Local unemployment and the timing of post-secondary schooling

Hans Henrik Sievertsen[a]

[a] *SFI - The Danish National Centre for Social Research. Contact: Herluf Trolles Gade 11, 1052 Copenhagen, Denmark. Phone: +45 3348 0846. E-mail:* hhs@sfi.dk.

Abstract

Using Danish administrative data on all high school graduates from 1984 to 1992, I show that local unemployment has both a short- and a long-run effect on school enrollment and completion. The short-run effect causes students to advance their enrollment, and consequently their completion, of additional schooling. The long-run effect causes students who would otherwise never have enrolled to enroll and complete schooling. The effects are strongest for children of parents with no higher education.

Keywords: Demand for schooling, Post-secondary education, Local labor markets.
JEL: I24, J24

1. Introduction

Delaying entrance into higher education is a common practice in Europe and North America. Among the Danish 2001 high school graduating cohort, less than one out of five who eventually attended university entered immediately after high school (Foley and Groes, 2012). Almost every second US undergraduate student in 2000 delayed their post-secondary schooling (Horn et al., 2002). In this present paper I study how the timing of post-secondary schooling is affected by local labor market conditions at the time of graduation from upper secondary schooling.

A rich empirical literature documents that the demand for education is counter-cyclical (Pissarides, 1981; Fredriksson, 1997; Rice, 1999; Card and Lemieux, 2000; Bedard and Herman, 2008). The opportunity costs of schooling are reduced in recessions, as the chances of finding unskilled employment are lower than in economic good times. Despite a vast amount of research, there is no evidence on how local labor market conditions affect the individual student's timing of continued schooling. The observed counter-cyclicality may be driven either by individuals who postpone their school enrollment in economic good times and return to education in bad times (a temporary effect), or by individuals joining the labor market if job opportunities are good at the time of graduation, and never continuing in post-secondary schooling (a permanent effect).

Denmark makes an excellent case to study the effects of local labor market conditions on post-secondary schooling for at least two reasons: One, all students graduate from high school (i.e. upper-secondary schooling) in the same month, which allows me to record the local labor market conditions at the exact time of relevance. Two, Danish administrative data on the complete Danish population allows me to track the school record for up to ten years after graduation. Using data on all high school graduates from 1984 to 1992, I estimate the effect of local unemployment on enrollment and completion of post-secondary schooling (as measured 10 years after the end of high school). I find that a one percentage point increase in local unskilled unemployment increases the probability of continued schooling immediately after high school by 0.5 percentage points, the probability of continued schooling within ten years by 0.3 percentage points, and the probability of completed additional schooling within ten years by 0.3 percentage points. I find that both the short- and long-run effects are driven by children of parents with no college degree. The long-run effect is driven by students who enroll and complete shorter educational programs. There is no long-run effect on college enrollment and completion.

My results show that local business cycles have two effects on continued education after high school. The short-run effect causes students who would normally delay continued schooling to continue earlier (a temporary effect). The long-run effect causes individuals who would otherwise never again enroll in education to enroll and complete additional schooling (a permanent effect).

This paper is organized as follows. Section 2 describes the institutional setting and provides a brief review of existing literature, and section 3 describes the empirical strategy and the identifying assumptions. Section 4 explains the data, and section 5 presents the results. Section 6 concludes.

2. Background

2.1. The Danish institutional setting

Compulsory education begins in August of the year that children turn seven and ends after nine years of schooling. After leaving compulsory education, an individual can choose between three-year upper secondary school (high school), vocational training (apprenticeship programs), or the labor market. There are three high school program types: "Academic High School" (STX), "Higher Commercial Examination Programme" (HHX), and "Higher Technical Examination Programme" (HTX). All high school programs give equal access to university education and shorter educational programs (e.g., nursing school, teachers' college). Almost all Danish educational programs are free, and students older than 18 are eligible for a monthly student grant.

For the analysis I use data on all high school graduates (from all program types). In the main analysis I define any continued education after high school as continued education (that is all educational programs count as continued education, including apprenticeship programs, nursing schools, and college education). I focus on the transition from upper-secondary schooling to post-secondary schooling because the labor market constitutes a real alternative to continued education. That is, high school graduates are typically aged 18-20 years old and allowed to work in any available job. While the transition from compulsory schooling to upper-secondary schooling also constitutes an interesting margin, because it is the individuals' first educational choice, the labor market for under 18-year olds in Denmark is rather special.

All Danish high school students graduate in June and apply for continued schooling later that month. I can therefore study the effect of labor market conditions on the timing of continued schooling by looking at the unemployment rates in May. The local area is defined as the commuting zone the student lived in four years prior to graduation. This is to avoid any selection into low unemployment areas.[1]

Denmark has two institutional systems for unemployment: unemployment benefits and social assistance. Individuals who are members of an unemployment fund may be eligible for unemployment benefits. Membership of an unemployment fund is voluntary, with eligibility for unemployment benefits depending on previous employment and education. Danish high school graduates rarely satisfy these requirements, because very few have sufficient work experience and therefore are dependent on social assistance. At the time of my sample period, the level of social assistance corresponded to the level of the student grant for individuals below the age of 23.

2.2. A Brief Review of the Literature

A rich literature exists on the link between school enrollment and both national labor market conditions (Pissarides, 1981; Fredriksson, 1997; McVicar and Rice, 2001; Dellas and Sakellaris, 2003; Ewing et al., 2010) and sub-national labor market conditions (Rivkin, 1995; Rice, 1999; Albert, 2000; Card and Lemieux, 2000; Petrongolo and San Segundo, 2002; Dellas and Sakellaris, 2003; Giannelli and Monfardini, 2003; Bedard and Herman, 2008; Flannery and O'Donoghue, 2009; Clark, 2011; Barr and Turner, 2013; Reiling and Strøm, 2015). Table 1 summarizes the main contributions. All studies find that demand for schooling is counter-cyclical, except for Bedard and Herman (2008), who find that men's enrollment in masters programs is pro-cyclical. Evidence covers Canada, Ireland, Italy, Norway, Spain, Sweden, the United Kingdom, and the United States, and all levels of post-compulsory schooling. The

[1] Results are robust to the definition of local area and to when I record the home municipality.

main measure for the business cycle condition is unemployment, although inflation, earnings, growth rates and employment rates have also been used.

Dellas and Sakellaris (2003) find that the cyclicality is similar across gender but not across ethnicity. In contrast, Pissarides (1981); Card and Lemieux (2000); Petrongolo and San Segundo (2002); Rivkin (1995) and Bedard and Herman (2008) find that men react more to business cycle fluctuations than women. Rice (1999) finds that the cyclicality decreases in ability, while Bedard and Herman (2008) find that the cyclicality of postgraduate schooling among men is driven by those with the highest GPA. Rice (1999) finds that the effects are strongest in recessions, but Dellas and Sakellaris (2003) conclude that the cyclicality is symmetric in economic recessions and expansions. Demand for schooling is counter-cyclical from upper secondary schooling (Rice, 1999) through graduate school (Bedard and Herman, 2008).

Compared to these studies, the contribution of this paper is twofold. First, I study the effect of local labor market conditions on the timing of continued schooling. On the one hand Dellas and Sakellaris (2003) observe that the increase in college enrollment in recessions is driven by new high school graduates, indicating the existence of a permanent effect. On the other hand. Barr and Turner (2013) note that the a large part of the increase in college enrollment during recessions comes from students that are not recent high school graduates, indicating that the business cycle has little permanent effect on staying-in-rates. I explicitly analyze whether the counter-cyclicality of demand for schooling is a temporary or a permanent effect.

Second, this paper is the first to analyze heterogeneity with respect to parental background. Intergenerational-correlations in educational attainment and earnings are observed even in Denmark, where education is free and students are subsidized (Holm and Jæger, 2008). I analyze whether the inter-generational educational link varies over the business cycle.

2.3. Local labor markets

Previous studies have considered the labor market conditions at the state, province, region or community level. While these choices often have been limited by data availability, I can in principle use any definition, as I compute the labor market conditions based on administrative registers on the full population. I follow Rice (1999) and measure the local labor market conditions in terms of unemployment rates, defined as the number of benefit claimants relative to the size of the work force. Because the main theoretical argument for the counter-cyclicality in the demand for schooling is the opportunity cost in terms of unskilled employment (see e.g. Rice (1999)), the labor market conditions should be measured at a level that reflects the individual's job searching area. While commuting zones as defined by the Economic

Table 1: Empirical findings on the counter-cyclicality of schooling

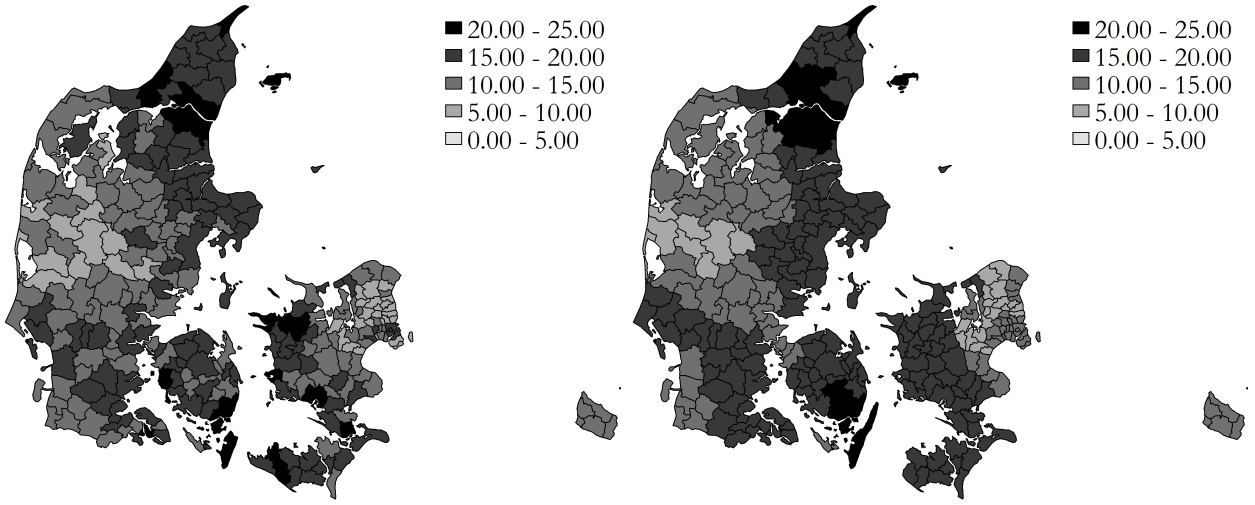
Study	*Type*	*Data*	*Outcome*	*Cyclicality measure*	*Fixed effects*	*Heterogeneity*	*Is schooling counter-cyclical?*
Pissarides (1981)	Time-series	UK; nat; 1955-1978	Schooling aged 16	Unemployment (youth, graduate, & general)	NA	Gender	Yes^{H}
Rivkin (1995)	Micro-level (Mult. logit)	US; community; 1980	Post high school	Unemployment, wage return	No	Gender, ethnicity	Yes^{H}
Fredriksson (1997)	Time-series (W2SLS)	SE; nat; 1967-1991	Schooling aged 22	Unemployment & wages (skilled & unskilled)	NA	No	Yes
Rice (1999)	Micro-level (Logit)	UK; loc; 1988,1990, 1991	Schooling aged 16-17	Unemployment	Region	Gender; GCSE; up/downturn	Yes^{H}
Albert (2000)	Micro-level (Logit)	ES; reg; 1987-1998	Schooling aged 19-24	Unemployment (skilled & unskilled)	Year	No	Yes
Card and Lemieux (2000)	Micro-level (WLS)	US/CA; reg; 1971, 1981, 1991	Schooling aged 19-24	Employment	Region & Year	Gender	Yes^{H}
McVicar and Rice (2001)	Time-series (CVAR)	UK; nat; 1954-1994	Schooling aged 16	Unemployment	NA	Gender	Yes ^{H}
Petrongolo and San Segundo (2002)	Micro-level (Logit)	ES; reg; 1987,1991;1996	Schooling aged 16-17	Employment	Region	Gender	Yes ^{H}
Dellas and Koubi (2003)	Time-series	US; reg; 1950-1990	Schooling aged 16-35	Unemployment, wages, interest rates	NA	Age groups	Yes^{H}
Dellas and Sakellaris (2003)	Micro-level (probit)	US; reg; 1968-1988	Schooling aged 18-22	Unemployment	State, trends	Up/downturn, gender, ethnicity	Yes ^{H}
Giannelli and Monfardini (2003)	Micro-level (Mult. probit)	IT; reg; 1995	Schooling aged 18-32	Unemployment & lifetime earnings	Region	Gender	Yes ^{H}
Bedard and Herman (2008)	Micro-level (probit)	US; reg; 1993-2001	Postgraduate schooling	Unemployment	State & year	GPA, gender, major, program	Yes^{H}
Flannery and O'Donoghue (2009)	Micro-level (logit)	IE; reg; 1994-2001	Schooling aged 17-22	Employment & lifetime earnings	Region & wave	No	Yes
Ewing et al. (2010)	Time-series (VAR)	US; national; 1963-2004	College enrollment	Growth and inflation	NA	Gender	Yes^{H}
Clark (2011)	Micro-level	UK; regional; 1975-2008	Post-compulsory schooling	Youth unemployment	Region, year & regional trends.	Gender	Yes
Barr and Turner (2013)	Micro-level	US; states; 1978-2011	College enrollment	Unemployment	State & year	Age and college type	Yes^{H}
Reiling and Strøm (2015)	Micro-level	NO; labor-market regions; 1971-2004	Upper-secondary schooling (completion)	Unemployment	Region & year	Gender	Yes

This table by no means covers all contributions but only highlights the main trends and developments.
^{H} indicates that the counter-cyclicality of schooling differs by subgroup.

Research Service (ERS) of the United States Department of Agriculture might seem ideal for such purposes, such areas have not been defined for Denmark. I therefore follow the methodology used by the ERS and define commuting zones using the Danish administrative data.

I define the commuting zones using the following methodology (see Tolbert and Sizer (1996) for a detailed description): (1) I compute the size of the labor force for each municipality in Denmark. (2) For each municipality I calculate the number of workers working in each of the 271 Danish municipalities. (3) For each pair of municipalities, j and i, I compute a dissimilarity measure $D_{ij} = 1 - \frac{totalcommuters_{ij}}{min(laborforce_i, laborforce_j)}$, where $totalcommuters_{ij}$ is the sum of the number of workers living in j and working in i, and the number of workers living in i and working in j. (4) I employ a hierarchical cluster analysis on the resulting 271×271 dissimilarity matrix with a dissimilarity cutoff of 0.9 (which is lower than applied for the US case). I apply the approach on averages for the the period 1984 to 1992 and obtain 65 commuting zones, but the results is quite robust across years.[2] There are on average 443 high school graduates per year in a commuting zone (compared to 106 per municipality).

Figure 1 shows the spatial distribution of unemployment rates in 1984 by both municipality and commuting zones. While commuting zones will be used for the main analysis, I also show results using the municipal level.



(a) Municipal level (b) Commuting zone level

Figure 1: Local unemployment rates (in percent) in May 1984 by municipal and commuting zone level. For individuals aged 16-29 with at most a high school degree. The source is administrative data from Statistics Denmark. The definition of unemployment rates is described in the Appendix.

[2] Ashournia et al. (2014) uses a similar strategy to define commuting zones in the Danish setting.

3. Empirical Strategy

The starting point is a short-run estimation in which the dependent variable takes the value of one if the individual continues in education immediately after graduating from high school. The following linear probability model (LPM) is estimated by means of ordinary least squares (OLS).

$$en_{ict} = \alpha_0 + \alpha_1 une\_u_{ct} + \alpha_2 une\_s_{ct} + \boldsymbol{\beta}_0' \boldsymbol{X}_{ict} + \boldsymbol{\omega}_c + \boldsymbol{\lambda}_t + \boldsymbol{\eta}_c \times year_t + \varepsilon_{ict} \qquad (1)$$

Where en_{ict} is the enrollment indicator for individual i living in commuting zone c graduating from high school in June year t. The variable une_u_{ct} is the unskilled youth unemployment rate in commuting zone c in May, year t. $\boldsymbol{\omega}_c$ and $\boldsymbol{\lambda}_t$ are a set of dummies capturing year and commuting zone fixed effects, respectively. $\boldsymbol{\eta}_c \times year_t$ is a set of commuting zone specific linear time trends.[3] Local skilled unemployment may affect the expected return to continued schooling, and may be correlated to unskilled unemployment. To avoid a potential omitted variable bias problem in the point-estimate on unskilled unemployment, I also include the unemployment rate for skilled workers, une_s_{ct}.

$\boldsymbol{X}_{ict}$ is a vector of controls. I include labor force and cohort size to control for variation in demand and supply for jobs and schooling. Given a rich literature on the importance of parental background for the educational choice (see e.g. Willis and Rosen (1979)), I include a measure of parents education, employment status, wealth, and income (as well as squared wealth and income terms). As siblings may influence the educational choice through information and by affecting the available resources in the family, I add variables for the number of siblings, number of siblings in education, and number of siblings who have completed post secondary education. Finally, I include a gender dummy, a variable for age, and a dummy for whether the individual is of non-western descent. As the variation in unemployment is obtained across commuting zones, I cluster the standard errors by this level.

The empirical strategy is based on the identifying assumption that the year and commuting zones fixed effects and the commuting zone specific linear time trends are sufficient to capture any unobservable characteristic that is correlated with both continued schooling and local unemployment. The variation in local unemployment could come from plant closures or downsizing, changes in cohort size, or plant openings. I will test the identifying assumption using a placebo test, based on the assumption that if there is any remaining

[3] Figure A.1 in the Appendix shows the distribution of unemployment rates with and without fixed effects and trends. While the fixed effects remove a substantial amount of variation in unemployment rates, the further inclusion of linear trends only reduces the variation slightly.

unobservable characteristic that affects both the labor market condition and the decision to continue schooling, then it must be correlated with the students school performance.

I analyze the effect of local unemployment on the timing of continued and completed schooling by estimating equation (1) 11 times, where only the dependent variable is changed to correspond to the year of interest. For each year j after high school, my dependent variable is a dummy that takes the value of one if the individual has been enrolled at some point within the j years. The full model consists of eleven equations, representing the immediate effect and the following ten years after high school. These equations are estimated by OLS, but as enrollment within $j+1$ years is not independent of enrollment within j years, the standard errors are corrected to account for this interdependence.

4. Data Description

4.1. Data selection

The applied data comes from longitudinal administrative registers covering all high school graduates in Denmark from 1984 to 1992. The individuals are followed for eleven years after graduation. I have data on each student's school record up to ten years after he or she left high school.

The raw sample consists of 279,171 observations. 14,794 observations are deleted because they are the individual's second high school degree. I further drop 5,394 observations for whom the educational level of the parents is unknown. The final estimation sample covers 258,983 observations.[4] In the long-run regressions I drop additional observations because individuals either leave the country or die.

4.2. Variables

For immediate continued schooling the dependent variable equals one if the individual is enrolled in an educational program at a Danish institution in October the year the individual graduates from high school. For continued schooling within $\tilde{j}$ years the dependent variable takes the value of one if the individual is enrolled in October in year $\tilde{j}$, or was enrolled in October in any year $j = 0 \ldots \tilde{j}$. In other words, the dependent variable measures the cumulative effect. For the timing effect on completion, the dependent variable takes the value of one if the individual has completed additional schooling within $j = 0 \ldots \tilde{j}$ years.

The timing of when the variables are recorded is crucial for this analysis. I record unemployment in May just before the individual makes the educational decision in June, to (1) ensure that the individual is not included in the unemployment measure and (2) to ensure

[4]The selection has basically no impact on the main results. Results are available on request.

that the labor market situation is captured at the time of the individual decision. The individual's commuting zone is measured by the place of residence in December the year before entering high school in August. Figure 2 illustrates the timing of measurements.

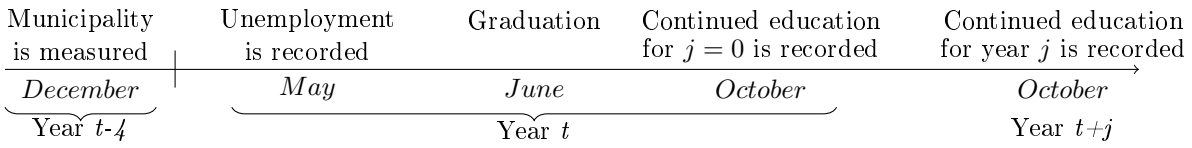


Figure 2: Timing of events and measurements

The variables on local unemployment rates are created using administrative registers on the complete Danish population. Local unskilled youth unemployment in May is defined as the number of benefit claimants (social assistance and unemployment benefits) aged 16 to 29 with at most a high school degree relative to the total number of individuals with these same characteristics that are not enrolled in education. Skilled unemployment is measured among all 16-to-64-year-olds who have completed post secondary education. I include a dummy for whether parents are self-employed and for whether they were unemployed in May, the latter to rule out business cycle effects driven by parents. A description of all variables appears in the Appendix.

The unemployment rates act as proxies for the high school graduates' perception of the local labor market conditions in the empirical analysis. While the unemployment is measured with a very high level of precision, because the number of benefit claimants is measured on a daily basis (i.e. the number of benefit claimants is weighted by the number of days individuals claimed benefits relative to the number of work days in a given month), there might still be measurement errors in these proxies. As an example, an announcement of a mass layoff later in the year will affect the perception of the labor market conditions, but it will no be recorded in the unemployment rates. The resulting attenuation bias implies that the estimated effects understate the true effect of local labor market conditions, and any zero-findings should be interpreted with caution.

Table 2 provides yearly means for selected variables. There are about 30,000 high school graduates per year (i.e. 443 per local area). Less than one-third of the graduates continue schooling immediately after high school, but about nine out of ten eventually continue schooling. Three out of four complete additional schooling within ten years after high school, and almost two-thirds of those complete a college a degree. High school graduates are mostly girls and they are on average 18.6 years old (at the end of the calendar year). Among the high school graduates, 65 percent are children of parents with no college degree.

The enrollment patterns shown in Table 2 imply that about two-thirds of those who

Table 2: Descriptive statistics

Year	*Cohort*	*une_u*	en_0	en_{10}	com_{10}	$comv_{10}$	$comc_{10}$	*female*	*age*	*lowedu*
1984	30,110	14.9	31.4	85.3	72.2	69.9	43.8	58.1	18.6	69.2
1985	29,596	14.0	33.6	89.4	75.6	73.0	45.3	57.8	18.5	67.9
1986	28,748	11.9	30.2	87.6	74.5	72.5	45.5	59.2	18.6	67.5
1987	26,683	14.5	28.7	89.5	76.8	74.9	47.2	57.9	18.6	65.8
1988	26,000	16.9	27.3	90.1	77.1	75.3	48.2	57.8	18.6	64.2
1989	27,267	16.9	27.8	90.9	78.8	77.2	49.2	58.2	18.6	63.1
1990	28,599	13.5	27.9	91.9	78.9	77.3	50.7	57.7	18.6	61.3
1991	31,110	14.1	29.2	92.6	79.7	78.3	49.7	58.0	18.6	61.7
1992	30,870	18.0	26.7	93.1	80.9	79.2	51.5	57.8	18.7	60.5
All	258,983	15.0	30.3	90.0	77.2	75.3	47.9	58.0	18.6	64.6

Notes: *Cohort*: Number of high school graduates. une_u: May unskilled youth unemployment rate. en_0: percent of students continuing schooling immediately after high school. en_{10}: percent of students continuing schooling within ten years after high school. com_{10}: percent of students completing additional schooling within ten years after high school. $comv_{10}$: percent of students completing at least vocational training within ten years after high school. $comc_{10}$: percent of students completing at least college within ten years after high school. *female*: percent of female high school graduates. *age*: average age of high school graduates. *lowedu*: percent of high school graduates with non-college educated parents.

eventually continue schooling take at least one gap year. As all healthy men are drafted for military service at the age of 18, an obvious reason for gap years could be military service. This is however not the driving force, as the immediate enrollment rate is higher for men, while the long-run enrollment rate is lower for men (not shown), implying that gap years is more frequent among women. Students are typically traveling, engaged in non-market activities or full-time employed during their gap-year (Foley and Groes, 2012). Figure 3 shows the enrollment and completion rates for the ten years after high school graduation. While a decreasing fraction of students continue schooling immediately after high school, an increasing fraction of graduates eventually enroll and complete additional schooling after high school. Most students take between one and three gap years, and after four years less than one out of five have not continued schooling.

5. Results

5.1. Short-run effects

The regression results for the short-run effect appear in Table 3. The coefficient in column (1) is a obtained by estimating a simple version of equation (1), which includes only unskilled unemployment. The point estimate has the expected sign, but is not very precisely estimated. Column (2) shows the results from estimating a specification that also includes commuting zone fixed effects, commuting zone specific linear trends, and year fixed effects.

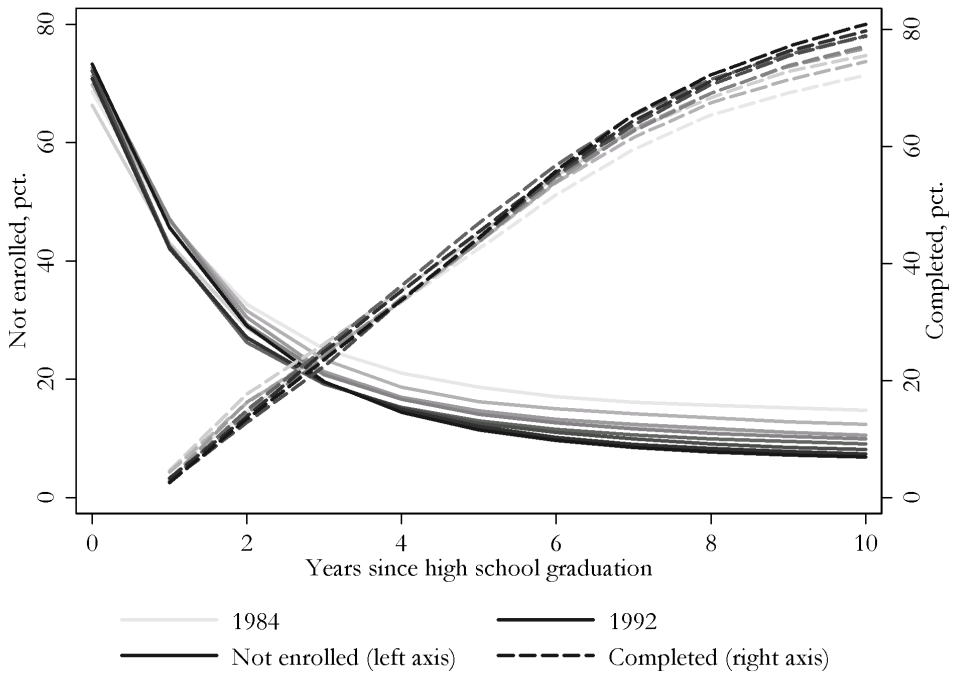


Figure 3: Educational enrollment and completion post high school graduation
Notes: The graph shows enrollment and completion patterns for the first ten years after high school graduation for all years 1984 to 1992. The darkness of the lines is increasing in years.

The point estimate is 50 percent larger than in the first specification. In column (3) I further add a measure of skilled unemployment. Both unemployment rates have the expected signs and are precisely estimated. Higher unskilled unemployment reduces the chance of unskilled employment and thereby the expected opportunity cost of continued schooling. Higher skilled unemployment reduces the expected returns to continued education and therefore the probability that the student will enroll. Adding a rich set of covariates has little effect on the point estimates as shown by the results in column (4). A one percentage point increase in local unskilled youth unemployment increases the probability of continued schooling by 0.50 percentage points. Evaluated at the sample means the point estimate in column (4) of Table 3 implies an elasticity of 0.25, which is slightly larger than the 0.18 found for post-compulsory schooling in the United Kingdom (Clark, 2011).[5]

[5]The last row of table 2 shows the sample means. The sample means for unemployment and enrollment rates are 0.15 and 0.303. The elasticity of enrollment with respect to unemployment is given by: $0.5 \times 0.15/0.303 = 0.248$.

Table 3: Estimation results: short-run effects
Dependent variable: Immediate enrollment

	(1)	(2)	(3)	(4)
une_u	0.18*	0.27*	0.49***	0.50***
	(0.10)	(0.14)	(0.18)	(0.18)
une_s			-1.44***	-1.45***
			(0.53)	(0.53)
Observations	258,983	258,983	258,983	258,983
Fixed effects and trends	No	Yes	Yes	Yes
Covariates	No	No	No	Yes

Notes: The coefficients are obtained by estimating equation (1) with OLS. The covariates included are described in Appendix Table A.1. Fixed effects and trends refer to commuting zone specific linear trends as well as year and commuting zone fixed effects. Standard errors clustered on the commuting zone level in parenthesis. *p<0.1, **p<0.05, and ***p<0.01.

5.2. Robustness

Before I turn to the long-run effects it is useful to consider whether I can trust the causal interpretation of the point-estimates, and whether they are sensitive to plausible specification changes. This paper exploits variation in local unemployment between commuting zones across years. I thereby assume that there are no unobserved time-varying municipality effects affecting unemployment and continued education, that goes beyond a linear time trend. I assess this assumption by means of a placebo test in column (1) and (2) of Table 4. Column (1) shows point estimates from estimating a model corresponding to column (4) in Table 3 on a subsample of students for whom I have information on their final high school grade point average (GPA). This variable is only available for students from academic high schools, for whom the effect is smaller but still not negligible. Column (2) shows point estimates from estimating the same model, but where the dependent variable is the grade point average. While the point-estimates on unemployment rates are positive, there are no significant correlations between unemployment rates and how the students perform in high school. This supports the idea that the unemployment rates do not capture unobserved characteristics that affect the schooling decision, because I would expect these characteristics to be correlated with the students' school performance.

Column (3) in Table 4 shows results for a specification where the local labor market is defined by the municipality. The point estimates are considerably smaller than in the main specification, but they still provide evidence of a counter-cyclicality (an elasticity with respect to unskilled unemployment of 0.11). In column (4) I present results from a specification in

which the local labor market is defined by the residence at high school graduation, and not by the residence prior to high school enrollment as in the main specification. This change reduces the point estimates magnitudes slightly. In column (5) I present point estimates for a specification with more narrowly defined unemployment rates. In this version I define unskilled youth unemployment among 16 to 19 year olds (in contrast to 16 to 29 year olds in the main specification). The point estimates are considerably smaller, but they confirm the counter-cyclicality (an elasticity with respect to unskilled unemployment of 0.13). In contrast to column (5), column (6) shows point estimates for a more general definition of unemployment. Using the general unemployment rate instead of unskilled youth unemployment leads to a considerably larger point estimate (an elasticity with respect to unemployment of 0.34). Finally, column (7) shows the results from a specification where the unemployment rates are measured in terms of the average for all months from January to May in the year of high school graduation. Point estimates are slightly larger in magnitude and also slightly more precise than in the main specification.[6]

To sum up, while the placebo test indicates that the deterministic specification is sufficient to capture unobservable effects, the changes in definitions affect the magnitudes, but not the overall conclusions.

5.3. Long-run effects

The long-run results appear in Table 5. Odd columns show results from estimating equation (1), using enrollment and completion of continued schooling as the dependent variables. The long-run enrollment effect shown in column (1) is smaller than the short-run effect. This indicates that local labor market conditions at the time of high school graduation both affects when students continue schooling and whether they continue schooling at all. As 90 percent of all graduates continue schooling within ten years after high school the long-run enrollment elasticity with respect to unskilled unemployment is considerably lower than the short-run elasticity (0.05 compared to 0.25).

Column (3) shows that there is also a long-run effect on completion of additional schooling. Evaluated at the variable means the elasticity of completion with respect to unskilled unemployment is 0.06, which is about 50 percent larger than the 0.04 found for completion of upper-secondary schooling by Reiling and Strøm (2015). Column (5) and (7) show results for completing at least vocational training and a college degree, respectively. There is no effect on completion of college education, which suggests that local labor market conditions at the time of high school graduation only has a permanent effect on the decision to enroll

[6]I also tested whether students react to the change in unemployment rates from January to May. Regression results (not shown) give no indication of such behavior.

Table 4: Estimation results - Robustness
Dependent variable: Immediate enrollment

	GPA sample (1)	GPA outcome (2)	Municipal level (3)	Not lagged (4)	Youth unempl. (5)	General unempl. (6)	Average unempl. (7)
une_u	0.36**	0.37	0.23***	0.46**	0.31**	1.34***	0.58***
	(0.17)	(0.28)	(0.09)	(0.19)	(0.13)	(0.41)	(0.20)
une_s	-1.23**	-1.42	-0.41	-1.33**	-1.12**	-1.72***	-1.51**
	(0.54)	(0.89)	(0.25)	(0.56)	(0.45)	(0.58)	(0.71)
Observations	200,660	200,660	258,983	260,346	258,983	258,983	258,983
Clusters	65	65	271	65	65	65	65

Notes: The coefficients are obtained by estimating equation (1) with OLS. In column (1) the sample is restricted to the students for whom the final GPA is available. In column (2) the dependent variable is the final high school GPA. In column (3) municipalities are used as local labor market area. In column (4) the local area is defined by the area of residence at the time of high school graduation. In column (5) the unskilled unemployment rate only covers individuals aged 16-19. In column (6) the unskilled unemployment rate is the general unemployment for all individuals aged 16-64. In column (7) the unemployment rates are the average rates for January to May in the year of high school graduation. Standard errors clustered on the commuting zone level (except column (4) for which they are on the municipal level) in parenthesis. *p<0.1, **p<0.05, and ***p<0.01.

and complete shorter educational programs.

The interpretation of the long-run effects depends on how correlated labor market conditions are over time. Figure A.2 in the Appendix show point estimates from estimating equation (1) using local unemployment in year t after graduation as the dependent variable. Unemployment in year $t+1$ is positively correlated with unemployment at time t, but unemployment in years $t+2$ to $t+4$ are negatively correlated with unemployment at time t.[7] One possible explanation for this pattern is that if higher unemployment causes more students to continue schooling immediately after high school, the unskilled unemployment is lower in the following years, because of less demand for unskilled jobs.

As unemployment rates are correlated over time, the long-run effects may not be due to unemployment at high school graduation, but rather due to labor market conditions in the following years. To account for this I follow Reiling and Strøm (2015) and estimate long-run effects, including unskilled unemployment rates for each of the interim years. The point

[7] While the dependent and independent variables are defined on the commuting zone level I estimate on an individual level to weight each commuting zone relative to its influence in the main regression. In regression I keep the zone fixed at the zone the individual lived in during high school. If I let the commuting zone at time t be zone of residence in time t the patterns are the same, but the magnitudes are smaller.

Table 5: Estimation results: long-run effects
Dependent variable: Enrollment and completion

	enr_{10} (1)	enr_{10} (2)	com_{10} (3)	com_{10} (4)	$comv_{10}$ (5)	$comv_{10}$ (6)	$comc_{10}$ (7)	$comc_{10}$ (8)
une_u	0.29**	0.24*	0.32***	0.31**	0.38***	0.37***	0.09	0.23
	(0.12)	(0.14)	(0.12)	(0.12)	(0.12)	(0.12)	(0.16)	(0.14)
une_s	-0.52	-0.32	-0.93**	-0.79**	-1.09**	-0.91**	-0.76	-0.81
	(0.39)	(0.38)	(0.42)	(0.39)	(0.46)	(0.40)	(0.51)	(0.52)
Observations	249,267	249,267	242,970	242,970	242,970	242,970	242,970	242,970
$une_{us,1-9}$	No	Yes	No	Yes	No	Yes	No	Yes

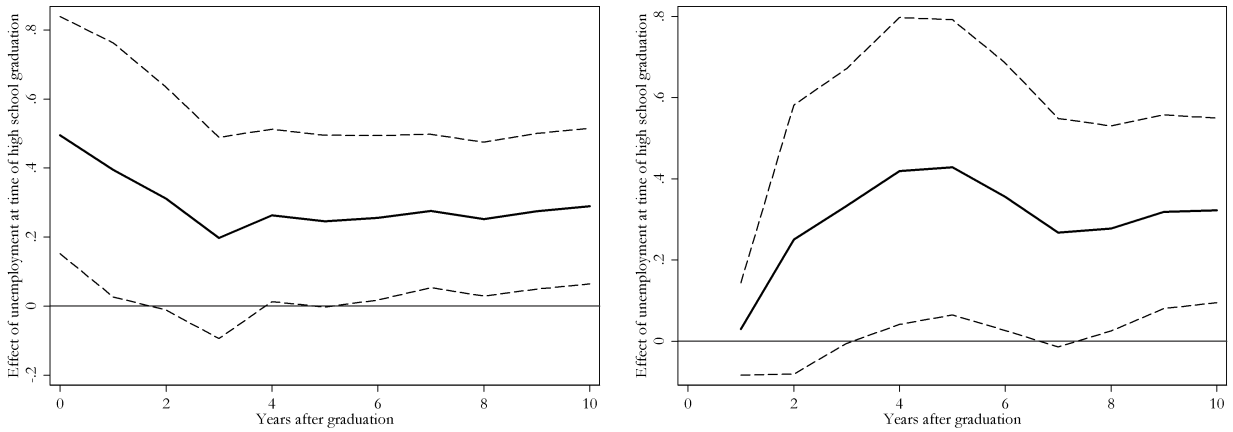
Notes: The coefficients are obtained by estimating equation (1) with OLS. In column (1) the dependent variable equals one if the individual has been enrolled in an educational program within ten years after high school graduation. In column (3) the dependent variable equals one if the individual has completed additional schooling within ten years after high school graduation. In column (5) the dependent variable equals one if the individual has completed at least vocational training within ten years after high school graduation. In column (7) the dependent variable equals one if the individual has completed at least college within ten years after high school graduation. All even columns are as the previous odd columns, but they also include unskilled unemployment rates for all interim years. Standard errors clustered on the commuting zone level in parenthesis. *p<0.1, **p<0.05, and ***p<0.01.

estimates are shown in the even columns of table A.2. While the magnitudes are slightly smaller, the overall conclusions are not affected.

To obtain a more detailed picture of the effect of local labor market conditions at the time of graduation on continued schooling, Figure 4 shows the timing effect. The vertical axes show the coefficient on unskilled youth unemployment, α_1, for the 11 equations, corresponding to the ten years post high school graduation. The first Figure, 4a, shows the long-run enrollment effect, and the second Figure, 4b, shows the long-run completion effect. After about four years the coefficient on α_1 is constant for the enrollment model. This indicates that the local labor market conditions affect both the decision whether to continue immediately or postponing enrollment by up to four years, and the decision of whether to enroll at all. The long-run completion patterns are less clear, but the significant effect after four years is in line with the timing effect. Worse labor market conditions causes individuals to enroll in shorter educational programs immediately after high school and complete these programs after four years.

5.4. Heterogeneity

An advantage of the Danish administrative data is that it also allows me to consider heterogeneity with respect to parental background and high school program type, an aspect



(a) Continued education.

(b) Completed education.

Figure 4: The marginal effect of a one-percentage point increase in local unskilled unemployment - at the time of high school graduation - on the probability of continued and completed education within zero to ten years after leaving high-school. The dashed lines mark the 95% confidence intervals. Results are obtained by estimating 11 separate OLS regressions where the dependent variable takes value of one if the individual continues schooling within 0, 1, ...10 years, respectively. The standard errors are clustered on the commuting area level and corrected for the interdependence between the 11 equations.

not yet analyzed in the literature. These effects appear in Table 6. Columns (1) to (3) show that while the short-run effect is similar across type, the long-run effect is driven by students from vocational high-school programs. Columns (4) to (6) show that both the short- and long-run effects are much stronger for children of low-educated parents. For children of college-educated parents there is only an imprecisely estimated effect of local labor market conditions.

6. Conclusion

This paper shows that local labor market conditions has both a short- and long-run impact on continued schooling. The short-run effect causes students who in any case would enroll within five years to continue in education immediately. They therefore also complete their additional education earlier. The long-run effect causes students who would otherwise never continue in education to enroll and complete additional schooling.

Students who join the labor market in good times instead of continuing schooling, might get used to the higher income and increase consumption, making returning to schooling difficult, which causes the long-run effect. The effects are heterogeneous with respect to parental background. The results show that children of less educated parents react more to business cycles in both the short and the long run.

During the Great recession, the Danish youth experienced an eight percentage point

Table 6: Estimation results - Linear Probability Model - Heterogeneity by parental background

	enr_0	enr_{10}	com_{10}	enr_0	enr_{10}	com_{10}
	(1)	(2)	(3)	(4)	(5)	(6)
une_u	0.54**	0.66***	0.61***	0.33*	0.14	0.20*
	(0.25)	(0.17)	(0.17)	(0.17)	(0.11)	(0.12)
aca	-0.15***	0.19***	0.11***			
	(0.03)	(0.02)	(0.02)			
$aca \times une\_u$	-0.11	-0.51***	-0.41***			
	(0.17)	(0.12)	(0.13)			
$lowedu$				0.00	-0.09***	-0.05***
				(0.02)	(0.01)	(0.01)
$lowedu \times une\_u$				0.24***	0.21***	0.17***
				(0.08)	(0.04)	(0.05)
Observations	258,983	249,267	242,970	258,983	249,267	242,970

Notes: The coefficients are obtained by estimating are modified specification of equation (1) with OLS. The specification does not include individual controls, but include the main and interaction effects for high school program type and parental background, respectively. *voc* refers to vocational high schools (in Danish: HHX and HTX). *lowedu* equals one if none of the parents have completed college. In columns (1) and (4) the dependent variable equals one if the individual continued schooling immediately after high school graduation. In columns (2) and (5) the dependent variable equals one if the individual has been at enrolled in an educational program within ten years after high school graduation. In columns (3) and (6) the dependent variable equals one if the individual has completed additional schooling within ten years after high school graduation. Standard errors clustered on the commuting zone level in parenthesis. *p<0.1, **p<0.05, and ***p<0.01.

increase in unemployment rate from 2007 to 2012.[8]. Such a change would correspond a short-run increase in enrollment rates of 4 percentage points, or 13 percent, evaluated at the sample mean. The long-run run completion effect is 2.6 percentage points, corresponding to 3 percent, evaluated at the sample mean. During the sample period 1984 to 1992 unemployment rates varied considerably more between labor market areas than across years. A change in unemployment of the difference between the lowest and highest unemployment rates in 1992 (24 percentage points) causes a change in the long-run completion rate of almost 8 percentage points. This effect corresponds to the overall increase in ten year completion rates from 1984 to 1992, from 72 to 81 percent.

The analysis was carried out with Danish administrative data on all high school graduates from 1984 to 1992. Each cohort was followed for ten years, thereby allowing me to assess the effects of local unemployment on continued and completed schooling in each of the

[8]According to the Statistics Denmark Labor Market Survey among individuals aged 15-24.

first ten years following high school. Local business cycle fluctuations affect the timing of continued schooling after high school, as well as the completion rate of continued schooling after high school graduation. Policy makers can therefore potentially increase enrollment and completion rates by making youth employment less attractive.

An natural extension to this study is to impose more structure on the estimated model. Such a structural approach would identify parameters of the individual's preferences, thereby allowing for policy simulations of counter factual scenarios.

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7. Appendix

Table A.1: Variable definitions

une_{us}	Average unemployment rate in May for individuals with at most a high-school degree. The labor force is defined as all individuals aged between 16 and 29, who do not attend education.	I
une_{sk}	Average unemployment rate in May for individuals with at least a university degree. The labor force is defined as all individuals aged between 16 and 64, who do not attend education.	I
enr_j	Equals one if the individual has been enrolled in any education in October year j after leaving high-school.	D
com_j	Equals one if the individual has completed another education within ten years after leaving high-school.	D
$comv_j$	Equals one if the individual has completed at least vocational training within ten years after leaving high-school.	D
$comc_j$	Equals one if the individual has completed at least college within ten years after leaving high-school.	D
voc	Equals one if the individual graduated from a vocational high school track.	
$lowedu$	Equals one if none of the parents have a college degree.	C
$female$	Equals one if the individual is a female.	C
$non-western$	Equals one if the individual has a non-western origin (Western: EU, Andorra, Iceland, Liechtenstein, Monaco, Norway, San Marino, Switzerland, Vatican City State, Canada, United States, Australia, New Zealand).	C

Continued on the next page.

Table A.1 *continued.*

$cohortsize$	Number of high school graduates in the local area.	C
$labormarketsize$	Size of the local labor force (16-64 year olds, at most high school degree).	C
age	The age in the year of high school graduation.	C
$siblings$	Number of siblings.	C
$siblingswedu.$	Equals one if a sibling has completed post secondary schooling.	C
$siblingsinedu.$	Equals one if a sibling is enrolled in post secondary schooling.	C
$une_{f,m}$	Equals one if the father(f)/mother(m) was unemployed in May.	C
$wealth$	Parents net-wealth, measured in 100,000 DKK (2010 level). Also included with an additional quadratic term.	C
$income$	Parents net-income, measured in 100,000 DKK (2010 level). Also included with an additional quadratic term.	C
$self - employment_{f,m}$	Equals one if the father(f)/mother(m) are self-employed.	C

I: Variable of interest, D: Dependent variable, C: Control.

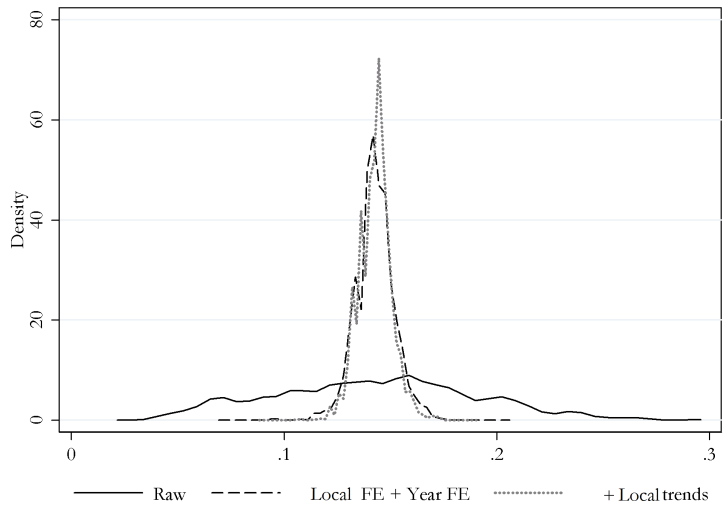

Figure A.1: Distribution of unskilled youth unemployment rates
Notes: The kernel density graphs are computed using an Epanechnikov kernel and an "optimal" bandwidth (minimize the mean integrated squared error). Raw is a density plot of the unadjusted local unemployment rates. Local FE + Year FE is a density plot of the residuals from regressing the the unemployment rate on year and commuting area fixed effects. + Local trends is a density plot of the residuals from regressing the the unemployment rate on commuting zone specific linear trends, year and commuting zone fixed effects. The average unemployment rate is added to the residuals to make the graphs comparable.

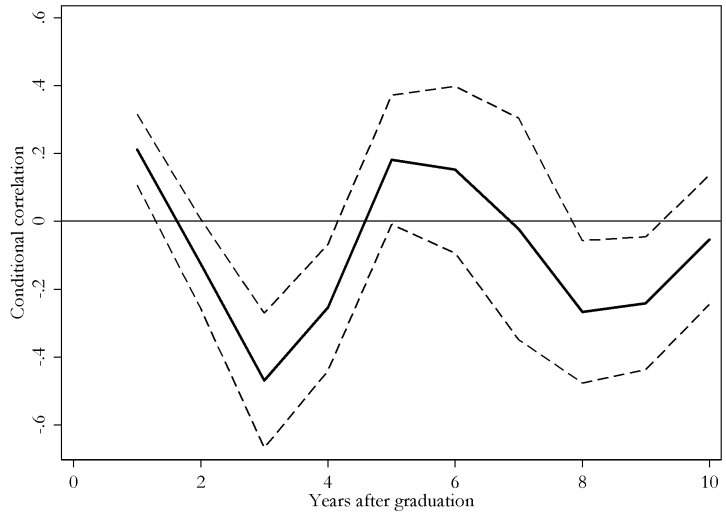

Figure A.2: Unemployment at time of high school graduation and the following ten years
Notes: The objective is to estimate the correlation in unemployment rates over time, conditional on the deterministic specification. The point of departure is thus a commuting zone level model: $une\_u_{tc} = \alpha_0 + \alpha_1 une\_u_{c0} + \alpha_2 une\_s_{c0} + \boldsymbol{\omega}_c + \boldsymbol{\lambda}_t + \boldsymbol{\eta}_c \times year_t + \varepsilon_{ct}$. However, to weight each commuting zone according to the influence in the main analysis I weight each zone by the number of students. This corresponds to an individual level OLS regression, which I then use to obtain the above estimates. The individual level regression is also required to accomadate the individual level timing of t. In the specification above une_u_{tc} refers to the unemployment in the commuting zone the individual resided in during high school.