Strategic or Scarred? Disparities in College Enrollment and Dropout Response to Macroeconomic Conditions*

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Abstract

Recessions create enduring effects (scars) on young individuals' careers. I build a dynamic life-cycle model calibrated to US data to investigate how educational choices amplify or mitigate these scarring effects by income. Low-income young people face dual scarring effects: an increased likelihood of dropping out of college and enduring negative labor market entry effects. High- and middle-income young people strategically evade these repercussions by delaying labor market entry through timely college enrollment during economic downturns.

JEL Codes: *E24, E32, E61, I23, I24.*

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Macroeconomic conditions are well-known to affect young people's schooling choices (Gustman & Steinmeier (1981), Betts & McFarland (1995), Sakellaris & Spilimbergo (2000), Dellas & Koubi (2003), Johnson (2013), Boffy-Ramirez et al. (2013), Guo (2018), Cajner et al. (2021), Stuart (2022), Schanzenbach et al. (2024), Sadaba et al. (2024)) but less is understood about how these impacts vary by students' socioeconomic backgrounds. Labor force entry decisions during recessions involve difficult trade-offs for recent high school graduates and college students. On the one hand, family financial distress creates a wealth effect that raises the relative cost of staying in college. On the other hand, a weak labor market lowers the opportunity cost of being outside the labor force. This paper focuses on how the relative importance of these mechanisms correlates with family income, the distinct patterns of college enrollment and completion in response to macroeconomic conditions, and quantifying the lifetime impacts of experiencing a rise in the unemployment rate, similar to that in the 2009 economic recession, during critical times—around high school graduation and during college attendance—across different family income levels.

I introduce a model with endogenous schooling decisions that quantifies the lifetime impact of experiencing a recession for young individuals. The model has liquidity constraints and persistent effects of labor market entry conditions on current wages that impact college enrollment and dropout decisions heterogeneously by income levels. I estimate this model to match key moments for the US using CPS micro data. The model successfully replicates the following novel empirical findings. Low-income college students, or the bottom 35% of the distribution of yearly family income, are more likely to drop out of college during periods of high unemployment, while high-income students, or the top 25% of the distribution of yearly family income, tend to stay and earn their degrees. High-income individuals who faced high unemployment rates around their high school graduation are more likely to have attended college and earned a degree years later. I estimate the model to reproduce the two main counterfactuals of the paper displaying substantial drops in lifetime consumption for the poorest subgroups within the low-income group when a recession occurs during two pivotal periods: around high school graduation and during college attendance. Finally, the model highlights the strategic role of college decisions made by middle and high-income individuals as a means to mitigate such long-term effects.

I present a dynamic life-cycle individual decision-making model to quantify the lifetime impacts of experiencing a recession during these two pivotal time periods for young individuals: high school graduation and attending college. The model incorporates endogenous choices regarding college enrollment, college completion, as well as decisions regarding consumption and savings, all starting from different initial asset levels. Business cycles are generated by a productivity variable subject to a stochastic process. Wages depend both on the current productivity state and the productivity state at the individual's labor market entry, 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.

During economic recessions, individuals with sufficient liquidity are more inclined to enroll in college or complete their degrees due to lower wages and strong incentives to delay labor market entry. These incentives are further amplified by labor market rigidities, which cause the initial conditions to have persistent effects on future wages.

Using CPS micro data I document these trade-offs presented in the model. I find that low-income individuals are disproportionately susceptible to the enduring adverse effects of high unemployment rate periods during two pivotal time periods. While attending college, periods of high unemployment rates are correlated with a higher probability of dropping out of college without earning a degree for this income group. In addition, around high school graduation, periods of high unemployment rate are correlated with a lower probability of pursuing 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 enter the labor force even when the labor market is weak, resulting in comparatively milder but persistent repercussions stemming from unfavorable labor market entry conditions. By contrast, high-income individuals strategically evade these scarring effects. When periods of high unemployment coincide with college attendance, they are more likely to complete their college degree, and when such economic downturns coincide with their high school graduation, they are also more likely to enroll in college.

An increase in the unemployment rate in a US state equivalent to the rise experienced during the 2009 crisis correlates with an increase in the likelihood of dropping out of college of 10% for the low-income group and an insignificant change in the probability of transitioning from the labor force to college. In contrast, the same rise in the unemployment rate in a state is associated with a 4% reduction in the probability of dropping out of college and a 13% increase in the probability of transitioning from the labor force to college for high-income individuals.

An increase in the unemployment rate in a US state comparable to that in the 2009 crisis is also linked to an increase in college enrollment disparity between high and low-income groups of 10%.[1] 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 of 32%.

The substantial increase in college enrollment among high-income individuals after a rise in the unemployment rate in the respondent's state around their high school graduation does not fully translate into the same magnitude rise in future college degree holders within this income bracket. This spike in college enrollment is followed by an increase in college dropouts among high-income individuals as economic conditions rebound post-recession. One plausible mechanism consistent with this fact that I explore in the model is that, for this more economically privileged group, the diminished opportunity cost incentivizes even individuals who might be *a priori* less academically suited for college, as suggested by the higher enrollment rates previously observed. Once they realize about their poor academic performance and the labor market has recovered they might

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

choose to drop out of college. I find that this type of college dropout more prevalent among the male population. The model successfully generates these different types of college dropouts.

I use this same dataset to estimate four key parameters of the model—the variance of the business cycle, the college wage premium, the influence of labor market entry conditions on current wages, and tuition fees—with key moments of the data. Experiencing a rise in the unemployment rate in a state similar to the rise experienced in the 2009 recession while attending college carries substantial adverse implications for the lifetime consumption of the poorest subgroup within the low-income group.[2] This subgroup experiences a 40% reduction in lifetime consumption (in present value terms), stemming from the increase in college dropout rates following a recession. The average impact on the entire low-income bracket is an 11% drop in their lifetime consumption.[3]

Next, I find that the poorest subgroup within the low-income experiences a 9% reduction in lifetime consumption following a recession around high school graduation date stemming from the negative labor market entry effects. The most affected subgroup is the second poorest within the low-income group. The wealth effect provoked by the recession around the time of high school graduation significantly precludes them from going to college. A recession at this time reduces lifetime consumption by 24% for this income subgroup. The average impact on the entire low-income bracket is a 10% drop in lifetime consumption.

The effects of experiencing the same rise in the unemployment rate in a state are relatively moderate for the remaining income groups. Middle and high-income individuals experience a decrease of slightly below 2% in present value lifetime consumption when the shock occurs during college attendance, and around 3% when it occurs around high school graduation. This is because they tend to stay in college if a recession happens while they are enrolled, and they are likely to enroll in college if it occurs around their high school graduation, making them less susceptible to labor market turbulence.

College enrollment and completion decisions magnify recessions' scarring effects for the poorest individuals but mitigate them for the entire middle and high income. 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 whose college decisions respond strategically to these shocks. Policies aimed at reducing the impact of these types of rigidities would therefore potentially benefit the poorest the most.

This paper is structured as follows: in Section 1, I introduce a dynamic individual decision-making model designed to capture the dynamics of college decisions as a response to macroeconomic conditions. 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

[2]In my model I have 4 grids within the low-income group so the poorest subgroup would represent a fourth of the low-income group which is the bottom 35% of the family income distribution. So, the poorest subgroup in my model, assuming that each subgroup has the same number of individuals, would represent approximately the bottom 9% of the young individual population.

[3]In the model I use the present value of expected lifetime consumption. The term expected comes from the fact that the model will have an expectation term capturing the auto-regressive nature of the productivity process.

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. In Section 3.3 I show some robustness checks to the aforementioned empirical findings. Additionally, in Section 3.4, I carefully discuss the central identifying assumptions underpinning the empirical section of the paper. In Section 4 I calibrate the model to match key moments in the US and in Section 5 I present the main results 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 the unemployment rate in a state similar to the rise 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 the recent empirical literature regarding the negative and persistent effects of entering the labor market during economic crises. I contribute to this branch of the literature by allowing individuals in the model to endogenously choose their labor force entry timing via schooling decisions. Second, it shows the counter-cyclicality of college enrollment, with a novel finding regarding the distinct elasticities across income levels. Another relevant contribution is the distinction between people who finish the degree and those who drop out from college. Third, it also contributes to the branch of the literature focused on analyzing the unequal impacts of economic recessions across different income levels. I show that schooling decisions play an important role in widening the income gap in the aftermath of a recession.

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 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 better predict 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) documents these persistent entry effects for Ph.D. graduates who enter the job market during a recession. He finds that Ph.D. candidates who graduate during recessions experience lower wages, lower probabilities to get positions in top-50 schools and lower overall productivity levels, measured in terms of publications and research citations even years after the recession. Kondo (2015) focuses on the heterogeneity in these effects across gender and race. Choi et al. (2020) shows the same entry effects for South Korean college graduates who entered the labor market during the Asian financial crisis. They expanded their analysis to other relevant variables such as marriage, fertility and asset building beyond earnings and employment.

This paper contributes to this branch of the literature by replicating this empirical fact using CPS data. I show 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 allow the labor market entry decision to be endogenous for an individual that can use college enrollment to postpone it and to strategically avoid these negative entry effects. I find empirical evidence of such behavior 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. Acabbi et al. (2022) 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 more 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), Guo (2018), Cajner et al. (2021), Stuart (2022), Schanzenbach et al. (2024), Sadaba et al. (2024)). This paper contributes to this branch of the literature in two main ways. First, I show that the cyclicality in college enrollment varies by income level. Low-income individuals' schooling decisions are also affected by the wealth effect induced by economic recessions whereas higher income individuals seem to react more strongly to the opportunity cost channel. Second, I distinguish individuals who graduate and earn their college degrees from those who drop out from college which have significant economic and policy implications.

Finally, I also contribute to the branch of literature that focuses on the uneven impacts of economic recessions by income levels. The last recessions have had a relatively larger negative impact on the lower income segments of the population (Heathcote et al. (2010), Sierminska & Takhtamanova (2011), Hoynes et al. (2012), Pfeffer et al. (2013), Brzezinski (2018), Simona-Moussa & Ravazzini (2019), Heathcote et al. (2020)). I contribute by exploring a novel channel for which recessions impact more strongly lower income segments of the population which is endogenous schooling decisions.

1 Model

I introduce a dynamic life-cycle individual decision-making model to quantify the lifetime impact of experiencing a rise in the unemployment rate in a state 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 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 presents interesting trade-offs. In expansions individuals are incentivized to enter the labor market to earn high wages. This effect is amplified by labor market rigidities, which cause initial entry conditions to have persistent impacts on future earnings. Conversely, during recessions individuals with sufficient liquidity have strong incentives to enroll in or complete their college education.

Environment

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

$$U = \mathbb{E}_0 \sum_{t=0}^{T} \beta^t u(c_t). \tag{1}$$

Agents know their initial level of assets (a_o), their ex-ante probability of being a good fit for college (p) and the aggregate productivity state of the economy (z_t). Agents choose enrolling (e) and dropout decisions (d) which will determine their schooling level (X_t). While enrolled they will also face an exogenous revelation of their own type. They also choose their consumption (c_t) and next period asset level (a_{t+1}). The budget constraint that individuals face is the following:

$$(1 + r)a_t + y_t(X_t, z_t, \tilde{z}) + g(z_t) = a_{t+1} + c_t + f_t(X_t), \tag{2}$$

where

$$a_{t+1} \geq \xi. \tag{3}$$

The left-hand side of the budget constraint represents all the income sources available to the individual. a_t is the asset level at period t, and r exogenous rate of return. Labor income, denoted as y_t, depends on the schooling state X_t, current productivity state z_t, and the productivity state at labor market entry, denoted by $\tilde{z}$. Additionally, the function $g(z_t)$ represents the parental transfers received by the individual, which depends on the current productivity state. This is to ensure that enrolled students remain susceptible to current economic conditions. For example, a negative shock on parental transfers might emulate parental job loss, exerting some 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, which depend on the schooling state. 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:

$$z_t = \mu + \rho z_{t-1} + \epsilon_t, \tag{4}$$

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:

$$X_{t+1} = \Psi(X_t, e, d), \tag{5}$$

Timing ane Income Structure

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). She also knows that productivity follows a Markov process and the transition probabilities. The individual confronts pivotal decisions regarding schooling, 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. The individual only earns the college wage premium if she graduates from college after having observed she is a good fit for it; 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. Once an individual drops out of college she cannot enroll again.

Figure 1 illustrates the dynamic evolution of schooling decisions within the model. In period $t = 0$, the agent must choose whether to enroll in college. If the individual enrolls, she will be in

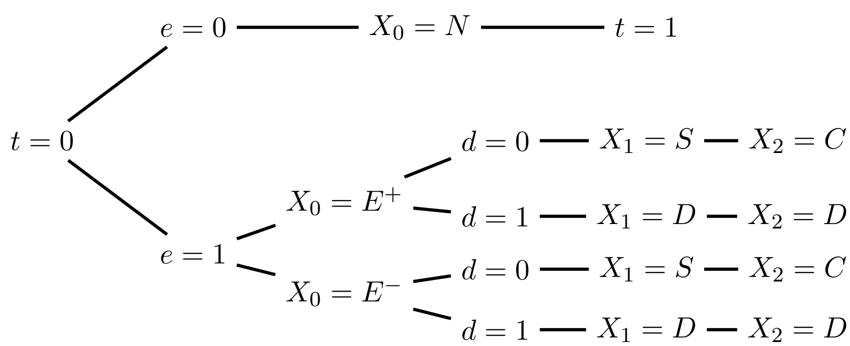

Figure 1: Diagram of schooling decisions

state $X_0 = E^+$ or $X_0 = E^-$, depending on the exogenous realization of her suitability for college, such as observing her own grades. The agent knows her probability of being a good fit for college (p). If she decides not to enroll, she will be in state $X_0 = N$ and will reconsider her enrollment decision (e) in $t = 1$. While enrolled (E^+ or E^-), the individual must decide whether to drop out of college (d). Regardless of her type, if she decides to drop out, she will enter state $X_1 = D$ and remain there permanently. If she decides to stay in college, she will enter state $X_1 = S$, which represents the senior year of college. Being a senior in $t = 1$ means that the agent will automatically become a college degree holder in $t = 2$ when she enters the labor market ($X_2 = C$). However, the individual will only enjoy the college wage premium ($\theta(X_t) = \theta(C)$) if she graduates and also receives a favorable realization about her type (E^+).

Labor income is a function of schooling state X_t:

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

$$\theta(X_t) = \begin{cases} \theta(C) & \text{if } X_t \in \{C\} \text{ and } X_{t-\tau} = E^+ \text{ for some } \tau \geq 2, \\ \theta(N) & \text{if } X_t \in \{C\} \text{ and } X_{t-\tau} = E^- \text{ for some } \tau \geq 2, \\ \theta(N) & \text{if } X_t \in \{N, D\}. \end{cases}$$

While enrolled in college, labor income is equal to zero. In the other states, income depends on $\theta(X_t)$, denoting the college wage premium. Specifically, if an individual has successfully completed college following a favorable assessment of her college suitability, $\theta(X_t) = \theta(C)$, where $\theta(C) > \theta(N)$. Moreover, labor income is influenced by the current state of the economy, denoted by z_t, as well as the economic conditions at the time of labor market entry, represented by $\tilde{z}$. The parameter $0 < \psi_t < 1$ governs the extent to which initial conditions impact current income levels and I included a subscript t to allow for the possibility of shutting down the effect of initial conditions after some t periods since this effect does not seem to be permanent in the data.

The model generates three types of college dropouts. First, academic dropouts, individuals who, after learning their unsuitability for college (E^-), perhaps due to academic struggles or course failures, opt to drop out of college. In that case, even attaining the degree would not enhance their future θ, making the future investment in college tuition less worth it. This type of dropouts is the type we see in Stange (2012). Second, financial dropouts, individuals who, irrespective of their realization regarding their aptitude for college, confront an adverse productivity shock that disrupts parental transfers ($g(z_t)$), plunging them into financial distress and unable to pay for tuition. This mechanism aims to capture the wealth effect of economic recessions. Lastly, strategic dropouts, individuals who, despite realizing their prospective benefits of the college wage premium (E^+), and despite not being financially constrained, choose to abandon college due to an exceptionally robust state of the economy, preferring immediate entry into the labor force. We do not see these types of dropouts occurring in the data nor in the model in the calibration used.

Trade-offs and Predictions of the Model

The expected income for a recent high school graduate who chooses to enroll in college in $t = 0$ is the following:

$$\begin{aligned} Y^C = -f + p\Big(-f + \theta(C)\mathbb{E}_0 \sum_{t=2}^{T} \big[\psi_t(\exp(z_2)) + (1-\psi_t)(\exp(z_t))\big]\Big) \\ + (1-p)\Big(\theta(N)\mathbb{E}_0 \sum_{t=1}^{T} \big[\psi_t(\exp(z_1)) + (1-\psi_t)(\exp(z_t))\big]\Big), \end{aligned} \tag{6}$$

where $\theta(C)$ represents the college wage premium for a graduate who has realized she is a good fit for college (E^+), thus $\theta(C) > \theta(N) = 1$.[4] I exclude all parental transfers ($g(z_t)$) as they are independent of the decision to enroll in college. In this scenario, with probability p, the agent will be a good fit for college, pay tuition for two periods, and enter the labor market in $t = 2$, making her $\tilde{z} = z_2$. Conversely, with probability $(1 - p)$, she will not be a good fit for college, drop out, and enter the labor market in $t = 1$, resulting in her $\tilde{z} = z_1$.

The expected income for a recent high school graduate who chooses not to enroll in college is the following:

$$Y^N = \theta(N)\mathbb{E}_0 \sum_{t=0}^{T} \big[\psi_t(\exp(z_0)) + (1-\psi_t)(\exp(z_t))\big]. \tag{7}$$

Higher tuition costs (f) make the choice of attending college less attractive compared to entering the labor market directly. Conversely, higher probabilities of being a good fit for college (p) and a higher college wage premium (θ) increase the attractiveness of pursuing higher education.

Now, let's focus on the role of business cycles and expectations. A favorable current state of the economy (z_0) makes entering the labor market more appealing, as individuals do not earn wages while enrolled in college. This effect is further amplified by a larger ψ, indicating more persistent

[4] I assume $\theta(N) = 1$.

labor market entry conditions. Conversely, poor current economic conditions and positive future prospects make attending college more attractive, with these effects also being enhanced by ψ.

Equations (6) and (7) imply that there are some thresholds for p and $\theta(C)$ for which an individual is indifferent between choosing to attend college or entering the labor force.

$$\hat{p} = \frac{\theta(N)\Lambda^C + f - \theta(N)\Lambda^B}{\theta(C)\Lambda^A - \theta(N)\Lambda^B - f}, \tag{8}$$

and

$$\hat{\theta}(C) = \frac{\theta(N)\Lambda^C + (1-p)\theta(N)\Lambda^B + f + pf}{p\Lambda^A}, \tag{9}$$

where $\hat{p}$ corresponds to the ex-ante probability of being a good fit for college such that $Y^C = Y^N$ and $\hat{\theta}(C)$ is the college wage premium such that $Y^C = Y^N$. Λ^A, Λ^B and Λ^C are the lifetime expected income of entering the labor force at $t = 2$, $t = 1$ and $t = 0$.[5] I derive both $\hat{p}$ and $\hat{\theta}(C)$ in the Mathematical Appendix B.1.

The model predicts that higher tuition fees (f) would increase both the threshold probability ($\hat{p}$) and the threshold college wage premium ($\hat{\theta}(C)$). This implies that if college becomes more costly, only individuals with a higher *a priori* probability of being a good fit for college would enroll. Additionally, individuals would require a higher college wage premium to be indifferent between attending college and entering the labor market directly.

Higher expected gains from entering the labor force in $t = 2$ (Λ^A), for individuals who have spent the first two periods in college, would lower the threshold probability ($\hat{p}$). This means that even individuals less fit for college would be incentivized to enroll, and the required college wage premium for indifference would decrease. Conversely, higher expected lifetime income for individuals entering the labor force in $t = 0$ (Λ^C) would increase the threshold probability ($\hat{p}$), making less academically fit individuals prefer not to attend college, and would also raise the required college wage premium ($\hat{\theta}$).

The effects of higher expected lifetime income for entering the labor force in $t = 1$ are less straightforward. Taking the derivative of $\hat{p}$ with respect to Λ^B, it is positive as long as the expected gains from graduating college and entering the labor force in $t = 2$, minus the tuition, are higher than the expected gains from entering the labor force directly in $t = 0$.[6] The effects on the college wage premium threshold are positive. Higher expected income for entering the labor market in $t = 1$ without a college degree increases the required college wage premium to be indifferent between going to college or not.

In the next section, I describe the dataset used to calibrate and estimate the model. This dataset will also reveal the two novel empirical findings replicated by the model.

[5] $\Lambda^A \equiv \mathbb{E}_0 \sum_{t=2}^{T} [\psi_t \exp(z_2) + (1-\psi_t)\exp(z_t)]$, $\Lambda^B \equiv \mathbb{E}_0 \sum_{t=1}^{T} [\psi_t \exp(z_1) + (1-\psi_t)\exp(z_t)]$ and $\Lambda^C \equiv \mathbb{E}_0 \sum_{t=0}^{T} [\psi_t \exp(z_0) + (1-\psi_t)\exp(z_t)]$

[6] $\frac{\partial \hat{p}}{\partial \Lambda^B} = \frac{\theta(N)\left[\theta(N)\Lambda^C - (\theta(C)\Lambda^A - 2f)\right]}{\left[\theta(C)\Lambda^A - \theta(N)\Lambda^B - f\right]^2}$

2 Data

I use yearly aggregate data from the US Census to present stylized facts regarding educational choices as a response to macroeconomic conditions. I show that college enrollment has been countercyclical since 1970 in the US.

I also use Integtated Public Use Microdata Series (IPUMS) Current Population Survey (CPS) monthly micro data spanning from January 1992 to July 2024, which constitutes the central dataset for the main empirical facts in Section 3.[7] I split the data set into two: longitudinal and cross-sectional data. I use the longitudinal data to unveil the first main empirical finding: 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 stay in college amid high unemployment rate periods. Further, I observe that middle and high-income individuals are also more likely to transition from the labor force to college during high unemployment rate periods.

I use the cross-sectional data to show the second empirical finding: high unemployment rates around high school graduation exert varying effects on future college enrollment decisions across different income groups. 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 to examine school enrollment trends in the United States.[8] The main dependent variable is the annual college enrollment of students under 35 years old relative to the entire student age population deviations from the trend.[9] 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.

I run a linear regression to examine the relationship between the main dependent variable, yearly college enrollment deviations from trend and key business cycle variables, as specified in equation 10. The data spans yearly observations from 1970 to 2022.

$$y_t = \alpha + \beta_1 \text{ business cycle}_t + \epsilon_t \tag{10}$$

In Table 1 I present the regression results including five independent variables that capture the business cycle phase. These variables include deviations from the NAIRU, the yearly mean of the unemployment rate, a binary indicator denoting the occurrence of a recession and the real

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

[8] More specifically I use the Table A.7: College Enrollment of Students 14 Years Old and Over (`https://www.census.gov/data/tables/time-series/demo/school-enrollment/cps-historical-time-series.html`).

[9] 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.

GDP yearly growth rate.[10] To align these business cycle variables with the academic calendar, I converted them so 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 independent of macroeconomic realizations in the subsequent two quarters of that year. As a robustness exercise, I extend the regression analysis to encompass linear and exponential time trends, the results persist unaltered, see Table A1.

Table 1: College enrollment is counter-cyclical

	Effect on college enrollment deviations from trend
Unemployment rate (p.p.)	0.329***
	(0.102)
Unemployment rate deviations from NAIRU (p.p.)	0.394***
	(0.102)
Recession (binary)	0.243
	(0.366)
Real GDP growth (YoY%)	-0.243***
	(0.079)

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. 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 increase of 1.9 standard deviations of yearly college enrollment deviations from the long run trend.

In conclusion, college enrollment seems counter-cyclical on aggregate. The underlying intuition suggests that during high unemployment rate periods, labor market outcomes deteriorate, thereby reducing the opportunity cost of pursuing higher education. However, 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 for different income levels.

2.2 Micro CPS Data

I use IPUMS CPS monthly data spanning from January 1992 to July 2024. The CPS adopts a rotating panel design, wherein each individual appears for consecutive 4-month periods, followed

[10] 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 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.

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 use two data sets: one for longitudinal analyses, examining 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 analysis. I present descriptive statistics for key variables in Table A2, where I applied the weights using the variable *wtfinl* to account for the sample's representativeness.[11] Additionally, Table A3 presents the same descriptive statistics without any weighting.

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 for individuals appearing after the 8 month absence in order to better identify the relevant transitions. In the cross-sectional data set, in the last two columns, I adopt a cross-sectional approach and keep only one observation per individual. Furthermore, to discern the heterogeneous effects across different family income levels, I limit the second data set to a sub-sample comprising individuals aged 25 or younger.[12]

I only include observations from individuals who have responded to the questionnaire called *SCHLCOLL* in order to distinguish people who are currently enrolled in college or not. This variable only included people from ages 16 to 24 until 2012 and from ages 16 to 54 from 2013 onward.

The variable "family income" captures the aggregate income received by all members of the respondent's family over the past 12 months. I focus all my analysis on young individuals to better proxy this "family income" variable as external for the young individual and to avoid possible endogeneity issues regarding the relationship between own earnings and educational choices. The questionnaire explicitly defines the components comprising this income, including 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. 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 slightly more than a third of the young sample, comprise individuals with an annual family income below \$30,000. middle-income individuals, representing also slightly more than a third of the young sample, encompass those with family incomes ranging between \$30,000 and \$75,000. Lastly, high-income individuals, accounting for around a fourth of the young sample, pertain to those with an annual family income exceeding \$75,000.[13]

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 because there was

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

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

[13] 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 also control for the year of the interview and for time trends within the income group in the main regressions shown in Section 3.

a change in the categorical groups included in January 1992. In Table A4, I present a comparative analysis of this variable between the two distinct sample periods, including the option "Some college but no degree" that is only available from January 1992 onward.

In Figure 2 I illustrate the evolving trends in the three principal educational level groups over time. The percentage of individuals with a high school diploma or less, accounted for approximately 68% of the population under 25 years old in 1992. However, this figure has subsequently decreased and now stands at 57%. Conversely, the percentage of individuals with a bachelor's degree or higher, constituted a mere 10% of the under 25 years old population in 1992, but this proportion has risen significantly to almost 20% in the last decade. The intermediate group includes individuals with some higher education but without a bachelor's degree. This education category has remained quite stable around 23%.

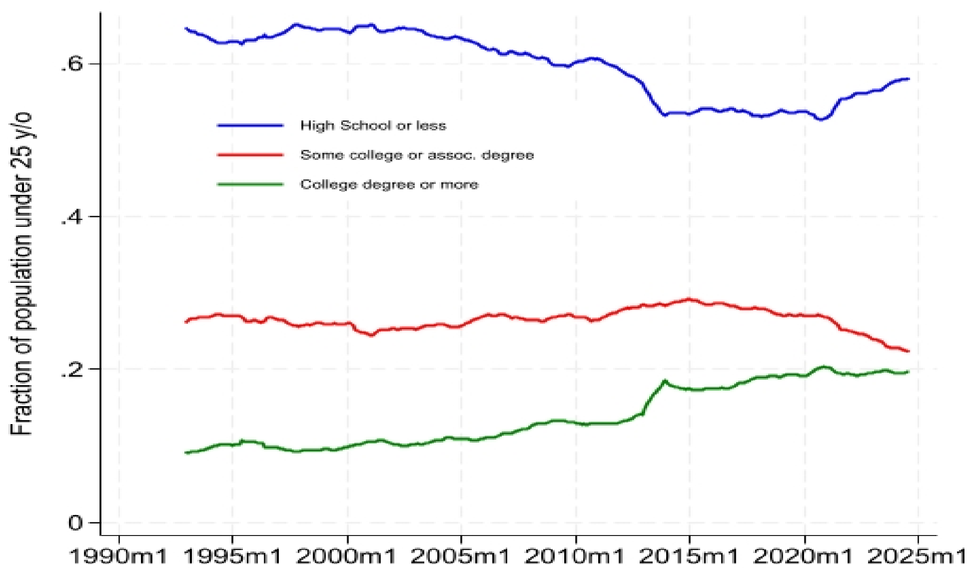

Figure 2: Evolution of educational groups over time.

Note: I compute the 12-month moving averages fractions of employed people under 25 years old in the sample that have a High School diploma or less, some college education (including people with associate degrees) and a college degree or more. I only include non-current students. The fractions sum up to 1 in each month.

3 Main Empirical Findings

I present the central empirical findings of the paper in this section regarding the differential responses of college enrollment and completion to the changes in the unemployment rate, contingent on family income groups. High unemployment rates exert varying impacts on individuals' decisions concerning college enrollment based on their family income. These empirical findings are key to better understand the trade-offs presented in the theoretical model. Particularly, the negative wealth effect which in the model I hypothesize as liquidity constraints and the strategic efforts to avoid scarring effects stemming from bad labor market entry become pronounced during high unemployment rate periods. The negative wealth effect becomes notable as it compels individuals with lower incomes to prematurely drop out from college. Conversely, high-income individuals are more likely to enroll in college, seeking to avoid the scarring effects associated with bad labor market entries. In Section 3.1 I analyze responses following a rise in the unemployment rate in a state while being enrolled in college or in the labor force, whereas in Section 3.2 I analyze responses following a rise in the unemployment rate in a state 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 magnitude of 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):

$$y_{i,t} = \beta_0 + \beta_1 u_i^{HS} + \Gamma \mathbf{X}_{i,t} + \epsilon_{i,t}, \tag{11}$$

where $y_{i,t}$ is the outcome variable: log of real earnings in 1992 terms or a binary equals 1 if the individual was unemployed t years after own high school graduation, u_i^{HS} is the unemployment rate in a state around high school graduation date and $\mathbf{X}_{i,t}$ are controls such as sex, race and the year of the interview.[14]

Figure 3 illustrates the dynamic evolution of the coefficient β_1 over t periods following high school graduation for individuals who did not pursue higher education and were employed at the time of the interview. A 1 percentage point (p.p.) increase in the unemployment rate in a state around high school graduation is associated with a significant decline in average real earnings for the employed population persisting for over a decade after high school completion. There is also an approximate 0.5 p.p. immediate increase in the probability of experiencing unemployment that vanishes relatively more quickly.

I repeat the same analysis for individuals who graduated from college in Figure A.1. I restricted the sample to individuals who have a college degree but not more in order to better approximate their college graduation date, 4 years after their 18th birthday. The effects of the unemployment rate in the respondent's state on real earnings are markedly mitigated. 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. In contrast, enrolling in college during economic downturns presents the advantage of postponing labor market

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

entry, thereby evading these deleterious and enduring consequences. Further, the negative labor market entry effects seem to virtually vanish for the college sample.

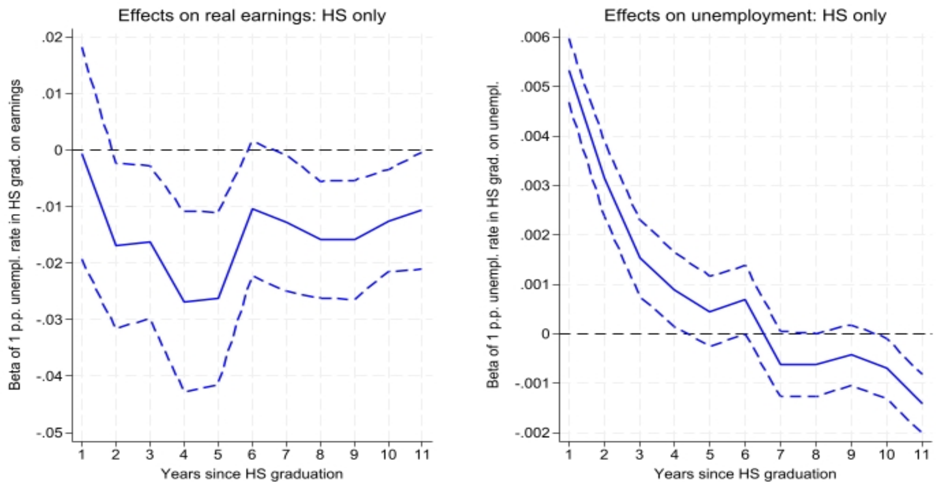

Figure 3: Negative and persistent effects of graduating during recessions.

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.

These findings are economically significant. For instance, the accumulated earnings losses from entering the labor force during a recession similar to the 2009 Great Recession would result in a substantial 8.7% decline in real earnings over the first decade of employment, even when accounting for equivalent employment probabilities. This value is computed by summing the first 10 coefficients and multiplying by 5.6, reflecting the 5.6 percentage point increase in the national unemployment rate during the 2009 recession. Additionally, entering the labor force during an economic state akin to the 2009 Great recession would be linked to a 0.54 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 9.14% for the first decade after entry.[15] These detrimental effects of entry are comparatively lower and less persistent for college graduates, as depicted in Figure A.1.

Based on these findings, I examine whether young individuals from richer families tend to enter the labor force during better macroeconomic conditions when compared to those from relatively disadvantaged households. 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

[15] I calculate this value by multiplying the real earnings losses conditional on being employed by the probability of being employed (0.9946). I assume that with the remaining probability earnings are 0.

panel regressions are conducted as follows:

$$z_{i,t} = \alpha_0 + \alpha_1 u_t + \alpha_2 \text{Mid. Inc.} \times u_t + \alpha_3 \text{High. Inc.} \times u_t + \Gamma \mathbf{X}_{i,t} + \nu_{i,t}, \tag{12}$$

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 unemployment rate in the respondent's state during the interview.[16] I controlled for sex, race, age, income group, state, time of the interview and a time trend that interacted with the income group. From this analysis I exclude people who complete the degree, therefore only considering people who leave college without earning the degree.

Table 2: Transitions from enrolled to dropout and from labor force to enrolled

	College Dropouts		LF → College	
	(1)	(2)	(3)	(4)
u_t	0.186**	0.147**	-0.310**	-0.093
	(0.082)	(0.063)	(0.156)	(0.080)
Mid. Inc. × u_t	-0.231***	-0.196***	0.663***	0.525***
	(0.073)	(0.062)	(0.131)	(0.104)
High. Inc. × u_t	-0.244***	-0.208***	0.910***	0.665***
	(0.083)	(0.071)	(0.182)	(0.139)
Obs.	706,702	706,702	2,024,651	2,024,651
R-squared	0.000	0.004	0.006	0.015
Controls	No	Yes	No	Yes
Test Middle ($\alpha_1 + \alpha_2$)	-0.045	-0.049	0.353***	0.431***
Test High ($\alpha_1 + \alpha_3$)	-0.058*	-0.061**	0.600***	0.572***

Panel regression using random effects. Effects in p.p. with respect to staying in college / staying in the labor force. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

I present the results of the panel regression in Table 2 and the results of the pool cross-section regression in Table A7 which are almost identical. In columns (1) and (2) I show that individuals from lower income backgrounds are more susceptible to experiencing scarring effects generated by periods of high unemployment rate periods. Specifically, the positive coefficient $\hat{\alpha}_1 > 0$ indicates

[16] I also run the same regressions using the lag of the unemployment rate as well. The results are robust to these specifications as shown in Table A5

that, on average, low-income students 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 students actually are more likely to stay enrolled in college during high unemployment rate periods.

The results in columns (3) and (4) indicate that low-income individuals exhibit a negative or 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.

These findings are also economically significant. A rise in the unemployment rate in a state akin to the rise experienced in the 2009 crisis is associated with a 0.8 percentage point increase in the likelihood of dropping out of college for low-income individuals (0.147*5.6), constituting 10% of the mean for this socio-demographic group. Conversely, the same increase in the unemployment rate is linked to a 0.3 percentage point decrease, equivalent to 3% of the mean 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, only a drop of 0.5 pp, or a 3% of their mean. In contrast, this rise in the unemployment rate corresponds to an increase in this probability of 2.4 percentage points, accounting for 15% of the mean, for middle-income individuals, and a rise of 3.2 percentage points, equivalent to 13% of the mean, for high-income individuals.

In Table A6 I show the analysis decomposed by sex and we see virtually no differences between male and female respondents. Further, Tables A8 and A9 present a parallel analysis employing the max and the mean unemployment rate in a state including the 4 months leading up to the census interview leading to indistinguishable results.

These empirical findings show the importance of the negative wealth effect impacting mainly 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 scarring effects shown in Figure 3. Intuitively, this wealth effect 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, 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 distress—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 3 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 only a high school diploma, those who have gone to college and the subset who have gained the college degree are depicted within each income group. For instance, within the low-income group, 29.16% have obtained a high school diploma only, while 33.96% have pursued higher education, while 6.77% have already earned a college degree.[17] 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 1.94 times higher for high-income individuals than for their low-income counterparts. In comparison, this difference is relatively smaller at 1.19 times higher for middle-income individuals compared to low-income individuals.

Table 3: Composition of education by income groups

% within income group	HS diploma only	Gone to college	College degree
low-income	29.16	33.96	6.77
middle-income	26.09	36.28	9.10
high-income	18.75	42.28	12.23
Disparity Ratios		College / HS	Degree / HS
Mid. inc. / low-income		1.19	1.50
High inc. / low-income		1.94	2.81

Source: IPUMS CPS.

Note: The top panel represents the proportions of people aged between 18 and 25 years old who have a high school diploma only, have gone to college and have a college degree within each income group. The remaining fraction corresponds to young people who do 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 4 I present the disparity ratios between income groups concerning college dropouts and individuals with only a high school diploma. 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.

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 4 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 reach their earnings peak around the

[17] Therefore, the remaining 36.88% 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 the unemployment rate at the time of High school graduation to explain educational choices.

Table 4: Composition of education by income groups excluding enrolled students

% within income group	HS diploma only	Dropout
low-income	32.66	11.96
middle-income	28.27	11.75
high-income	19.76	10.73
Disparity Ratios		Drop. / HS
Mid. inc. / low-income		1.15
High inc. / low-income		1.48

Source: IPUMS CPS.

Note: The top panel represents the proportions of people aged between 18 and 25 years old who have a high school diploma only or are college dropouts 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 college dropouts with respect to people with a high school only for middle (high) income divided by the same fraction for low-income. That is $(\frac{\text{College dropout}}{\text{HS only}})^{\text{Middle-income}}/(\frac{\text{College dropout}}{\text{HS only}})^{\text{Low-income}}$

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 4% over their lifetime. Meanwhile, college degree holders earn, on average, a remarkable 62% more than those without a college education during their lifetime.

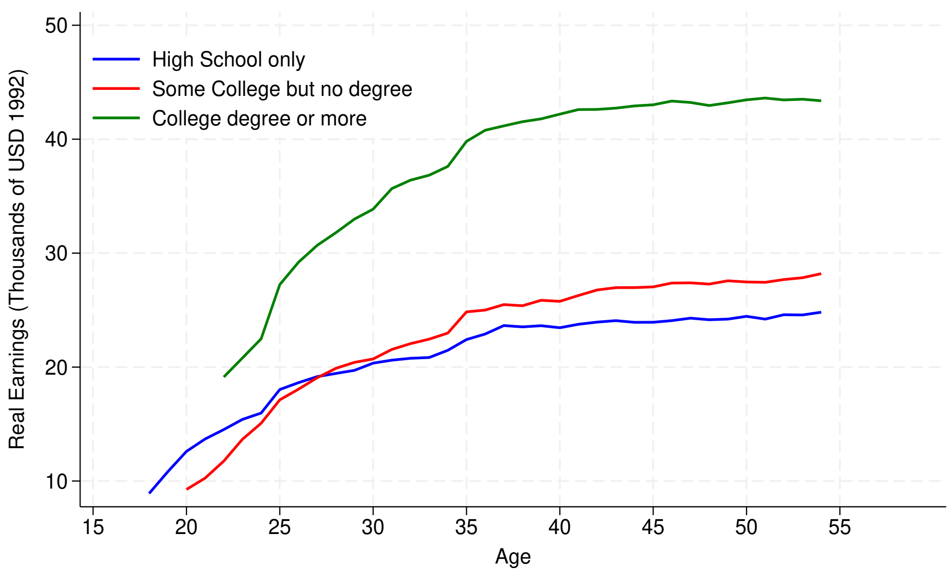

Figure 4: Lifetime real earnings by educational group

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.

In Figure 5 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.[18] 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 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.

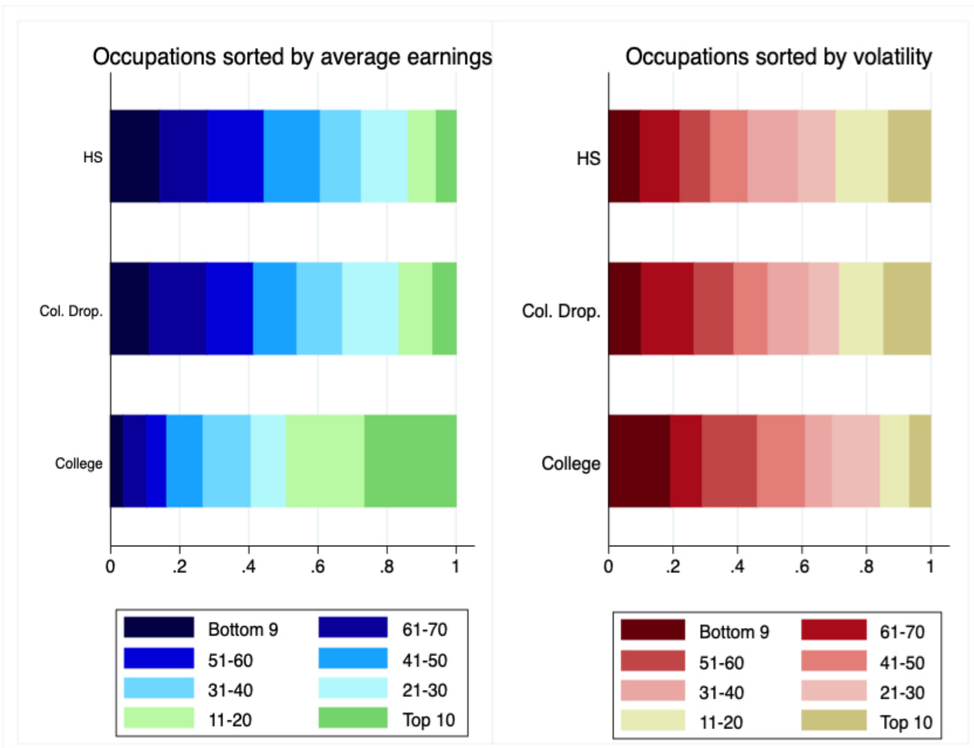

Figure 5: Occupation sorting by earnings and volatility. Relative proportion by educational group.

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 tend to be over-represented in occupations with lower average real earnings whereas people with a college degree 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, the bottom 9 occupations are the 9 occupations with lower volatility in their earnings across time.

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

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

obtaining a college degree and real earnings from the previous charts, I explore the potential effects of periods of high unemployment rates on subsequent college enrollment for individuals belonging to different income strata. I analyze the micro IPUMS CPS monthly dataset spanning from January 1992 to July 2024. 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:

$$y_i = \beta_0 + \beta_1 u_i^{HS} + \beta_2 \text{Mid. Inc.}_i \times u_i^{HS} + \beta_3 \text{High. Inc.}_i \times u_i^{HS} + \Gamma \mathbf{X}_i + \epsilon_i, \tag{13}$$

where y_i is a binary that equals 1 if an individual has gone to college at some point in 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 unemployment rate in the respondent's state around high school graduation, denoted as u_i^{HS}, is considered as the key variable of interest, and it is interacted with the family income group. $\mathbf{X}_i$ 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 unemployment rate in the respondent's state around high school graduation with the family income group. For the low-income group, the coefficient β_1 represents the marginal effect of the unemployment rate in the respondent's state 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 unemployment rate in the respondent's state during January to May of the graduation year as a proxy for the macroeconomic conditions at that time.[19] 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.

I present the estimated coefficients in Table 5 that describe the echo effect of having experienced a rise in the unemployment rate in the respondent's state around high school graduation on an individual's educational attainment some months or years after, derived from equation (13) and clustering standard errors at the state level. A 1 percentage point increase in the unemployment rate in the respondent's state around high school graduation on college enrollment is correlated with a 0.191 percentage point increase on the probability of having attended college for low-income

[19]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.

Table 5: College enrollment and completion and the business cycle

	Attended college		College Degree or more	
u_i^{HS}	0.169***	0.191	-0.002	-0.286**
	(0.060)	(0.121)	(0.063)	(0.112)
Mid. Inc. $\times$ u_i^{HS}	0.547***	0.356	0.728***	0.284
	(0.083)	(0.234)	(0.094)	(0.223)
High. Inc. $\times$ u_i^{HS}	0.850***	0.363	2.065***	0.969***
	(0.083)	(0.255)	(0.114)	(0.192)
State Controls	No	Yes	No	Yes
Clustered SE state	No	Yes	No	Yes
Obs.	665,552	665,552	364,787	364,787
R-squared	0.020	0.059	0.045	0.263
Test Middle ($\beta_1 + \beta_2$)	0.716***	0.547***	0.726***	-0.003
Test High ($\beta_1 + \beta_3$)	1.019***	0.554***	2.063***	0.683***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

individuals. For the middle-income group the combined effect is substantially larger, of $\beta_1 + \beta_2 = 0.191 + 0.356$ amounting to 0.547 percentage points, and for the high-income group the effect is $\beta_1 + \beta_3 = 0.191 + 0.363$, which results in a 0.554 percentage point increase.

The economic implications of these findings are noteworthy. For instance, a rise in the unemployment rate in the respondent's state 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 ratios, as evident from the results in Table 3. Based on the linear probability model coefficients presented in Table 5, the middle-to-low-income ratio would increase from 1.19 to 1.30, representing a relative rise of 9%. Similarly, the high-to-low-income ratio would rise from 1.94 to 2.16, signifying a relative increase of 11%. 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. Regarding the college degree-to-high school ratios, a spike in the unemployment rate in the respondent's state of the 2009 recession magnitude would correlate with a rise in the middle-to-low income ratio from 1.50 to 1.67 (11%) and a rise in the high-to-low income ratio from 2.81 to 3.67 (31%).

I conduct a similar analysis to explore the probability of being a college dropout, as presented in Table 6. 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 include current students intending to graduate eventually. When considering an increase in the unemployment rate in a state equivalent to the 5.6 percentage points observed during the 2009 crisis, I find that the middle-to-low-income ratio rises from 1.14 to 1.22, representing a relative increase of 7%, and the high-to-low-income ratio increases from 1.48 to 1.63, signifying a 10% rise.[20]

[20]Table A15 extends this analysis to associate degrees, focusing on both academic and occupational degrees. The

Table 6: College dropouts and college degree and the business cycle

	College Dropout	
u_i^{HS}	0.226***	0.260**
	(0.073)	(0.108)
Mid. Inc. $\times$ u_i^{HS}	0.366***	0.281*
	(0.105)	(0.223)
High. Inc. $\times$ u_i^{HS}	0.777***	0.438*
	(0.132)	(0.221)
State Controls	No	Yes
Clustered SE state	No	Yes
Obs.	324,353	324,353
R-squared	0.006	0.029
Test Middle ($\beta_1 + \beta_2$)	0.592***	0.541***
Test High ($\beta_1 + \beta_3$)	1.004***	0.698***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Tables A13 and A14 reveal that the counter-cyclicality in college enrollment is more pronounced among the male population, being 50% stronger for middle-income and 12% stronger for high-income individuals. Low-income individuals, both male and female, are significantly less responsive. High-income males exhibit a 13% stronger response in college completion rates to changes in the unemployment rate compared to high-income females. This heightened counter-cyclicality in male enrollment also leads to a higher probability of college dropout following a recession around high school graduation. Specifically, middle-income males react 35% more strongly than middle-income females, and high-income males react 21% more strongly compared to high-income females.

In Table 7 I show the baseline disparity ratios across: 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 the unemployment equivalent to the 5.6 percentage points observed during the 2009 recession, using the coefficients derived from Tables 5 and 6.

The response patterns to having experienced a high unemployment rate in a state 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

results for occupational degrees show minimal reaction to changes in the unemployment rate. However, for academic degrees, the reaction closely mirrors what we observe for regular college degrees.

Table 7: Implied compositional change by income groups

Disparity Ratios	Col. enrolled / HS		Drop. / HS		Col. degree / HS	
	Avg.	Shock	Avg.	Shock	Avg.	Shock
Mid. inc. / Low inc.	1.19	1.30	1.14	1.22	1.50	1.67
High inc. / Low inc.	1.94	2.16	1.48	1.63	2.81	3.67

Source: IPUMS CPS.

Note: For each column group I show the average disparity ratio in the first column, which correspond to the same values I showed in Tables 3 and 4 and the second column are the implied disparity ratios given the regression results from Tables 5 and 6. The implied disparity ratios are calculated for a rise in the unemployment rate in a state of 5.6 p.p. which is similar to the one experienced in 2009.

with considerable divergence of existing educational composition disparities between low and high-income individuals, as evident from Table 7.

The dynamics of the college dropouts is particularly interesting. A rise in the unemployment rate in the respondent's state concurrent with high school graduation is associated with a subsequent rise in the likelihood of individuals becoming college dropouts relative to those with only a high school diploma. This can be attributed to the pronounced rise in college enrollments subsequent to a decline in the opportunity cost coming from a worse 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 realizing they are a bad fit for college, in the model realizing the E^{-}, 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 socio-economic 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 the unemployment rate 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 the 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 (12) 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 A8 and A9 present the results obtained from these alternative specifications. The results are robust to the ones shown in 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 3.

To further investigate the second empirical fact, I re-estimate regression (13) 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 A16 and A17 present the results obtained from these alternative specifications. The results remain very similar to the ones presented using the average state unemployment rate between the months of January until May. I also use the unemployment rate in May only, a proxy for the high school graduation month, during the 18th birthday (Tables A18 and A19), which yields consistent and robust outcomes.

Finally, in Table A20 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 drops but it is still positive and statistically significant. 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 A21 and A22 I show the results of the second empirical fact. The results remain similar as well.

3.4 Discussion of the Main Assumptions

A fundamental assumption underpinning the empirical framework is the appropriateness of using the variable FAMINC from the IPUMS CPS 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 likely 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 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.2 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 A23 remain consistent when limiting the age to 23 years old. Tables A24 and A25 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 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 unemployment rate in the respondent's state around high school graduation correlates with the probability of switching income groups during this time frame.

4 Solution Method and Calibration

To solve the model I assume individuals exclusively choose their schooling, consumption, and savings during the initial three periods ($t = 0$, $t = 1$ and $t = 2$). Starting from $t = 3$ and extending to $t = T$, they only consume a known amount of deterministic income.

I discretized the state space that includes 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 ($u(c) = ln(c)$). 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 8 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 four parameters using moments in the data. I estimate the variance of the business cycle, the college wage premium parameter, the effect of entry conditions on current wages and tuition costs.

Table 8: Calibrated and estimated parameters

Parameter	Value	Description
Calibrated:		
β	0.926	2 year discount factor (4% annual int. rate)
T	24	Total number of 2-y periods (plus $t = 0$)
$g(z)$	$9(z-1)$	Parental transfers as a function of z with mean 0
μ	1	Mean of the productivity process
ρ	-0.2	Auto-regressive parameter
ξ	-3	Liquidity constraints
Estimated:		
σ^2	0.0885	Variance of the error term of the productivity process
θ	1.79	College wage premium
ψ	0.34	Effect of entry conditions on wages
f	1.995	Tuition fees

I present the estimated values for the four crucial parameters in Table 9 along with the targeted empirical moments. To estimate the variance of the business cycle parameter (σ) I target the drop relative change in real earnings weighted by the probability of being employed for young people during the 2009 crisis. Real earnings fell by 11.4% but since the probability of being unemployed rises by 5.6 p.p., the real drop in earnings is of 16.56%.

The 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 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 third 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 3, focusing on the initial 6 years (3 periods in the model) post labor force entry. The empirical value of 0.899 means that an individual entering the labor force during a recession earns on average 10.10% less than an individual entering in an expansion for the first 6 years.[21] 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, more specifically in Table 3. The final two columns of the table underscore the model's adeptness in replicating these empirical values.

Table 9: Estimation Method of Moments

Parameter	Value	Moment	Empirical Value	Model Value
σ	0.0885	$\frac{\text{Y}^{\text{Rec}}}{\text{Y}^{\text{Exp}}}$	0.858	0.858
θ	1.79	$\frac{\text{Y}^{\text{C}}}{\text{Y}^{\text{NC}}}$	1.62	1.62
ψ	0.34	$\frac{\text{Y}_{\text{young}}^{\text{NC Rec}}}{\text{Y}_{\text{young}}^{\text{NC Exp}}}$	0.90	0.91
f	1.995	$\frac{(\text{Col./HS})^{H}}{(\text{Col./HS})^{L}}$	1.94	2.02

Note: I estimate four parameters in the model. First, σ is the variance of the error term in the business cycle parameter. I target the ratio of average real earnings at the peak of the recession with respect to the boom for the young population aged below 25 years old weighted by the different probability of being unemployed. Second, θ is the college wage premium. I target the ratio of average lifetime real earnings of people who have a college degree Y^C over the average lifetime real earnings of people who only have a high school diploma Y^NC which is 1.62. Third, ψ is the parameter that states how important are labor market entry conditions on current wages. I target the ratio of the real earnings of an individual who entered the labor market during a recession vs. an individual who entered during an expansion, focusing only on individuals with no college education so that the labor market entry is more identifiable. For the college tuition f parameter I target the college enrollment disparity ratio between high and low income young individuals that I documented in Table 3.

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.

[21] I use a rise in the unemployment rate 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.

5.1 Financial Dropouts

I first analyze the impact of experiencing a recession for currently enrolled students. In Table 10 I show the percentage of individuals by income level that drop out of college in expansions and in recessions.[22] In periods of economic expansion there are no financial dropouts. However, in recessions, a subgroup of the low-income group, specifically the most financially vulnerable, drops out of college due to the tangible influence of parental transfers ($g(z)$). While this only impacts a marginal fraction within the low-income group, their drop in lifetime utility is substantial due to their forced college drop out.

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 2.

Table 10: % 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 11 I document the percentage of individuals opting for immediate college enrollment (in $t = 0$). Immediate college enrollment increases during recessions, but only for higher income individuals. In contrast, low-income individuals do not respond at all. I attribute this to the trade-off experienced by those in the low-income bracket following a recession. On one hand, an economic downturn places them in financial distress, impeding them to pay for tuition costs. Conversely, the same economic downturn increases the incentives to delay 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 5.

In Table 12 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

[22]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 11: % of people going to college in $t = 0$

Income level	Expansion	Recession
low-income	35.4	35.4
middle-income	50	66.7
high-income	50	75

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.

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 6.

Table 12: p threshold for enrolling in $t = 0$

Income level	Expansion	Recession
low-income	.	.
middle-income	54.6	36.4
high-income	54.6	27.3

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 13 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 2.

Table 13: % of people going to college in $t = 1$

Income level	Expansion	Recession
low-income	6.3	0
middle-income	25	0
high-income	27.8	2.8

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.

6 Counterfactuals

In this section I present the two main counterfactuals of the paper which answer the two main research questions of the paper: What is the lifetime impact of experiencing 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 6 I plot the expected lifetime utility levels for each initial asset level. 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.3.

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 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%

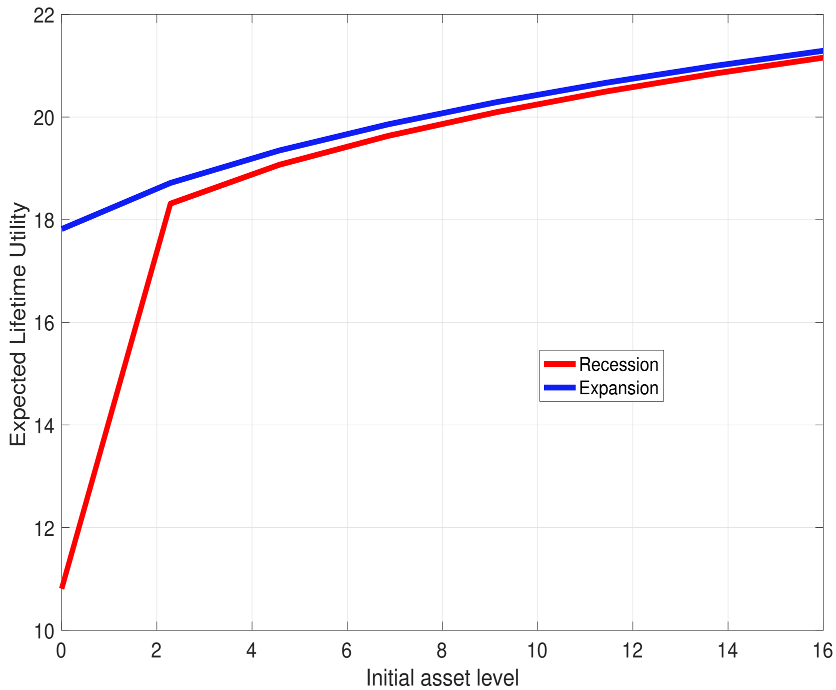

Figure 6: Experiencing an economic recession while enrolled in college

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.

loss in expected lifetime present value consumption.

In Table 14 I display a summary of the percentage drop in both expected lifetime utility and expected lifetime present value consumption by income groups 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 sub-groups 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 10) 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.

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 7 I plot the expected lifetime utility level for each initial

Table 14: % 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	37.96	38.70
Second-poorest group	2.21	2.28
low-income avg.	10.15	10.66
middle-income avg.	0.97	1.99
high-income avg.	1.72	1.84
Richest group	0.64	1.77

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.

asset levels. I also show the expected lifetime consumption in present value in Figure A.4.

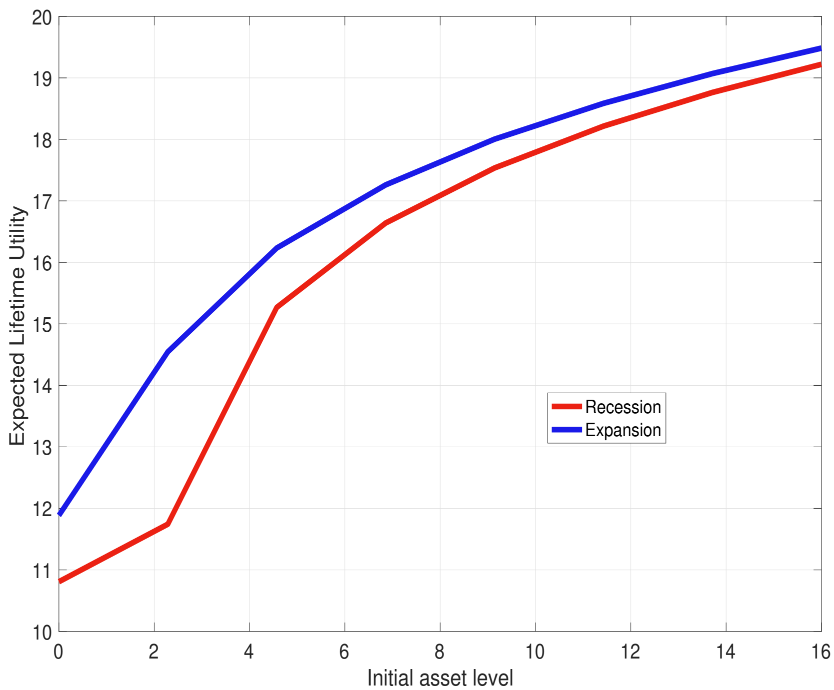

Figure 7: Experiencing an economic recession at high school graduation

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.

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, 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 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. Consequently, 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 24%. I again show the summary of the % drop in expected lifetime utility for income groups in Table 15.

Table 15: % 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	6.99	6.94
Second-poorest group	8.24	14.84
low-income avg.	6.02	6.97
middle-income avg.	2.52	3.12
high-income avg.	1.58	2.82
Richest group	1.29	2.68

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 16 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 force 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 16: % 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 14, 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 17 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.

In Tables 18 and 19 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

Table 17: % 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 15, 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 $\xi = -1000$

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.

7 Conclusions and Policy Relevance

College decisions can 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 serves 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

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	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 14, 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 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	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 15, 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 $\psi = 0$.

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

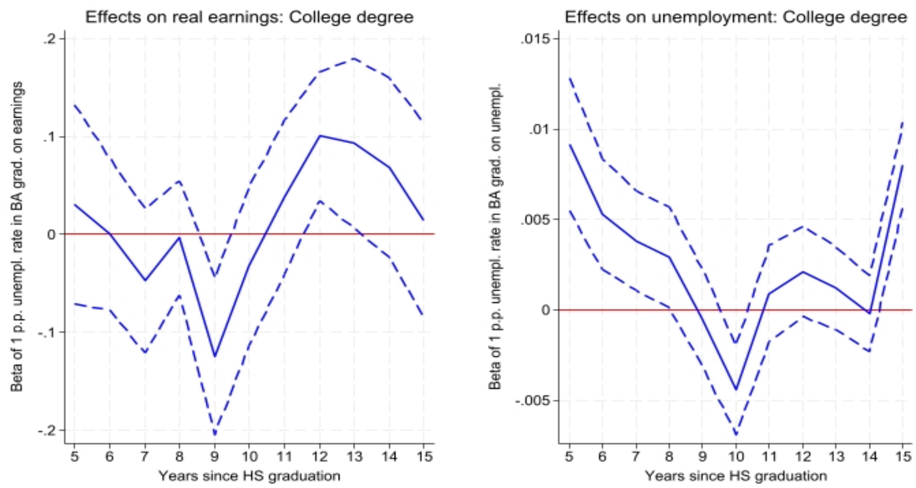

Figure A.1: Negative and persistent effects of graduating from college during recessions.

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), and therefore I assume they entered the labor market 4 years after graduating from HS. I represent β_1 for each age group of the following regression: $y_{i,t} = \beta_0 + \beta_1 u_i^{BA} + \Gamma \mathbf{X}_{i,t} + \epsilon_{i,t}$, where u_i^{BA} is the unemployment rate that this cohort group experienced when they graduated from college.

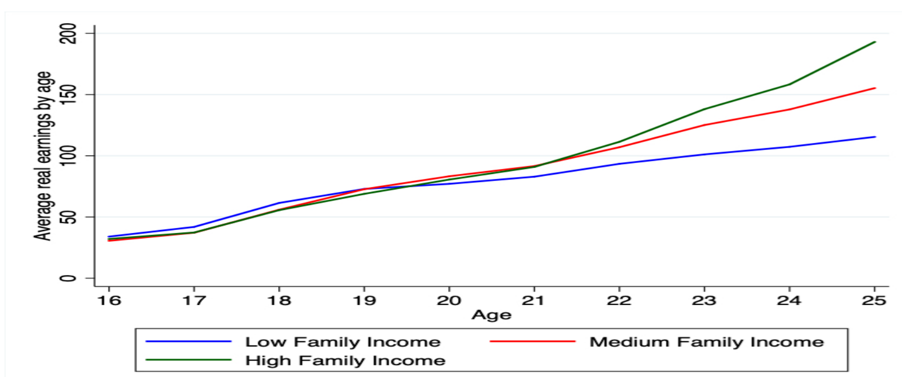

Figure A.2: Differences in real earnings by age and family income group

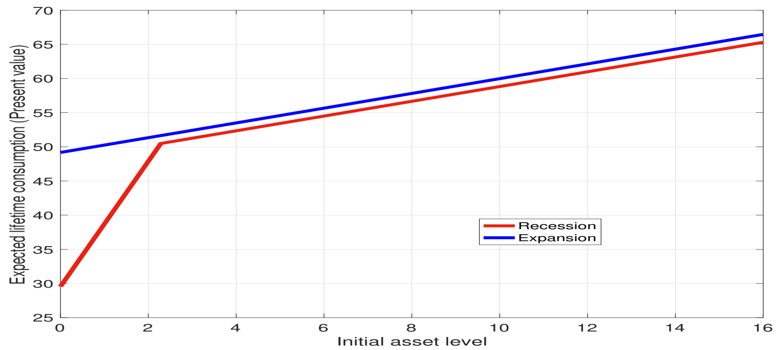

Figure A.3: Experiencing an economic recession while enrolled in college

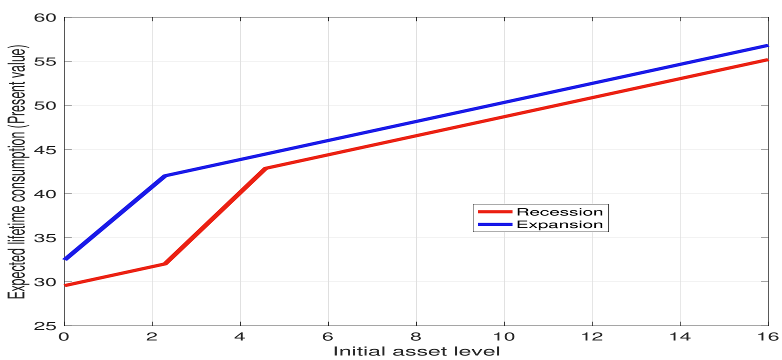

Figure A.4: Experiencing an economic recession at high school graduation

Tables

Table A1: College enrollment is counter-cyclical using linear and exponential trends

	Effect on college enrollment deviations from trend
Unemployment rate (p.p.)	0.398***
	(0.077)
Unemployment rate deviations from NAIRU (p.p.)	0.405***
	(0.077)
Recession (binary)	0.242
	(0.322)
Real GDP growth (YoY%)	-0.233***
	(0.064)

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: IPUMS CPS data: Descriptive Statistics weighted

	Longitudinal		Cross-sectional	
	All ages	Age $\leq$ 25	All ages	Age $\leq$ 25
Age	30.19	20.09	30.48	20.28
Sex (Female %)	50.42	50.21	50.37	50.14
Race (White %)	75.39	76.11	75.48	76.25
High-school or less (%)	48.35	61.79	47.41	60.22
Some college (%)	27.11	28.48	27.86	29.96
Bachelor's or more (%)	24.54	9.73	24.73	9.81
Weekly earnings ($)	796.43	416.87	775.26	387.43
Family Income (x = Yearly Income)				
Low % ($x <$ \$30k)	26.87	35.67	26.63	35.58
Middle % (\$30k $\leq x <$ \$75k)	36.23	36.95	36.18	36.90
High % ($x \geq$ \$75k)	36.90	27.38	37.19	27.52
Labor force (%)	72.56	61.61	72.29	61.68
Employed (%)	66.51	53.53	66.83	54.33
Unemployed (%)	6.06	8.08	5.46	7.35
Appearances	3.78	3.74	1	1
Individuals	**2,158,404**	**1,086,525**	**2,158,558**	**1,075,005**

Source: IPUMS CPS.

Table A3: IPUMS CPS data: Descriptive Statistics unweighted

	Cross-sectional		Longitudinal	
	All ages	Age $\leq$ 25	All ages	Age $\leq$ 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 or less (%)	47.98	61.66	50.30	63.06
Some college (%)	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 <$ \$30k)	32.72	40.33	29.53	38.11
Middle % (\$30k $\leq x <$ \$75k)	40.08	37.25	37.05	37.43
High % ($x \geq$ \$75k)	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: IPUMS CPS.

Table A4: 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: IPUMS CPS.

Table A5: Transitions from enrolled to dropout and from labor force to enrolled using the lag of unemployment rate

	College Dropouts	LF → College
u_{t-1}	0.161**	-0.119
	(0.066)	(0.081)
Mid. Inc. × u_{t-1}	-0.190***	0.533***
	(0.062)	(0.104)
High. Inc. × u_{t-1}	-0.176***	0.645***
	(0.066)	(0.134)
Obs.	706,702	2,024,651
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	-0.029	0.415***
Test High ($\alpha_1 + \alpha_3$)	-0.015	0.526***

Panel regression using random effects. Effects in p.p. with respect to staying in college / staying in the labor force. 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 by sex

	Dropouts	LF → College	Dropouts	LF → College
	Male		Female	
u_t	0.149**	-0.081	0.143*	-0.104
	(0.060)	(0.075)	(0.076)	(0.093)
Mid. Inc. × u_t	-0.216***	0.430***	-0.176*	0.633***
	(0.056)	(0.084)	(0.093)	(0.140)
High. Inc. × u_t	-0.208***	0.647***	-0.206**	0.677***
	(0.070)	(0.137)	(0.086)	(0.149)
Obs.	327,825	1,064,289	378,877	960,362
R-squared	0.004	0.010	0.004	0.012
Test Middle ($\alpha_1 + \alpha_2$)	-0.068	0.349***	-0.033	0.529***
Test High ($\alpha_1 + \alpha_3$)	-0.059	0.567***	-0.063**	0.572***

Panel regression using random effects. Effects in p.p. with respect to staying in college / staying in the labor force. Clust. standard (state level) 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 pool cross-section

	College Dropouts		LF $\rightarrow$ College	
u_t	**0.143*** **	**0.131***	**-0.028**	**0.050**
	(0.033)	(0.073)	(0.022)	(0.071)
Mid. Inc. $\times$ u_t	-0.236***	-0.192***	0.461***	0.367***
	(0.048)	(0.070)	(0.031)	(0.088)
High. Inc. $\times$ u_t	-0.182***	-0.142*	0.665***	0.458***
	(0.046)	(0.079)	(0.038)	(0.124)
Obs.	706,702	706,702	2,024,651	2,024,651
R-squared	0.001	0.004	0.007	0.015
Controls	No	Yes	No	Yes
Test Middle ($\alpha_1 + \alpha_2$)	**-0.009*** **	**-0.060**	**0.434*** **	**0.417*** **
Test High ($\alpha_1 + \alpha_3$)	**-0.039**	**-0.011**	**0.638*** **	**0.508*** **

Pooled cross-section regression. Effects in p.p. with respect to staying in college / staying in the labor force. Clust. standard (state level) 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 using max unemployment rate

	College Dropouts	LF $\rightarrow$ College
$\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.140**	-0.127*
	(0.057)	(0.077)
Mid. Inc. $\times$ $\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	-0.174***	0.478***
	(0.056)	(0.095)
High. Inc. $\times$ $\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	-0.179***	0.537***
	(0.061)	(0.120)
Obs.	706,702	2,024,651
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	-0.034	0.351***
Test High ($\alpha_1 + \alpha_3$)	-0.038	0.410***

Panel regression using random effects. Effects in p.p. with respect to staying in college / staying in the labor force. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A9: Transitions from enrolled to dropout and from labor force to enrolled using average unemployment rate

	College Dropouts	LF $\rightarrow$ College
$\overline{u}_t$	0.129**	-0.099
	(0.059)	(0.081)
Mid. Inc. $\times$ $\overline{u}_t$	-0.191***	0.566***
	(0.059)	(0.106)
High. Inc. $\times$ $\overline{u}_t$	-0.225***	0.733***
	(0.070)	(0.145)
Obs.	706,702	2,024,651
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	-0.062*	0.467***
Test High ($\alpha_1 + \alpha_3$)	-0.095***	0.634***

Panel regression using random effects. Effects in p.p. with respect to staying in college / staying in the labor force. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A10: Transitions from enrolled to dropout and from labor force to enrolled for poorer low-income

	College Dropouts	LF $\rightarrow$ College
u_t	0.143*	-0.611***
	(0.083)	(0.173)
Mid. Inc. $\times$ u_t	-0.125*	0.869***
	(0.067)	(0.175)
High. Inc. $\times$ u_t	-0.211**	1.182***
	(0.086)	(0.232)
Obs.	706,702	2,024,651
R-squared	0.005	0.016
Test Middle ($\alpha_1 + \alpha_2$)	0.018	0.258***
Test High ($\alpha_1 + \alpha_3$)	-0.068**	0.572***

Panel regression using random effects. Effects in p.p.. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A11: College enrollment and the business cycle for poorer low-income

	Attended college
u_i^{HS}	**-0.307**
	(0.261)
Mid. Inc. $\times$ u_i^{HS}	0.688**
	(0.280)
High. Inc. $\times$ 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 A12: 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 A13: College enrollment and completion and the business cycle by sex

	Att. college	College or more	Att. college	College or more
	Male		Female	
u_i^{HS}	0.199	-0.243**	0.181	-0.330**
	(0.124)	(0.112)	(0.152)	(0.140)
Mid. Inc. $\times$ u_i^{HS}	0.461**	0.270	0.260	0.287
	(0.183)	(0.163)	(0.315)	(0.306)
High. Inc. $\times$ u_i^{HS}	0.386	0.960***	0.340	0.965***
	(0.234)	(0.170)	(0.305)	(0.274)
State Controls	Yes	Yes	Yes	Yes
Clustered SE state	Yes	Yes	Yes	Yes
Obs.	317,594	179,901	347,958	184,886
R-squared	0.049	0.224	0.060	0.289
Test Middle $(\beta_1 + \beta_2)$	0.661***	0.027	0.442**	-0.044
Test High $(\beta_1 + \beta_3)$	0.585***	0.717***	0.521**	0.635***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A14: College dropouts and college degree and the business cycle by sex

	College Dropout	
	Male	Female
u_i^{HS}	0.300**	0.220*
	(0.129)	(0.108)
Mid. Inc. $\times$ u_i^{HS}	0.314	0.235*
	(0.206)	(0.282)
High. Inc. $\times$ u_i^{HS}	0.457**	0.403
	(0.209)	(0.332)
State Controls	Yes	Yes
Clustered SE state	Yes	Yes
Obs.	166,521	157,832
R-squared	0.027	0.027
Test Middle ($\beta_1 + \beta_2$)	0.614***	0.455*
Test High ($\beta_1 + \beta_3$)	0.757***	0.624**

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A15: Associate degrees and the business cycle

	Assoc. occupational		Assoc. academic	
	(1)	(2)	(3)	(4)
u_i^{HS}	-0.140***	-0.044	0.077*	-0.029
	(0.039)	(0.052)	(0.044)	(0.067)
Mid. Inc. $\times$ u_i^{HS}	0.137**	0.058	0.265***	0.180
	(0.060)	(0.079)	(0.068)	(0.122)
High. Inc. $\times$ u_i^{HS}	0.215***	0.018	0.500***	0.318**
	(0.076)	(0.083)	(0.091)	(0.142)
Controls	No	Yes	No	Yes
Obs.	286,910	286,910	290,301	290,301
R-squared	0.002	0.032	0.006	0.051
F-test Middle ($\beta_1 + \beta_2$)	-0.003	0.013	0.342***	0.152
F-test High ($\beta_1 + \beta_3$)	0.075	-0.026	0.577***	0.290**

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A16: College enrollment and completion and the business cycle using the maximum unemployment between January and May

	Attended college		College Degree or more	
$\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.047	0.162	-0.173***	-0.194**
	(0.055)	(0.103)	(0.055)	(0.085)
Mid. Inc. $\times \max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.174**	0.090	0.252***	0.125
	(0.076)	(0.162)	(0.079)	(0.158)
High. Inc. $\times \max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.184**	-0.016	0.582***	0.271**
	(0.077)	(0.153)	(0.095)	(0.111)
State Controls	No	Yes	No	Yes
Clustered SE state	No	Yes	No	Yes
Obs.	665,552	665,552	364,787	364,787
R-squared	0.019	0.059	0.042	0.262
Test Middle $(\beta_1 + \beta_2)$	0.221***	0.251**	0.079	-0.069
Test High $(\beta_1 + \beta_3)$	0.231***	0.145	0.408***	0.078

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A17: College dropouts and college degree and the business cycle using the maximum unemployment between January and May

	College Dropout	
$\max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.020	0.163
	(0.065)	(0.103)
Mid. Inc. $\times \max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.115	0.110
	(0.091)	(0.174)
High. Inc. $\times \max\{u_{t-4}, u_{t-3}, u_{t-2}, u_{t-1}, u_t\}$	0.217**	0.107
	(0.108)	(0.138)
State Controls	No	Yes
Clustered SE state	No	Yes
Obs.	324,353	324,353
R-squared	0.005	0.029
Test Middle $(\beta_1 + \beta_2)$	0.135**	0.273*
Test High $(\beta_1 + \beta_3)$	0.237***	0.270***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A18: College enrollment and completion and the business cycle using only May

	Attended college		College Degree or more	
u_i^{HS}	0.085	0.158	-0.145**	-0.253***
	(0.057)	(0.108)	(0.058)	(0.095)
Mid. Inc. $\times$ u_i^{HS}	0.294***	0.183	0.392***	0.191
	(0.079)	(0.183)	(0.084)	(0.181)
High. Inc. $\times$ u_i^{HS}	0.355***	0.088	0.953***	0.463***
	(0.081)	(0.175)	(0.102)	(0.132)
State Controls	No	Yes	No	Yes
Clustered SE state	No	Yes	No	Yes
Obs.	665,552	665,552	364,787	364,787
R-squared	0.019	0.059	0.042	0.263
Test Middle ($\beta_1 + \beta_2$)	0.379***	0.340***	0.248***	-0.063
Test High ($\beta_1 + \beta_3$)	0.441***	0.246**	0.809***	0.209**

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A19: College dropouts and college degree and the business cycle using only May

	College Dropout	
u_i^{HS}	0.105	0.204*
	(0.068)	(0.111)
Mid. Inc. $\times$ u_i^{HS}	0.181*	0.153
	(0.097)	(0.195)
High. Inc. u_i^{HS}	0.346***	0.186**
	(0.116)	(0.155)
State Controls	No	Yes
Clustered SE state	No	Yes
Obs.	324,353	324,353
R-squared	0.006	0.029
Test Middle ($\beta_1 + \beta_2$)	0.286***	0.357**
Test High ($\beta_1 + \beta_3$)	0.451***	0.390***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A20: Transitions from enrolled to dropout and from labor force to enrolled excluding COVID

	College Dropouts	LF $\rightarrow$ College
u_t	0.105*	-0.055
	(0.061)	(0.079)
Mid. Inc. $\times$ u_t	-0.207***	0.579***
	(0.061)	(0.107)
High. Inc. $\times$ u_t	-0.268***	0.854***
	(0.075)	(0.157)
Obs.	688,976	1,983,714
R-squared	0.004	0.015
Test Middle ($\alpha_1 + \alpha_2$)	-0.102***	0.524***
Test High ($\alpha_1 + \alpha_3$)	-0.163***	0.799***

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

Table A21: College enrollment and completion and the business cycle excluding COVID

	Attended college		College Degree or more	
u_i^{HS}	0.180***	0.271**	-0.080	-0.250**
	(0.060)	(0.119)	(0.063)	(0.114)
Mid. Inc. $\times$ u_i^{HS}	0.527***	0.364	0.643***	0.274
	(0.083)	(0.229)	(0.095)	(0.212)
High. Inc. $\times$ u_i^{HS}	0.819***	0.387	1.781***	0.835***
	(0.087)	(0.265)	(0.115)	(0.200)
State Controls	No	Yes	No	Yes
Clustered SE state	No	Yes	No	Yes
Obs.	647,525	647,525	354,199	354,199
R-squared	0.020	0.058	0.042	0.261
Test Middle ($\beta_1 + \beta_2$)	0.707***	0.635***	0.563***	0.024
Test High ($\beta_1 + \beta_3$)	0.999***	0.658***	1.702***	0.585***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A22: College dropouts and college degree and the business cycle excluding COVID

	College Dropout	
u_t	0.232***	0.325***
	(0.073)	(0.105)
Mid. Inc. $\times$ u_t	0.367***	0.297
	(0.106)	(0.212)
High. Inc. u_t	0.832***	0.519**
	(0.133)	(0.241)
State Controls	No	Yes
Clustered SE state	No	Yes
Obs.	316,336	316,336
R-squared	0.006	0.029
Test Middle ($\beta_1 + \beta_2$)	0.599***	0.622***
Test High ($\beta_1 + \beta_3$)	1.064***	0.843***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A23: Transitions from enrolled to dropout and from labor force to enrolled with 23 year old or younger

	College Dropouts	LF $\rightarrow$ College
u_t	0.139**	-0.140*
	(0.069)	(0.082)
Mid. Inc. $\times$ u_t	-0.187***	0.509***
	(0.065)	(0.106)
High. Inc. $\times$ u_t	-0.194***	0.655***
	(0.075)	(0.140)
Obs.	237,750	1,762,211
R-squared	0.003	0.023
Test Middle ($\alpha_1 + \alpha_2$)	-0.048	0.368***
Test High ($\alpha_1 + \alpha_3$)	-0.055*	0.514***

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

Table A24: College enrollment and completion and the business cycle with 23 year old or younger

	Attended college		College Degree or more	
u_i^{HS}	0.217***	0.330**	-0.175***	-0.185
	(0.066)	(0.129)	(0.064)	(0.124)
Mid. Inc. $\times$ u_i^{HS}	0.462***	0.378*	0.341***	0.227
	(0.094)	(0.195)	(0.096)	(0.161)
High. Inc. $\times$ u_i^{HS}	0.690***	0.323	1.338***	0.735***
	(0.097)	(0.238)	(0.125)	(0.183)
State Controls	No	Yes	No	Yes
Clustered SE state	No	Yes	No	Yes
Obs.	532,803	532,803	275,928	275,928
R-squared	0.018	0.062	0.026	0.242
Test Middle ($\beta_1 + \beta_2$)	0.678***	0.708***	0.166**	0.042
Test High ($\beta_1 + \beta_3$)	0.907***	0.653***	1.163***	0.550***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A25: College dropouts and college degree and the business cycle with 23 year old or younger

	College Dropout	
u_t	0.231***	0.378***
	(0.080)	(0.127)
Mid. Inc. $\times$ u_t	0.267**	0.215
	(0.116)	(0.201)
High. Inc. u_t	0.723***	0.399*
	(0.146)	(0.210)
State Controls	No	Yes
Clustered SE state	No	Yes
Obs.	262,485	262,485
R-squared	0.007	0.036
Test Middle ($\beta_1 + \beta_2$)	0.498***	0.591***
Test High ($\beta_1 + \beta_3$)	0.954***	0.774***

Effects in p.p. with respect to only High School. Clust. standard (state level) errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

B Mathematical Appendix

B.1 Derivation of p and θ thresholds

To derive the threshold values for p and θ at which an individual would be indifferent between going to college and entering the labor force directly, we need to set the expected incomes Y^C and Y^N equal to each other:

$$Y^C = Y^N$$

Given the equations:

$$\begin{aligned} Y^C = -f + p\left(-f + \theta(C)\mathbb{E}_0 \sum_{t=2}^{T} [\psi_t \exp(z_2) + (1-\psi_t)\exp(z_t)]\right) \\ + (1-p)\left(\theta(N)\mathbb{E}_0 \sum_{t=1}^{T} [\psi_t \exp(z_1) + (1-\psi_t)\exp(z_t)]\right) \end{aligned}$$

$$Y^N = \theta(N)\mathbb{E}_0 \sum_{t=0}^{T} [\psi_t \exp(z_0) + (1-\psi_t)\exp(z_t)]$$

Set $Y^C = Y^N$:

$$\begin{aligned} -f + p\left(-f + \theta(C)\mathbb{E}_0 \sum_{t=2}^{T} [\psi_t \exp(z_2) + (1-\psi_t)\exp(z_t)]\right) \\ + (1-p)\left(\theta(N)\mathbb{E}_0 \sum_{t=1}^{T} [\psi_t \exp(z_1) + (1-\psi_t)\exp(z_t)]\right) \\ = \theta(N)\mathbb{E}_0 \sum_{t=0}^{T} [\psi_t \exp(z_0) + (1-\psi_t)\exp(z_t)] \end{aligned}$$

To simplify, let's denote:

$$\Lambda^A = \mathbb{E}_0 \sum_{t=2}^{T} [\psi_t \exp(z_2) + (1-\psi_t)\exp(z_t)]$$

$$\Lambda^B = \mathbb{E}_0 \sum_{t=1}^{T} [\psi_t \exp(z_1) + (1-\psi_t)\exp(z_t)]$$

$$\Lambda^C = \mathbb{E}_0 \sum_{t=0}^{T} [\psi_t \exp(z_0) + (1-\psi_t)\exp(z_t)]$$

The equation becomes:

$$-f + p\left(-f + \theta(C)\Lambda^A\right) + (1-p)\left(\theta(N)\Lambda^B\right) = \theta(N)\Lambda^C$$

Expanding and defining $\hat{p}$ as the p such that $Y^C = Y^N$:

$$-f - \hat{p}f + \hat{p}\theta(C)\Lambda^A + \theta(N)\Lambda^B - \hat{p}\theta(N)\Lambda^B = \theta(N)\Lambda^C$$

Rearranging:

$$-\hat{p}f + \hat{p}\theta(C)\Lambda^A - \hat{p}\theta(N)\Lambda^B = \theta(N)\Lambda^C + f - \theta(N)\Lambda^B$$

$$\hat{p}\Big(\theta(C)\Lambda^A - \theta(N)\Lambda^B - f\Big) = \theta(N)\Lambda^C - \theta(N)\Lambda^B + f$$

Solving for $\hat{p}$:

$$\hat{p} = \frac{\theta(N)\Lambda^C - \theta(N)\Lambda^B + f}{\theta(C)\Lambda^A - \theta(N)\Lambda^B - f}$$

This equation gives the threshold value for p at which an individual would have the same lifetime income if she decides to go to college and if she decides to enter the labor force directly.

I do the same for the derivation of $\hat{\theta}(C)$ which is college wage premium such that $Y^C = Y^N$.

Starting from:

$$-pf + p\hat{\theta}(C)\Lambda^A - p\theta(N)\Lambda^B = \theta(N)\Lambda^C + f - \theta(N)\Lambda^B$$

Rearranging:

$$p\hat{\theta}(C) = \theta(N)\Lambda^C - \theta(N)\Lambda^B + p\theta(N)\Lambda^B + f + pf$$

$$p\hat{\theta}(C)\Lambda^A = \theta(N)\Lambda^C + (1-p)\theta(N)\Lambda^B + f + pf$$

Solving for $\hat{\theta}(C)$:

$$\hat{\theta}(C) = \frac{\theta(N)\Lambda^C + (1-p)\theta(N)\Lambda^B + f + pf}{p\Lambda^A}$$