# Business Cycles and the Gender Gap in Educational Investment*

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**Abstract**

We examine how economic conditions shape gender differences in educational investments. Using Swedish register data and within-family variation in siblings' exposure to local unemployment rates prior to graduating high school, we study university enrollment and major choice over the business cycle. We find that men do not increase their overall university attendance during recessions but are more likely to shift towards fields associated with lower unemployment risks. In contrast, women respond to recessions by increasing both university attendance and completion rates. However, they do not shift toward fields with lower unemployment risks or higher earnings, although many women are academically prepared for demanding degrees. In the long run, exposure to recessions during the final high school years widens the gender gap in lifetime earnings. These findings suggest that men and women use different strategies to cope with recessions, with potentially long-term economic consequences.

**Keywords:** unemployment, education, degree choice, occupational choice, gender
**JEL Codes:** I26, J16, J24

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# 1 Introduction

Tertiary education is pursued globally by an increasing number of students. At the same time, the gap in educational choices and outcomes between men and women continues to widen. In many countries, including Sweden, more women than men attend college today; men and women also choose different fields of study. These patterns translate into a substantial gap in occupational choices. For instance, the share of female nurses in Sweden continuously hovers around 90% while just under 80% of engineers in the country are male. These differences in occupational choices, in turn, have consequential effects on earnings and career trajectories.

In this paper, we explore some of the drivers behind those differences. More specifically, we would like to understand if educational choices are strongly affected by economic conditions and whether men and women respond differently to changes in those conditions when making those choices. We focus on business cycles and exposure to unemployment rates as these affect all individuals and have previously been shown to have a strong effect on university graduates (e.g., Beffy et al., 2012, Blom et al., 2021, Bütikofer et al., 2022). To establish this, we link exposure to regional unemployment in the final year of high school to university enrollment and subject choices among Swedish students between 1992 and 2009. We then compare the choices made between full siblings who graduated within that period of time, dependent on their respective level of unemployment exposure. This allows us to address potential concerns about unobserved family-specific factors that may be affecting those choices.

We find that there is a pronounced difference in how men and women respond to those unemployment fluctuations. Female students are more likely to enroll in higher education when facing higher unemployment and subsequently graduate with a degree. At the same time, they do not necessarily opt for subjects that offer higher earnings or greater unemployment resilience. We find that the effect is not driven by female students with more constrained academic options at the end of their high-school studies. Male students, in turn, do not appear to respond strongly to fluctuations in unemployment. These differences seem to have a bearing on future labor market outcomes, with females exposed to higher unemployment having lower accumulated earnings.

This paper contributes to the economic literature on the role of macroeconomic conditions in shaping educational investments by introducing a gender perspective. We build upon work that examines the effect of macroeconomic shocks – booms and busts – on students' choice of college major (Beffy et al., 2012, Stoet and Geary, 2018, Blom et al., 2021, Bütikofer et al., 2022, Weinstein, 2022). To our knowledge, only one paper so far has a focus on gender gaps: Blom et al. (2021) study college major choice during booms and busts in the U.S. and find that, conditional on enrollment, students choose more challenging and higher-return majors during

downturns, and that women respond more strongly to these adverse economic shocks.[1]

In contrast to this prior work, we examine both the enrollment margin and the margin of college major choice in a system where college enrollment is free of charge. We find a pronounced change in college enrollment and completion among females in response to economic downturns, whereas males show no response. Thus, our study highlights the importance of investigating the enrollment margin, which cannot be observed from data on college enrollees alone. We show that the marginal students – those who enroll in college if exposed to a downturn – are females, particularly those from households with relatively low parental education. As such, crises have the potential to expand the educational investments among females from low-SES backgrounds. However, in terms of aggregate earnings, these shifts do not lead to reversals in gender gaps, thus highlighting that college completion alone is not a sufficient prerequisite for closing gender gaps in earnings.

In fact, our data is consistent with marginal students opting for gender-stereotypical fields. That is, downturns do not lead to a more balanced distribution of college majors across genders but instead perpetuate existing specialization gaps. This finding is in line with prior work, according to which women choose specializations with lower earnings potential (e.g., Buser et al., 2017, Card and Payne, 2021, Zafar, 2013), likely driven by lower preferences for monetary returns (Zafar, 2011, 2013, Wiswall and Zafar, 2015, Reuben et al., 2017). While prior evidence on this finding comes from survey data, we investigate actual economic choices and, using full-population register data, show that the gender gaps in the returns to college (predicted and actual ones) do not close. Furthermore, we add to the literature by documenting that these choices have consequences on real accumulated earnings in the longer run.

# 2 Background

## 2.1 Swedish educational system

Education is compulsory for Swedish residents between the ages of 6 and 16. Since the early 1990s, the Swedish school system is relatively decentralized. There is a national curriculum, but municipalities are responsible for financing both public schools and privately-run independent schools (friskolor). Public schools are responsible for providing school placements for all students in a given municipality, while independent schools have agency over the number of

[1] A related strand of the literature also examines family-level economic shocks (i.e., parental unemployment). While this is not the focus of our paper, we consider parental unemployment as a control variable in our robustness checks and find that it is not a main driver of our effects. See Oreopoulos et al. (2008), Rege et al. (2011), Hilger (2016), Huttunen and Riukula (2019), Mörk et al. (2020), Willage and Willén (2022), Grenet et al. (2023) for related literature.

students they decide to admit.

As a result of the decentralization, parents have a greater sway over the school choice. Families can wish for a specific school, both independent and municipal. Students who wish to switch school can also do so provided there are slots. Compulsory schooling is divided into three stages: lower (grades 0-3), middle (grades 4-6), and upper (grades 7-9). At the end of each stage, students take mandatory national tests in the core subjects of Mathematics, Swedish, and English.[2] These national tests are locally graded at the school using national guidelines. In grade 9, the national tests are high-stakes for students since they influence the final compulsory school grades, which can affect admission to high school programs.

In the last year of compulsory schooling, students can apply for high school (gymnasiet) admission within their municipality. High school lasts three years, and most students finish it around age 19. This is also the stage in the Swedish education system where specialization starts. There are currently 18 high school programs that students can choose from: 6 academic and 12 vocational. Graduation from an academic program provides the necessary basic qualification to enter a university, with the Natural Sciences track allowing for admission into the widest range of degrees. In vocational programs, there is also the possibility of fulfilling additional requirements to attend university. In their final year of high school, students can apply for specific programs at a university of their choice. Admission is centralized, with approximately 85% of places allocated based on high school grades and the rest on national test scores. University enrollment and attendance are free of charge. Students also have access to universal financial aid in the form of low-interest loans to cover living expenses.

## 2.2 Swedish financial and economic crisis

The Swedish economic crisis of the early 1990s followed the collapse of a credit boom that emerged after financial deregulation in the late 1980s. The crisis had severe and uneven labor market consequences, with unemployment rising rapidly from near full employment to historically high levels of 12 percent. Although the downturn was national in scope, increases in unemployment varied substantially across counties, reflecting differences in local industrial composition and exposure to cyclical labor demand (see Appendix Figure A.1). Young workers were particularly hard-hit by the crisis, as reflected in high unemployment rates among youth and young adults. Another economic downturn happened in the 2000s, associated with the global financial crisis, which resulted in a sharp but comparatively short-lived increase in unemployment.

[2] In grade 9, there are also national tests in one social science (Geography, History, Religion, Social science) and one natural science subject (Biology, Chemistry, Physics), with the subject randomized at the school level.

# 3 Empirical Approach

To examine whether business cycle conditions at the time of graduation shape high school graduates' educational investment and labor market outcomes up to age 30, we estimate regressions of the following form:

$$y_{icr} = \beta\, UE_{c,r} + X'_{ic}\gamma + W'_{rc}\rho + \delta_c + \delta_f + \epsilon_{icr}, \tag{1}$$

where $y_{icr}$ denotes the outcome of individual $i$ graduating from high school in cohort $c$ and residing at the time of graduation in county $r$. Specifically, we study four outcomes capturing high school graduates' participation in tertiary education from the year of graduation up to eight years later: whether the graduate enrolls in college for at least one semester, the number of completed college credits, college graduation, and field of study for those who graduated from college (in nine broad categories). $UE_{c,r}$ measures the county-level unemployment rate in the year before high school graduation, which we assume to be the most relevant period for cohorts when making their education decisions. $X_{ic}$ is a vector of individual-specific characteristics, including 9th grade GPA (with parental unemployment included in robustness checks), while $W_{rc}$ is a vector of region-specific characteristics, such as local university capacity, also included in robustness checks. $\delta_c$ and $\delta_f$ represent cohort and family fixed effects, and $\epsilon_{icr}$ is the error term. All regressions are fully interacted with gender, except for the family fixed effects, and standard errors are clustered at the county-by-cohort level.

Our identification strategy relies on within-siblings variation in exposure to county-level unemployment rates in the year before high-school graduation. As local labor market conditions fluctuates over time, siblings from the same household may graduate under different economic environments. By implementing a design that includes family fixed effects, we account for all time-invariant family characteristics, which can mitigate potential confounding. For example, families with higher socioeconomic status may select into counties with more stable labor markets, which could affect their children's exposure to local unemployment while also correlating with educational outcomes. This sibling comparison allows to effectively isolate local conditions from such shared family background. Moreover, given that families rarely change counties between the graduations of their children (only about 2% do), family fixed effects also absorb time-invariant regional characteristics, which is why separate region fixed effects are not included in our model. This means that even if, for example, local historical industrial structure affects unemployment by shaping job availability and simultaneously influences educational outcomes by determining the demand for skilled workers, it would not confound our estimates.

Cohort fixed effects are also included to account for national-level shocks or policy changes that uniformly affect each graduating cohort. For instance, a nationwide university expansion

or a reform in student aid policy could shift overall college enrollment trends, and cohort fixed effects ensure that such influences are not attributed to variation in local unemployment.

The coefficient $\beta$ captures the effect of an increase in unemployment in the year before high-school graduation on our outcomes. The interpretation of the magnitude of the $\beta$ coefficient naturally depends on how the unemployment variable is scaled. If unemployment were measured on a scale of 0 to 1, the coefficient $\beta$ would capture the effect of going from no unemployment to full unemployment in a county. Since such extreme changes are never observed in the data, we scale the unemployment by its standard deviation, which is about 0.02 percentage points. As such, the coefficient $\beta$ captures the effect of a one-standard deviation increase in unemployment on our outcome.

We conduct a series of robustness checks to assess the sensitivity of our baseline specification. First, a potential concern for our interpretation is the presence of time-varying regional characteristics that simultaneously correlate with local unemployment dynamics and post-secondary decisions. To evaluate the relevance of such omitted regional factors, we incorporate local university capacity as an additional county-level control in a robustness specification. Local university capacity is particularly relevant because expansions in nearby higher-education institutions may coincide with fluctuations in local labor markets. For instance, a region experiencing rising unemployment might simultaneously expand university seats to stimulate human capital development. Such expansions could both correlate with local unemployment and directly increase the likelihood that high-school graduates enroll in and complete college. Failing to account for this could overestimates the effect of unemployment on educational attainment.

When we include county-level university capacity as an additional control, the estimates remain broadly consistent. The effect of unemployment on boys remains negligible, while for girls it continues to increase the likelihood of obtaining a degree. However, the somewhat reduced magnitude for girls suggests that local university capacity may play a role in shaping educational outcomes.

# 4 Data and descriptive statistics

## 4.1 Data

**Sample.** We use data from the Swedish Interdisciplinary Panels (SIP), a set of large-scale multi-generational databases constructed by merging individual-level data from Swedish administrative registers. The SIP data are collected and stored by Statistics Sweden and made available by Lund University's Center for Economic Demography. The database we use covers all individuals born between 1973-1995, along with their parents and siblings, and provides

annual observations up to 2017.[3]

Our sample includes all individuals from the 1992 to 2009 Swedish high-school graduation cohorts, which aligns with the available birth years and allow sufficient time to examine their subsequent educational and early labor market trajectories. From this sample, we exclude students who do not have at least one sibling graduating from high school within the same cohorts, as our analysis relies on a sibling fixed-effects strategy. This reduces the sample by approximately 40%, resulting in a final dataset of 856,219 students across 380,832 families.

**High-School Cohorts.** We use the High School Register (Registret över slutbetyg från gymnasiet) to identify the students included in this study. The register contains detailed information on all individuals who have completed upper secondary education in Sweden, including their final grades for each completed course, the type of study program (e.g., academic or vocational track), the year of graduation, and the school attended. Students are linked to both their mother and father using the Multigenerational Register (Flergenerationsregistret), and are preserved in the sample only if a sibling who graduated from high school within the observed cohorts shares both parents.

**Local Unemployment Rates at Graduation.** To measure local labor market conditions, we use yearly county-level unemployment rates from the Labor Force Surveys, a nationally representative survey that provides official labor market statistics in Sweden. Students are linked to local labor market conditions through the Population Register (Befolkningsregistret), which provides their county of residence. Since students typically make their post-secondary education decisions the year preceding high school graduation, we assign the local unemployment rate from this year to each student. This measure serves as our treatment variable, reflecting the economic environment students face when deciding on their post-secondary paths.

**Educational Outcomes.** We draw on data from the University Register (Universitets- och högskoleregistret), to examine students' higher education outcomes as our dependent variables. It provides information on individuals' enrollment in higher education programs, the number of annual credits earned, and graduation records. We consider only degrees of at least 120 credits when examining graduation outcomes. Enrollment and credits are observed over a nine-year period starting in the year of high school graduation, while graduation outcomes are recorded over the same period but beginning two years after graduation, the earliest point at which such degrees can be completed.

The field of study can be reliably observed upon graduation, which allows us to assess both participation and specialization within tertiary education. We aggregate these fields into nine broad categories to capture field choice as an additional higher education outcome. For individuals with more than one degree in the selected time period, we retain the field from the earliest

[3]Selected variables for earnings and employment information are available up to 2016 only.

one. When multiple degrees are completed in the same year, we select the one with the highest number of credits, and if there are still multiple degrees with the same number of credits, we choose the most frequently observed field among them in that given year.

**Labor market outcomes.** To link a student's subsequent earnings to the local labor market conditions they faced when making post-secondary education decisions, we use the Income and Taxation Register (Registret över inkomster- och taxeringar). The variable we use measures earnings, excluding social benefits such as parental leave or sickness benefits, and is adjusted for inflation using Statistics Sweden's Consumer Price Index. In addition to earnings, we observe students' employment status using the Occupation Register (Yrkesregistret). The variable indicates whether an individual is employed, with employment measured specifically in the month of November each year. Both earnings and employment are tracked from the year of high school graduation up to ten years afterward .

## 4.2 Descriptive Statistics.

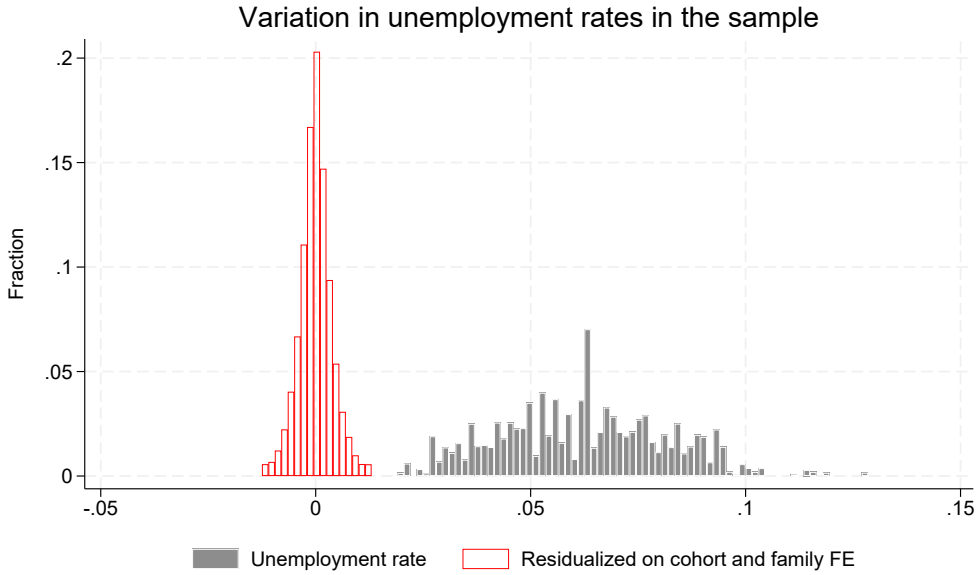
*County-level unemployment rates*. Figure 1 displays a histogram of county-level unemployment rates for the period 1991–2008. While Sweden had 24 counties until 1996 and 21 counties from 1997 onward, we maintain a consistent 21-county structure for the entire study period. The average unemployment rate over this interval is approximately 6 percent, with a standard deviation of 2 percentage points.

The figure also illustrates the variation in county unemployment-rate exposure that we exploit in our identification strategy. Our approach relies on comparing siblings who experienced different county-level unemployment deviations from the national trend. To assess this variation, we residualize county-level unemployment rates on cohort and family fixed effects. The resulting residuals are well behaved and approximate a normal distribution.

For most sibling groups, the within-family difference in county-level unemployment relative to the national trend falls between around 0 and 2 percentage points, providing sufficient variation for our empirical design. This variation arises from the county-specific unemployment trajectories, which are presented in Figure A.1 in the appendix. Although counties generally exhibit similar temporal patterns, there remains notable local variation across regions, which generates the within-family differences that we exploit in our identification strategy.

*Background variables*. Table 1 reports summary statistics for the key variables used as controls in our specifications and in the heterogeneity analyses, presented separately by gender. Student performance, measured by standardized 9th-grade GPA, tends to be higher for female students, with a statistically significant average difference of 0.32 standard deviations. High school track

Figure 1: Variation in unemployment rates in the sample




*Notes:* The figure above shows county-level unemployment rates for 1991–2008, as well as the distribution of residualized rates conditional on cohort and family fixed effects. The residuals are winsorized at the 0.5th and 99.5th percentiles.

enrollment also shows clear gender differences. Males are more likely to choose STEM (26.5% vs. 15.7%) and vocational tracks (41.8% vs. 33.5%), while females are more likely to enroll in business (31.4% vs. 17.4%) and other academic tracks (17.0% vs. 11.4%). All of these differences are statistically significant.

Family background characteristics are measured in the year prior to high school graduation. Overall, these characteristics are generally similar across genders, with only small differences (none exceeding one percentage point) that are statistically significant in parental education, employment, and the mother's share of household earnings. Males are slightly more likely to have college-educated and employed parents, and a mother with a higher relative earnings share.

Table A.2 in the appendix compares the characteristics of students in the sibling sample to those of students with no other siblings graduating in the study period. Overall, there are noticeable differences between the two groups. Students in the sibling sample tend to have higher standardized 9th-grade GPAs and are more likely to enroll in academic tracks.

Family background differences are also apparent. Students in the sibling sample are more likely to have college-educated and employed parents, with higher maternal relative earnings. These results suggest that the sibling sample is slightly advantaged in terms of both academic performance and family background compared to the rest of the population. This provides important context for assessing the external validity of the analyses based on the sibling sample.

Table 1: Summary Statistics – Student Background

| | Male | Female | Diff. | P-Value | Obs |
|---|---|---|---|---|---|
| *Student characteristics* | | | | | |
| 9th grade GPA (std.) | 0.166 | 0.484 | 0.318 | 0.000 | 845,242 |
| *High school track* | | | | | |
| STEM track | 0.265 | 0.157 | -0.108 | 0.000 | 851,716 |
| Business track | 0.174 | 0.314 | 0.141 | 0.000 | 851,716 |
| Other academic track | 0.114 | 0.170 | 0.056 | 0.000 | 851,716 |
| Vocational track | 0.418 | 0.335 | -0.084 | 0.000 | 851,716 |
| Unknown track | 0.029 | 0.025 | -0.004 | 0.000 | 851,716 |
| *Family characteristics* | | | | | |
| Father college-educated | 0.231 | 0.224 | -0.007 | 0.000 | 851,716 |
| Mother college-educated | 0.360 | 0.351 | -0.009 | 0.000 | 851,716 |
| Mother bread winner | 0.509 | 0.506 | -0.003 | 0.004 | 819,249 |
| Father employed | 0.840 | 0.835 | -0.006 | 0.000 | 851,716 |
| Mother employed | 0.878 | 0.875 | -0.003 | 0.000 | 851,716 |
| Father workplace closure | 0.021 | 0.020 | -0.000 | 0.269 | 851,716 |
| Mother workplace closure | 0.015 | 0.016 | 0.000 | 0.135 | 851,716 |

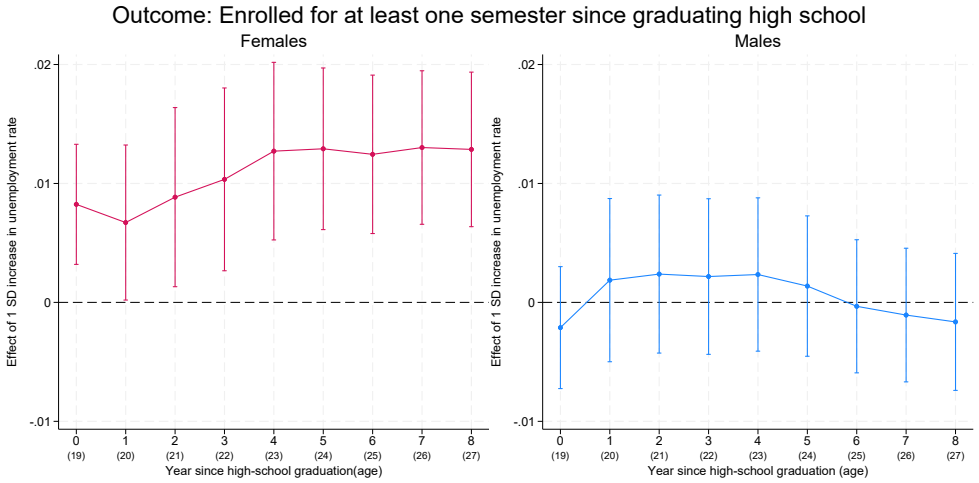
*Notes:* This table presents summary statistics for our study sample, covering the key variables used as controls or in the heterogeneity analyses, reported separately by gender. Not all variables are observed for the same number of individuals, though the differences in sample size are small. The 9th-grade variable represents students' standardized average grade. All family characteristics are measured in the year prior to graduation. A parent is considered college-educated if their graduation is recorded in official school records. A female parent is classified as the breadwinner if her share of household earnings is above the median. Parents are considered employed if their tax records show earnings (excluding social benefits) above 5% of the median. A workplace closure is recorded if the company the parent works for closes during that year.

# 5 Results

## 5.1 Educational outcomes

We first examine whether exposure to higher levels of unemployment has a direct effect on enrollment in our sample. Figure 2 shows the effect on enrolling for at least one semester within 8 years of finishing high school. We can observe a clear difference between the genders. While there is essentially no effect on males throughout the observed period, females are consistently more likely to enol in that time frame. A standard deviation increase in unemployment rate relative to that of one's sibling increases their propensity to enroll by approximately 4.5% in the first year after high school. That rate subsequently increases to approximately 1.3% from

Figure 2: Effect of Unemployment Exposure on Enrollment




*Notes:* The figure shows the results of OLS regressions of enrollment (binary indicator for being enrolled for at least one semester 0–8 years after high-school graduation) on the county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

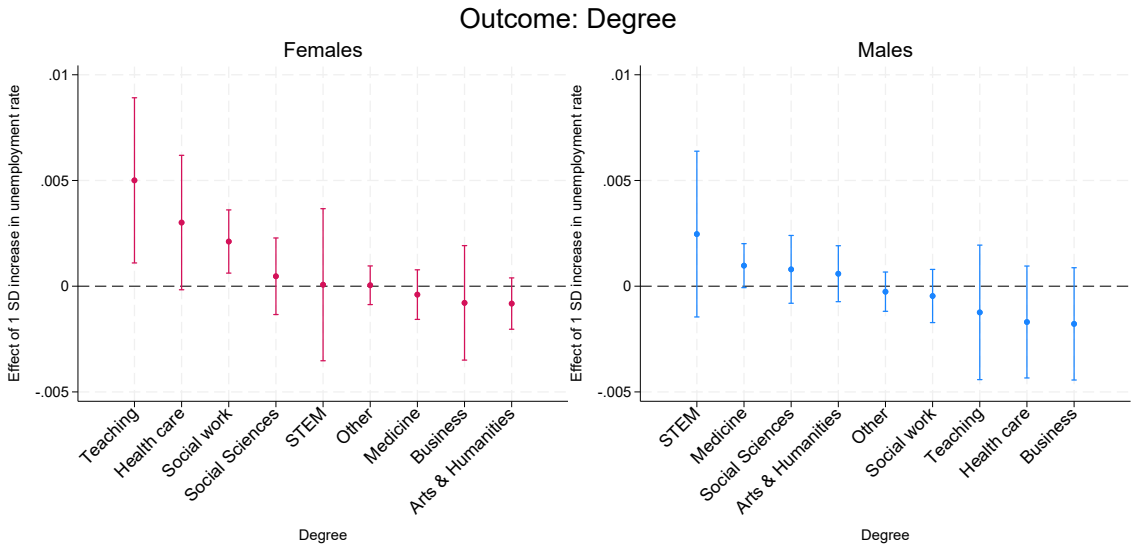
year 4 onward. This trend is also reflected in the propensity to obtain more completed credits. In Figure A.2, we observe that females accumulate approximately 25% credits within the next 8 years while there does not appear to be a measurable effect on males. This pattern also translates into a higher likelihood of graduating, with female students being 2.5% - 4% more likely to graduate 6-8 years after high school.

Unemployment exposure produces an effect not only on the external margin of enrolling and graduating. it also appears to affect the propensity to graduate with a degree in different subjects, which we amalgamate under 9 different categories. In Figure 3, we visually represent these patterns. Similarly to the case of overall enrollment and graduation, we do not find a statistically significant effect on males for any of the subject groups. For females, however, we do see an increased propensity to graduate in subjects related to teaching and social work. The effect corresponds to an approximately 7% and 10% higher likelihood to graduate in those disciplines, respectively. Notably, we do not observe an increase in the likelihood of women opting for STEM or business-related subjects with higher exposure to unemployment.

## 5.2 Degree characteristics

In this subsection, we examine the characteristics of degrees chosen by the affected students in further detail. To generate those characteristics, we use a more refined classification of different degrees that encompasses 38 individual subjects. We then use labor market outcomes of all in-

Figure 3: Effect of Unemployment Exposure on Graduation by Subject Group

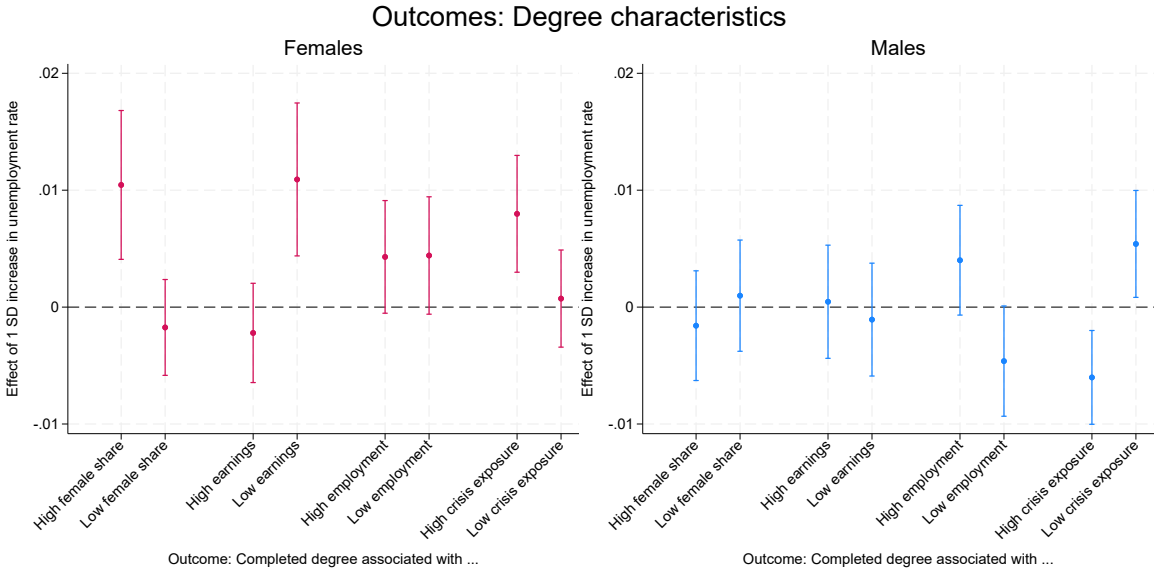



*Notes:* The figure shows the results of OLS regressions of degree graduation (binary indicators for completing a degree within eight years after high-school graduation for each broad fields: Teaching, Health Care, Social Work, Social Sciences, STEM, Medicine, Business, Arts and Humanities, and Others) on county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on degree graduation.

dividuals who graduated with those degrees and aged between 30 and 45 available in our sample to construct the four corresponding metrics for each degree. For simplicity of presentation, we classify all degrees to be either below or above the median in each of the characteristics. Figure 4 presents the estimated effects of unemployment exposure on degree choices along these dimensions, separately for women and men.

In line with the results in the previous sub-section, we indeed observe that women do not respond to higher unemployment by opting for degrees associated with higher earnings (e.g., STEM or business degrees). Conversely, we find that affected females were more likely to opt for degrees with, on average, lower earnings. They were also not more likely to select subjects associated with lower unemployment or crisis exposure. Overall, female students appear to respond by opting for degrees where they are already relatively over-represented. At the same time, we do not find that female students are more likely to study locally in response to higher unemployment. If that were the case, it could indicate being less selective about their study choice in a tighter labor market. However, we find that, if anything, they are more likely to pursue education away from home. When it comes to male students, we only detect a statistically significant effect when it comes to the crisis exposure metric. Namely, males are somewhat less likely to enroll in subjects with higher exposure and vice versa.

Figure 4: Effect of Unemployment Exposure on Graduation by Degree characteritics




*Notes:* The figure shows the results of OLS regressions of graduation (binary indicator for graduating with a university degree within 8 years of completing high school) on the county-level unemployment rates by several indicators of degree characteritics. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on degree characteritics.

## 5.3 Heterogeneity and Mechanisms

Having established that female students are more likely to pursue degrees associated with lower earnings and a higher crisis exposure, in this section we explore if this effect is driven by students of any specific background. First, we consider the academics. In Figure A.5, we can observe that female students with GPAs both above and below the median are approximately equally more likely to graduate within 8 years of high school. In Figure A.6, we also plot the effect by the track attended during high school. There, we see that the likelihood of graduation increases somewhat more among women who were enrolled either in the Business track or one of the vocational tracks. However, these corresponding increases are not statistically significantly different between each other. Jointly, these outcomes do not indicate a strong compositional effect when it comes to academic background. In line with the earlier results, we do not observe significant heterogeneity in either of the dimensions among male students.

Next, we examine if the effects could be driven by students' socio-economic background. In Figure A.7, we split the results by parental educational background. We find that among females, the increase in the likelihood of graduation is somewhat higher among students whose parents do not have a degree. The difference is comparable between mothers and fathers. At the same time, this relative increase is not statistically significantly different from students whose parents do have a degree. We also find that the likelihood to graduate is somewhat higher among female students whose mothers earn a larger share of the total household income. However, this

relative increase is similarly not statistically significant. Consistently with the academic background results, we do not find significant socioeconomic heterogeneities among male students.

## 5.4 Robustness

We conduct a number of checks to ensure that our results are robust to alterations in the econometric specification, the definition of the independent variable, and other potential confounding factors. Firstly, in Table A.5 we examine whether our estimates vary significantly depending on the fixed effects included in the specification. We find that while the estimated coefficients decrease for both men and women when including sibling fixed effects, the difference between the gender remains fairly stable. This is consistent with the difference within the genders being smaller when comparing siblings. Even between siblings, we find that female students are similarly more likely to graduate from college in response to local unemployment. This result also appears robust to whether we use overall or gender-specific local unemployment rates, as shown in Table A.7. Finally, in Table A.6 we show that our results are not driven by increases in supply. The coefficients do not appear sensitive to openings of new universities and programs in Sweden in the studied time period.

## 5.5 Labor Market Outcomes

While higher exposure to unemployment appears to have a measurable effect on educational choices, it is also important to assess whether this effect translates into a meaningful impact on future labor market outcomes. We first examine whether affected students experience a higher rate of unemployment themselves. This appears to primarily be the case of males in the first few years after high school. For them, the likelihood of being employed decreases by approximately 6% following a 1 standard deviation increase in the overall unemployment rate, with the effect gradually dissipating over the next three years. This shock appears considerably smaller for female students, with an approximately 2% corresponding drop in employment that is only statistically significant in the first year. This difference might be driven by higher enrollment rate among females and the fact that fewer of them enter the labor market directly after high school.

We observe a similar pattern when it comes to earnings. The initial shock is more pronounced for males. A similar increase in the unemployment rate results in an approximately 4% drop in log earnings among males. This effect dissipate over the next four years, with the more affected males eventually marginally out-earning their counterparts 6 to 10 years after high school. For female students, there is an initial drop in earnings by approximately 1.6%, with the decline no longer statistically significant after 3 years.

The pattern also looks somewhat different between the genders when considering cumulative earnings. For males, we can similarly observe that after the original shock, the difference in accumulated earnings tends to converge to zero after approximately seven years. For females, on the other hand, this convergence does not occur to the same extent, with accumulated earnings remaining lower for the students affected by greater unemployment.

# 6 Conclusion

In this paper, we examine to what extent economic conditions shape the difference in educational and occupational choices between men and women. To that end, we investigate how exposure to regional unemployment in the last year of high school affects the decisions related to higher education. To account for idiosyncratic differences prompted by socioeconomic characteristics, we rely on the differences in exposure between siblings.

We find that men's decisions on whether to enroll and what subjects to choose remain largely unaffected by changes in the local economic environment. At the same time, female students exposed to higher unemployment are more likely to enroll and graduate within seven years of completing high school. Counterintuitively, they are more likely to opt for subjects associated with lower earnings and lesser unemployment resilience that already attract a higher share of female students. The effect does not appear driven by those with a weaker academic background who might be more restricted in their tertiary education choices. They are also not uniquely driven by students of a particular socioeconomic background. We also find that these results eventually translate in lower accumulated earnings for the affected female students.

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# Appendix

Table A.1: Summary Statistics – Sibling vs. One-Child Comparison

| | Sibling | Obs | One child | Obs | Diff. | P-Value |
|---|---|---|---|---|---|---|
| *Student characteristics* | | | | | | |
| 9th grade GPA (std.) | 0.325 | 845,242 | 0.141 | 513,711 | -0.184 | 0.000 |
| *High school track* | | | | | | |
| STEM track | 0.211 | 851,716 | 0.159 | 519,469 | -0.051 | 0.000 |
| Business track | 0.244 | 851,716 | 0.238 | 519,469 | -0.006 | 0.000 |
| Other academic track | 0.142 | 851,716 | 0.132 | 519,469 | -0.010 | 0.000 |
| Vocational track | 0.376 | 851,716 | 0.448 | 519,469 | 0.071 | 0.000 |
| Unknown track | 0.027 | 851,716 | 0.023 | 519,469 | -0.004 | 0.000 |
| *Family characteristics* | | | | | | |
| Father college-educated | 0.228 | 851,716 | 0.156 | 519,469 | -0.071 | 0.000 |
| Mother college-educated | 0.355 | 851,716 | 0.257 | 519,469 | -0.098 | 0.000 |
| Mother rel. earnings high | 0.508 | 819,249 | 0.482 | 471,049 | -0.026 | 0.000 |
| Father employed | 0.838 | 851,716 | 0.784 | 519,469 | -0.053 | 0.000 |
| Mother employed | 0.877 | 851,716 | 0.838 | 519,469 | -0.038 | 0.000 |
| Father workplace closure | 0.021 | 851,716 | 0.021 | 519,469 | -0.000 | 0.935 |
| Mother workplace closure | 0.016 | 851,716 | 0.017 | 519,469 | 0.001 | 0.000 |

*Notes:* This table compares individuals with at least one sibling graduating during the study period to those without any sibling graduating in the same period. Means, sample sizes, differences, and p-values are reported.

Table A.2: Enrolled in college degree

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Dep.var.: | Enrolled for at least one semester ... years after HS graduation | | | | | | | | |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Male × Unemployment Rate | –0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | –0.000 | –0.001 | –0.002 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Female × Unemployment Rate | 0.008*** | 0.007** | 0.009** | 0.010*** | 0.013*** | 0.013*** | 0.012*** | 0.013*** | 0.013*** |
| | (0.003) | (0.003) | (0.004) | (0.004) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) |
| Difference | –0.010*** | –0.005** | –0.006*** | –0.008*** | –0.010*** | –0.012*** | –0.013*** | –0.014*** | –0.015*** |
| | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Mean outcome female | 0.175 | 0.352 | 0.469 | 0.536 | 0.578 | 0.607 | 0.627 | 0.642 | 0.654 |
| Mean outcome male | 0.138 | 0.278 | 0.372 | 0.424 | 0.456 | 0.478 | 0.495 | 0.507 | 0.516 |
| Scaled effect female | 4.7 | 1.9 | 1.9 | 1.9 | 2.2 | 2.1 | 2.0 | 2.0 | 2.0 |
| Scaled effect male | –1.5 | 0.7 | 0.6 | 0.5 | 0.5 | 0.3 | –0.1 | –0.2 | –0.3 |
| Observations | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 |
| Region-Cohorts | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 |
| *R*-squared | 0.58 | 0.63 | 0.66 | 0.67 | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 |

- The table shows the results of OLS regressions of enrollment (binary indicator for being enrolled for at least one semester 0–8 years after high-school graduation) on the county-level unemployment rates. The regressions control for 9th grade GPA, cohort fixed-effects, and siblings fixed effects. All parameters except for the siblings fixed-effects are interacted with a female dummy.
- The row "Difference" displays the difference between the male and female coefficient.
- The "scaled effect" denotes the effect of a one-standard-deviation increase in the unemployment rate over the gender-specific mean of the dependent variable ("percentage change").
- Robust standard errors are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Table A.3: Graduated from College

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Dep.var.: | Graduated by ... years after HS graduation | | | | | | |
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Male × Unemployment Rate | −0.002*** | −0.003*** | −0.003* | −0.001 | 0.001 | 0.001 | −0.001 |
| | (0.001) | (0.001) | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) |
| Female × Unemployment Rate | 0.001 | 0.004*** | 0.005** | 0.006** | 0.010*** | 0.010*** | 0.009*** |
| | (0.001) | (0.001) | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) |
| Difference | −0.002*** | −0.007*** | −0.008*** | −0.007*** | −0.009*** | −0.009*** | −0.009*** |
| | (0.000) | (0.001) | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) |
| Mean outcome female | 0.011 | 0.046 | 0.108 | 0.185 | 0.262 | 0.323 | 0.366 |
| Mean outcome male | 0.001 | 0.012 | 0.039 | 0.087 | 0.141 | 0.187 | 0.219 |
| Scaled effect female | 6.6 | 7.8 | 4.5 | 3.4 | 3.7 | 3.1 | 2.4 |
| Scaled effect male | −116.5 | −27.8 | −8.1 | −1.0 | 0.5 | 0.4 | −0.3 |
| Observations | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 |
| Region-Cohorts | 378 | 378 | 378 | 378 | 378 | 378 | 378 |
| *R*-squared | 0.46 | 0.48 | 0.50 | 0.54 | 0.57 | 0.59 | 0.61 |

- The table shows the results of OLS regressions of obtaining a college degree (binary indicator for obtaining a degree within 3–8 years after high-school graduation) on the county-level unemployment rates. The regressions control for 9th grade GPA, cohort fixed-effects, and siblings fixed effects. All parameters except for the siblings fixed-effects are interacted with a female dummy.
- The row "Difference" displays the difference between the male and female coefficient.
- The "scaled effect" denotes the effect of a one-standard-deviation increase in the unemployment rate over the gender-specific mean of the dependent variable ("percentage change").
- Robust standard errors are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Table A.4: Accumulated Labor Earnings (log)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dep.var.: → | Log accumulated earnings ... years after HS graduation | | | | | | | | | | | |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Male × Unemployment Rate | −0.17*** | −0.11*** | −0.08*** | −0.06*** | −0.04*** | −0.03*** | −0.02** | −0.01 | −0.01 | −0.00 | −0.00 | −23.38 |
| | (0.03) | (0.02) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (22.90) |
| Female × Unemployment Rate | −0.07** | −0.06** | −0.05** | −0.04** | −0.04*** | −0.03*** | −0.03*** | −0.03*** | −0.02*** | −0.02*** | −0.02*** | −71.51** |
| | (0.03) | (0.03) | (0.02) | (0.02) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (28.29) |
| Difference | −0.10*** | −0.05** | −0.03 | −0.01 | −0.00 | 0.00 | 0.01 | 0.02* | 0.02** | 0.02** | 0.02*** | 48.13 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (36.22) |
| Mean outcome female | 4.234 | 5.422 | 6.047 | 6.468 | 6.806 | 7.105 | 7.378 | 7.626 | 7.834 | 8.004 | 8.142 | 8.142 |
| Mean outcome male | 3.870 | 5.233 | 6.030 | 6.550 | 6.941 | 7.269 | 7.565 | 7.834 | 8.061 | 8.248 | 8.142 | 8.142 |
| Scaled effect female | −1.6 | −1.1 | −0.8 | −0.6 | −0.5 | −0.5 | −0.4 | −0.3 | −0.3 | −0.3 | −0.3 | −1.5 |
| Scaled effect male | −4.4 | −2.1 | −1.3 | −0.8 | −0.6 | −0.4 | −0.3 | −0.1 | −0.1 | −0.0 | −0.0 | −0.4 |
| Observations | 851,714 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 | 851,716 |
| Region-Cohorts | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 |
| *R*-squared | 0.59 | 0.61 | 0.62 | 0.62 | 0.62 | 0.62 | 0.61 | 0.59 | 0.58 | 0.58 | 0.57 | 0.63 |

- The table shows the results of OLS regressions of the log of accumulated labor earnings for 0–8 years after graduation on the county-level unemployment rates. Log earnings are replaced by 0 if the person did not have any labor earnings in a given year. The regressions control for 9th grade GPA, cohort fixed-effects, and siblings fixed effects. All parameters except for the siblings fixed-effects are interacted with a female dummy.
- The row "Difference" displays the difference between the male and female coefficient.
- The "scaled effect" denotes the effect of a one-standard-deviation increase in the unemployment rate over the gender-specific mean of the dependent variable ("percentage change").
- Robust standard errors are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Table A.5: Robustness: Fixed Effects and Controls

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Dep.var.: | College degree within 7 years after high school | | | | |
| Male × Unemployment Rate | 0.010*** | –0.001 | 0.001 | 0.001 | 0.001 |
| | (0.003) | (0.003) | (0.003) | (0.002) | (0.003) |
| Female × Unemployment Rate | 0.022*** | 0.012*** | 0.010*** | 0.010*** | 0.006* |
| | (0.004) | (0.004) | (0.003) | (0.003) | (0.003) |
| Difference | –0.012*** | –0.012*** | –0.009*** | –0.009*** | –0.005 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) |
| Cohort fixed effects | ✓ | ✓ | ✓ | ✓ | ✓ |
| County fixed effects | ✓ | | | | |
| Sibling fixed effects | | ✓ | ✓ | ✓ | ✓ |
| Grades | | | ✓ | ✓ | ✓ |
| Birth order | | | | ✓ | ✓ |
| County-specific cohort trends | | | | | ✓ |
| Mean outcome, female | 0.323 | 0.323 | 0.323 | 0.323 | 0.323 |
| Mean outcome, male | 0.187 | 0.187 | 0.187 | 0.187 | 0.187 |
| Scaled effect, female | 6.7 | 3.6 | 3.1 | 3.2 | 1.8 |
| Scaled effect, male | 5.4 | –0.4 | 0.4 | 0.5 | 0.4 |
| Observations | 851,687 | 851,687 | 851,687 | 851,687 | 851,687 |
| Region-Cohorts | 378 | 378 | 378 | 378 | 378 |
| $R$-squared | 0.03 | 0.56 | 0.59 | 0.59 | 0.59 |

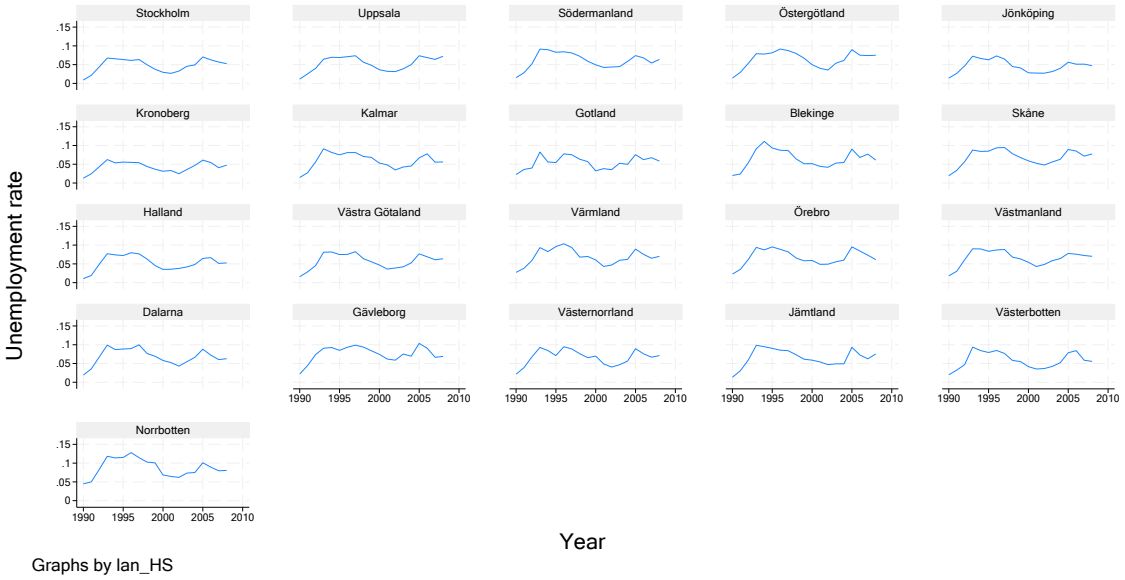
- The table shows the results of OLS regressions of obtaining a college degree (binary indicator for obtaining a degree within 7 years after high-school graduation) on the county-level unemployment rates for different fixed effects combinations. Robust standard errors are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Table A.6: Robustness: University Openings

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Dep.var.: | College degree within 7 years after HS | | | |
| Male × Unemployment Rate | 0.001 | 0.001 | 0.001 | 0.003 |
| | (0.003) | (0.003) | (0.003) | (0.003) |
| Female × Unemployment Rate | 0.010*** | 0.009*** | 0.009*** | 0.008*** |
| | (0.003) | (0.003) | (0.003) | (0.003) |
| University opening | | ✓ | | |
| Big university opening | | | ✓ | |
| New enrollment | | | | ✓ |
| Mean outcome male | 0.187 | 0.187 | 0.187 | 0.187 |
| Mean outcome female | 0.323 | 0.323 | 0.323 | 0.323 |
| Observations | 851,687 | 851,687 | 851,687 | 851,687 |
| Region-cohorts | 378 | 378 | 378 | 378 |
| *R*-squared | 0.59 | 0.59 | 0.59 | 0.59 |

- The table shows the results of OLS regressions of obtaining a college degree (binary indicator for obtaining a degree within 7 years after high-school graduation) on the county-level unemployment rates, controlling for the opening of new universities in the given period of time. Robust standard errors are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Figure A.1: Unemployment Rate by County



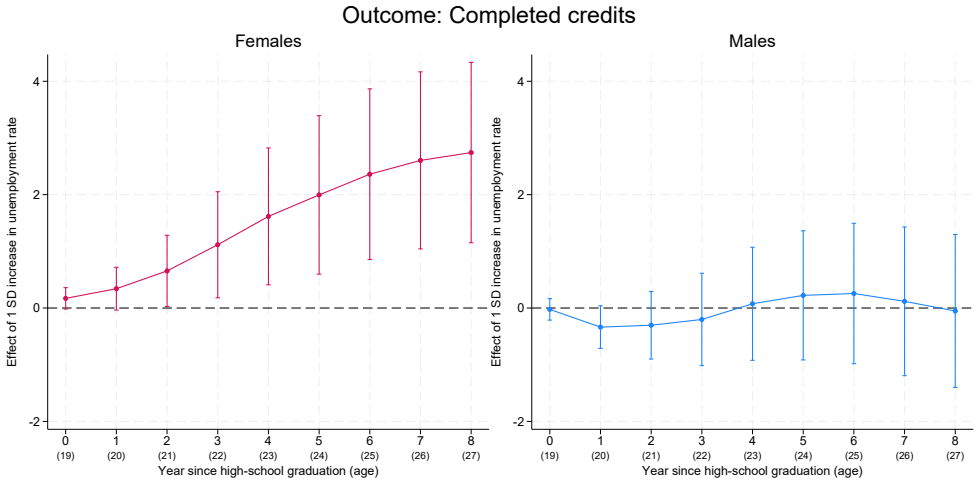

*Notes:* This figure shows the county-level unemployment trajectories for all 21 Swedish counties between 1991 and 2008.

Table A.7: Robustness: Male and Female Unemployment

| | (1) | (2) | (3) |
|---|---|---|---|
| Dep.var.: | College degree within 7 years after HS | | |
| | Males | | |
| Unemployment rate | 0.001 | | |
| | (0.003) | | |
| Unemployment rate male | | −0.002 | |
| | | (0.002) | |
| Unemployment rate female | | | 0.000 |
| | | | (0.002) |
| | Females | | |
| Unemployment | 0.010*** | | |
| | (0.003) | | |
| Unemployment rate male | | 0.005* | |
| | | (0.003) | |
| Unemployment rate female | | | 0.010*** |
| | | | (0.003) |
| Mean outcome male | 0.187 | 0.187 | 0.187 |
| Mean outcome female | 0.323 | 0.323 | 0.323 |
| Observations | 851,687 | 851,687 | 851,687 |
| Region-cohorts | 378 | 378 | 378 |
| *R*-squared | 0.59 | 0.59 | 0.59 |

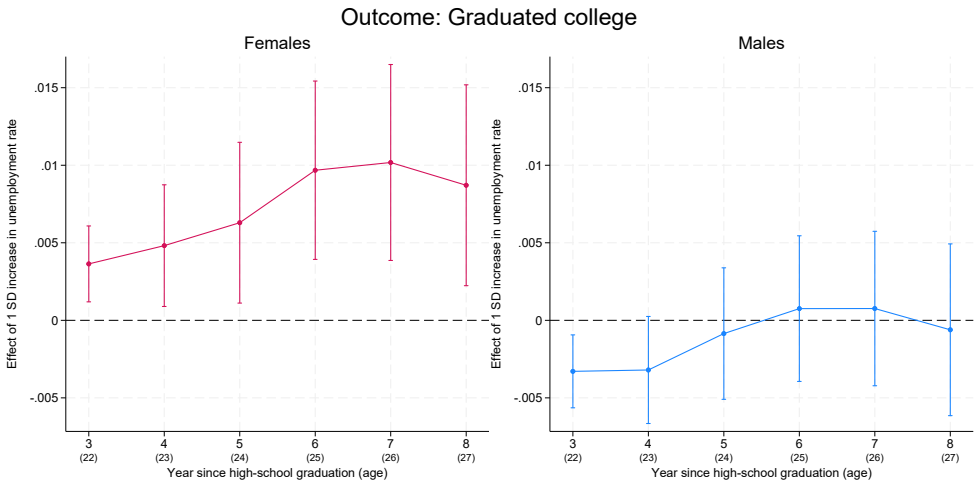
- The table shows the results of OLS regressions of obtaining a college degree (binary indicator for obtaining a degree within 7 years after high-school graduation) on the county-level overall and gender-specific unemployment rates. Robust standard errors are in parentheses. * p<0.1, **p<0.05, ***p<0.01.

Figure A.2: Effect of Unemployment Exposure on Completed Credits



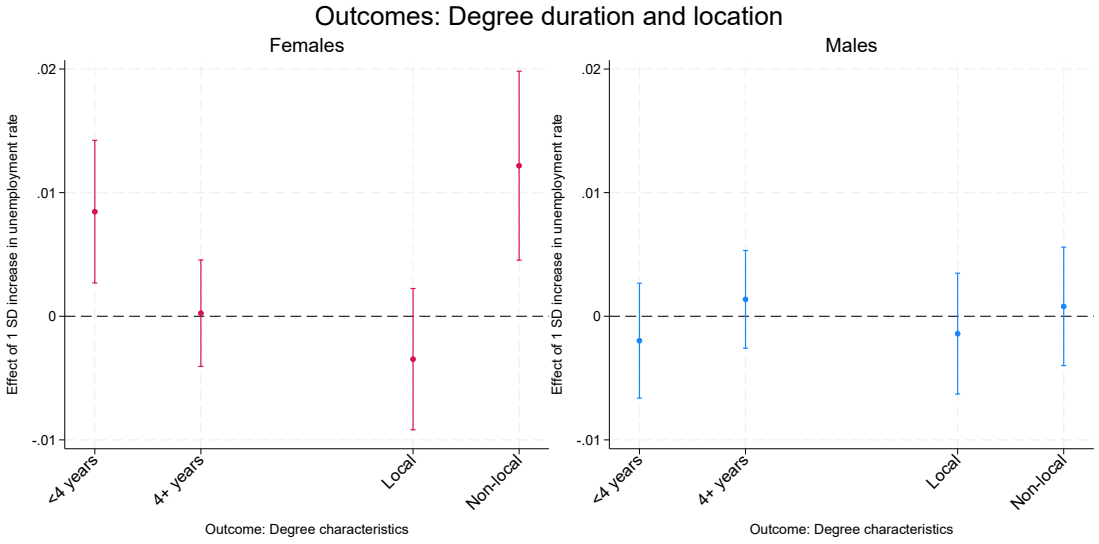

*Notes:* The figure shows the results of OLS regressions of accumulated completed university credits for 0–8 years after high-school graduation on the county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on completed credits.

Figure A.3: Effect of Unemployment Exposure on Graduating College



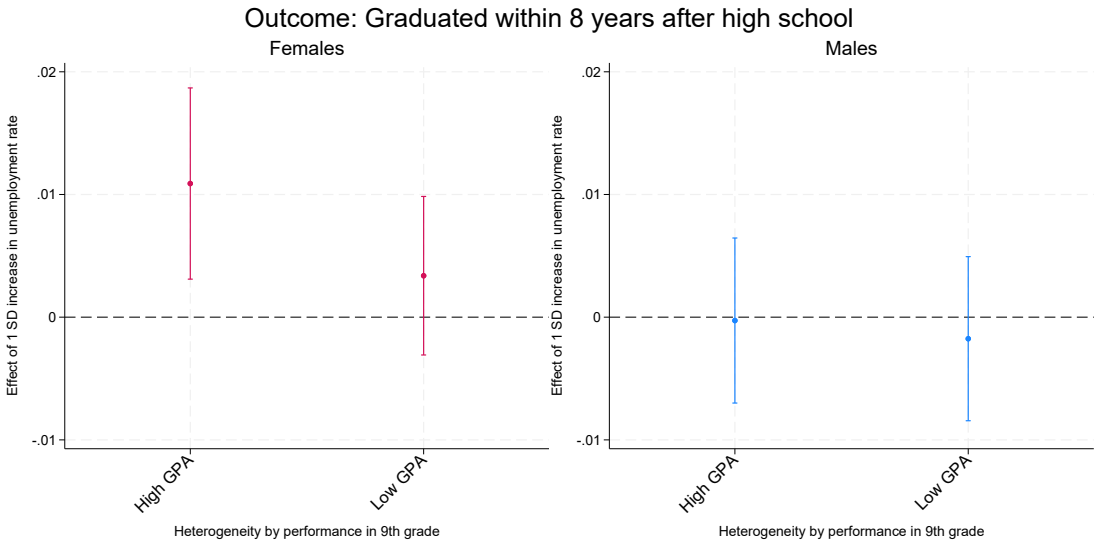

*Notes:* The figure shows the results of OLS regressions of obtainaing a college degree (binary indicator for obtaining a degree within 3-8 years after high school graduation) on the county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on college degree.

Figure A.4: Effect of Unemployment Exposure on Degree Duration and Location



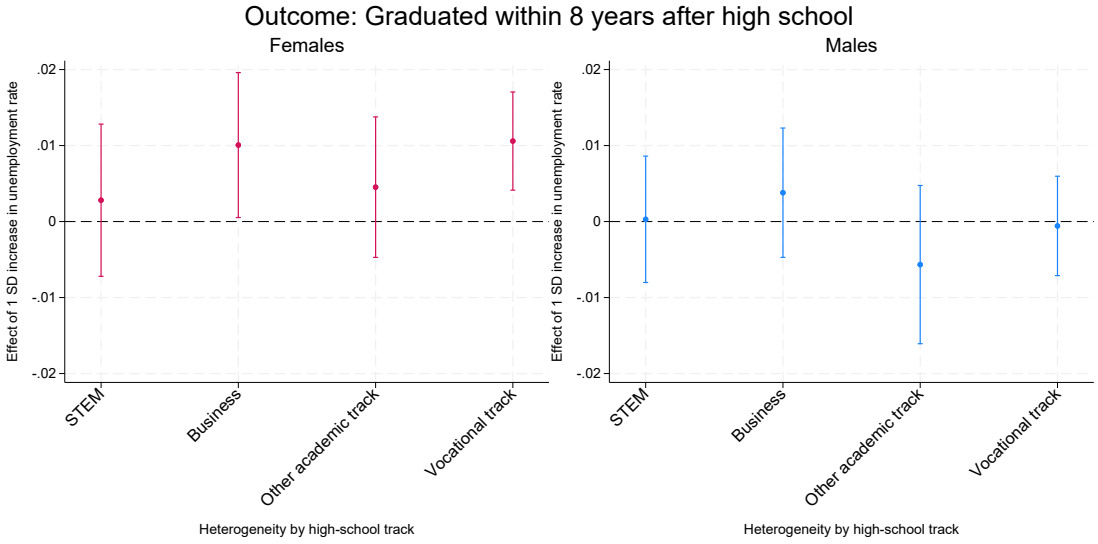

*Notes:* The figure shows the results of OLS regressions of graduation on the county-level unemployment rates by the duration and location of the corresponding degree (binary indicator for graduating with a university degree that corresponds to the respective metric within 8 years of completing high school). The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.5: Effect of Unemployment Exposure on Graduation by GPA in Grade 9



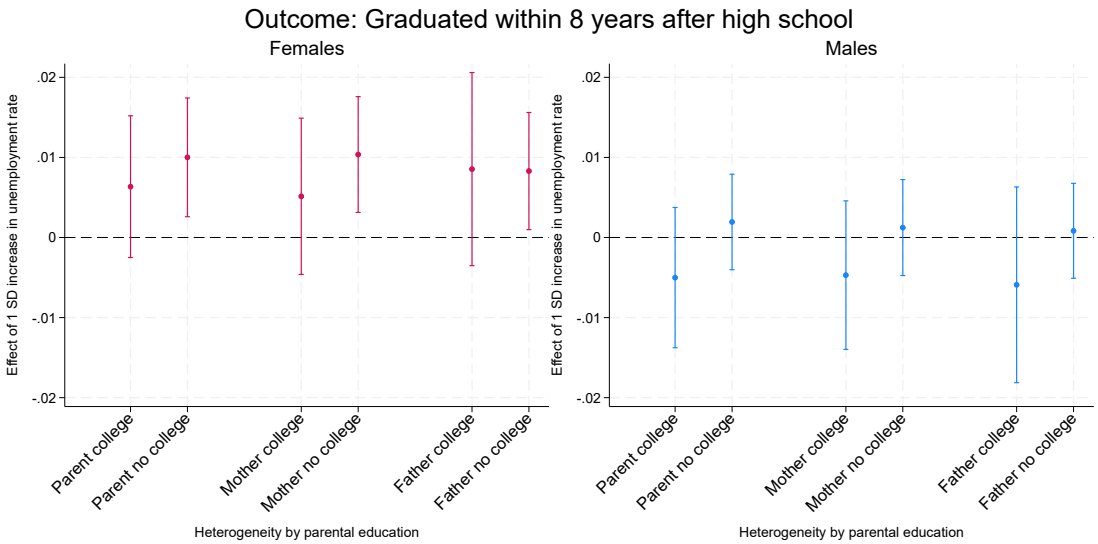

*Notes:* The figure shows the results of OLS regressions of graduation on the county-level unemployment rates by compulsory school GPA. The regressions control, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.6: Effect of Unemployment Exposure on Graduation by High School Track



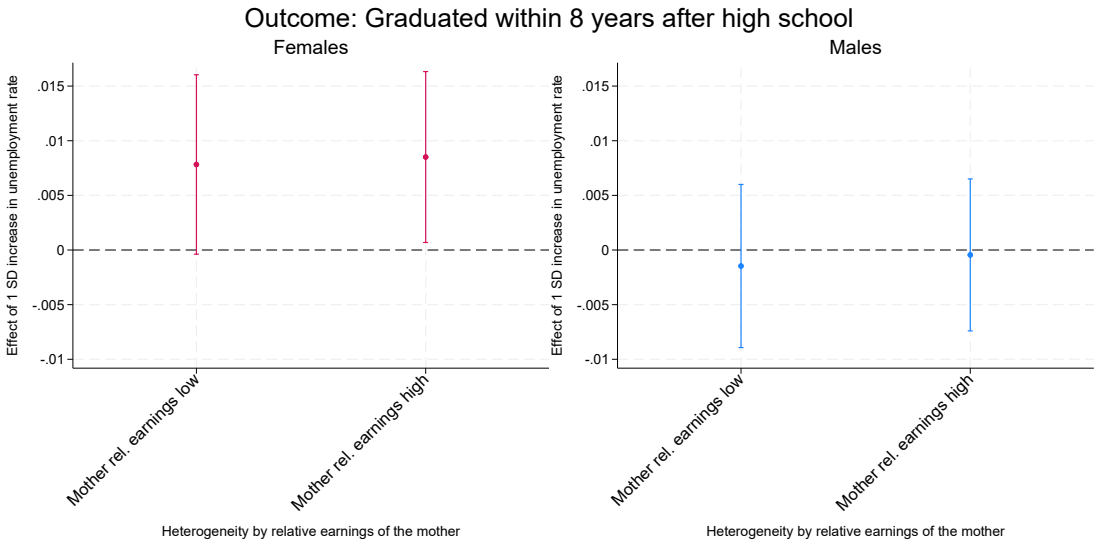

*Notes:* The figure shows the results of OLS regressions of graduation on the county-level unemployment rates by study track selected in high school. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.7: Effect of Unemployment Exposure on Graduation by Parental Education



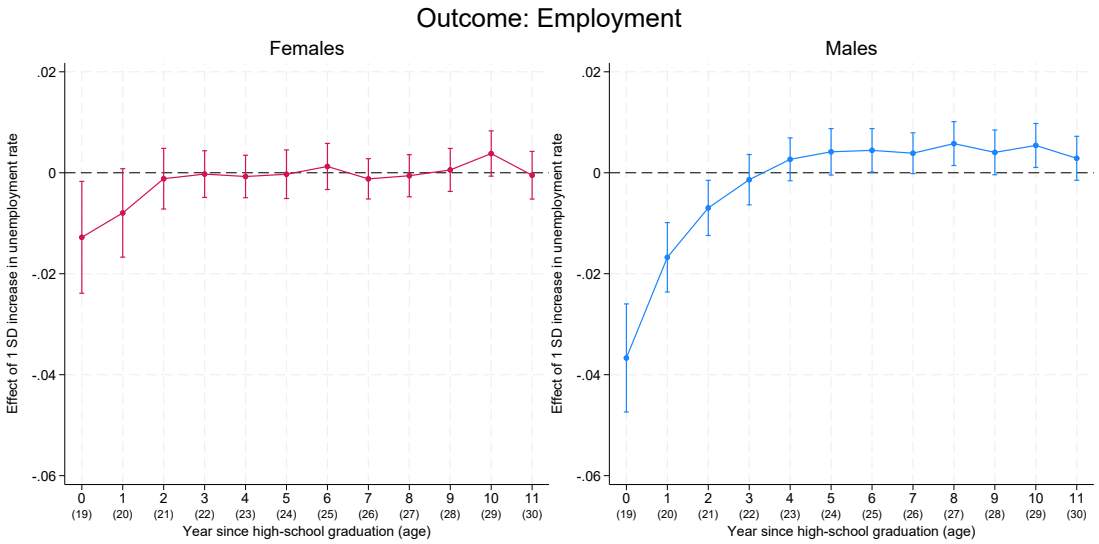

*Notes:* The figure shows the results of OLS regressions of graduation on the county-level unemployment rates by parental education (binary indicator for each parent having the corresponding level of education). The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.8: Effect of Unemployment Exposure on Graduation by Mother's Relative Earnings



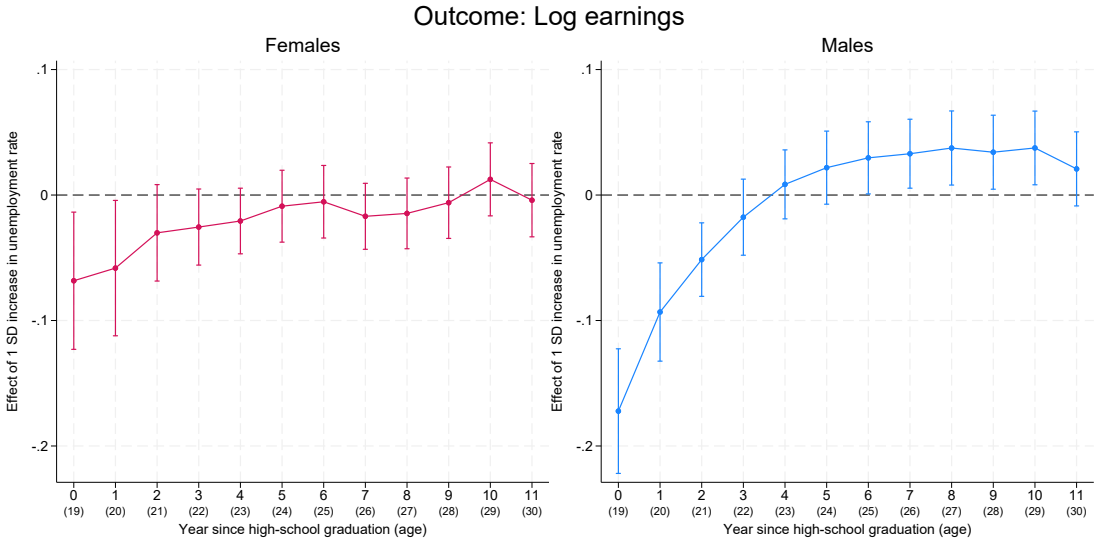

*Notes:* The figure shows the results of OLS regressions of graduation on the county-level unemployment rates by parental relative earnings (binary indicator for each parent having the corresponding level of relative earnings). The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.9: Effect of Unemployment Exposure on Subsequent Employment




*Notes:* The figure shows the results of OLS regressions of the likelihood of employment X years after graduation on the county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.10: Effect of Unemployment Exposure on Subsequent Earnings




*Notes:* The figure shows the results of OLS regressions of one's earnings X years after graduation on the county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.

Figure A.11: Effect of Unemployment Exposure on Subsequent Cumulative Earnings


*Notes:* The figure shows the results of OLS regressions of one's cumulative earnings X years after graduation on the county-level unemployment rates. The regressions control for 9th-grade GPA, cohort fixed effects, and sibling fixed effects, with all parameters except the sibling fixed effects interacted with a female dummy. Results are shown separately for men and women. The figure displays the absolute effect of a one–standard-deviation increase in the unemployment rate on enrollment.