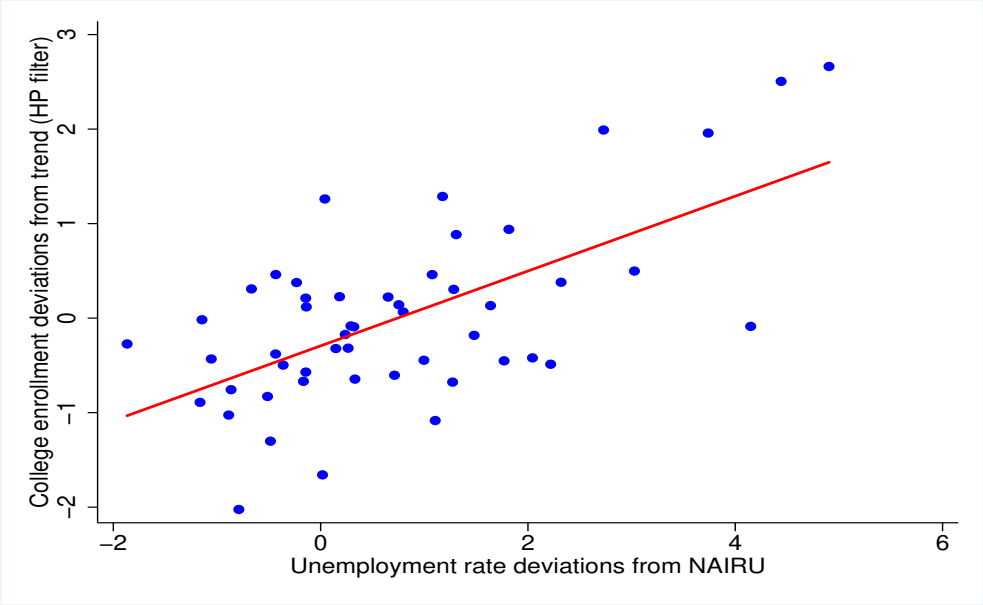
Figure 1 illustrates that aggregate college enrollment has been mainly counter-cyclical. Periods with higher deviations from natural levels of unemployment rate are correlated with higher aggregate enrollment since 1970. I also run a linear regression to examine the relationship between the main dependent variable, yearly college enrollment deviations from

[4]The reason I use the data since 1992 is because the category college dropout was non-existent prior to that date.

[5]More specifically I use the Table A.7: College Enrollment of Students 14 Years Old and Over.

[6]I take the following age groups from the United Nations dataset: 15 years old to 19 years old, 20 to 24, 25 to 29 and 30 to 34.

Figure 1: Aggregate college enrollment is counter-cyclical



Note: In the x-axis I show the difference between national unemployment rate and the Non-accelerating inflation rate of unemployment (NAIRU) and in the y-axis the cyclical component of aggregate college enrollment using HP filter.

Source: CPS IPUMS and FRED.

trend and key business cycle variables, as specified in equation 1. The data spans yearly observations from 1970 to 2020.

$$y_t = \alpha + \beta_1 \text{ business cycle}_t + \epsilon_t \tag{1}$$

In Table 1 I present the regression results encompassing six distinct independent variables, all indicative of various aspects of the business cycle. These variables include unemployment rate deviations from NAIRU, the yearly mean and yearly maximum of the unemployment rate, a binary indicator denoting the occurrence of a recession, the real GDP yearly growth rate and the cyclical component of real GDP.[7] To align these business cycle variables with the academic calendar, I reconfigured them in a manner such that real GDP in 1990 represents the cumulative sum of real GDP from 1989:III, 1989:IV, 1990:I, and 1990:II. This adjustment ensures that the decision to pursue college education commencing September 1990 remains

[7] I am using the NBER recession periods. Since the NBER does not use yearly frequency to define recession periods, I define a recession year in period t if there is at least one recession month in the second half of $t-1$ or the first half of t. For instance, for year 2002, if there is a recession month between July of 2001 and June of 2002 both included, 2002 would be considered a recession year. I do this to account for academic calendar decisions.

independent of macroeconomic realizations in the subsequent two quarters of that year. It is important to note that the business cycle variables at the current time, denoted by t, pertain to the third and fourth quarters of the preceding year, as well as the first and second quarters of the current year. As a robustness, I extend the regression analysis to encompass linear and exponential time trends, yet the results persist unaltered, as presented in Table A1.

Table 1: College enrollment is counter-cyclical

Effect on college enrollment deviations from trend	OLS
Unemployment rate deviations from NAIRU (p.p.)	0.396***
	(0.087)
R-squared	**0.402**
Unemployment rate (p.p.)	0.366***
	(0.099)
R-squared	**0.362**
Maximum Unemployment rate (p.p.)	0.230**
	(0.099)
R-squared	**0.251**
Recession (binary)	0.435*
	(0.250)
R-squared	**0.044**
Real GDP growth (YoY%)	-0.205***
	(0.053)
R-squared	**0.177**
Cyclical component of Real GDP (p.p.)	-31.158***
	(10.500)
R-squared	**0.182**

Source: CPS, World Bank population, UN population by groups, Federal Reserve Bank Saint Louis.

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

College enrollment is strongly counter-cyclical. This effect is both statistically and economically significant. Considering that the student age population in the US has averaged around 80 million people since 1970, an average national unemployment rate increase akin to the magnitude experienced during the last Great Recession, approximately 5.6 percentage points, would be associated with an average upsurge of 1.4 million new students.

Figure A.1 showcases the role of economic growth expectations on aggregate enrollment,

yielding intuitive results.[8] Notably, macroeconomic expectations during the first and second quarters of a given year demonstrate a negative correlation with college enrollment, given that this period precedes the commencement of the academic year. Conversely, the expectations during the third and fourth quarters display no significant impact, as college enrollment is already underway during this phase.

In conclusion, while refraining from asserting any causal relationship, it is evident that college enrollment is manifestly counter-cyclical. The underlying intuition suggests that during high unemployment rate periods, labor market outcomes deteriorate, thereby reducing the opportunity cost of pursuing higher education. However, it is essential to note that high unemployment rate periods may simultaneously exert negative effects on individuals' liquidity, potentially hindering their ability to afford substantial tuition costs. Section 3 is dedicated to probing these two channels, delving into the role of family income and its implications for educational choices amidst economic fluctuations.

2.2 Micro CPS data

I use CPS IPUMS monthly data spanning from January 1992 to December 2022. The CPS adopts a rotating panel design, wherein each individual appears for consecutive 4-month periods, followed by an 8-month absence from the sample, before potentially reappearing for another 4 months. I only keep observations for individuals aged at least 16 years old.

I present two distinct types of data sets: one for longitudinal analyses, enabling a comprehensive examination of individuals' transitions both into and out of college, as well as the transitions from the labor force to college and the other dedicated to cross-sectional investigations. I present descriptive statistics for key variables in Table 2, where I applied the weights using the variable *wtfinl* to account for the sample's representativeness.[9] Additionally, Table A2 presents the same descriptive statistics without any weighting, offering a valuable point of comparison.

For the longitudinal data, the first two columns of the table, I keep an average of nearly four observations per individual to facilitate the study of pertinent transitions. I drop observations after for individuals appearing after the 8 month absence in order to better identify the relevant transitions. In the cross-sectional data set, last two columns, I adopt a cross-sectional approach and keep only one observation per individual. Furthermore, to discern

[8] I regress the same dependent variable, yearly change in enrollment as a % of student age population with expected growth of real GDP from the Survey of Professional Forecasters using the Annualized Percent Change of Mean Responses for real GDP forecast. Figure A.1 shows the main coefficients of expectations about yearly growth real GDP in current time. In the horizontal axis I show the effect of these expectations for the four different quarters. In Figure A.2 I do the same exercise using one quarter ahead forecasts.

[9] All econometric analysis presented in the paper will be using these weights as suggested by CPS IPUMS.

Table 2: CPS IPUMS data: Descriptive Statistics weighted

	Longitudinal		Cross-sectional	
	All ages	Age ≤ 25	All ages	Age ≤ 25
Age	29.72	20.07	43.60	20.44
Sex (Female %)	50.46	50.24	51.55	50.20
Race (White %)	75.74	76.42	80.20	76.52
High-school diploma or less (%)	49.16	61.85	47.79	60.85
Some college and assoc. degrees (%)	27.46	28.73	26.31	28.46
Bachelor's or more (%)	23.38	9.42	26.01	10.68
Weekly earnings ($)	744.47	381.38	743.89	388.87
	Family Income (x = Yearly Income)			
Low % ($x <$ \$30,000)	28.53	37.00	31.82	39.05
Middle % (\$30,000 $\leq x <$ \$75,000)	36.76	37.11	39.42	36.97
High % ($x \geq$ \$75,000)	34.71	25.89	28.77	23.98
Labor force (%)	71.98	61.79	66.20	63.55
Employed (%)	65.64	53.51	61.93	55.18
Unemployed (%)	6.34	8.27	4.27	8.37
Appearances	3.76	3.73	1	1
Individuals	**1,973,561**	**1,038,132**	**5,011,241**	**1,324,698**

Source: CPS IPUMS.

the heterogeneous effects across different family income levels, I limit the second data set to a sub-sample comprising individuals aged 25 or younger.[10]

The first data set, featured in the first two columns, is exclusively dedicated to analyzing transitions both into and out of college, as well as the transitions from the labor force to college. Consequently, it includes observations solely from individuals who have participated in high school or college during the course of the data, discernible by a non-zero value of the variable *SCHLCOLL* This filtering criterion leads to a substantially lower average age in the first data set, rendering it especially conducive to investigating the diverse and crucial transitions in the educational and labor market spheres.

The variable "family income" serves as a crucial metric, capturing the aggregate income received by all members of the householder's family over the past 12 months. Focusing the analysis on young individuals is crucial to better proxy this variable as external for the young individual, so one can think about it as parental income. The questionnaire explicitly defines the components comprising this income, encompassing money derived from employment, net business or rental income, pensions, dividends, interest, social security payments, and any other monetary inflows received by family members aged 15 years or older.

[10]Family income variable also includes own individual's earnings. however, at young ages this correlation is close to 0.

Given its categorical nature and the change in criterion as of October 2003, I categorize this variable into three distinct groups with comparable weights. The sample divides into three income cohorts as follows: low-income individuals, constituting approximately 30% of the sample, comprise individuals with an annual family income below $30,000. middle-income individuals, representing approximately 40% of the sample, encompass those with family incomes ranging between $30,000 and $75,000. Lastly, high-income individuals, accounting for around 30% of the sample, pertain to those with an annual family income exceeding $75,000.[11]

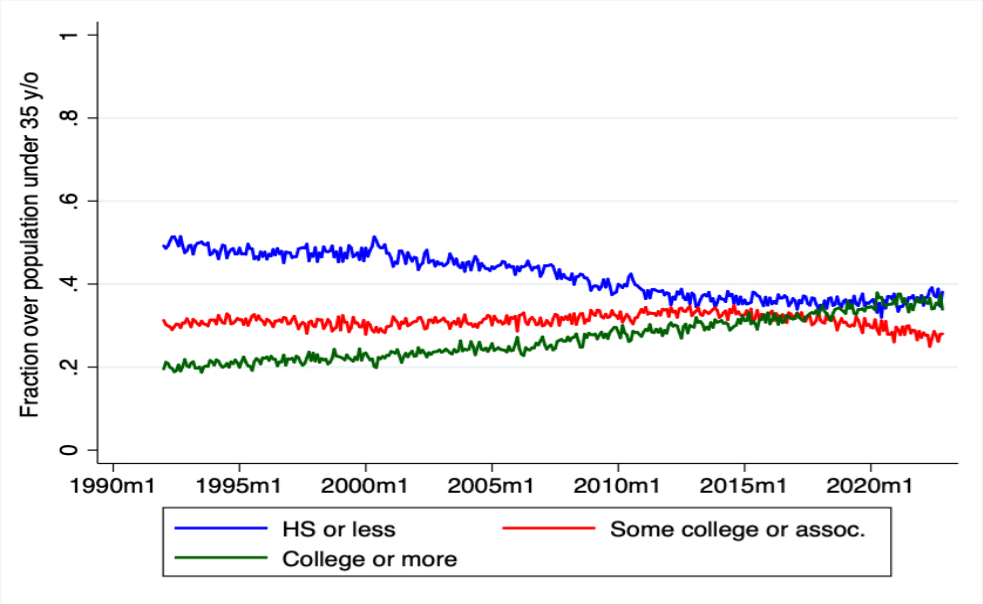
The variable "education" ($EDUC$), extracted from the CPS dataset, provides the educational attainment levels prevalent within the sample. I only keep the period from 1992 to 2022 because there was a change in the categorical groups included in January of 1992. In Table A3, I present a comparative analysis of this variable between the two distinct sample periods, encompassing the option "Some college but no degree" solely from January 1992 onwards. Notably, prior to 1992, the absence of a response dedicated to potential college dropouts renders it challenging to discern between college dropouts and individuals possessing completed college degrees that are shorter (e.g., 1, 2, or 3 years). To address this concern, I deliberately focus the analysis from 1992 onwards to ensure the reliability and integrity of the data.

In Figure 2 I illustrate the evolving trends in the three principal educational level groups over time. The low educational attainment group, encompassing individuals with a high school diploma or less, accounted for approximately 50% of the employed population below 35 years old in 1992. However, this figure has subsequently decreased and now stands at below 40%. Conversely, the high educational attainment group, comprising individuals with a bachelor's degree or higher, constituted a mere 20% of the employed population in 1992, but this proportion has risen significantly to almost 40% in recent times.

The intermediate group comprises individuals with some higher education but lacking a bachelor's degree. Over the observed period, this education category exhibited no distinct trend, experiencing only a modest increase from 30% in 1992 to 28% in 2022. To provide a comprehensive view, Figure A.3 offers a graphical depiction of the evolving dynamics within this educational group, further disaggregated into three distinct categories. For analytical purposes, I adopt the subcategory "some college but no degree" as a proxy for college dropouts, constituting 23% of the sample under 35 years old since 1992. Nonetheless, it is pertinent to acknowledge that this choice presents a potential issue due to the inherent

[11]These brackets of income are in current $ terms, so they are not normalized because I do not observe the exact amount, but just the bracket in which an individual belongs to. This should not be an issue given that the brackets are sufficiently broad. I will also control for year of the interview and for time trends within income group in the main regressions

Figure 2: Evolution of educational groups over time.



inclusion of currently enrolled students within the "some college but no degree" category, as will be elaborated upon in subsequent sections.

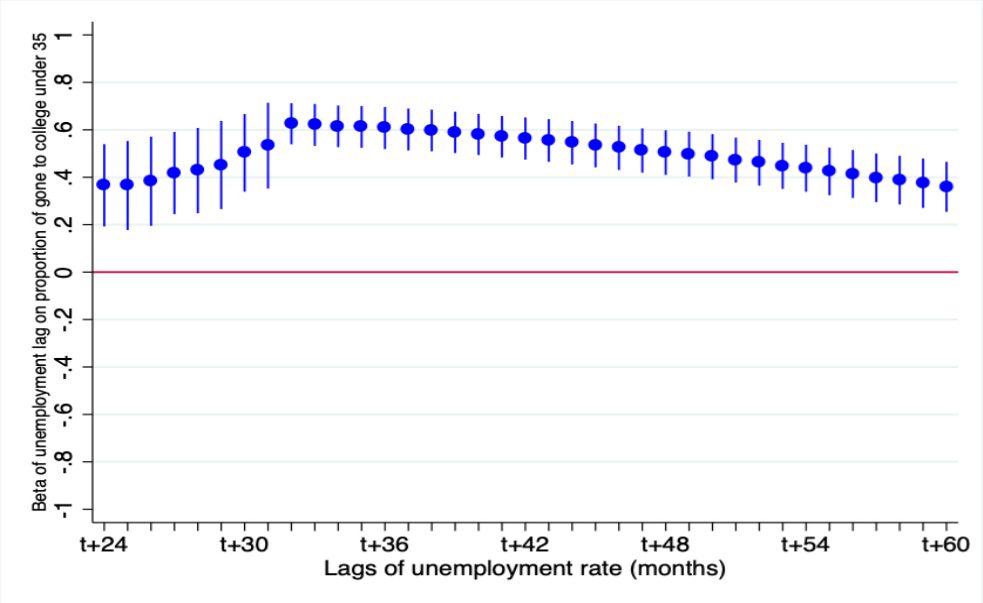
I use national business cycles in the US to show how the proportions of people who attended college and degree holders change in the aftermath of a rise in unemployment rate. I run the following regressions:

$$y_t = \beta_0 + \sum_{l=24}^{60} \beta_l x_{t-l} + \beta_2 t + \beta_3 e^{at} + \epsilon_t, \tag{2}$$

where y_t represents the proportion of individuals aged 35 years or younger who have attended college, while x_{t-l} denotes the national unemployment rate l months in the past. Employing a comprehensive set of lags ranging from the 24th month (2 years) to the 60th month (5 years) (as depicted in Figure 3), I systematically examine the relationship between x_{t-l} and y_t. In light of the conspicuous trends evident in the data, I incorporate both a linear time trend and an exponential time trend in the regression analyses. This augmentation allows for a more comprehensive examination of temporal dynamics and better captures the underlying temporal patterns present in the data. To conduct the regressions, each of the x_{t-l} values corresponding to various lags is situated along the horizontal axis, while the corresponding coefficient β_l, together with its 95% confidence intervals, is plotted on the vertical axis.

The empirical analysis reveals a positive and statistically significant relationship between the proportion of individuals who have pursued college education and the unemployment rate, particularly with a time lag ranging from 2 to 5 years. Importantly, the observed effect is not only statistically robust but also holds considerable economic significance. For instance, an incremental rise of 1 percentage point in the unemployment rate is associated with an average increase of 0.6 p.p. in the proportion of young individuals attending college, observed 3 years later. This substantial increment represents approximately 1% of the overall proportion of individuals aged under 35 years who have pursued college education. Consequently, an economic shock equivalent to the magnitude of the 2008 crisis would be correlated with a relative increase of approximately 5.8% in the proportion of college attendees, observed 3 years after the crisis event after controlling for time trends. The outcomes without the inclusion of time trends are presented in Figure A.4, and they demonstrate analogous patterns, albeit with notably larger coefficients.

Figure 3: Effect of lag unemployment rate on the proportion of people who has gone to college



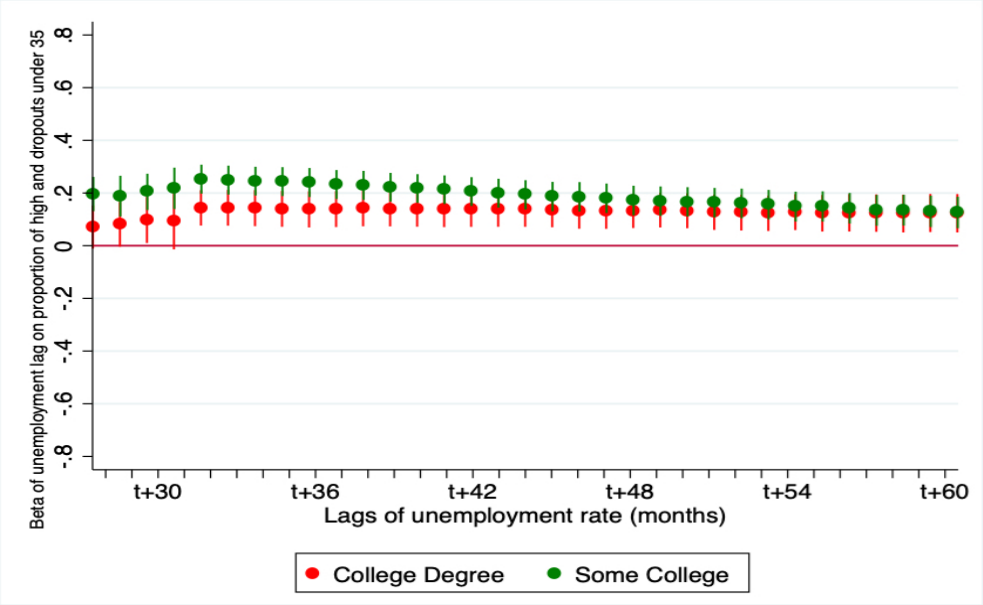
Note: Each dot (with its corresponding confidence interval) represents the main coefficient of an unemployment rate lag on the proportion of people (under 35) who have gone to college. I represent β_l of the following regression: $y_t = \beta_0 + \sum_{l=24}^{60} \beta_l x_{t-l} + \beta_2 t + \beta_3 e^{at} + \epsilon_t$, where x_{t-l} is the unemployment rate l months ago and y_t is the current proportion of people who has gone to college.

I extend the analysis to explore the proportions of individuals possessing some college

education without completing their degrees and those holding a college degree, all aged under 35 years. In Figure 4, the green line depicts a substantial increase in the proportion of individuals with some college education in response to unemployment with a time lag of 2 to 5 years. This observed effect, once again, bears economic significance. A 1-percentage point surge in the US unemployment rate corresponds to a rise of 0.2 percentage points in the proportion of individuals with some college education but no degree, observed around 2 to 3 years later, representing a 1% relative increase. Notably, an economic shock akin to the magnitude of the 2008 crisis would have been correlated with a 5% relative increase in the proportion of individuals with some college education. In contrast, the red line illustrates the effects on the proportion of individuals holding a college degree, displaying a positive reaction with a time lag of 4 to 5 years, commensurate with the typical duration of college degree attainment. Specifically, a 1-percentage point rise in the unemployment rate leads to a 0.2 percentage point increase in the proportion of individuals with college degrees, observed 5 years later. This increment accounts for 1% of the population aged between 16 and 35 years holding a college degree. Analogously, an economic upheaval on the scale of the 2008 crisis would have been linked to an impressive 6.5% relative increase in the proportion of college degree holders, evident 5 years subsequent to the crisis. The coefficients exhibit a doubling in magnitude when the time trends are not accounted for, as depicted in Figure A.5.

A notable observation from Figure 4 pertains to the category "some college but no degree", encompassing both individuals who will eventually complete their degrees and current students who have yet to complete the program. This introduces an evident issue, as the proportion of individuals with college degrees starts reacting to the lag in the unemployment rate only 4 years later, while the proportion of those with some college displays earlier reactions. To address this complexity and better capture the dynamics surrounding college dropouts, it becomes imperative to employ more sophisticated econometric tools, which will be deployed in the ensuing section of this paper. These enhanced methodologies will enable a more refined examination of college attendance and dropout patterns, providing deeper insights into the interplay between economic conditions and educational decisions. In Figure A.6, I also examine the response of the proportion of individuals holding associate degrees to lags in the unemployment rate. Interestingly, the proportion of associate degree occupational holders appears to be insensitive to the lag in the unemployment rate, displaying a lack of significant reaction. However, the proportion of academic associate degree holders demonstrates an increase in response to a lagged rise in the unemployment rate. The observed increase in academic associate degrees is of 4% in this particular group of young individuals with a 1-percentage point increase in the unemployment rate.

Figure 4: Effect of unempl. rate on the prop. of people with some college (green) and college degree (red).



Note: Each dot (with its corresponding confidence interval) represents the main coefficient of an unemployment rate lag on the proportion of people (under 35) who have some college education (green) and a college degree (red). I represent β_l of the following regression: $y_t = \beta_0 + \sum_{l=24}^{60} \beta_l x_{t-l} + \beta_2 t + \beta_3 e^{at} + \epsilon_t$, where x_{t-l} is the unemployment rate l months ago and y_t is the current proportion of people who has some college education (in green) or has a college degree (in red).

Subsequently, I extend the analysis by estimating Equation (2) separately for each state, utilizing state-specific unemployment rates. Figure A.7 shows the analogous trend for college enrolled students by state. As depicted in Figure A.8, the proportion of the high-skilled population exhibits a somewhat moderate increase, with a 4 to 5 year lag in response to state-level unemployment rates. Moreover, Figure A.9 presents a box plot showcasing the dropout proportions across states. The box plot illustrates the average (line) and the interquartile range, representing the 25th to 75th percentile of all 51 betas corresponding to individual states.

In essence, the findings underscore the counter-cyclicality of college enrollment, where individuals are more inclined to enroll in college during adverse macroeconomic conditions. This counter-cyclicality is economically significant as well. Moving forward, in Section 3, I outline the empirical approach designed to shed light on how this counter-cyclicality in college enrollment translates into college completion and explores the degree to which counter-cyclicality varies across different income levels. Additionally, the section will unveil the

two principal empirical findings concerning income mobility arising from the cyclicality of educational choices. These findings are instrumental in enhancing our comprehension of the implications of business cycles on educational decision-making and their subsequent impact on income mobility.

3 Empirical Findings

I present the central empirical findings of the paper in this section, which shed light on the differential responses of college enrollment and completion to the changes in unemployment rate, contingent on family income groups. High unemployment rates exert varying impacts on individuals' decisions concerning college enrollment based on their family income levels. These empirical findings are key to unveil the main mechanisms underpinning the theoretical model. Particularly, the presence of liquidity constraints and the strategic efforts to evade scarring effects stemming from bad labor market entry become pronounced during high unemployment rate periods. The influence of liquidity constraints becomes notable as it compels individuals with lower incomes to prematurely drop out from college. Conversely, high-income individuals are more inclined to proactively enroll in college, seeking to avoid the lasting scarring effects associated with bad labor market entries. In Section 3.1 I analyze responses following a rise in state's unemployment rate while being enrolled in college or in the labor force, whereas in Section 3.2 I analyze responses following a rise in state's unemployment rate around high school graduation. Notably, in all analyses including different income groups, the dataset is limited to individuals aged below 25 years, mitigating the potential correlation between personal income and overall family income at older ages.

3.1 Low-income are scarred and high-income are strategic

Before analyzing the heterogeneous responses of experiencing high unemployment rates while being enrolled in college for young individuals it is important to quantify the scarring effects of experiencing a bad labor market entry. I estimate the following regression model which brings similar results as Schwandt & Von Wachter (2019):

$$y_{i,t} = \beta_0 + \beta_1 u_i^{HS} + \Gamma \mathbf{X}_{i,t} + \epsilon_{i,t}, \tag{3}$$

where $y_{i,t}$ is the outcome variable: real earnings or a binary equals 1 if the individual was unemployed t years after own high school graduation, u_i^{HS} is the state's unemployment rate at high school graduation date and $\mathbf{X}_{i,t}$ are controls such as sex, race and the year of

the interview.[12]

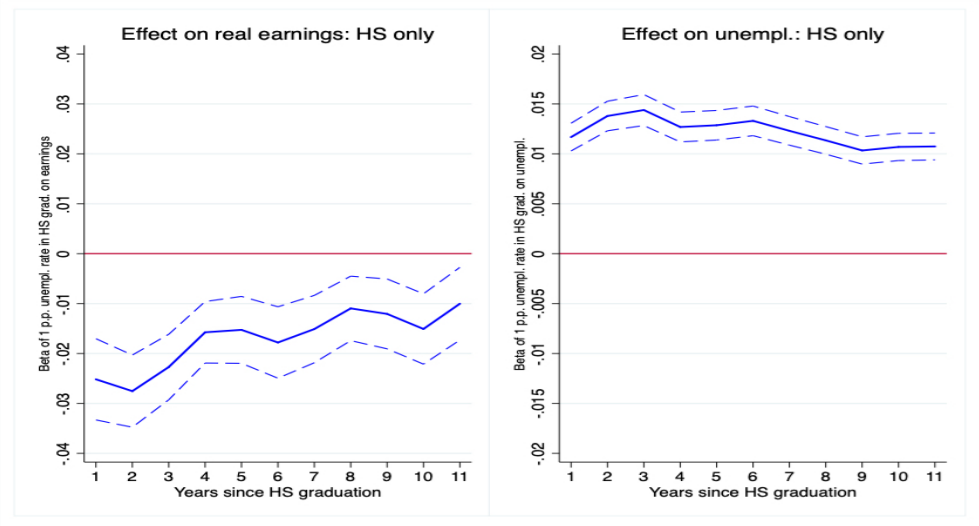
Figure 5a presents the dynamic evolution of coefficient β_1 over t periods following high school graduation. The findings reveal that a 1 percentage point (p.p.) increase in state's unemployment rate around high school graduation is associated with a notable decline in average real earnings, ranging from 1 to 3 p.p., persisting for over a decade after high school completion. Concurrently, there is an approximate 1 p.p. increase in the probability of experiencing unemployment. However, upon shifting the focus to individuals who graduated from college, as demonstrated in Figure 5b, the effects of state's unemployment rate on earnings and unemployment are markedly mitigated. In the college sample, β_1 is exhibited starting 5 periods after high school graduation since individuals with a college degree typically do not enter the labor force before that time. The results are consistent with intuitive expectations, where a high school graduation coinciding with a period of high unemployment rate leads to adverse impacts on earnings and unemployment probabilities primarily for those who enter the labor market. In contrast, enrolling in college during economic downturns presents the advantage of postponing labor market entry, thereby evading these deleterious and enduring consequences.

These findings are economically significant. For instance, the accumulated earnings losses resulting from entering the labor force during a recession akin to the 2009 Great recession would translate to a substantial 10% decline in real earnings over the initial decade of employment, all while accounting for being employed with equivalent probability. Additionally, entering the labor force during an economic state akin to the 2009 Great recession would be linked to a 6.7 p.p. higher likelihood of experiencing unemployment during the ten years following high school graduation. Thus, accounting for the higher probability of being unemployed, entering the labor market during a recession similar to the 2009 one is correlated with a significant reduction in real earnings of around 16% for the first decade after entry. However, it is worth noting that the detrimental effects of entry are comparatively lower and less persistent for college graduates, as depicted in Figure A.10.

Based on these findings, I examine whether young individuals from richer families tend to start their labor force participation during better macroeconomic conditions when compared to those from relatively disadvantaged households. To address this aspect, I use the longitudinal data shown in section 2.2. I observe an individual for up to four consecutive months, then she disappears for the subsequent 8 months and appears again in the sample for four more consecutive months. I only keep the first up to four appearances for all individuals, nevertheless, the results are robust to maintaining the full sample. The subsequent pooled

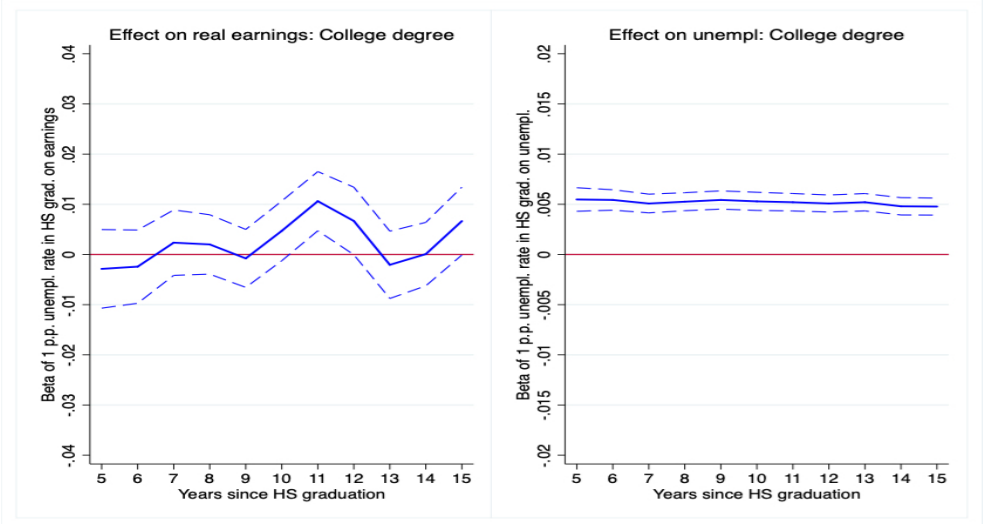
[12] I use the average state's unemployment rate from January to May of the graduation year as a proxy for u_i^{HS}

Figure 5: Negative and persistent effects of graduating high school during recessions.



(a) High School only

Note: The x-axis represents the age group in the regression, that is, for the high school group, 2 years since HS graduation comprises people who are 20 years old (since I assume they graduate from high school when they are 18). I represent β_1 for each age group of the following regression: $y_{i,t} = \beta_0 + \beta_1 u_i^{HS} + \Gamma \mathbf{X}_{i,t} + \epsilon_{i,t}$, where u_i^{HS} is the unemployment rate that this cohort group experienced when they graduated high school.



(b) College degree

Note: The x-axis represents the age group in the regression, that is, for the college group, 6 years since HS graduation comprises people who are 24 years old (since I assume they graduate from high school when they are 18). I start at 5 years since HS graduation because for this sample they have attended college after graduation. I represent β_1 for each age group of the following regression: $y_{i,t} = \beta_0 + \beta_1 u_i^{HS} + \Gamma \mathbf{X}_{i,t} + \epsilon_{i,t}$, where u_i^{HS} is the unemployment rate that this cohort group experienced when they graduated high school.

regressions are conducted as follows:

$$z_{i,t} = \alpha_0 + \alpha_1 u_t + \alpha_2 \text{Mid. Inc.} \times u_t + \alpha_3 \text{High. Inc.} \times u_t + \Gamma \mathbf{X}_{i,t} + \nu_{i,t}, \tag{4}$$

where $z_{i,t}$ is a binary that takes value 1 if the individual has transitioned from being enrolled in college to not be currently enrolled in that particular month, and 0 if she stayed in school. That is, an individual appearing four consecutive months, if she was working in the first period, then enrolled in college in the second period and she kept enrolled during the third month and finally dropped out of college in the last month, $z_{i,t}$ would be: $z_{i,t} = N/A$ for $t = 1$, $z_{i,t} = 0$ for $t = 2$, $z_{i,t} = 0$ for $t = 3$ and $z_{i,t} = 1$ for $t = 4$. If she is not enrolled nor has she been enrolled during this time range then $z_{i,t}$ is missing. Another example, if an individual appears to be enrolled in college the first month and then she drops out in the second period we would have: $z_{i,t} = 0$ for $t = 1$, $z_{i,t} = 1$ for $t = 2$ and $z_{i,t} = N/A$ for $t = 3$ and $t = 4$. I also run the regression for which $z_{i,t}$ takes value of 1 if the individual has transitioned from the labor force to college and 0 if she has stayed in the labor force.

u_t is the current state's unemployment rate during the interview.[13] I control for sex, race, age, income group, time of the interview and a time trend interacted with income group. From this analysis I exclude people who complete the degree, therefore only considering people who leave college without earning the degree.

Table 3: Transitions from enrolled to dropout and from labor force to enrolled

	College Dropouts	LF → College
u_t	**0.112****	**0.020**
	(0.057)	(0.069)
Mid. Inc. × u_t	-0.190***	0.405***
	(0.057)	(0.088)
High. Inc. × u_t	-0.169**	0.424***
	(0.065)	(0.120)
Obs.	672,803	1,935,398
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	**-0.078****	**0.425*****
Test High ($\alpha_1 + \alpha_3$)	**-0.057***	**0.445*****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

I present the results of the pooled regression in Table 3 and the results of the panel regression in Table A5. Individuals from lower income backgrounds are indeed more sus-

[13] I also run the same regressions using the lag of unemployment rate as well. The results are robust to these specifications as shown in Table A4

ceptible to experiencing scarring effects generated by periods of high unemployment rate periods. Specifically, the positive coefficient $\hat{\alpha}_1 > 0$ indicates that, on average, low-income individuals are more prone to drop out of college during periods of high unemployment rates. Contrary, the coefficients $\hat{\alpha}_1 + \hat{\alpha}_2 < 0$ and $\hat{\alpha}_1 + \hat{\alpha}_3 < 0$ reveal that middle-income and high-income individuals actually are more inclined to persist in their college enrollment during high unemployment rate periods.

A distinct pattern emerges when analyzing the second column of the same table. Here, the results indicate that low-income individuals exhibit no significant change in their likelihood of transitioning from the labor force to college during unfavorable economic conditions, whereas their middle and high-income counterparts are substantially more likely to undertake such transitions. Tables A6 and A7 portray a parallel analysis employing the max and the mean state's unemployment rate encompassing the 4 months leading up to the interview, which encompasses the ongoing month as well. This approach is chosen to accommodate transitions occurring at any point within this 4-month window for each individual, and it yields results that are virtually indistinguishable from the previous analysis.

In Table A8 I show the same results but redefining the low-income group to be those who earn less than \$7,500 instead of less than \$30,000 so that they represent the bottom 5% of the income distribution instead of the bottom 30% as in the main analysis. This analysis reveals that for this poorest income group the effects are stronger. The poorest individuals are more likely to drop out and less likely to enroll in college in periods of high unemployment.

The economic implications of these findings are of notable significance. A rise in state's unemployment rate akin to the 2009 crisis is associated with a 0.6 percentage point increase in the likelihood of dropping out of college for low-income individuals, constituting 7% of the mean (or a rise in this probability by a factor of 1.07). Conversely, the same increase in unemployment is linked to a 0.4 percentage point decrease, equivalent to 5% of the mean (rise in this probability by a factor of 1.05), in the probability of dropping out of college for middle-income individuals, and a decrease of 0.3 percentage points, equivalent to 4% of the mean, for their high-income counterparts. When examining the probability of transitioning from the labor force to college, there is almost no change for low-income individuals during periods of high unemployment rates. In contrast, this rise in unemployment corresponds to an increase in this probability of 2.4 percentage points, accounting for 20% of the mean, for middle-income individuals, and a rise of 2.5 percentage points, equivalent to 15% of the mean, for high-income individuals.

Putting the focus on the poorest 5% of the sample, instead of the entire low-income bracket, the results are substantially larger. The same rise in state's unemployment rate is correlated with a 0.83 percentage point increase in the likelihood of dropping out of college

for low-income individuals, constituting 12.4% of the mean (or a rise of this probability by a factor of 1.124). This same rise in unemployment corresponds to a reduction in the probability to transition from the labor force to college for this income group of 3.72 percentage points, accounting for 16.2% of the mean.

These initial empirical findings shed light on the substantial role financial constraints play, particularly during recessions, impacting low-income individuals by compelling them to prematurely drop out of college. This often forces them into the labor force during unfavorable economic conditions, thereby incurring the aforementioned scarring effects. Intuitively, the financial constraint mechanism appears less present for high-income enrollees, as they appear more likely to persist in college even amidst periods of high unemployment rates. Moreover, high-income individuals exhibit strategic behavior within the labor force, choosing to enroll in college during economic downturns, strategically optimizing their entry conditions. In summary, this analysis underscores that low-income individuals bear the lasting scars of economic recessions—stemming from adverse labor market entries and the inability to complete their degrees due to financial constraints—while high-income individuals strategically avoid these scars by leveraging college enrollment.

3.2 College enrollment and completion disparities

In general, high-income individuals are more likely to go to college. In Table 4 I provide an insight into the educational composition disparities across different income groups. In the upper section of the table, the proportions of individuals aged below 25 years old possessing solely a high school diploma and those with some level of college education are depicted within each income group. For instance, within the low-income group, 30.15% have obtained a high school diploma only, while 34.67% have pursued higher education.[14] In the lower section, I present a measure of the relative disparities in these proportions within income groups. Specifically, the proportion of young individuals with college attendance relative to those with only a high school diploma is 2.06 times higher for high-income individuals than for their low-income counterparts. In comparison, this difference is relatively smaller at 1.27 times higher for middle-income individuals compared to low-income individuals. Notably, these disparities have exhibited a downward trend since 1992, as illustrated in Figure A.11. However, for the purpose of establishing baseline disparities across income groups, I present the average disparity ratios spanning from 1992 to 2022 in the table. These figures serve as

[14]Therefore, the remaining 35.18% do not have a HS diploma. I disregard the proportion of people with no HS diploma in the analysis since the main independent variable I will use in the following econometric regressions will be using unemployment rate at the time of High school graduation to explain educational choices.

crucial benchmarks in the examination of educational discrepancies among varying income strata.

Table 4: Composition of education by income groups

% within income group	HS diploma only	Gone to college
low-income	30.15	34.67
middle-income	26.49	38.70
high-income	18.75	44.31
Disparity Ratios	Gone to College / HS only	
Mid. inc. / low-income	1.27	
High inc. / low-income	2.06	

Source: CPS IPUMS.

Note: The top panel represents the proportions of people aged between 18 and 25 years old who have a high school diploma only or have gone to college within each income group. The remaining fraction corresponds to young people who does not have a high school diploma. Notice that, for low ages, it is common to not have completed high school yet. These proportions are only informative as baseline relative comparisons between income groups. In the bottom panel I display disparity ratios, which show the fraction of people who have gone to college with respect to people with a high school only for middle (high) income divided by the same fraction for low-income. That is $(\frac{\text{Gone to college}}{\text{HS only}})^{\text{Middle-income}} / (\frac{\text{Gone to college}}{\text{HS only}})^{\text{Low-income}}$

In Table 5 I present the disparity ratios between income groups concerning college dropouts and individuals with only a high school diploma, as well as between college degree holders and those with solely a high school education. In order to obtain a more accurate representation of college dropouts, I limited the sample to young adults not currently enrolled in college. This measure was taken to address the issue of including current students within the subcategory of "some college but no degree", who are yet to complete their degrees. Consequently, the first column of "high school only" in the current table may not align precisely with the previous table, given the restricted sample. Additionally, I show the evolution of these disparity ratios in Figure A.12 and Figure A.13, providing a comprehensive temporal perspective on the educational discrepancies across income groups in relation to college dropouts and degree holders.

The disparities in educational attainment have significant implications for lifetime earnings, with high-income young adults generally exhibiting a higher likelihood of possessing college degrees or some college education, leading to comparatively higher average earnings. Figure 6 provides a detailed illustration of the average real earnings trajectory by age for each educational group. The chart starts at age 16 for the "high school only" group, age 20 for college dropouts, and age 22 for college degree holders. Notably, all educational groups

Table 5: Composition of education by income groups

% within income group	HS diploma only	Dropout	College degree
low-income	33.26	13.47	6.86
middle-income	28.41	13.50	11.31
high-income	19.68	12.06	15.43
Disparity Ratios		Drop. / HS	Col. degree / HS
Mid. inc. / low-income		1.17	1.93
High inc. / low-income		1.51	3.80

Source: CPS IPUMS.

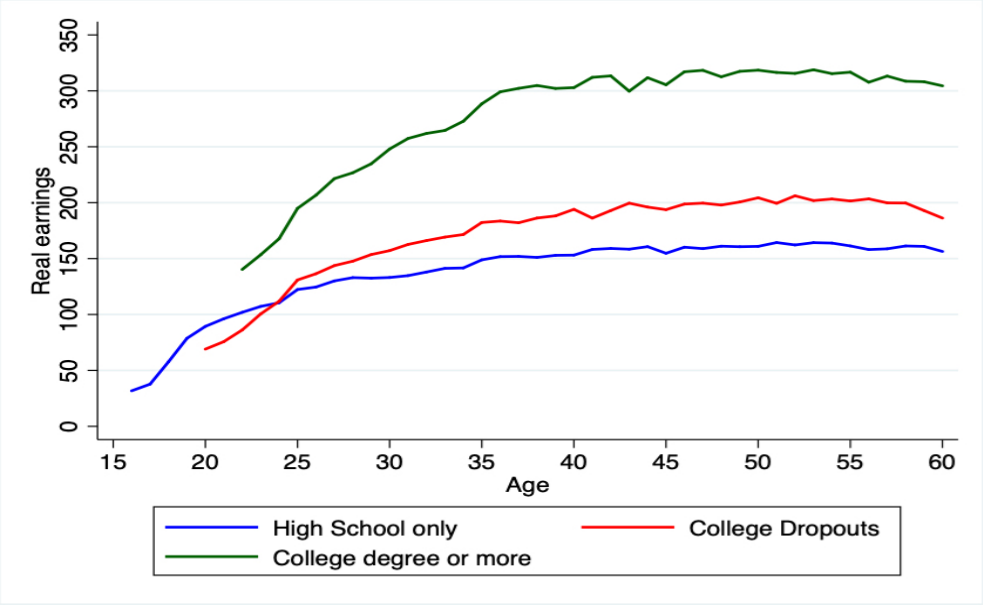
Note: The top panel represents the proportions of people aged between 18 and 25 years old who have a high school diploma only, are college dropouts or have a college degree within each income group. For this analysis I excluded people who are currently enrolled in college to better identify college dropouts. In the bottom panel I display disparity ratios, which show the fraction of people who have a college degree (or dropout) with respect to people with a high school only for middle (high) income divided by the same fraction for low-income. That is $(\frac{\text{College degree}}{\text{HS only}})^{\text{Middle-income}}/(\frac{\text{College degree}}{\text{HS only}})^{\text{Low-income}}$

reach their earnings peak around the ages of 45 to 50. It is intuitive that college dropouts initially earn less than individuals with no higher education due to their lack of experience; however, they eventually surpass the earnings of their non-college-educated counterparts by 7% over their lifetime. Meanwhile, college degree holders earn, on average, a remarkable 64% more than those without a college education during their lifetime. Figure A.14, which depicts the same graph for the year 2022, reveals a nearly identical earnings pattern to the entire sample, reinforcing the long-term consequences of disparities in educational choices.

In Figure 7 I provide an extensive examination of the occupational sorting patterns among young adults with different educational backgrounds across 79 distinct occupational categories within the dataset (all except the military which I excluded). To facilitate analysis, I aggregate observations of individuals aged below 35 years old based on their occupation and educational groups.[15] The bar graph illustrates the relative proportions of workers in each occupational bracket. Notably, individuals with only a high school (HS) diploma exhibit a substantial share of workers (approximately 45%) in the bottom 30 occupations in terms of average earnings, compared to less than 20% for those with a college degree. Conversely, individuals with college education constitute a significant portion (almost half) of the workforce in the top 20 highest-earning occupations, while the same proportion is notably lower for those with only a high school diploma. Examining occupations by volatility reveals that people with only a high school diploma are over-represented (around 30%) in

[15]I use 35 years old instead of 25 to do this exercise in order to have more observations of employed individuals.

Figure 6: Lifetime real earnings by educational group



Note: I plot the average real earnings collapsed by age for each educational group. Again, I exclude current enrolled students to better identify college dropouts.

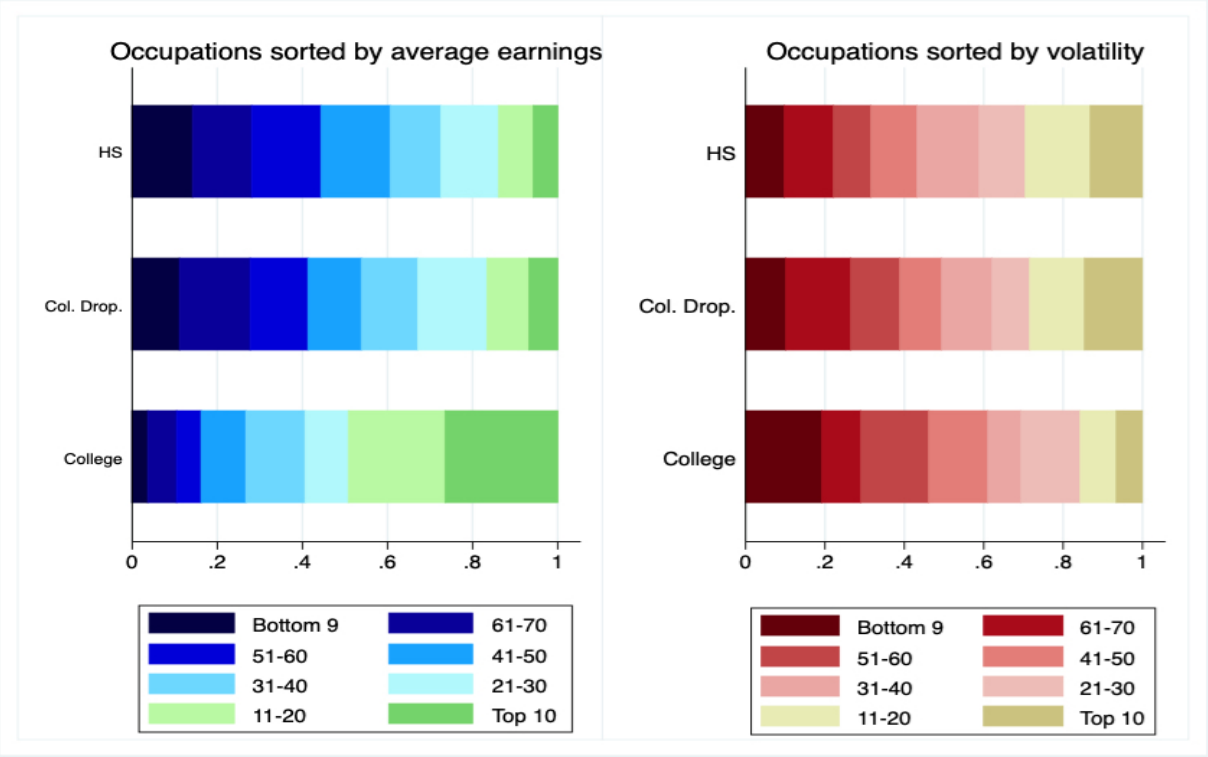
the top 20 most volatile occupations, while college-educated individuals tend to work in more stable jobs, with almost 20% in the bottom 9 occupations in terms of volatility. Figure A.15 presents a different representation, showing the cumulative proportion of individuals per occupation, instead of groups of 10 occupations, from lower to higher average earnings in the left panel, and from less to more volatile occupations in the right panel.

Considering the substantial variations observed in lifetime earnings and occupational choices across distinct educational groups, although I am not suggesting a direct causal relationship between obtaining a college degree and real earnings from the previous charts, it becomes imperative to explore the potential effects of periods of high unemployment rates on subsequent college enrollment for individuals belonging to different income strata. To address this inquiry, I analyze the micro CPS IPUMS monthly dataset spanning from January 1992 to December 2022. Employing cross-sectional data, I estimate the following linear probability model regression that shows the echo effect of having experienced high unemployment rates during your high school graduation on your future educational attainment:

$$y_{i,t} = \beta_0 + \beta_1 u_{i,t}^{HS} + \beta_2 \text{Mid. Inc.}_{i,t} \times u_{i,t}^{HS} + \beta_3 \text{High. Inc.}_{i,t} \times u_{i,t}^{HS} + \Gamma \mathbf{X}_{i,t} + \epsilon_{i,t}, \qquad (5)$$

where $y_{i,t}$ is a binary that equals 1 if an individual has gone to college at some point in

Figure 7: Occupation sorting by earnings and volatility. Relative proportion by educational group.



Note: In the left panel I show the proportion of workers in each occupation bracket for three different educational groups. Occupations are sorted by average real earnings. For instance, people with only high school they tend to be over-represented in occupations with lower average real earnings whereas people with a college degree they tend to be over-represented in the top-10 occupations in terms of average real earnings. In the right panel I repeat the exercise but the occupation sorting is done via occupation volatility. So, bottom 9 occupations are the 9 occupations with lower volatility in their earnings across time.

their lifetime relative to having only a high school diploma, and 0 otherwise. I also explore in separate regressions the probabilities of being a college dropout and a college graduate. The state's unemployment rate around high school graduation, denoted as $u_{i,t}^{HS}$, is considered as the key variable of interest, and it is interacted with the family income group. $\mathbf{X}_{i,t}$ are control variables such as age, race, sex, year of the interview and family income group. Specifically, I focus on estimating the coefficients β_2 and β_3, which represent the interaction effects of the state's unemployment rate around high school graduation with the family income group. For the low-income group, the coefficient β_1 represents the marginal effect of the state's unemployment rate around high school graduation, while for the middle-income group, it is $\beta_1 + \beta_2$, and for the high-income group, it is $\beta_1 + \beta_3$. It is noteworthy that the subscript t is absent as this analysis is cross-sectional, examining variations across individuals.

Since the dataset does not provide precise graduation dates I construct a proxy for them. I rely on the year of the interview and the individual's age, assuming that high school graduation occurs at 18 years old. Accordingly, I use the average state's unemployment rate during January to May of the graduation year as a proxy for the macroeconomic conditions at that time.[16] Furthermore, I adopt the assumption that an individual's family income group at the time of the interview reflects their income group at the time of high school graduation. This assumption should not be problematic given the age range of individuals considered, between 18 and 25 years old, and the relatively broad nature of family income categories, which do not undergo substantial changes within a few years.

Table 6: College enrollment and the business cycle

	Attended college
u_i^{HS}	**0.151**
	(0.138)
Mid. Inc. $\times$ u_i^{HS}	0.370
	(0.244)
High. Inc. $\times$ u_i^{HS}	0.310
	(0.277)
Clustered SE state	Yes
Obs.	838,668
R-squared	0.057
Test Middle ($\beta_1 + \beta_2$)	**0.521*** **
Test High ($\beta_1 + \beta_3$)	**0.461** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

I present the estimated coefficients in Table 6 that describe the echo effect of having experienced a rise in state's unemployment around high school graduation on an individual's educational attainment some months or years after, derived from equation (5) and clustering standard errors at the state level. A 1 percentage point increase in state's unemployment rate around high school graduation on college enrollment is correlated with a 0.151 percentage point increase on the probability of having attended college for low-income individuals, the effect is not statistically significant. For the middle-income group the combined effect is

[16]The analysis is replicated with alternative specifications, utilizing both the maximum unemployment rate between January and May, and solely the unemployment rate in May. Robustness checks show that the results hold under each of these specifications. This choice of months is deliberate, as it coincides with the period when recent graduates initiate their job search or submit college applications. Examining macroeconomic conditions later in the year would not capture these crucial decision-making processes as effectively.

substantially larger, of $\beta_1 + \beta_2 = 0.151 + 0.370$ amounting to 0.521 percentage points, and for the high-income group the effect is $\beta_1 + \beta_3 = 0.151 + 0.310$, which results in a 0.461 percentage point increase. I also run these regressions but using the bottom 5% as the low-income in Table A9. We observe that for this group the probability of having attended college following a period of high unemployment rate around high school decreases.

The economic implications of these findings are noteworthy. For instance, a rise in the state's unemployment rate akin to the 5.6 percentage point increase observed during the 2009 crisis would correlate with a significant divergence in the college-to-high school enrollment ratios, as evident from the results in Table 4. Based on the linear probability model coefficients presented in Table 6, the middle-to-low-income ratio would increase from 1.27 to 1.39, representing a relative rise of 9%. Similarly, the high-to-low-income ratio would rise from 2.06 to 2.26, signifying a relative increase of 10%. The observed stronger inclination of individuals from wealthier families to respond to business cycles by enrolling in college by the age of 18 implies that composition disparities would widen between individuals from poorer and wealthier backgrounds following a spike in unemployment.

Table 7: College dropouts and college degree and the business cycle

	College Dropout	College degree or more
u_i^{HS}	**0.214***	**-0.218**
	(0.109)	(0.138)
Mid. Inc. $\times$ u_i^{HS}	0.333	0.368
	(0.234)	(0.258)
High. Inc. $\times$ u_i^{HS}	0.275	1.052***
	(0.264)	(0.229)
Obs.	427,165	400,507
R-squared	0.032	0.242
Test Middle ($\beta_1 + \beta_2$)	**0.547*** **	**0.150**
Test High ($\beta_1 + \beta_3$)	**0.489****	**0.834*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

I conduct a similar analysis to explore the probability of being a college dropout and college completion, as presented in Table 7. In these regressions, I exclude currently enrolled students to focus specifically on college dropouts, thereby ensuring that the variable "some college but no degree" does not encompass ongoing students intending to graduate eventually. When considering a state's unemployment rate increase equivalent to the 5.6 percentage points observed during the 2009 crisis, I find notable compositional disparities in dropout rates compared to high school graduates across income groups. Specifically, the middle-

to-low-income ratio rises from 1.17 to 1.27, representing a relative increase of 9%, and the high-to-low-income ratio increases from 1.51 to 1.60, signifying an 6% rise. For college degree holders, the ratios show a more pronounced change, with the middle-to-low-income ratio increasing from 1.93 to 2.20, indicating a relative rise of 14%, and the high-to-low-income ratio surging from 3.80 to 5.01, representing an impressive 32% increase. In Table A10 I show that when I re-define low-income individuals to be the bottom 5% instead of the bottom 30% of the population in terms of income the results are even in this direction.

Table A11 extends this analysis to associate degrees, with a focus on both academic and occupational degrees. Notably, while enrollment in occupational degrees declines during periods of high state's unemployment rates, the reaction to business cycles across income groups is not statistically different. However, in the case of academic degrees, the pattern closely resembles that of college degrees, as the probability of having an academic associate degree decreases during periods of high state's unemployment rates for low-income individuals while significantly increasing for high-income young individuals.

In Table 8 I provide a comprehensive overview of the disparity ratios across the various scenarios discussed: college enrollment vs. high school only, college dropout vs. high school only, and college degree holder vs. high school only. Within each disparity group, I compare the ratios between middle and low-income, as well as between high and low-income. The first column presents the average disparity ratio, while the second column represents the disparity ratio corresponding to an increase in state's unemployment equivalent to the 5.6 percentage points observed during the 2009 recession, using the coefficients derived from Tables 6 and 7.

Table 8: Implied compositional change by income groups

Disparity Ratios	Col. enrolled / HS		Drop. / HS		Col. degree / HS	
	Avg.	Estim. if Recess. HS	Avg.	Estim. if Recess. HS	Avg.	Estim. if Recess. HS
Mid. inc. / Low inc.	1.27	1.39	1.17	1.27	1.93	2.20
High inc. / Low inc.	2.06	2.26	1.51	1.60	3.80	5.01

Source: CPS IPUMS.

Note: For each column groups I show the average disparity ratio in the first column, which correspond to the same values I showed in Tables 4 and 5 and the second column are the implied disparity ratios given the regression results from Tables 6 and 7. The implied disparity ratios are calculated for a rise in state unemployment of 5.6 p.p. which is similar to the one experienced in 2009.

The response patterns to having experienced a high state's unemployment rate during each individual's high school graduation differ significantly across income groups. For those from low-income families, having experienced high unemployment rates around high school

graduation is correlated with a low rise in their probability of having attended college and a decline in their probability of having earned a college degree. For high-income individuals the rise is substantially larger both in their likelihoods of having attended and completed college. The implication of these findings is that periods of high unemployment rates around high school graduation are associated with considerable divergence of existing educational composition disparities between low and high-income individuals, as evident from Table 8.

Of particular interest is the influence on the segment of college dropouts within the population. A rise in the state's unemployment rate concurrent with high school graduation is associated with a consequential subsequent rise in the likelihood of individuals becoming college dropouts relative to those who possess solely a high school diploma. This phenomenon can be attributed to the pronounced rise in college enrollments subsequent to a decline in the economic incentives prompting young adults to enter the labor market. This surge in enrollment encompasses individuals who, under different economic circumstances, might not have pursued higher education. Consequently, a subset of these individuals, after encountering an incompatibility with the academic environment of college, opt to drop out from college. As such, periods of high unemployment rates around the time of high school graduation not only impact the overall magnitude of college attendees but also the composition of this cohort. The economic downturn encourages individuals who may have not previously contemplated attending college to do so, which eventually heightens the likelihood of observing an augmented count of college dropouts. This effect is specially larger for high-income individuals. Among individuals with low-income, the increase in the probability of becoming a college dropout is of a comparatively modest magnitude.

These two empirical findings have notable implications, particularly concerning college dropouts. When unemployment rises around high school graduation date, it is associated with an increase in the probability of college dropouts from, mainly, middle and high-income groups. This can be attributed to these income groups being more inclined to enroll in college during challenging economic times. However, the surge in college enrollment during periods of high unemployment rates does not directly translate into a proportionate increase in college completion. On the contrary, the impact of a spike in unemployment differs for individuals already enrolled in college. In this case, a rise in unemployment rate is correlated with an increase in the probability of dropping out for low-income individuals already attending college, while it leads to an increase in the probability of staying and completing the degree for middle and higher income individuals. As a result, periods of high unemployment rates exhibit diverse implications for the economic background of college dropouts, contingent upon the timing of the economic shock.

3.3 Robustness

In this subsection, I subject the two primary empirical findings of the paper to a battery of robustness tests. To further investigate the first empirical fact, I re-estimate regression (4) while employing an alternative specification for macroeconomic conditions around high school graduation dates. Specifically, I consider using the maximum unemployment rate and the average unemployment rates between January and May of the 18th birthday, as opposed to the current observed unemployment rate. Tables A6 and A7 present the results obtained from these alternative specifications. The results are robust to the ones showed in the Section 3.1.

The implications of this first empirical fact are that richer individuals are more inclined to evade the negative entry effects illustrated in Figure 5. To better understand the disparities in earnings demonstrated in the figure, I investigate whether differential occupational sorting for individuals experiencing high or low unemployment rates at entry plays a role. In other words, it is essential to examine whether those who graduate high school during high unemployment rate periods tend to sort into different types of occupations that, on average, offer lower pay.

To assess this, I devise a similarity index to gauge the educational groups' occupational sorting. This index computes the relative proportions of individuals with only a high school diploma, college dropouts, and college degree holders within each occupation. Specifically, the similarity index between a college dropout and a college degree holder is derived as follows:

$$\text{Sim}_{CD,COL} = \sum_j \frac{|\pi_{CD,j} - \pi_{COL,j}|}{\pi_{CD,j} + \pi_{COL,j}},$$

where $\pi_{CD,j}$ is the proportion of college dropouts in occupation j and $\pi_{COL,j}$ is the proportion of college degree holders in occupation j. Therefore, a high value of this index means that the two educational groups are very different in terms of occupational sorting.

In Figure A.15, I present the occupational sorting patterns of young individuals, aged 30 years or younger, based on their average earnings for each occupation (left panel) and the earnings volatility within each occupation (right panel). Moving on to Figure A.16, I investigate the distinctions between individuals possessing only a high school diploma and college dropouts concerning those with a college degree or higher qualifications. Remarkably, individuals with only a high school diploma (blue lines) and college dropouts (red lines) exhibit striking similarity in terms of sorting into low-paid occupations and jobs with low earnings volatility. However, they diverge significantly when it comes to middle and high-earning occupations, as well as jobs with higher volatility. In these cases, individuals with

only a high school diploma differ more from college degree holders than individuals with some college education.

Furthermore, my analysis reveals that there is no substantial disparity in occupational sorting based on the state's unemployment rate experienced around high school graduation. As demonstrated in Figures A.17 (for high school-only individuals) and A.18 (for college dropouts), those who encountered state unemployment rates above their state mean (blue lines) and below their state mean (red lines) exhibit nearly identical occupational sorting in both average earnings and volatility. Consequently, the observed differences in earnings for individuals with varying state's unemployment rates around high school graduation are not attributable to distinct occupational sorting.

To further investigate the second empirical fact, I re-estimate regression (5) while adopting an alternative specification for macroeconomic conditions around high school graduation dates. Specifically, I consider using the maximum unemployment rate occurring between January and May of the 18th birthday, as opposed to the average rate. Tables A12 and A13 present the results obtained from these alternative specifications. When using the maximum unemployment rate high-income individuals do not appear to be more likely to have attended college following a rise in state's unemployment in high school graduation, however the results on college completion remain robust to this specification as well. Moreover, I also explore the usage of the unemployment rate in May, a proxy for the high school graduation month, during the 18th birthday (Tables A14 and A15), which yields consistent and robust outcomes.

Finally, in Table A16 I show the first empirical fact but excluding the COVID years. The magnitude of the probability of dropping out of college during high unemployment rate periods for low-income individuals drop significantly but it is still positive. For middle and high-income individuals this probability is even more negative than in the case with the full sample. Regarding the transitions from the labor force and college the results remain almost unchanged. In Tables A17 and A18 I show the results of the second empirical fact. low-income individuals are now more likely to respond to higher unemployment rates around high school by enrolling in college than before, however, this elasticity remains higher for middle and high-income. Regarding the probability of earning a college degree in the aftermath of having experienced a rise in state's unemployment rate around high school graduation is unchanged as well as the differences across income levels.

3.4 Discussion of the main assumptions

A fundamental assumption underpinning the empirical framework is the appropriateness of using the variable FAMINC from the CPS IPUMS dataset as a reliable proxy for family income, which remains independent of own earnings. Failure to meet this assumption could result in simultaneity bias, wherein higher income individuals are not only more inclined to attend college, but individuals who attend college may also have higher earnings following graduation. This assumption gains importance due to the data's nature, as the information pertaining to family income is collected during interviews, not at the time of high school graduation. Consequently, observations encompass individuals aged around 30 to 40 years who have already graduated from college and currently earn above-average incomes. This situation could inadvertently introduce bias, suggesting a positive relationship between higher family income and the likelihood of college attendance. While the FAMINC variable includes own earnings, all empirical analyses focus exclusively on young individuals aged 25 years or younger.

Figure A.19 portrays average real earnings by age and family income groups. Starting at age 23, the earnings lines diverge, with higher family income groups earning more on average. However, below the age of 23, there is little variation in own earnings across income groups. In order to increase sample size, particularly for college graduates who might require additional years, all empirical analyses are conducted up to age 25. I performed additional regressions, restricting the sample to ages 23 or younger, and the results remain mainly robust. The results in Table A19 remain consistent when limiting the age to 23 years old. Tables A20 and A21 depict nearly identical findings concerning college enrollment and completion's counter-cyclical nature across income groups. Consequently, the main empirical findings of the paper hold under scenarios where family income exhibits little to no correlation with own earnings (ages 23 or lower) or is almost uncorrelated (ages 25 or lower).

An additional salient consideration regarding this variable relates to the family income group observed for each individual, which corresponds to the time of the survey rather than the high school graduation period. A potential concern arises if, during the period from high school graduation to the interview date (spanning up to 7 years or 5 years for the 23-year-old sample), individuals experiencing higher unemployment rates around high school graduation dates are more or less likely to switch their family income category before the interview date. This becomes particularly relevant as estimators could be biased if the state's unemployment rate at high school graduation correlates with the probability of switching income groups during this timeframe. Thorough scrutiny of these assumptions is vital to ensure the validity and reliability of the empirical findings.

4 Model

In this section, I introduce a dynamic individual decision-making model to properly answer the main research questions of the paper: what is the lifetime impact of experiencing a rise in state's unemployment rates similar to the one experienced in the 2009 recession at two critical points in time for young individuals-high school graduation and college enrollment-across different income levels. The model incorporates essential components, including an exogenous productivity process that induces business cycles, differential initial asset levels leading to initial inequalities, liquidity constraints, and the endogenous decision to enroll in college and to whether complete or drop out. The model successfully replicates key empirical observations of the data. Particularly, during economic recessions, the model predicts that among those already enrolled in college, low-income individuals are more likely to drop out of college due to binding liquidity constraints. Furthermore, the model successfully captures the strategic decision-making of high-income individuals concerning college enrollment, showcasing their inclination to delay college enrollment during favorable macroeconomic conditions. Notably, the model aligns with real-world observations that during economic recessions, the composition of college enrollees change both in terms of average income and in terms ex ante academically fitness. Specifically, these downturns prompt a rise in the average wealth of college attendees while concurrently reducing their academic preparedness. Combining these insights, the model predicts that college dropouts predominantly hail from low-income brackets when a recession occurs during enrollment, whereas during a recession coinciding with high school graduation, an anomalous spike in college enrollment primarily involves individuals initially less predisposed to pursue higher education, many of whom will eventually drop out.

Environment

Time is discrete and finite. There is no production. Individuals derive utility from consumption:

$$U = \mathbb{E}_0 \sum_{t=0}^{T} \beta^t u(c_t). \tag{6}$$

Agents know their initial level of assets, their ex-ante probability of being a good fit for college and the aggregate productivity state of the economy. Agents will choose their schooling level, consumption and savings for the first 3 periods, that is from $t = 0$ to $t = 2$ both included. From $t = 3$ to $t = T$ individuals will not be able to change their schooling level and they will just consume the deterministic levels of income with no possibility of

saving. The budget constraint that individuals face is the following:

$$(1+r)a_t + y_t(X_t, z_t, \tilde{z}) + g(z_t) = a_{t+1} + c_t + f_t(X_t, e, d), \tag{7}$$

where

$$a_{t+1} \geq \xi, \tag{8}$$

The left-hand side of the budget constraint encapsulates the diverse income sources available to the individual. a_t represents the asset level at period t, and r stands for the exogenously determined rate of return. Labor income, denoted as y_t, is contingent upon schooling choices X_t, current productivity state z_t, and the productivity state at labor market entry, denoted by $\tilde{z}$. Additionally, $g(z)$ denotes the parental transfers received by the individual, which depends on the current productivity state. Notably, this element ensures that enrolled students remain susceptible to current economic conditions. For example, a negative shock on parental transfers might emulate parental job loss, exerting financial pressure on the student.

The right-hand side shows the various expenditures. a_{t+1} represents the asset level in the next period, while c_t is the consumption level. f_t denotes tuition costs, contingent on schooling decisions as well as enrollment (e) and dropout (d) choices. Crucially, the asset level for the next period (a_{t+1}) must not fall below the threshold parameter ξ, embodying liquidity constraints.

The stochastic element z_t corresponds to a productivity shock, and its evolution follows a Markov process $\Pi = [\pi_{ij}]$, where $\pi_{ij} = Pr(z_{t+1} = z_j | z_t = z_i)$. The productivity process follows an AR(1) process:

$$z_t = \mu + \rho z_{t-1} + \epsilon_t, \tag{9}$$

where ρ is the persistence parameter and ϵ_t is distributed normally with mean 0 and variance σ^2.

Schooling levels will be determined by schooling levels in the previous period and by enrollment and dropping out decisions such that:

$$X_{t+1} = \Psi(X_t, e, d), \tag{10}$$

Table 9: Schooling decisions

$\Psi(X_t, e, d)$	X_{t+1}						
X_t	N	E	E^+	E^-	S	D	C
N (**e**)	■	■					
E			■	■			
E^+ (**d**)					■	■	
E^- (**d**)					■	■	
S							■
D						■	
C							■

Note: I filled in red all the possible transitions depending on the current educational state. In blank I represent all the impossible states for next period given the current state.

Timing

The world starts in $t = 0$ and the individual realizes the following: her ex-ante probability of being a good fit for college (p), her initial asset level (a_0), and the current economic state (z_0). Throughout periods $t = 0$ to $t = 2$, inclusive, the individual confronts pivotal decisions regarding schooling decisions, consumption, and savings. During enrollment, the individual does not receive any labor income but she has to pay tuition costs. It takes two periods to complete college. After finishing the first period of enrollment, the individual realizes her aptitude for college, for example, by observing her own grades. If deemed suitable, the individual would earn the college wage premium upon graduation; conversely, an unfavorable fit negates these gains, even upon successful completion. Subsequently, the individual must opt to either persist in college for the senior year or exit to the labor force in the ensuing period. Notably, once an individual drops out of college she cannot enroll again.

Table 9 illustrates the dynamic progression of schooling decisions within the model. The variable N corresponds to a state of educational attainment where an individual has never attended college. If starting from this level, the individual faces a choice of enrollment (e). Opting for enrollment, she will transition to state E in the subsequent period; otherwise, she remains in state N. While in state E, the individual encounters an exogenous realization regarding her suitability for college. This realization is beyond her control and thus does not involve a decision. If she realizes she is well-suited for college, she moves to state E^+; if deemed unfit, she moves to state E^-. In either state E^+ or E^-, the individual must decide whether to drop out of college (d) or not. Opting to drop out leads her to state D in the

next period, while choosing to persist results in transitioning to state S. Once an individual commits to completing her college education and advances to her senior year, she remains in state C indefinitely. Conversely, if she opts to drop out of college, she remains in state D permanently.

As previously stated, labor income is a function of schooling state X_t from $t = 0$ to $t = 2$:

$$y_t(X_t, z_t, \tilde{z}) = \begin{cases} \theta(X_t)\big[\psi_t(\exp(\tilde{z})) + (1-\psi_t)(\exp(z_t))\big] & \text{if } X_t \in \{N, D, C\} \\ 0 & \text{if } X_t \in \{E, E^+, E^-, S\} \end{cases}$$

$$\theta(X_t) = \begin{cases} (1, \infty) & \text{if } X_t \in \{C\} \quad \text{and} \quad X_{t-1} = E^+ \\ 1 & \text{if } X_t \in \{C\} \quad \text{and} \quad X_{t-1} = E^- \\ 1 & \text{if } X_t \in \{N, D\} \end{cases}$$

While enrolled in college, labor income is equal to zero. For individuals in alternative schooling states, income is contingent upon θ, denoting the college wage premium. Specifically, if an individual has successfully completed college following a favorable assessment of her college suitability, $\theta > 1$. Moreover, labor income is influenced by the current state of the economy, denoted by z_t, as well as the economic conditions prevailing at the time of labor market entry, represented by $\tilde{z}$. The parameter $0 < \psi < 1$ governs the extent to which initial conditions impact current income levels. Labor income becomes deterministic and equal for the rest of periods from $t = 3$ to $t = T$.

Within the model, three distinct categories of college dropouts emerge. Firstly, academic dropouts encompass individuals who, upon recognizing their unsuitability for college, perhaps due to academic struggles or course failures, opt to drop out of college. For these individuals, even attaining a degree would not enhance their future θ, rendering the endeavor nonviable. Secondly, financial dropouts encompass those individuals who, irrespective of their realization regarding their aptitude for college, confront an adverse productivity shock that disrupts parental transfers, plunging them into financial distress and rendering them incapable of meeting tuition expenses. Lastly, strategic dropouts encompass those individuals who, despite realizing the prospective benefits of the college wage premium, choose to abandon their college endeavors due to an exceptionally robust state of the economy, preferring immediate entry into the labor force. It is important to note that this last category of dropouts remains unobservable both in the model, based on the adopted parameterization, and in the empirical data.

Solution method and calibration

As previously noted, individuals exclusively engage in decisions regarding schooling, consumption, and savings during the initial three periods. Starting from $t = 3$ and extending to $t = T$, they only consume a known amount of deterministic income.

I discretized the state space encompassing the ex-ante probability of being well-suited for college (p), the initial asset level (a_0), and the initial productivity state (z_0). The utility function is logarithmic ($u(c) = ln(c)$). Subsequently, I calculated the expected lifetime consumption, earnings, and utility for all asset grids, considering the spectrum of all potential educational decisions. The feasible educational choices are: not going to college, enrolling in college in the initial period ($t = 0$), and enrolling in college in the subsequent period ($t = 1$). In expected terms, there is no reason to drop out of college, because, if an individual expects to drop out of college in $t = 0$ it is not optimal to enroll in college in the first place. College dropouts in the model will only occur if a shock, whether realizing one is a bad fit for college or experiencing a recession that impacts their budget constraints via parental income, consequently pushing the individual into a binding financial situation. I calculate each of these scenarios in isolation by comparing the utility levels given the optimal asset and consumption trajectories for each case. This sequential process leads to an optimal educational choice, contingent upon the individual's probability of a favorable outcome upon college enrollment (p), their initial asset endowment (a), and their initial productivity shock (z). I computed all utilities in expected terms contingent upon the initial productivity shock.

Table 10 presents the calibrated model parameters. To achieve coherence with an interest rate of 8% in a span of 2 years, roughly equivalent to a 4% annual rate, I set β accordingly. Moreover, I fix the time horizon at $T = 24$, encompassing 25 periods inclusive of $t = 0$, where each period denotes a 2-year interval. The parental transfers function ($g(z)$) is set to have mean 0, thus subtracting 1 to z, and I used different specifications regarding the multiplication of 4 and the main results hold. The mean of the productivity process (μ) is set to be equal to 1. The autoregressive coefficient ρ is tuned to facilitate business cycles of 2 years, thereby signifying that a recession in the present period augments the likelihood of a speedier recovery within two years. Lastly, the variance of the error term in the productivity process, denoted as σ^2, is calibrated to encompass a broad spectrum of productivity states. I estimate three parameters using moments in the data. I estimate the college wage premium parameter, the effect of entry conditions on current wages and tuition costs.

I present the estimated values for the three crucial parameters in Table 11 along with the targeted empirical moments. The estimation target for the college wage premium (θ) is the ratio of the expected lifetime earnings for an individual with a college degree to that of an individual possessing solely a high school diploma. Although the observed disparity

Table 10: Calibrated and estimated parameters

Parameter	Value	Description
Calibrated:		
β	0.926	2 year discount factor
T	24	Total number of 2-y periods (plus $t = 0$)
$g(z)$	$4(z-1)$	Parental transfers as a function of z with mean 0
μ	1	Mean of the productivity process
ρ	-0.2	Auto-regressive parameter
σ^2	0.1	Variance of the error term
ξ	-3	Liquidity constraints
Estimated:		
θ	1.81	College wage premium
ψ	0.12	Effect of entry conditions on wages
f	2.08	Tuition fees

in lifetime earnings between these cohorts in the data can be attributed to various factors beyond the mere possession of a college degree, this paper does not delve into their detailed dissection.

The second estimated parameter pertains to the impact of initial labor market conditions on current wages (ψ). This estimation aligns with the earnings of an individual possessing only a high school diploma, comparing those who entered the labor force during a high unemployment rate period to those who entered during an expansion. The empirical values are sourced from Figure 5a, focusing on the initial 6 years (3 periods in the model) post labor force entry. The empirical value of 1.18 means that an individual entering the labor force during a recession earns on average 18% less than an individual entering in an expansion for the first 6 years.[17] I already account for the higher probability of being unemployed during these 6 years.

Lastly, I estimate the parameter f, governing tuition costs. I match this parameter with a moment of the data that displays the disparity in college enrollment between high-income and low-income individuals, shown in the second empirical finding in Section 3.2. The final two columns of the table underscore the model's adeptness in replicating these empirical

[17] I use a rise in state's unemployment of the magnitude experienced in 2009, which corresponds to a 5.6 percentage point rise. I also use 6 years instead of 10 due to the fact that in the model there are only 3 periods of endogenous decisions, which correspond to 6 years in the data.

values.

Table 11: Estimation Method of Moments

Parameter	Value	Moment	Empirical Value	Model Value
θ	1.81	$\frac{Y^{C}}{Y^{NC}}$	1.64	1.64
ψ	0.12	$\frac{Y^{NC\ Exp}_{young}}{Y^{NC\ Rec}_{young}}$	1.18	1.18
f	2.08	$\frac{(Col./HS)^{H}}{(Col./HS)^{L}}$	2.06	2.07

5 Results

In this section I present the main results of the model given the aforementioned parametrization I used. The results align with the main empirical findings I documented in Section 3, however, the model allows me to better inspect the mechanisms behind them.

5.1 Financial dropouts

I first analyze the impact of experiencing a recession for currently enrolled students. In Table 12 I show the percentage of individuals by income level that drop out of college in expansions and in recessions.[18] In periods of economic expansion, financial dropouts naturally do not manifest. However, in the throes of a recession, a segment of the low-income stratum, specifically the most financially vulnerable, drops out of college due to the tangible influence of parental transfers ($g(z)$). While this phenomenon impacts only a marginal fraction of the populace, confined to the lowest income bracket within the low-income category, the ramifications of enforced termination of college education are notably profound.

The surge of financial dropouts coming from the poorest individuals during economic recessions is consistent with the first empirical fact shown in Section 3, specifically in the first column of Table 3.

[18]Since one of the variables is p, the ex-ante probability of being a good fit for college, for each income level I calculate the % of individuals given their different p for each income level.

Table 12: % of students dropping out of college

Income level	Expansion	Recession
low-income	0	25
middle-income	0	0
high-income	0	0

Note: For each income level I compute the average people who drop out of college in expansions and recessions. This average is calculated using the fact that p, the probability of being a good fit for college, is an exogenous parameter in the model and I assume there is a uniform density of people alongside this probability.

5.2 College enrollment by income level

I further explore the cyclical patterns of college enrollment stratified by income levels. In Table 13 I document the percentage of individuals opting for immediate college enrollment (in $t = 0$). Immediate college enrollment exhibits an uptick during periods of economic recession, particularly noticeable among the higher income individuals. In contrast, the response from low-income individuals is relatively subdued. I attribute this nuanced behavior to the intricacies of the trade-off experienced by those in the low-income bracket following a recession. On one hand, an economic downturn places them in dire financial straits, impeding them to pay for tuition costs. Conversely, the same economic downturn elevates the incentives to defer labor market entry, thus avoiding the well-documented scarring effects. Thus, individuals from higher income brackets, who are relatively immune to financial constraints, primarily react to the strategic aspect of this trade-off. Consequently, their propensity for immediate college enrollment experiences a substantial surge during recessionary phases. This finding is consistent with the second empirical finding shown in Section 3.2, particularly Table 6.

Table 13: % of people going to college in $t = 0$

Income level	Expansion	Recession
low-income	25	29.2
middle-income	33.3	66.7
high-income	33.3	77.8

Note: For each income level I compute the average people who decide to enroll in college in period $t = 0$ in expansions and recessions. This average is calculated using the fact that p, the probability of being a good fit for college, is an exogenous parameter in the model and I assume there is a uniform density of people alongside this probability.

In Table 14 I show the ex-ante probability thresholds for each income group deciding to immediately enroll in college. Notably, within low-income brackets, certain income segments exhibit no discernible p threshold because they never attend college for any p, so I cannot compute the p average for low-income. Remarkably, the p threshold experiences a significant decline during economic recessions. This phenomenon implies that individuals possessing lower probabilities of being well-suited for college are increasingly inclined to enroll, a response driven by the heightened economic incentives to postpone labor market entry. This fall in p will result in a subsequent rise in academic dropouts, as we observe in the data in Table 7.

Table 14: p threshold for enrolling in $t = 0$

Income level	Expansion	Recession
low-income	.	.
middle-income	72.7	36.4
high-income	72.7	24.4

Note: For each income level I compute the p threshold for which an income group decides to enroll in college in period $t = 0$. Higher p would represent higher gains from enrolling in college, so a p threshold of 72 means that for that income group, individuals with a probability of being a good fit for college of at least 72% decide to enroll in college. For low-income I cannot calculate the p threshold average since for some income brackets within low-income they never attend college.

5.3 Strategic delays in labor market entry

Finally, I show how the incentives to strategically delay labor market entry to avoid the scarring effects generated by economic recessions vary by income level. In Table 15 I illustrate the proportion of individuals opting for college attendance, albeit in the subsequent period ($t = 1$). During recessions, this strategic delay in enrollment is notably absent. Conversely, within expansionary phases, a considerable proportion of middle and high-income individuals opt to engage in employment initially, deferring college entry to capitalize on the favorable labor market conditions. Furthermore, given the negative auto-regressive parameter, an individual experiencing an expansion is more likely to encounter a recession in the subsequent period. These insights align with the trends elucidated in the second column of Table 3.

6 Counterfactuals

In this section I will present the two main counterfactuals of the paper which will try to answer the two main research questions of the paper: What is the lifetime impact of expe-

Table 15: % of people going to college in $t = 1$

Income level	Expansion	Recession
low-income	16.7	0
middle-income	41.7	0
high-income	47.2	0

Note: For each income level I compute the average people who decide to enroll in college in period $t = 1$ in expansions and recessions. This average is calculated using the fact that p, the probability of being a good fit for college, is an exogenous parameter in the model and I assume there is a uniform density of people alongside this probability.

riencing an economic recession while being enrolled in college by income levels? And what is the lifetime impact of experiencing an economic recession at high school graduation by different income levels? I also will address the same simulations but exploring the role of the two main rigidities in the model: liquidity constraints and the persistent effects of labor market entry conditions on wages.

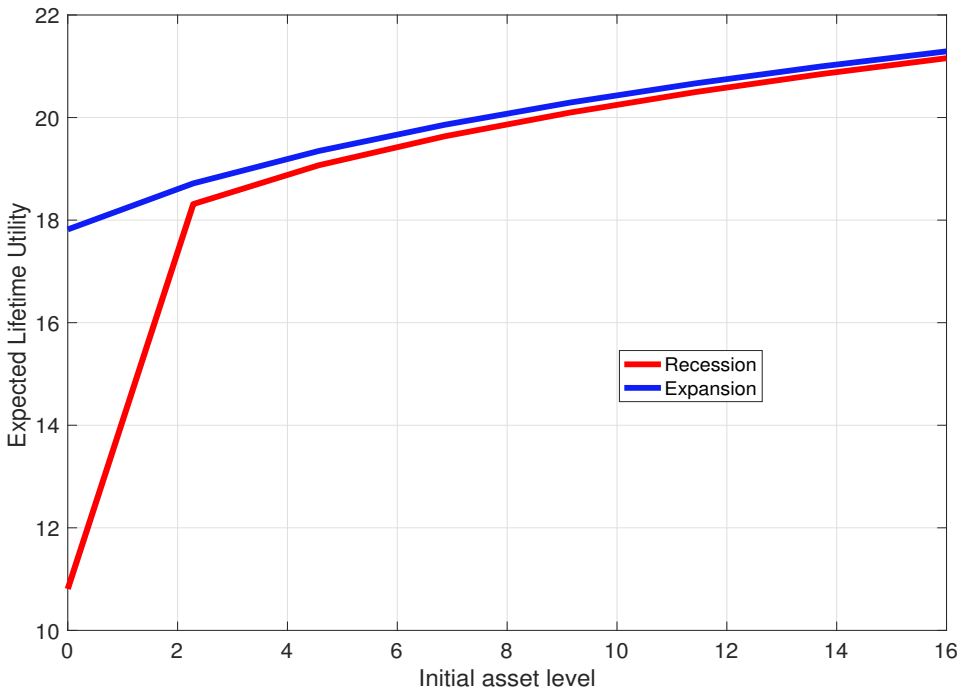
6.1 Recession while enrolled

First, I quantify the lifetime impacts of experiencing an economic recession while enrolled in college by income levels. For this first counterfactual I only consider enrolled students who already observed they are a good fit for college and therefore if they decide to complete the degree they will enjoy college wage premium ($\theta > 1$).

In Figure 8 I plot the expected lifetime utility levels for each initial asset levels. The blue curve represents an individual experiencing an economic expansion during their college enrollment, while the red curve represents an individual experiencing a recession during the same period. I plot the same figure but showing the lifetime impact in terms of present value consumption in Figure A.20.

Experiencing an economic recession while actively enrolled in college has negligible effects across all income groups except for the poorest one. The reason is that the economic state only impacts individuals through parental transfers while in college. Also, if a student experiences a recession while enrolled in college it is more likely that she will enter the labor force during a boom given the negative auto-regression parameter ρ of the productivity process. If a reduction in parental transfers does not constrain an individual within the liquidity margin, the effects remain minimal. However, the model demonstrates that the

Figure 8: Experiencing an economic recession while enrolled in college



Note: In the x-axis I display the initial asset level a_0 and in the y-axis I show the expected lifetime utility. This analysis is restricted to individuals who already are in college and observed that they are a good fit for college. The red line represents the expected lifetime utility for individuals who face a recession of a similar magnitude than in 2009 in $t = 0$ and in blue I show the expected lifetime utility for individuals who face an expansion of similar magnitude to the period right before the 2009 crisis.

poorest individuals bear the burden of a recession as they are forced to drop out of college, termed as "financial dropouts", resulting in significant lifetime losses. Among this segment, they experience an expected loss of 39% in terms of expected lifetime utility and 40% in terms of expected lifetime present value consumption. middle-income individuals only suffer a modest 1% loss in expected lifetime utility and a 2% loss in expected lifetime present value consumption. The richest group suffers a negligible 0.6% expected lifetime utility loss and a 1.7% loss in expected lifetime present value consumption.

In Table 16 I display a summary of the percentage drop in both expected lifetime utility and expected lifetime present value consumption by income groups of experiencing a recession while enrolled compared to experiencing an expansion. The analysis primarily focuses on three major income categories: low, middle, and high-income. Additionally, I included subgroups of particular interest, notably the poorest and the second-poorest cohorts, along with the richest segment. The findings underscore a significant impact solely on the most

financially deprived segment when they experience an economic downturn while in college. Specifically, a notable fraction (25%, as detailed in Table 12) of this cohort is forced to drop out of college due to financial constraints, leading to substantial repercussions. These repercussions are prominent but are highly concentrated within a specific subset of the low-income category, precisely the poorest individuals.

Table 16: % drop in expected lifetime utility and present value consumption when experiencing a recession while enrolled

Income level	% drop recession while enrolled	
	Utility	Consumption (PV)
Poorest group	39.34	39.92
Second-poorest group	2.16	2.23
low-income avg.	10.45	10.92
middle-income avg.	0.96	1.95
high-income avg.	0.72	1.80
Richest group	0.63	1.74

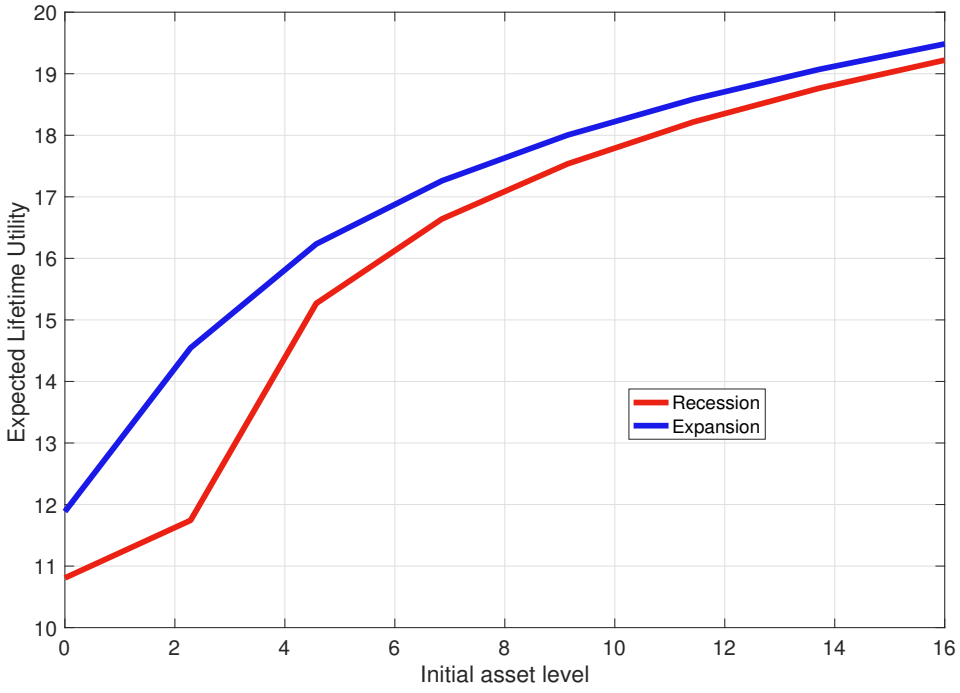
I represent the % drop in expected lifetime utility and in present value lifetime consumption for different income groups when facing a recession compared to an expansion for the subset of individuals who are already enrolled in college and have experienced a positive revelation about their college fit. The three main income groups are low-income, middle income and high-income. I also show sub-groups such as the poorest and second-poorest groups within the low-income and the richest group for illustration purposes.

6.2 Recession around high school graduation

Second, I quantify the lifetime impacts of experiencing an economic recession around high school graduation by income levels. In Figure 9 I plot the expected lifetime utility levels for each initial asset levels. I also show the expected lifetime consumption in present value in Figure A.21.

Once again, the richest group demonstrates lower susceptibility to the impacts of an economic recession, this time around high school graduation. Their ability to strategically delay college enrollment if they experience an economic upturn, or automatically enroll if a recession occurs, serves as a buffer against the adverse effects of recessions. Consequently,

Figure 9: Experiencing an economic recession at high school graduation



Note: In the x-axis I display the initial asset level a_0 and in the y-axis I show the expected lifetime utility. I use a given p for all the analysis of 81.8%. The main results are robust to many other reasonable values for p. The red line represents the expected lifetime utility for individuals who face a recession of a similar magnitude than in 2009 in $t = 0$ (so when graduating from high school) and in blue I show the expected lifetime utility for individuals who face an expansion of similar magnitude to the period right before the 2009 crisis.

the expected loss in lifetime utility due to a recession around high school graduation is a mere 1.4% for this affluent cohort. A similar trend is observed for the middle-income group, with an expected lifetime loss of 2.6%.

In contrast, the poorest individuals suffer more pronounced losses. Although their losses are significantly high, they are not the most severely impacted. Given that the poorest individuals never pursue college education, the effects of a recession are channeled through the enduring repercussions of a bad labor market entry. For this demographic, the expected loss in lifetime utility amounts to 9%. The expected loss in terms of lifetime present value consumption is also of 9%.

However, the utmost impact is observed within the second-poorest group among low-income individuals, or the middle-to-low-income. A recession prevents them from pursuing higher education, intensifying the scarring effects. Not only do they forgo attending college, but they are also compelled to join the labor force during an economic downturn. Conse-

quently, this income group faces an expected loss of 19.3% in terms of lifetime utility due to the recession's influence. In terms of expected lifetime present value consumption the loss would be of 24%. I again show the summary of % drop in expected lifetime utility for income groups in Table 17.

Table 17: % drop in expected lifetime utility and expected lifetime present value consumption when experiencing a recession around high school graduation

Income level	% drop recession around HS graduation	
	Utility	Consumption (PV)
Poorest group	9.07	8.97
Second-poorest group	19.27	23.79
low-income avg.	9.12	9.73
middle-income avg.	2.60	3.28
high-income avg.	1.65	2.98
Richest group	1.35	2.85

I represent the % drop in expected lifetime utility and in present value lifetime consumption for different income groups when facing a recession compared to an expansion in $t = 0$, that is, right at high school graduation. The three main income groups are low-income, middle income and high-income. I also show sub-groups such as the poorest and second-poorest groups within the low-income and the richest group for illustration purposes.

6.3 The role of liquidity constraints and entry conditions

I run again the previous counterfactuals but changing the main parameters that govern liquidity constraints (ξ) and the persistent labor market entry effects (ψ). The objective of this section is to inspect what income groups are more susceptible to the two main rigidities in the model.

Table 18 shows how the first counterfactual would change with harsher ($\xi = 0$) or with no liquidity constraints ($\xi = -1000$). The initial results, constituting the baseline shown in the first counterfactual, are presented in the first column. Notably, harsher liquidity constraints induce a discernible disparity in expected lifetime utility for the poorest group, albeit less pronounced than in the baseline scenario. This is because stringent liquidity constraints

forces this group to drop out of college even during economic expansions. Intriguingly, the second-poorest group, previously successful in completing college, now they become forced to drop out of college due to these heightened constraints during recessions. Consequently, the proportion of financial dropouts elevates from 25% to 50%, significantly amplifying the anticipated losses for this cohort. Notice that the notable 12.42% expected lifetime losses for the poorest group in the stringent liquidity constraint scenario are attributed to their bad labor market entry into the labor market after prematurely exiting college.

In the absence of liquidity constraints, there are no financial dropouts, resulting in minimal expected lifetime losses across all income groups. For both the middle and high-income groups, experiencing an economic downturn while enrolled has almost no impact in their lifetime utility levels in all scenarios, given their financial resilience. Not surprisingly, the scenario with no liquidity constraints benefits especially the poorest income groups.

Table 18: % drop in expected lifetime utility when experiencing a recession while enrolled

Income level	% drop in utility of experiencing a recessions while enrolled		
	Baseline	Harsh liq. constr.	No liq. constr.
Poorest group	39.34	12.42	2.70
Second-poorest group	2.16	35.67	1.88
low-income	10.45	12.65	1.77
middle-income	0.96	0.96	0.96
high-income	0.72	0.72	0.72
Richest group	0.63	0.63	0.63

I represent the % drop in expected lifetime utility for different income groups when facing a recession compared to an expansion for the subset of individuals who are already enrolled in college and have experienced a positive revelation about their college fit. The three main income groups are low-income, middle income and high-income. I also show sub-groups such as the poorest and second-poorest groups within the low-income and the richest group for illustration purposes. The baseline column is the one shown in 16, the second column corresponds to the same counterfactual but using $\xi = 0$, that is harsher liquidity constraints than in the baseline scenario, and the last column with virtually no liquidity constraints $\xi = -1000$

I show in Table 19 the same comparison but for the second counterfactual. The scenario

with harsher liquidity constraints has almost no impacts on middle and high-income groups, however, it has a large impact on low-income groups. As one would expect, the second-poorest group which is the most affected income group by experiencing a recession around high school graduation, is also the group that would benefit more from having no liquidity constraints.

Table 19: % drop in expected lifetime utility when experiencing a recession around high school graduation

Income level	% drop in utility of experiencing a recessions at high school graduation		
	Baseline	Harsh liq. constr.	No liq. constr.
Poorest group	9.07	12.42	9.07
Second-poorest group	19.27	18.41	15.29
low-income	9.12	12.22	8.16
middle-income	2.60	3.01	2.60
high-income	1.65	1.66	1.65
Richest group	1.35	1.35	1.35

I represent the % drop in expected lifetime utility for different income groups when facing a recession compared to an expansion in $t = 0$, that is at high school graduation. The three main income groups are low-income, middle income and high-income. I also show sub-groups such as the poorest and second-poorest groups within the low-income and the richest group for illustration purposes. The baseline column is the one shown in 17, the second column corresponds to the same counterfactual but using $\xi = 0$, that is harsher liquidity constraints than in the baseline scenario, and the last column with virtually no liquidity constraints $\xi = -1000$

In Tables 20 and 21 I show the same exercise but using the parameter governing the effect of labor market conditions at the time of entry ψ.

The influence of labor market entry conditions is notably limited within the context of the first counterfactual. This limitation stems from the focal point of this counterfactual, centered on currently enrolled students. Consequently, their susceptibility to impacts is confined to the decision of dropping out or completing college, contingent upon prevailing liquidity constraints within the economy. Additionally, income cohorts that successfully complete college and face an economic downturn while in enrollment exhibit a higher likelihood

of commencing their journey into the labor market during an expansionary phase. This propensity is driven by the negative auto-correlation parameter ρ inherent to the productive process.

The influence of labor market conditions is more pronounced within the domain of the second counterfactual. As previously observed, the middle and high-income groups remain entirely unaffected by this variable. In the event of encountering an economic downturn at $t = 0$, they would opt to enroll in college, rendering the ψ parameter inconsequential to their outcomes. Conversely, the poorest groups manifest substantial variations in expected lifetime utility losses between scenarios where ψ assumes high versus zero values.

Table 20: % drop in expected lifetime utility when experiencing a recession while enrolled

Income level	% drop in utility of experiencing a recessions while enrolled		
	Baseline	High ψ	$\psi = 0$
Poorest group	39.34	39.68	39.02
Second-poorest group	2.16	2.08	2.24
low-income	10.45	10.48	10.43
middle-income	0.96	0.91	1.01
high-income	0.72	0.68	0.75
Richest group	0.63	0.60	0.66

I represent the % drop in expected lifetime utility for different income groups when facing a recession compared to an expansion for the subset of individuals who are already enrolled in college and have experienced a positive revelation about their college fit. The three main income groups are low-income, middle income and high-income. I also show sub-groups such as the poorest and second-poorest groups within the low-income and the richest group for illustration purposes. The baseline column is the one shown in 16, the second column corresponds to the same counterfactual but using $\psi = 0.245$, that is twice the baseline, so larger effects of entry conditions on current wages. The last column corresponds to the case in which $\psi = 0$.

Table 21: % drop in expected lifetime utility when experiencing a recession around high school graduation

Income level	% drop in utility of experiencing a recessions at high school graduation		
	Baseline	High ψ	$\psi = 0$
Poorest group	9.07	9.98	8.16
Second-poorest group	19.27	19.56	18.98
low-income	9.12	9.37	8.87
middle-income	2.60	2.60	2.60
high-income	1.65	1.65	1.65
Richest group	1.35	1.35	1.35

I represent the % drop in expected lifetime utility for different income groups when facing a recession compared to an expansion in $t = 0$, that is at high school graduation. The three main income groups are low-income, middle income and high-income. I also show sub-groups such as the poorest and second-poorest groups within the low-income and the richest group for illustration purposes. The baseline column is the one shown in 17, the second column corresponds to the same counterfactual but using $\psi = 0.245$, that is twice the baseline, so larger effects of entry conditions on current wages. The last column corresponds to the case in which $\psi = 0$.

7 Conclusions and policy relevance

College decisions can whether magnify or mitigate scarring effects precipitated by economic recessions. Within the financially constrained individuals, represented by the poor, college decisions tend to amplify the repercussions of economic downturns. This amplification manifests through compelling these individuals to prematurely drop out of college and undergo an adverse labor force entry, consequently enduring persistent earnings losses. Conversely, for financially unconstrained individuals, the rich, college enrollment emerges as a potent tool to mitigate the scarring effects of economic recessions by strategically timing their college enrollment and enjoying better labor market entry.

Low-income individuals display a higher susceptibility to economic rigidities. Notably, both liquidity constraints and wage rigidities that result in the persistent impacts of labor market entry profoundly impact this specific income cohort. These rigidities make them

more likely to become a financial dropout and to enter or stay in the labor force during periods of depressed wages.

Policy interventions addressing labor market rigidities, which underpin the persistent effects arising from adverse labor market entry conditions, may yield relatively modest aggregate impacts but wield significant influence on low-income groups. The persistent wage effects noted for individuals entering the labor force during economic downturns are influenced not only by nominal rigidities but also encompass aspects like human capital accumulation and unfavorable matching during recessions. Initiatives focused on the training and upskilling of young workers who face challenging labor market entries could represent a valuable avenue to mitigate these scarring impacts.

Also, policy measures aimed at mitigating the influence of liquidity constraints on low-income individuals during these critical time periods can yield substantial favorable outcomes. For example, scholarships structured to depend not only on the income level at the time of enrollment but also on the current parental income could serve as a mechanism to retain low-income students in school, particularly during recessions. Flexible scholarship schemes, swiftly responsive to economic fluctuations, could potentially avoid financial dropouts and reduce the scarring effects of recessions on low-income groups.

Finally, I highlight the importance of recession timing—whether around high school graduation or while actively enrolled in college—on the demographic composition of college dropouts. Recessions coinciding with high school graduation correspond to an upsurge in college dropouts hailing from middle and high-income brackets and less academically suited. Conversely, during enrollment in college, the dropout pool tends to be predominantly low-income individuals, not necessarily characterized by poor academic fit.

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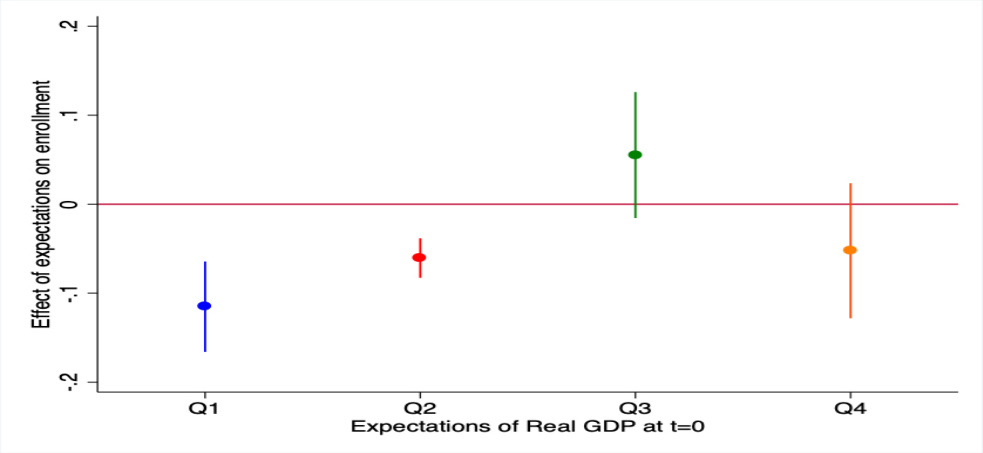
A Additional Figures and Tables

Figures

Figure A.1: Effect of $t = 0$ expectations on enrollment.



Note: Each dot corresponds to a coefficient of current expectations on college enrollment with its corresponding 95% confidence intervals. In the horizontal axis I show the coefficients for all different specifications using different survey timings (for all 4 quarters).

Figure A.2: Effect of $t - 1$ expectations on enrollment.

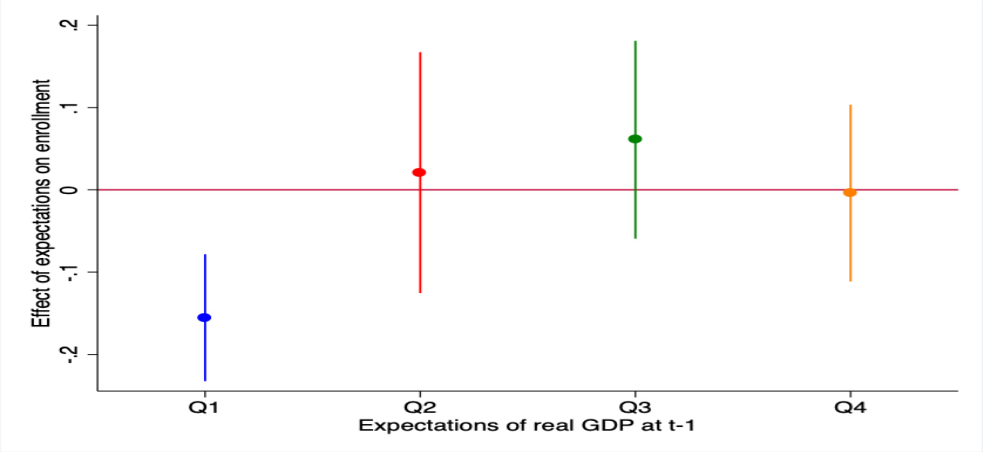


Figure A.3: Evolution of middle group over time.

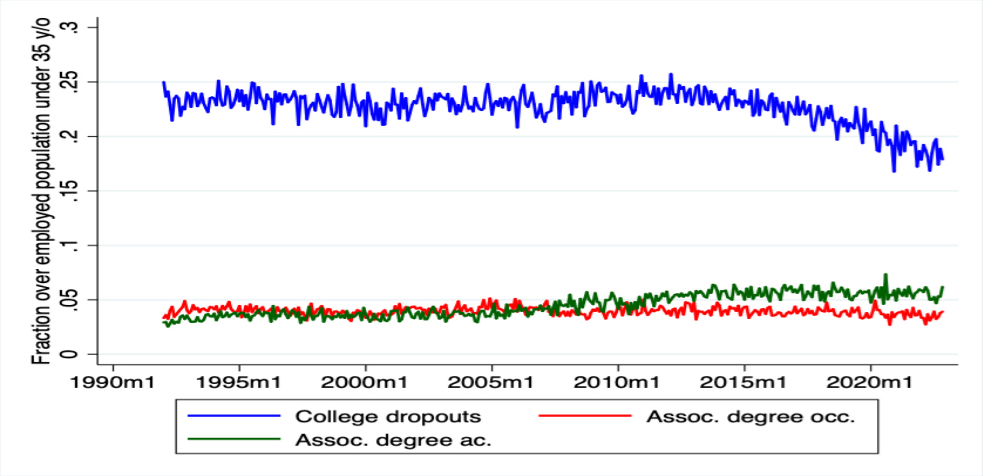
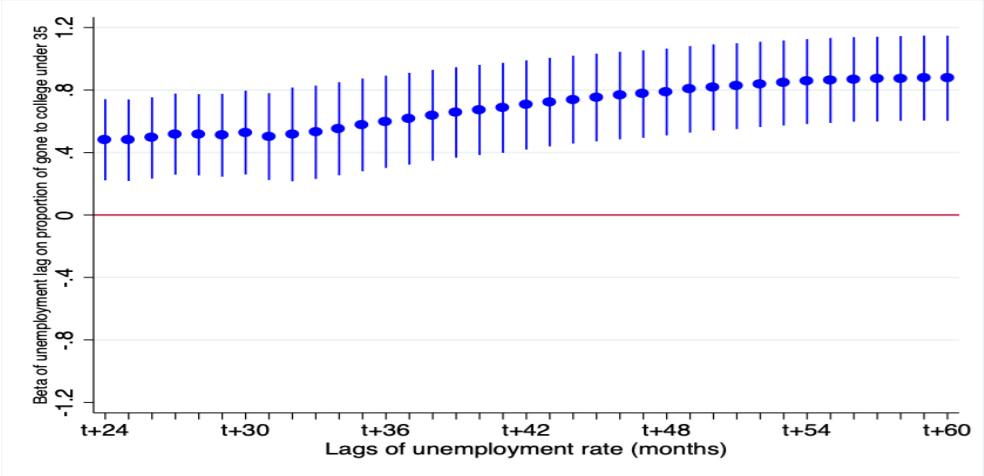
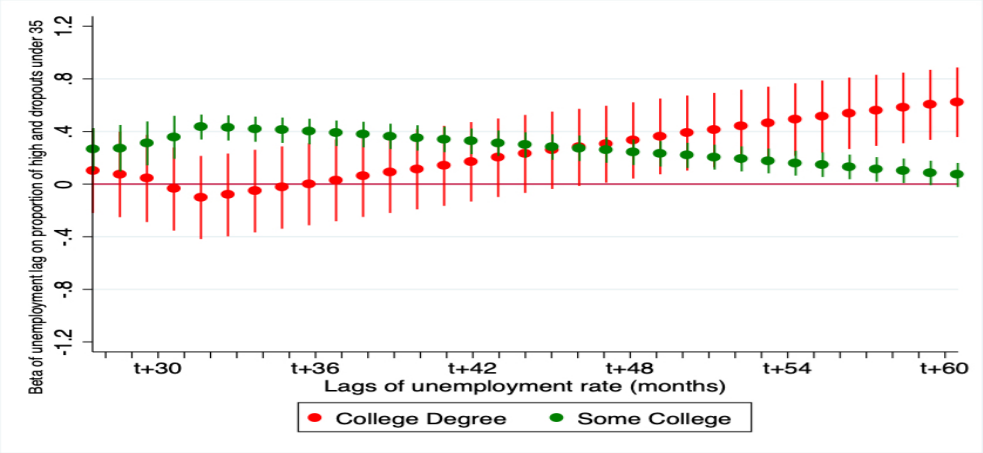


Figure A.4: Effect of lag unempl. rate on the proportion of people who has gone to college



Note: Each dot (with its corresponding confidence interval) represents the main coefficient of an unemployment rate lag on the proportion of people (under 35) who have gone to college.

Figure A.5: Effect of unempl. rate on some college (green) and college degree (red).



Note: Each dot (with its corresponding confidence interval) represents the main coefficient of an unemployment rate lag on the proportion of people (under 35) who have some college education (green) and a college degree (red).

Figure A.6: Effect of lag unempl. rate on the proportion of associate degree holders academic (green) and occupational (red)

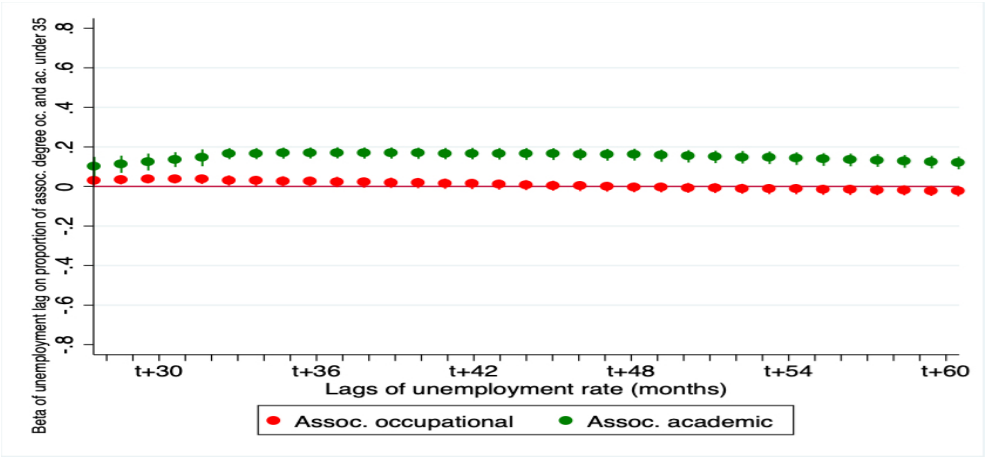


Figure A.7: Effect of lag state unempl. rate on college attended under 35, box plot of 51 states.

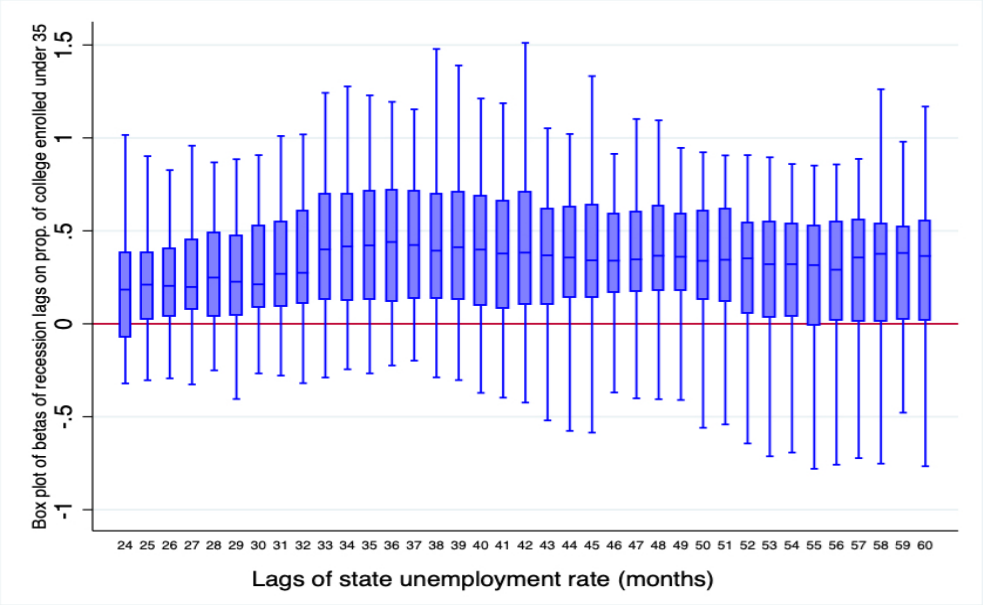


Figure A.8: Effect of lag unempl. rate on college degree under 35, box plot of 51 states.

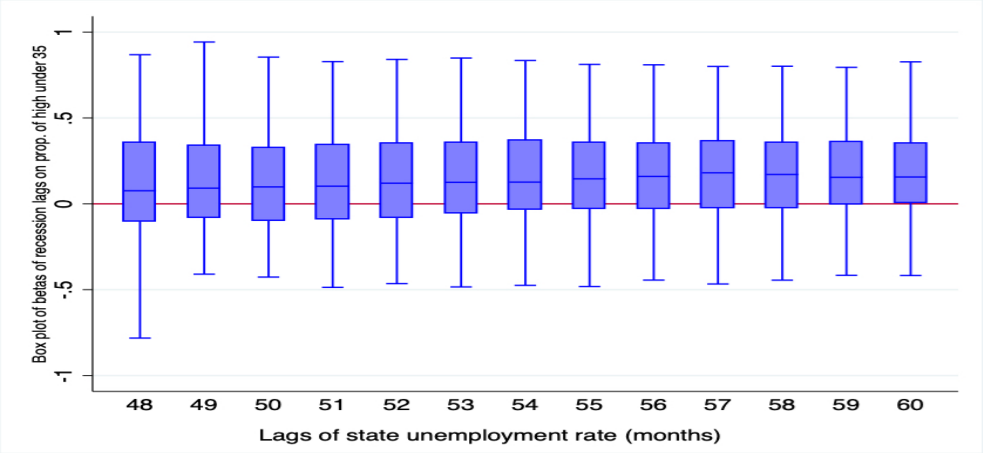


Figure A.9: Effect of lag unempl. rate on the proportion of dropouts under 35, box plot of 51 states.

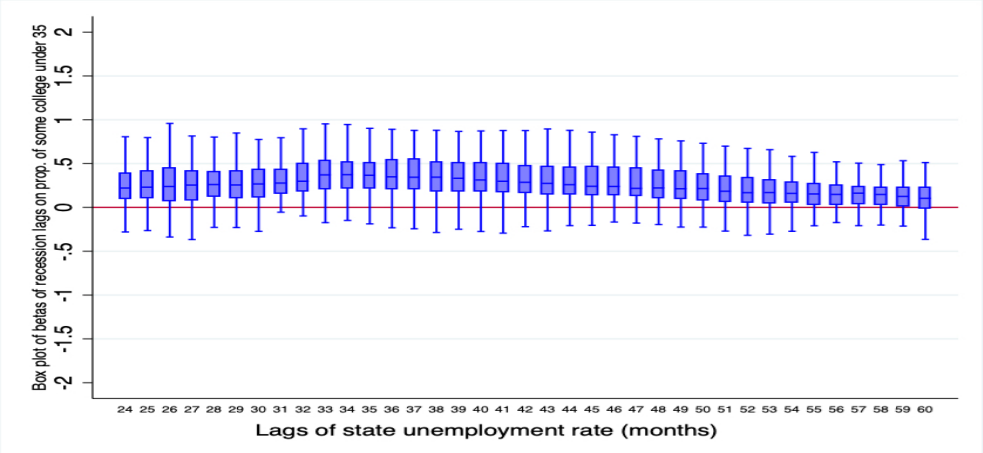


Figure A.10: Negative and persistent effects of graduating college during recessions.

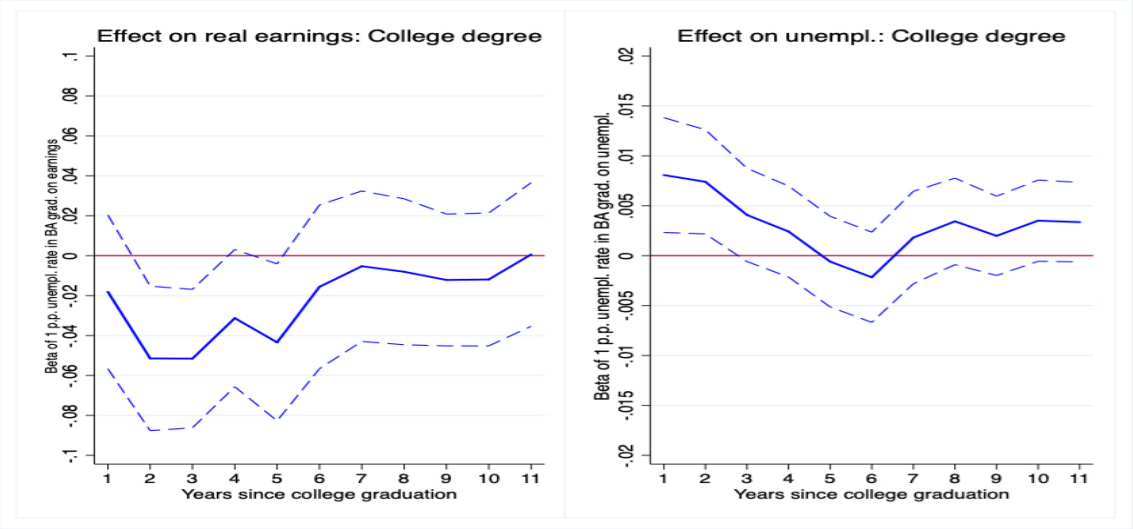


Figure A.11: Evolution of ratio College enrolled / HS only between middle-income and low-income and between high-income and low-income.

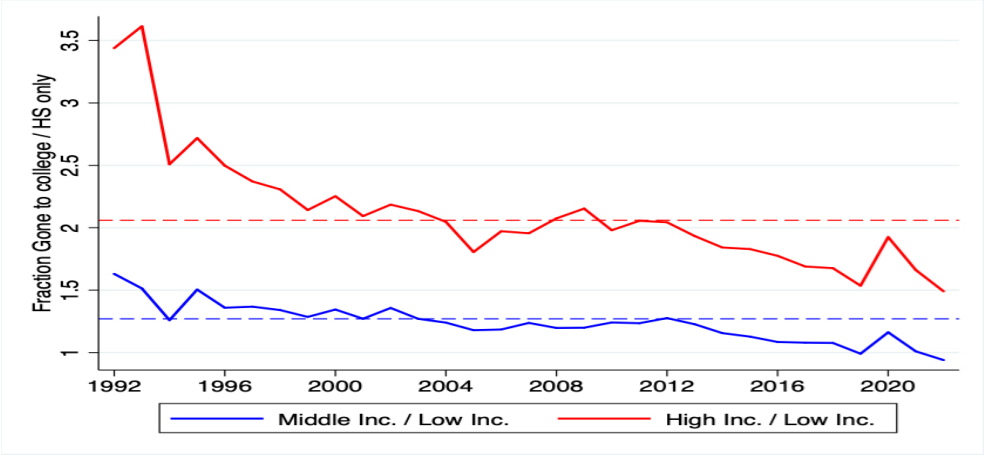


Figure A.12: Evolution of ratio College dropout / HS only between middle-income and low-income and between high-income and low-income.

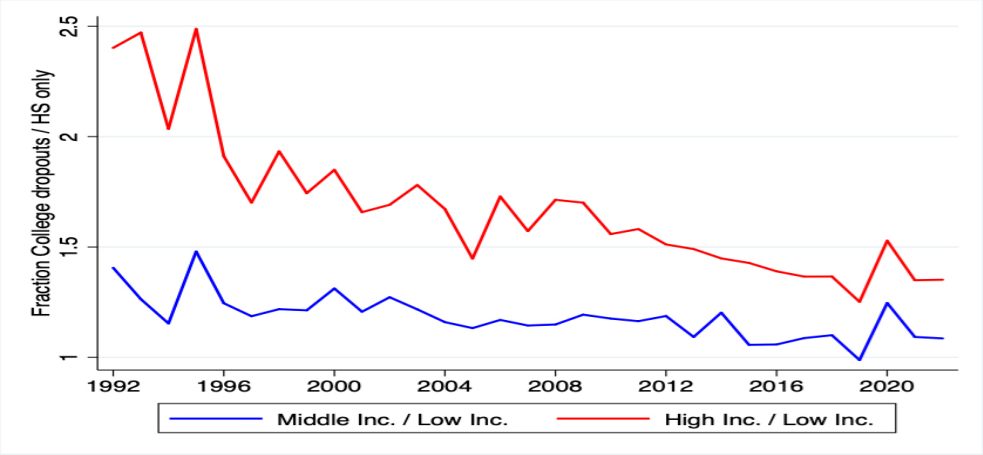


Figure A.13: Evolution of ratio College degree / HS only between middle-income and low-income and between high-income and low-income.

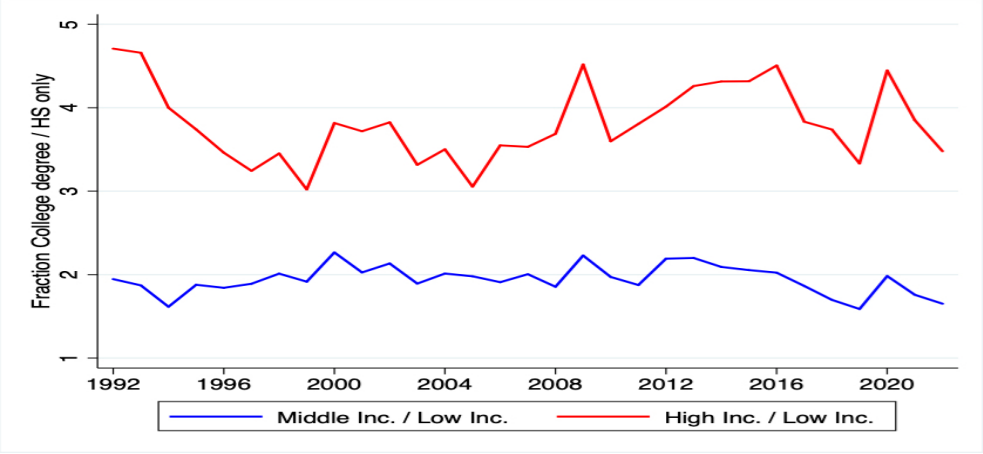


Figure A.14: Lifetime real earnings by educational group in 2022

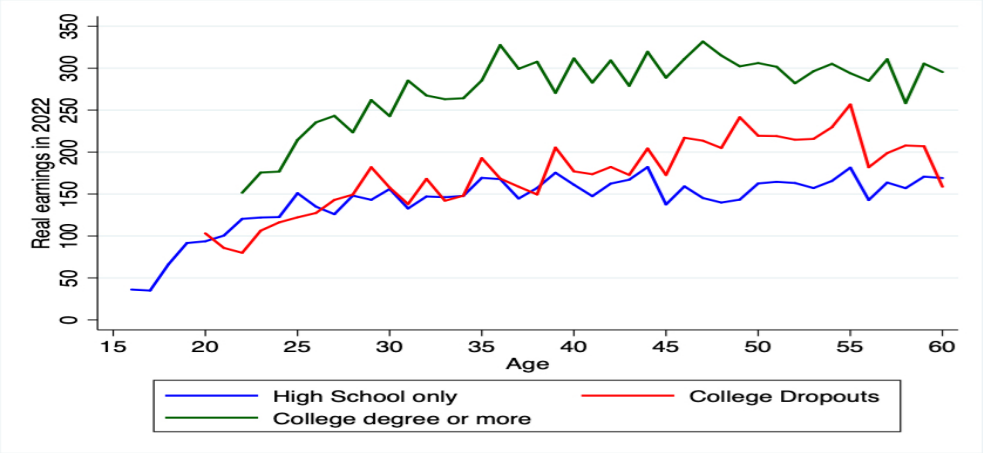


Figure A.15: Occupation sorting by educational group

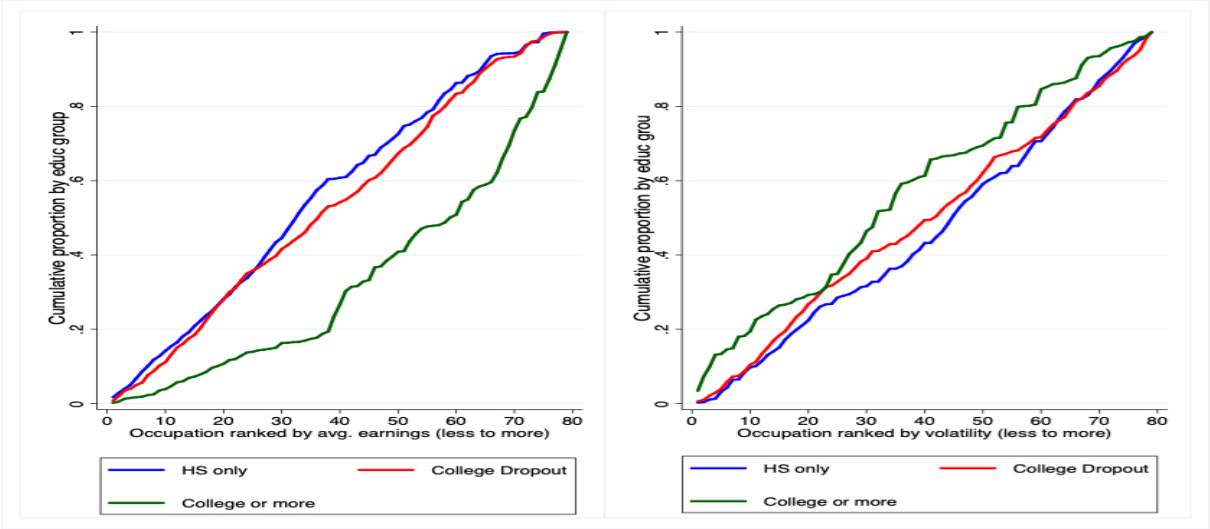


Figure A.16: Similarity index with respect to college degree or more by educational group

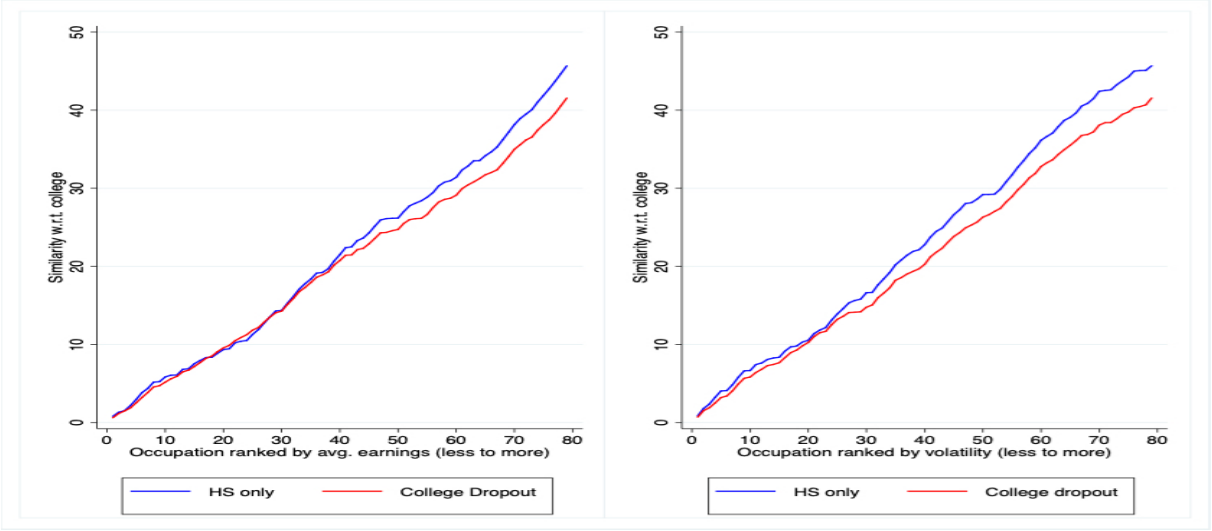


Figure A.17: Differences in Similarity index with respect to college degree or more for college high school only: High vs. low unemployment rate at HS graduation.

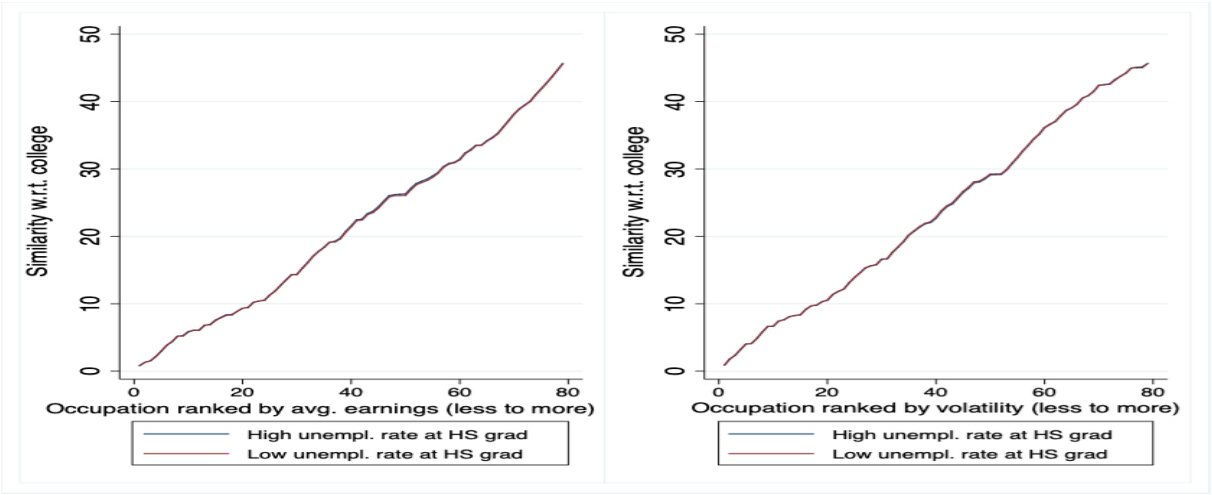


Figure A.18: Differences in Similarity index with respect to college degree or more for college dropouts: High vs. low unemployment rate at HS graduation.

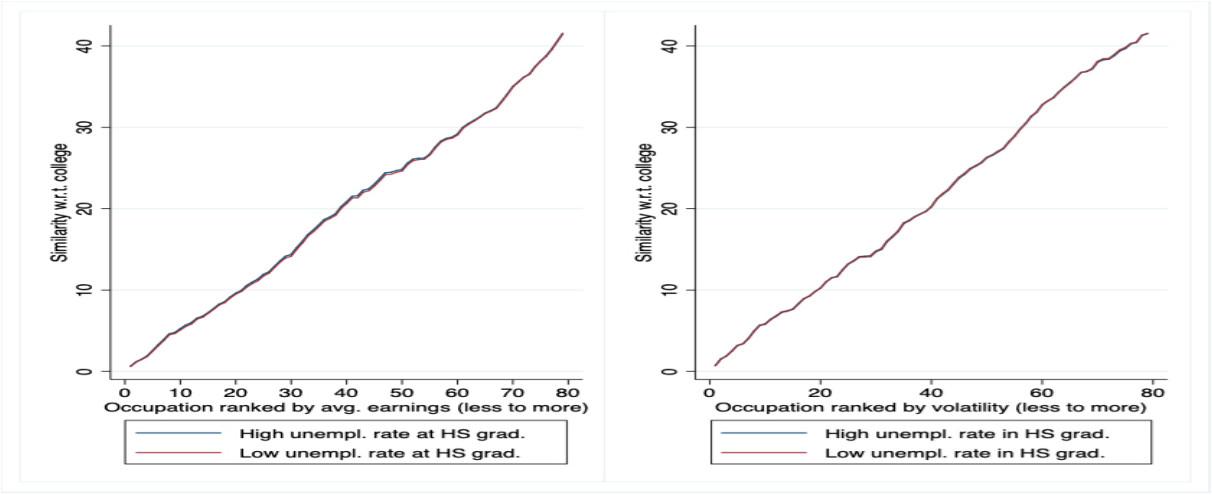


Figure A.19: Differences in real earnings by age and family income group

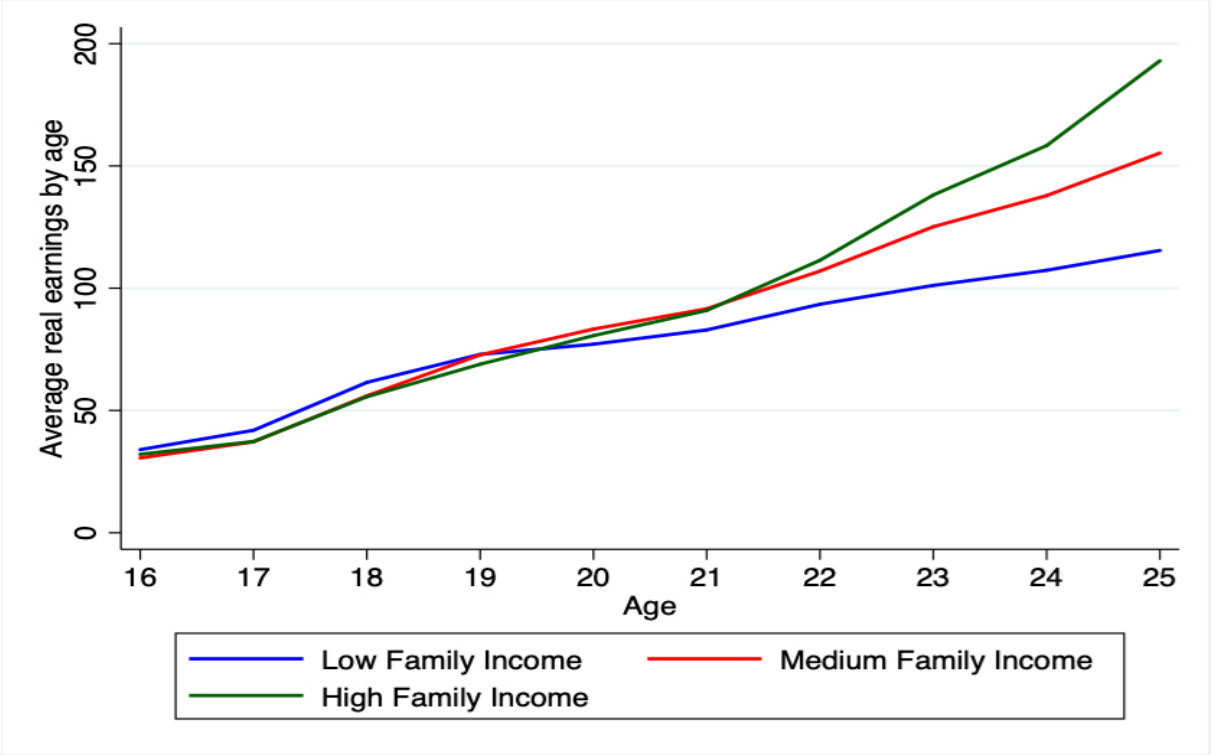


Figure A.20: Experiencing an economic recession while enrolled in college

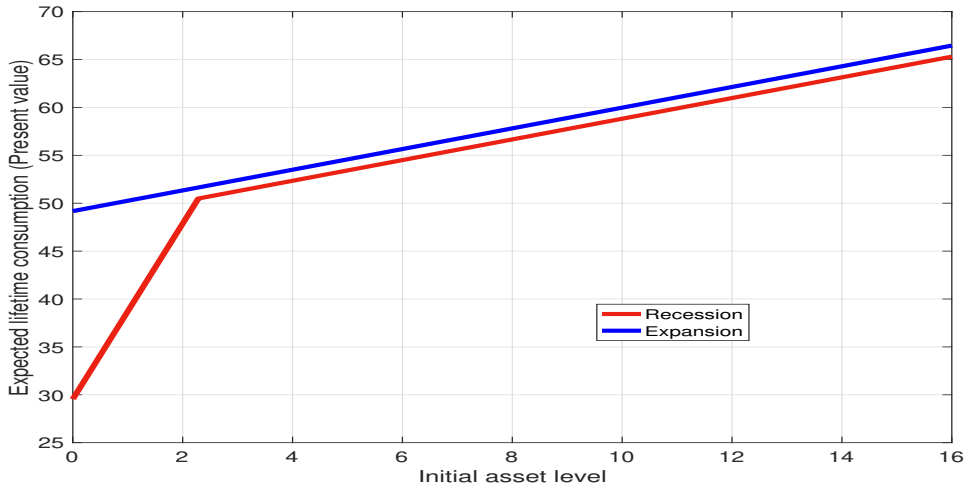
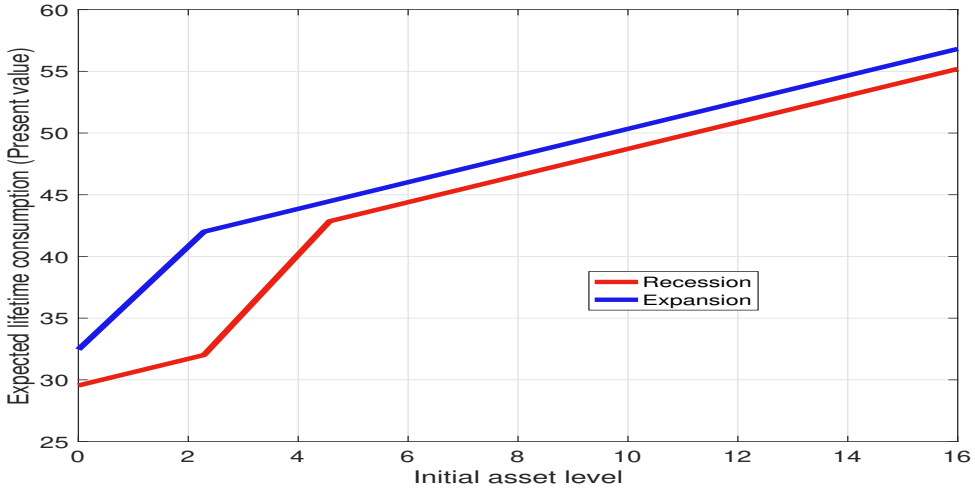


Figure A.21: Experiencing an economic recession at high school graduation



Tables

Table A1: College enrollment is counter-cyclical

Effect on college enrollment deviations from trend	OLS including linear and exponential trends
Unemployment rate deviations from NAIRU (p.p.)	0.405***
	(0.094)
R-squared	**0.457**
Unemployment rate (p.p.)	0.366***
	(0.095)
R-squared	**0.406**
Maximum Unemployment rate (p.p.)	0.265***
	(0.075)
R-squared	**0.372**
Recession (binary)	0.565**
	(0.267)
R-squared	**0.123**
Real GDP growth (YoY%)	-0.246***
	(0.051)
R-squared	**0.285**
Cyclical component of Real GDP (p.p.)	-31.000***
	(10.635)
R-squared	**0.236**

Source: CPS, World Bank population, UN population by groups, Federal Reserve Bank Saint Louis.

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A2: CPS IPUMS data: Descriptive Statistics unweighted

	Cross-sectional		Longitudinal	
	All ages	Age ≤ 25	All ages	Age ≤ 25
Age	44.38	20.36	29.29	19.93
Sex (Female %)	52.11	50.37	51.12	50.62
Race (White %)	82.77	79.41	79.19	79.44
High-school diploma or less (%)	47.98	61.66	50.30	63.06
Some college and assoc. degrees (%)	26.31	28.06	27.48	28.10
Bachelor's or more (%)	25.71	10.28	22.22	8.84
Weekly earnings ($)	720.01	366.41	708.26	352.86
	Family Income (x = Yearly Income)			
Low % ($x <$ \$30,000)	32.72	40.33	29.53	38.11
Middle % (\$30,000 $\leq x <$ \$75,000)	40.08	37.25	37.05	37.43
High % ($x \geq$ \$75,000)	27.21	22.42	33.42	24.46
Labor force (%)	66.04	64.34	71.87	62.45
Employed (%)	61.99	56.05	65.56	54.26
Unemployed (%)	4.04	8.24	6.28	8.14
Appearances	1	1	3.76	3.73
Individuals	**5,037,938**	**1,336,506**	**1,974,315**	**1,038,886**

Source: CPS IPUMS.

Table A3: Education variable change in criterion

Variable label	Jan. 1976 - Dec. 1991	Jan. 1992 - Dec. 2022
Low		
None, preschool, or kindergarten	✓	✓
Grades 1, 2, 3, or 4	X	✓
Grade 1	✓	X
Grade 2	✓	X
Grade 3	✓	X
Grade 4	✓	X
Grades 5 or 6	X	✓
Grade 5	✓	X
Grade 6	✓	X
Grades 7 or 8	X	✓
Grade 7	✓	X
Grade 8	✓	X
Grade 9	✓	✓
Grade 10	✓	✓
Grade 11	✓	✓
Grade 12th grade, no diploma	X	✓
Grade 12th grade, diploma unclear	✓	X
High school diploma or equivalent	✓	✓
Middle		
1 year of college	✓	X
2 years of college	✓	X
Some college but no degree	X	✓
Associate's degree, occ/voc prog.	X	✓
Associate's degree, academic prog.	X	✓
3 years of college	✓	X
High		
4 years of college	✓	X
Bachelor's degree	X	✓
5 years of college	✓	X
6 years of college	✓	X
Master's degree	X	✓
Professional school degree	X	✓
Doctorate degree	X	✓

Source: CPS IPUMS.

Table A4: Transitions from enrolled to dropout and from labor force to enrolled using the lag of unemployment rate

	College Dropouts	LF → College
u_{t-1}	**0.123***	**0.001**
	(0.062)	(0.069)
Mid. Inc. × u_{t-1}	-0.189***	0.415***
	(0.061)	(0.089)
High. Inc. × u_{t-1}	-0.117**	0.418***
	(0.057)	(0.111)
Obs.	672,803	1,935,398
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	**-0.066**	**0.416*** **
Test High ($\alpha_1 + \alpha_3$)	**0.006**	**0.420*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5: Transitions from enrolled to dropout and from labor force to enrolled using Panel regression

	College Dropouts	LF → College
u_t	**0.145** **	**-0.132***
	(0.057)	(0.079)
Mid. Inc. × u_t	-0.195***	0.558***
	(0.057)	(0.105)
High. Inc. × u_t	-0.231***	0.621***
	(0.066)	(0.137)
Obs.	671,770	1,932,490
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	**-0.005**	**0.427*** **
Test High ($\alpha_1 + \alpha_3$)	**-0.009*** **	**0.489*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A6: Transitions from enrolled to dropout and from labor force to enrolled using max unemployment rate

	College Dropouts	LF → College
$\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	**0.088***	**-0.033**
	(0.047)	(0.065)
Mid. Inc. × $\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	-0.171***	0.363***
	(0.048)	(0.076)
High. Inc. × $\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	-0.132**	0.315***
	(0.046)	(0.095)
Obs.	672,803	1,935,398
R-squared	0.004	0.332
Test Middle ($\alpha_1 + \alpha_2$)	**-0.084****	**0.329****
Test High ($\alpha_1 + \alpha_3$)	**-0.045**	**0.282****

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A7: Transitions from enrolled to dropout and from labor force to enrolled using average unemployment rate

	College Dropouts	LF → College
$\overline{u}_t$	**0.090***	**0.022**
	(0.053)	(0.070)
Mid. Inc. × $\overline{u}_t$	-0.189***	0.448***
	(0.056)	(0.092)
High. Inc. × $\overline{u}_t$	-0.183***	0.497***
	(0.062)	(0.129)
Obs.	672,803	1,935,398
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	**-0.099****	**0.470****
Test High ($\alpha_1 + \alpha_3$)	**-0.094*****	**0.520*****

Clustered (state) standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A8: Transitions from enrolled to dropout and from labor force to enrolled for poorer low-income

	College Dropouts	LF → College
u_t	**0.148****	**-0.665**
	(0.076)	(0.164)
Mid. Inc. × u_t	-0.135**	0.899***
	(0.069)	(0.162)
High. Inc. × u_t	-0.235***	1.153***
	(0.079)	(0.214)
Obs.	671,770	1,932,490
R-squared	0.004	0.016
Test Middle ($\alpha_1 + \alpha_2$)	**0.013**	**0.234****
Test High ($\alpha_1 + \alpha_3$)	**-0.086****	**0.488****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9: College enrollment and the business cycle for poorer low-income

	Attended college
u_i^{HS}	**-0.307**
	(0.261)
Mid. Inc. × u_i^{HS}	0.688**
	(0.280)
High. Inc. × u_i^{HS}	0.746**
	(0.371)
Clustered SE state	Yes
Obs.	838,668
R-squared	0.054
Test Middle ($\beta_1 + \beta_2$)	**0.521****
Test High ($\beta_1 + \beta_3$)	**0.461****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A10: College dropouts and college degree and the business cycle for poorer low-income

	College Dropout	College degree or more
u_i^{HS}	**0.192**	**-0.490***
	(0.299)	(0.284)
Mid. Inc. $\times$ u_i^{HS}	0.188	0.463
	(0.369)	(0.304)
High. Inc. $\times$ u_i^{HS}	0.288	1.278***
	(0.466)	(0.356)
Obs.	427,165	400,507
R-squared	0.030	0.234
Test Middle ($\beta_1 + \beta_2$)	**0.380*** **	**-0.027**
Test High ($\beta_1 + \beta_3$)	**0.480****	**0.788*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A11: Associate degrees and the business cycle

Effects in p.p.	Assoc. occupational		Assoc. academic	
w.r.t HS only	(1)	(2)	(3)	(4)
ur HS_i	-0.149***	-0.240***	0.089***	-0.085***
	(0.027)	(0.035)	(0.027)	(0.033)
Mid. Inc. $\times$ ur HS_i		0.073		0.084
		(0.056)		(0.055)
High. Inc. $\times$ ur HS_i		-0.022		0.245***
		(0.077)		(0.084)
Controls	No	Yes	No	Yes
Obs.	313,379	313,379	309,693	309,693
R-squared	0.000	0.027	0.00	0.037
F-test Middle ($\beta_1 + \beta_2$)		13.88***		0.00
F-test High ($\beta_1 + \beta_3$)		13.44***		4.28**

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A12: College enrollment and the business cycle using the maximum unemployment between January and May

	Attended college
u_i^{HS}	**0.097**
	(0.130)
Mid. Inc. $\times$ u_i^{HS}	0.152
	(0.198)
High. Inc. $\times$ u_i^{HS}	-0.008
	(0.211)
Clustered SE state	Yes
Obs.	838,668
R-squared	0.057
Test Middle ($\beta_1 + \beta_2$)	**0.250****
Test High ($\beta_1 + \beta_3$)	**0.089**

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A13: College dropouts and college degree and the business cycle using the maximum unemployment between January and May

	College Dropout	College degree or more
u_i^{HS}	**0.162**	**-0.139**
	(0.105)	(0.118)
Mid. Inc. $\times$ u_i^{HS}	0.172	0.257
	(0.216)	(0.258)
High. Inc. $\times$ u_i^{HS}	0.025	0.484***
	(0.196)	(0.167)
Obs.	427,165	400,507
R-squared	0.032	0.242
Test Middle ($\beta_1 + \beta_2$)	**0.334****	**0.117**
Test High ($\beta_1 + \beta_3$)	**0.187**	**0.345*****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A14: College enrollment and the business cycle using only May

	Attended college
u_i^{HS}	**0.116**
	(0.132)
Mid. Inc. $\times$ u_i^{HS}	0.225
	(0.213)
High. Inc. $\times$ u_i^{HS}	0.087
	(0.229)
Clustered SE state	Yes
Obs.	838,668
R-squared	0.057
Test Middle ($\beta_1 + \beta_2$)	**0.341*** **
Test High ($\beta_1 + \beta_3$)	**0.203**

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A15: College dropouts and college degree and the business cycle using only May

	College Dropout	College degree or more
u_i^{HS}	**0.200***	**-0.186**
	(0.107)	(0.127)
Mid. Inc. $\times$ u_i^{HS}	0.204	0.312
	(0.214)	(0.239)
High. Inc. $\times$ u_i^{HS}	0.084	0.655***
	(0.213)	(0.194)
Obs.	427,165	400,507
R-squared	0.032	0.242
Test Middle ($\beta_1 + \beta_2$)	**0.404****	**0.125**
Test High ($\beta_1 + \beta_3$)	**0.284***	**0.468*****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A16: Transitions from enrolled to dropout and from labor force to enrolled excluding COVID

	College Dropouts	LF → College
u_t	**0.080**	**0.056**
	(0.052)	(0.069)
Mid. Inc. × u_t	-0.197**	0.483***
	(0.060)	(0.099)
High. Inc. × u_t	-0.243***	0.633***
	(0.069)	(0.149)
Obs.	625,285	1,815,815
R-squared	0.004	0.016
Test Middle ($\alpha_1 + \alpha_2$)	**-0.117*****	**0.539****
Test High ($\alpha_1 + \alpha_3$)	**-0.163****	**0.689****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A17: College enrollment and the business cycle excluding COVID

	Attended college
u_i^{HS}	**0.271****
	(0.131)
Mid. Inc. × u_i^{HS}	0.198
	(0.240)
High. Inc. × u_i^{HS}	0.089
	(0.272)
Clustered SE state	Yes
Obs.	775,226
R-squared	0.056
Test Middle ($\beta_1 + \beta_2$)	**0.469****
Test High ($\beta_1 + \beta_3$)	**0.359****

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A18: College dropouts and college degree and the business cycle excluding COVID

	College Dropout	College degree or more
u_i^{HS}	**0.276*** **	**-0.139**
	(0.103)	(0.146)
Mid. Inc. $\times$ u_i^{HS}	0.270	0.221
	(0.220)	(0.252)
High. Inc. $\times$ u_i^{HS}	0.121	0.795***
	(0.262)	(0.235)
Obs.	397,742	368,842
R-squared	0.032	0.240
Test Middle ($\beta_1 + \beta_2$)	**0.545*** **	**0.082**
Test High ($\beta_1 + \beta_3$)	**0.397***	**0.657*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A19: Transitions from enrolled to dropout and from labor force to enrolled with 23 year old or younger

	College Dropouts	LF $\rightarrow$ College
u_t	**0.131***	**-0.427** **
	(0.077)	(0.174)
Mid. Inc. $\times$ u_t	-0.186**	0.682***
	(0.070)	(0.180)
High. Inc. $\times$ u_t	-0.220**	0.900***
	(0.083)	(0.225)
Obs.	636,581	1,688,258
R-squared	0.003	0.021
Test Middle ($\alpha_1 + \alpha_2$)	**-0.055**	**0.255*** **
Test High ($\alpha_1 + \alpha_3$)	**-0.088*** **	**0.473*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A20: College enrollment and the business cycle with 23 year old or younger

	Attended college
u_i^{HS}	**0.405*** **
	(0.127)
Mid. Inc. $\times$ u_i^{HS}	0.206
	(0.208)
High. Inc. $\times$ u_i^{HS}	-0.049
	(0.239)
Clustered SE state	Yes
Obs.	557,974
R-squared	0.063
Test Middle ($\beta_1 + \beta_2$)	**0.610*** **
Test High ($\beta_1 + \beta_3$)	**0.356***

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A21: College dropouts and college degree and the business cycle with 23 year old or younger

	College Dropout	College degree or more
u_i^{HS}	**0.592*** **	**-0.151**
	(0.106)	(0.127)
Mid. Inc. $\times$ u_i^{HS}	0.194	0.154
	(0.202)	(0.160)
High. Inc. $\times$ u_i^{HS}	-0.010	0.908***
	(0.222)	(0.198)
Obs.	284,510	236,582
R-squared	0.036	0.214
Test Middle ($\beta_1 + \beta_2$)	**0.786*** **	**0.003**
Test High ($\beta_1 + \beta_3$)	**0.582*** **	**0.757*** **

Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1