Education and Earnings Growth. Evidence from 11 European Countries.*

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Abstract

We use cohort data from 11 European countries to study whether experience profiles differ by educational attainment. Previous literature does not provide a clear answer to this question, that is important to evaluate private returns to education over the working life of individuals. We find evidence that employees with tertiary education have steeper experience profiles than employees with upper secondary or compulsory education. Hence, education provides not only an initial labor market advantage but also a permanent advantage that increases with time in the labor market. We also find that differences in earnings growth by education are lower in countries with a higher level of corporatism and higher in countries which have experienced both relatively fast labor productivity growth and a relatively low educational attainment. The educational system also seems to matter, because countries with a more stratified system of secondary education have smaller differences in earnings growth by education.

- Keywords: education, earnings growth, Europe
- JEL: J30

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1 Introduction

Does the slope of experience - earnings profiles vary with educational attainment? An answer to this question is important for the evaluation of the economic returns to education. For instance, the estimate of the internal rate of return to education, such as that computed by the OECD (1999) for a number of affiliated countries, requires information both on the costs and on the returns that individuals can expect over their working life as a consequence of their investment in education. When experience profiles by education are not parallel, information on their slope is necessary to compute expected lifetime earnings by educational attainment. The available empirical evidence suggests that participation in job related training programs is correlated with educational attainment (see OECD (1997)). Suppose that, because of the better access to training, earnings grow faster with experience for the more educated. In this case, education provides not only an initial labor market advantage, but also an advantage that cumulates over the working life.

Back in the early 1970s, Mincer (1974) answered this question in his path-breaking book as follows:

"..logarithmic experience profiles of weekly and hourly earnings .. are more nearly parallel, suggesting that relative "skill" differentials in wage rates do not change perceptibly with years of experience.." (p.70).

Following Mincer, a large body of literature has estimated Mincerian earning functions, that relate log earnings to schooling and labor market experience. This literature is reviewed by Psacharopoulos (1981), Willis (1986) and more recently by Card (1995). Additional evidence that the relationship between earnings and education is not affected by experience (parallel experience profiles) has been provided by Farber and Gibbons (1996), who have tested on US longitudinal data the implications of the pure learning model. This model predicts that, when ability is time invariant, the effect of schooling on wages is independent of experience.

Psacharopoulos and Layard (1979) are perhaps the first to show that experience profiles are steeper for individuals with higher educational attainment. They interpret their results in the light of the human capital model as evidence that education and training are complements: since training increases productivity and individuals with higher education are more likely to receive additional training over their working life, experience profiles are steeper for the more educated. Similar findings are obtained, for instance, by Knight and Sabot (1976), who use cross section data, and by Altonji and Dunn (1995) and Altonji and Pierret (1997), who use US panel data.

While higher education can be conducive to more training during working life, Neumann and Weiss (1995) argue that schooling-specific obsolescence of human capital is faster for the highly educated. They use this argument to explain their findings that wage differentials by education decrease with labor market experience. Converging experience profiles by education can also be

explained by the screening hypothesis. If higher education is a signal and firms learn about the (time invariant) ability of their employees over time, the partial effect of education on earnings is bound to fall with experience (Layard and Psacharopoulos (1974)).

The current paper contributes to this literature by presenting new empirical evidence on the relationship between experience profiles and education, based on a pseudo panel composed of two cohorts of individuals. The pseudo panel is obtained by collapsing cross section data of individuals from 11 European countries[1] over a period of time ranging from the early 1980s to the mid 1990s, depending on data availability for each country. The availability of similar data for the majority of Western European countries allows us to study whether differences in labor market institutions within Europe are correlated to differences in the dynamics of wage differentials by education. An important institutional factor considered in this paper is the degree of corporatism in industrial relations. Wage determination in Europe is the outcome of a bargain between unions and employers. This bargain can occur locally, at the sectorial level or nationally, and highly corporatist economies can be characterized by the presence of a centralized bargaining system. Another important institution is the degree of stratification of education systems into vocational and general tracks at the secondary level. Some European countries (Germany is an example) have systems that differentiate pupils into different tracks earlier on, other countries (France and Britain are examples) have more comprehensive systems of secondary education[2].

European countries differ also both in the composition of the labor force by educational attainment, with Nordic countries having substantially higher attainment than Southern countries, and in the long term rate of growth of labor productivity. Based on the standard human capital approach, we expect the slope of experience profiles to depend both on the pattern of human capital investment after labor market entry and on the return to the investment. This return can vary across countries because of differences in supply, measured by average educational attainment, and demand, captured by labor productivity growth (see Card and Lemieux (1999)).

The paper is organized as follows. Section 2 introduces the relationship between experience profiles and educational attainment, based on human capital theory. Section 3 presents the data and the estimation method. Section 4 is devoted to the results and Section 5 concludes.

[1] The countries are: Austria, Denmark, Finland, France, (West) Germany, Italy, The Netherlands, Norway, Portugal, Switzerland and the UK.

[2] "In some countries, primarily the English - speaking countries and Japan, there are almost no upper secondary institutions differentiated by curriculum - general or vocational - although students pursue different curricula in undifferentiated (or comprehensive) secondary schools.." (OECD (1995)).

2 Education and Earnings Growth

In the standard human capital model (see Willis (1986)), accumulated human capital after x years of labor market experience is given by

$$E(x) = E(0)\exp(\sigma s)\exp\left\{\rho\int_0^x [(\beta - \gamma t)]dt\right\}$$

where $E(x)$ and $E(0)$ are respectively the stock of human capital after x years of labor market experience and the initial stock of human capital, s is years of schooling, σ and ρ are the rates of return of investing in human capital at school and after schooling (training) and $\beta - \gamma t$ is net investment in human capital after schooling, that is assumed to decline over time t at the rate γ. Net investment is gross investment minus the rate of obsolescence of human capital, that can vary with attained education. Define US as a dummy variable equal to 1 if the individual has completed upper secondary school and to 0 otherwise, and TE as a dummy variable equal to 1 if tertiary education has been completed and to 0 otherwise. If we allow both the returns and the rate of net investment in human capital after labor market entry to vary with educational attainment, the above model can be extended as follows:

$$E(x) = E(0)\exp(\sigma_0 + \sigma_1 US + \sigma_2 TE)\exp[\rho_0 + \rho_1 US + \rho_2 TE] *$$

$$* \int_0^x \{(\beta_0 + \beta_1 US + \beta_2 TE) - (\gamma_0 + \gamma_1 US + \gamma_2 TE)t\}\, dt \qquad (2)$$

Notice that we are not constraining the coefficients β_i to be positive. To illustrate, assume that the obsolescence rate of human capital be positive and constant. If the rate of obsolescence is higher than the rate of accumulation, the stock of human capital is reduced. Suppose for instance that an engineer's human capital depreciates faster than the human capital of an individual with only compulsory education. With similar rates of accumulation, the coefficient β_2 is negative (see Neumann and Weiss (1995)).

Rearranging the above expression and recalling that earnings are proportional to accumulated human capital, we obtain

$$\ln y \quad \propto \quad \sigma_0 + \sigma_1 US + \sigma_2 TE + \rho_0\beta_0 x + (\beta_1\rho_0 + \beta_0\rho_1 + \beta_1\rho_1)USx$$

$$+(\beta_2\rho_0 + \beta_0\rho_2 + \beta_2\rho_2)TEx - \frac{\rho_0\gamma_0}{2}x^2 - \frac{1}{2}(\gamma_1\rho_0 + \gamma_0\rho_1 + \gamma_1\rho_1)USx^2$$

$$-\frac{1}{2}(\gamma_2\rho_0 + \gamma_0\rho_2 + \gamma_2\rho_2)TEx^2 \tag{3}$$

where y is real hourly earnings and x is potential experience, measured as age minus years of schooling minus age when school starts. The expression suggests that experience profiles by education are not parallel either when labor market returns to training differ by educational attainment, or when the rate of net investment in training varies with the level of education, or when both cases hold.

3 Data

Most studies that have estimated a classical Mincerian earnings function with cross section data have found hump shaped experience profiles. It is well known that an hump shaped profile can be generated by cohort effects, that is, by the contemporaneous presence in the same cross section of cohorts of individuals who have entered the labor market with different earnings. Typically, younger cohorts receive a higher entry wage. There are two main alternatives to cross section data: longitudinal data of individuals and pseudo panels of cohorts, where successive surveys are used to follow each cohort over time by looking at the members of the cohort who are randomly selected into each survey[3].

In this paper, we use the second alternative and collect cohort data from 11 European countries. We focus on two cohorts, the former including individuals born between 1940 and 1949, who started school just after the Second World War, and the latter including individuals born between 1950 and 1959, who is often called "the baby boom generation". For each cohort, we allocate individuals into three school levels: compulsory education, upper secondary education and tertiary education. For most countries, our data cover the 1980s and the first part of the 1990s.

As shown in Table 1, the typical number of years required to complete each level of education differs among the 11 countries. For instance, it takes longer to complete compulsory schooling in Germany and the Netherlands than elsewhere, especially in Italy and Portugal. Furthermore, the typical number of years of schooling required to complete general programs of upper secondary education,

[3]See Deaton (1997)) for a detailed discussion.

shown in the third column of the table, ranges from 10-12 years in the UK to 12-14 years in Switzerland and to 13-14 in the Netherlands. Finally, the range of required years for university - level education (long programs - first stage) typically goes from 15 in France to 20 in Switzerland, Germany and the Netherlands[4].

Table 1. Years of school typically required to complete compulsory, upper secondary and university-level education.

	Compulsory	Upper Secondary	University Level
Austria	11	12	16-19
Switzerland	9	12-14	20
Denmark	9	12-13	18-20
Finland	9	12	18-19
France	10	12	15
Germany	12	13	20
Italy	8	13	17
Norway	9	12	17
Portugal	8	11	16-18
UK	10	10-12	16
The Netherlands	13	13-14	20

Source: OECD (1998), Tables C3.1, X1.2b and X1.2d.

An important requirement of cohort data is that the cohort identifier be exogenous and time invariant. While year of birth meets this requirement by definition, school attainment in principle does not. To illustrate the potential implications of this for the analysis, consider the following example: compulsory education in Denmark ends at 16, and upper secondary education typically ends at 19-20 (OECD (1998)). Individuals born in 1959, who belong to the second cohort, have completed their compulsory education in 1975 but could still be in upper secondary education in 1977. If the data for the cohort born between 1950 and 1959 in Denmark were to start in 1977, we could not rule out the possibility that significant transitions of individuals from one educational level to another occur over time within the same cohort. We avoid this problem by starting our data from 1980, when the probability of observing significant flows from compulsory to upper secondary education is reasonably small for both cohorts in all the countries included in our sample.

[4] For compulsory education, we compute the number of years as age at the end of compulsory education minus age when school usually starts. Typical length refers to general programmes for upper secondary education (second column in Table X1.2b from OECD (1998)) and to first stage long programmes for university-level education (fourth column in Table X1.2d from OECD (1998)).

Notice that typical ages of graduation from compulsory, upper secondary and tertiary education vary across European countries. While it is reasonably safe for both cohorts in the case of compulsory and upper secondary education to start our data from 1980, the typical age of graduation for tertiary education ranges from 21 in the UK to 27 in Denmark[5]. Because of this, we choose to start our data for the second cohort with tertiary education from 1986. By so doing, we minimize the probability that individuals born between 1950 and 1959 change their education attainment during the sample period. We end up with a dataset of 579 observations. Each observation is a cell, that is identified by the following characteristics: country, year, period of birth and educational attainment. For each cell, we have information on real hourly earnings, age, potential labor market experience, measured as age minus years of schooling minus age when school starts, and gender. Definitions and summary statistics of the main variables used in the empirical analysis are presented in the Data Appendix.

We pool all the available information and estimate (3) using the fixed effects estimator, which captures time invariant effects with a set of dummies, that control for time invariant differences induced by the country, the period of birth and educational attainment. One pitfall of this method is that it does not allow us to identify the relationship between real hourly earnings and educational attainment. Given that the focus of the paper is on the relationship between education and earnings growth, however, this is of secondary importance.

4 Results

Real hourly wages increase over time both because individuals accumulate human capital at school and on the job, as predicated by the human capital model, and because of country - specific aggregate factors. We control for these factors by including in our regressions the standardized (lagged) unemployment rate U, the log of (lagged) real output per head $\ln \pi_{-1}$ and the (lagged) inflation rate $\Delta \ln p_{-1}$. These variables are allowed to vary both by country and over time. We use lags to remove the potential presence of problems associated to simultaneity bias. Labor market institutions in Europe suggest that collective bargaining between unions and employers are the predominant mechanism of wage determination. There is a broad consensus that real wage settlements in the presence of unions respond to the inflation rate, the rate of unemployment, that measures labor market tightness, and labor productivity (see Layard, Jackman and Nickell (1991)).

Table 2 presents our results based on the fixed effects estimator and on the usage of dummies to identify school levels. The second column shows the

[5]Source: OECD (1998), Table X1.2d, p.369. Given the small number of graduates from the second stage of university-level education (Masters and Doctoral courses), we only consider here graduates of the first stage of university education.

findings for both sexes and the last two columns distinguish by gender. The regression for both sexes also includes the variable F, the percentage of female employees in the cell[6]. The joint significance of the interactions of upper secondary (US) and tertiary (TE) education with experience and experience squared is tested using the Wald statistic. The p-values of the tests are shown in the bottom part of the table. We find evidence that these interactions are both significant and positive. Thus, the evidence suggests that experience profiles are not parallel but steeper for higher attained education. Figure 1 plots the simulated profiles, obtained by letting potential experience x vary from 0 to 35 years and by assigning to each profile the same starting value, equal to 1. Notice that experience profiles are generally steeper for males, independently of the level of attained education. On the other hand, the earnings growth gap between college graduates and high school graduates is larger for females.

Table 2. Fixed effect estimates. All cohorts, countries and school levels. School dummies for school levels. By gender. Dependent variable: log real hourly earnings.

	MF	M	F
x	.016**	.017**	.007
x^2	-.0002**	-.0001**	-.00006
$US * x$	.013**	.016**	.013*
$US * x^2$	-.0002	-.0002	-.0001
$TE * x$	.032**	.034**	.036**
$TE * x^2$	-.0005**	-.0006**	-.0006**
F	-.184**	-	-
U_{-1}	-1.423**	-1.644**	-1.074**
$\ln \pi_{-1}$	.282**	.157	.483**
$\Delta \ln p_{-1}$	-.570**	-.725**	-.401**
R^2	0.733	0.769	0.628
$W(x, x^2)$	(.00)	(.00)	(.24)
$W(US * x, US * x^2)$	(.00)	(.00)	(.00)
$W(TE * X, TE * X^2)$	(.00)	(.00)	(.00)
$Nobs$	579	548	526

Note: one star when the coefficient is significant at the 10 percent level of confidence and two stars when it is significant at the 5 percent level of confidence. P-values within parentheses. W is the Wald test statistic and Nobs the number of observations.

FIGURE 1 ABOUT HERE

[6]Separate regressions by gender have fewer observations because we exclude all the cells with a number of individuals smaller than 40.

Given the observed heterogeneity among countries in the number of years typically required to complete each level of education, we use the available information on average age and potential experience in each cell to compute the average number of years of schooling, ys, by school level, and interact this variable with potential labor market experience. The results in Table 3 confirm that the slope of experience profiles is increasing in the number of years of schooling[7].

Table 3. Fixed effect estimates. All cohorts, countries and school levels. Years of schooling for school levels. By gender. Dependent variable: log real hourly earnings.

	MF	M	F
x	- .025**	-.017*	-.041**
x^2	.0006**	.0005**	.0009**
$ys * x$	.005**	.004**	.006**
$ys * x^2$	-.00009**	-.00007**	-.0001**
F	-.155*	-	-
U_{-1}	-1.367**	-1.613**	-.994**
$\ln \pi_{-1}$	.165	.052	.351**
$\Delta \ln p_{-1}$	-.638**	-.766**	-.445**
R^2	0.740	0.771	0.650
$W(x, x^2)$	(.00)	(.00)	(.00)
$W(ys * x, ys * x^2)$	(.00)	(.00)	(.00)
$Nobs$	579	548	526

Note: see Table 2.

The findings in Table 2 are based on the assumption that experience profiles do not vary by cohort of birth. The earnings of both cohorts are observed in each country during the same period, but the labor market experience of the cohort born between 1940 and 1949 is about ten years longer than the experience of the younger cohort born between 1950 and 1959[8]. Table 4 presents empirical results that differentiate by cohort of birth. Figure 2 shows both the experience profiles of college graduates relative to high school graduates and the experience profiles of high school graduates relative to employees with only compulsory education. In each panel of the figure, relative earnings at zero experience have been normalized at zero. We find that the earnings differential between college and upper secondary school graduates increases faster with experience for the younger than for the older cohort during the first fifteen years of potential experience. For longer potential experience, however, the difference

[7] The fitted specification can be derived from Eq. (2) simply by assuming that either the return to investment or the rate of net investment after schooling are a function of years of schooling ys.

[8] Average age and potential experience in the sample are respectively 44.70 and 26.65 years for the older cohort and 35.53 and 17.65 years for the younger cohort.

in relative earnings growth between the two cohorts declines and eventually relative earnings growth becomes smaller for the younger cohort. This observed pattern in the dynamics of relative earnings is consistent with college graduates of the younger cohort investing relatively more in human capital than college graduates of the older cohort during the former part of their working life and relatively less during the latter part. The observed slowdown in relative net investment later in working life could also be attributed to faster depreciation of human capital. Following Card and Lemieux (1999), the higher rate of net investment by the younger cohort could be explained by the fact that younger cohorts of college educated individuals have higher levels of computer skills. Because of their stronger complementarity with computer intensive technologies, productivity and earnings grow faster for them, relative to high school graduates, than for older college graduates. It is an open question, however, why skills should grow at a slower rate or depreciate faster for college graduates of the younger cohort in the later part of working life. We also find that the earnings differential between upper secondary school graduates and individuals with only compulsory education grows faster for the older cohort. For this cohort, the experience profile of individuals with only compulsory education has a negative slope.

Table 4. Fixed effects estimates. By cohort. Dependent variable: log real hourly earnings.

	$Born\ 40-49$	$Born\ 50-59$
x	-.033**	.005
x^2	.0006**	.0002
$US*x$	.046**	.021
$US*x^2$	-.0006*	-.0003
$TE*x$	.079**	.110**
$TE*x^2$	-.0012**	-.003**
F	-.118	-.232*
U_{-1}	-1.239**	-1.622**
$\ln \pi_{-1}$	.270*	.146
$\Delta \ln p_{-1}$	-.656**	-.706**
R^2	0.70	0.80
$W(x, x^2)$	(.05)	(.00)
$W(US*x, US*x^2)$	(.00)	(.00)
$W(TE*x, TE*x^2)$	(.00)	(.00)
$Nobs$	300	279

Note: see Table 2.

FIGURE 2 ABOUT HERE

Earnings growth by education is likely to depend on the interaction of demand and supply factors. On the demand side, one could argue with Mincer (1989) that technical progress and training are complements. Rapid technical change leads to fast growth in labor productivity and induces individuals and firms to invest more in training. This generates steeper experience profiles. Since the better educated are more likely to be trained (OECD (1994)), it is reasonable to expect that rapid productivity growth increases earnings growth relatively more for the highly educated (see Card and Lemieux (1999))[9]. Given productivity growth, earnings growth by education is likely to be faster the smaller the relative supply of individuals with the required education.

The 11 European countries considered in this paper have both different levels of educational attainment and have experienced different rates of labor productivity growth during the sample period. Figure 3 is a scatter diagram that shows for each country the percentage of individuals in the active population who has attained at least upper secondary education (in 1992) and the average rate of labor productivity growth in the economy from 1976 to 1992 (Nickell and Layard (1997)). The figure shows that Italy and Portugal have had both the fastest growth of labor productivity, partly due to a process of technological catching up, and the lowest level of educational attainment.

FIGURE 3 ABOUT HERE

We look at the role of cross - country differences in demand and supply factors by estimating earnings profiles after interacting labor market experience both with the rate of growth of labor productivity during the period 1976-92, g_π, and with educational attainment for each school level, sh, measured by the percentage of 25 to 64 year-olds who in 1992 have attained compulsory, upper secondary and tertiary education. Notice that, while g_π varies only among countries, sh varies both by country and by school level. As shown in Table 5, we find that experience profiles are steeper the higher is labor productivity growth and the lower is the relative supply of employees with the relevant educational level. As expected, the estimated coefficient associated to the interaction between productivity growth and experience is larger for employees with tertiary education. Hence, countries which have had higher productivity growth have also experienced a higher dispersion of earnings growth by education.

[9]"The effects on the demand for human capital are more predictable if we assume complementarity between technology and human capital in the production functions. Under this assumption, rapid technical change raises the return on human capital attracting educated workers as well as encouraging training in the newer technologies. The bias of technological change toward human capital, therefore, means that ... wages of more educated workers increase more....in sectors with more rapid productivity growth.." (Mincer (1989), p.10)

Table 5. Fixed effects estimates. With interactions involving average labor productivity growth and educational attainment. Dependent variable: log real hourly earnings.

Variable	Coefficient
x	.014**
x^2	-.0003**
$TE * x$	.014**
$TE * x^2$	-.0003**
$g_\pi * x$	1.489**
$sh * x$	-.020**
$g_\pi * TE * x$	.751**
$sh * US * x$	.017**
$sh * TE * x$	-.039**
R^2	0.81
$Nobs$	579

Note: see Table 2. The regression also includes U_{-1}, $\ln \pi_{-1}$ and $\Delta \ln p_{-1}$. We have omitted the interaction terms $US * x$, $US * x^2$ and $g_\pi * US * x$ because they were not significantly different from zero.

A part from the fixed effects, we have treated so far the 11 European countries as if they were a single country. An interesting question, however, is whether the existing differences in the design of labor market institutions and educational systems within Europe can be associated to differences in the relationship between educational attainment and earnings growth. An important indicator of differences in labor market institutions in the European context is the index of corporatism. Broadly speaking, corporatism is associated to the degree of centralization of the wage bargain. While highly corporatist economies, such as Scandinavia and Austria, rely on centralized wage setting, less corporatist countries, including the UK, France and Italy, use either local or sectorial bargaining (see Calmfors (1993)). It is often argued that highly centralized economies trade the benefits of lower unemployment, due to the internalization of important external effects of wage setting, with the costs of lower wage dispersion (see Freeman and Gibbons (1993)). Based on this argument, we expect the differences in experience profiles by education to be larger in economies with more decentralized bargaining practices.

We use the Tarantelli index of corporatism (see Layard, Jackman and Nickell (1991)) to sort the 11 countries in the sample into two sub-samples, the countries with relatively high and with relatively low corporatism. In the former group we include Austria, Denmark, Switzerland, Norway and West Germany. In the latter group Finland, France, Italy, Portugal, the UK and the Netherlands. We create the dummy TAR, that is equal to 1 for the former group and to 0 for the latter group and interact this dummy with labor market experience for each educational level.

While educational systems in Europe have much in common, they differ in their degree of differentiation between vocational and academic education. Muller and Shavit (1998), for instance, distinguish between stratified and comprehensive systems of secondary education. In stratified systems (Germany, Austria, The Netherlands, Switzerland) students are separated early on into tracks which differ markedly in the curricula and in the probability that students go on to tertiary education. In comprehensive systems (to different degrees the rest of the countries in our sample), tracking starts later and there are smaller differences both among tracks and in the odds of continuation to tertiary education[10].

Germany and Britain are examples of the two systems, with France somewhat in between. In Germany, pupils have to choose at the age of 10 among three separate school-types, the *Gymnasium*, the *Realschule* and the *Hauptschule*. According to Muller and associates (1998), "...the tripartite structure..continues to channel children through the school age, each track providing a distinct educational experience with little transition between tracks.."(pp.144-45). In France, differentiation starts at 13, when pupils can leave the general system and enrol in less prestigious vocational tracks, but takes places mainly at the beginning of upper secondary school (Goux and Maurin (1998)). In Britain, secondary education was reorganized on comprehensive lines in the mid sixties, and the previous distinctions between secondary modern, technical and grammar schools were abolished (Heath and Cheng (1998)).

Early differentiation into vocational and general schooling could be associated to steeper experience profiles for school leavers who enter the labor market after compulsory or upper secondary education if the acquired vocational skills either improve the probability of starting an apprenticeship or facilitate the acquisition of additional skills on the job. Ceteris paribus, steeper profiles for graduates of compulsory and upper secondary schools also imply smaller earnings growth differentials between these graduates and college graduates. We evaluate these predictions by interacting labor market experience with the dummy T, equal to 1 for the countries with a stratified system (Germany, Austria, The Netherlands, Switzerland), where early tracking is more important, and to zero for the rest of the sample.

Notice that the group of countries with a stratified educational system partially overlaps with the group of countries with corporatist institutions. As shown in Table 6, highly corporatist economies are more likely to have stratified schools (average $T = 0.6$) than less corporatist economies (average $T = 0.16$). They also have on average a higher union density ($Udens$), lower productivity growth (g_π), higher real GDP ($GDP90$) and higher average educational attainment both at the upper secondary ($Sec92$) and at the tertiary level ($Ter92$). Moreover, employees in corporatist economies have completed, on average, a higher number of years of schooling (ys), independently of educational attainment.

[10] See also the discussion in OECD (1995) and Green, Wolf and Leney (1999)..

Table 6. Differences between highly corporatist economies and economies with low corporatism. Mean values.

	$TAR = 1$	$TAR = 0$
T	.60	.16
Udens	.47	.37
GDP90	1.21	0.99
Sec92	.55	.32
Ter92	.19	.15
ys (compulsory)	10.6	9.83
ys (upper sec.)	12.42	12.21
ys (tertiary)	17.76	16.75
g_π (76-92)	.014	.018

Since corporatist countries have both higher educational attainment and are more likely to have stratified schools, the coefficient associated to the interaction of the dummy TAR with labor market experience in an earnings function is difficult to interpret. One reason is that a significant coefficient could be capturing the specific demand and supply conditions prevailing in corporatist economies, rather than the effects of labor market institutions. Suppose for instance that we find that corporatist economies have steeper experience profiles. This could be the result either of corporatist institutions or of stratified schooling or finally of the interplay between the demand and supply effects considered in Table 5. To separate these factors, we interact potential experience by school level both with the dummy TAR and with the dummy T and also include in the regression demand and supply effects, as done in Table 5.

To save space, we only consider the case where school levels are measured by years of schooling. Results do not change in a qualitative way if we replace years of schooling with school dummies. The findings of this exercise are presented in Table 7. In the second column, we include only the interactions between potential experience, the product of experience and years of schooling and the dummy TAR. In the third column, we add the interactions with indicators of demand and supply. Finally, in the last column we also add the interactions with the dummy T.

Starting from the second column, we find that corporatist economies have both steeper experience profiles and smaller differences in these profiles by educational attainment. The estimated coefficients of the interactions between the dummy TAR, experience x and experience by years of schooling, $ys * x$, are reduced, however, to about half of their original size when we add to the regression the interactions with the demand and supply indicators and with the dummy T. Hence, about half of the difference in the slope of experience profiles associated to the corporatist dummy TAR is accounted by differences across countries in demand and supply conditions and by differences in the design of educational systems. Stratification and early tracking matter because countries

with a stratified system have both steeper experience profiles and smaller differences in earnings growth by education (see the last column in the table), as predicted above.

Table 7. Fixed effects estimates. All cohorts, countries and school levels. With interactions involving the dummies TAR and T. Dependent variable: log real hourly earnings.

Variable	Coefficient	Coefficient	Coefficient
x	-.021**	-.025**	-.035**
x^2	.0003**	.0003**	.0002**
$ys * x$	.004**	.003**	.003**
$ys * x^2$	-.00006**	-.00006**	-.00006**
$TAR * x$	.035**	.032**	.017**
$TAR * ys * x$	-.002**	-.001**	-.0009**
$g_\pi * x$	-	.007	.003
$sh * x$	-	.297	.838*
$g_\pi * ys * x$	-	.106**	.080**
$sh * ys * x$	-	-.00004	.0002
$T * x$	-	-	.021**
$T * ys * x$	-	-	-.0009**
R^2	0.82	0.85	.87
$W(TAR * x, TAR * ys * x)$	.00	.00	.02
$Nobs$	579	579	579

Note: see Table 2. The regression also includes U_{-1}, $\ln \pi_{-1}$ and $\Delta \ln p_{-1}$.

In particular, we find evidence that corporatist economies with a stratified educational system (Austria, Germany and Switzerland) have both steeper experience profiles and lower differentials in earnings growth by education than corporatist economies with a more comprehensive system of secondary education (Denmark and Norway). Conditional on demand and supply effects, countries that do not belong to either group because of their low corporatism and of the comprehensive nature of their secondary education (Finland, France, Italy, Portugal and the UK), have both flatter experience profiles and more pronounced differences in earnings growth by education. We conclude that the relationship between educational attainment and earnings growth, a key component of the economic returns to education, is not invariant to the differences in the design of labor market institutions and of educational systems that characterize European countries.

5 Conclusions

We have used cohort data from 11 European countries to study whether experience profiles differ by educational attainment. Previous literature does not

provide a clear answer to this question, that is important to evaluate private returns to education over the working life of individuals. We find evidence that employees with tertiary education have steeper experience profiles than employees with upper secondary or compulsory education. Hence, education provides not only an initial labor market advantage but also a permanent advantage that increases with time in the labor market. We associate differences in earnings growth by education among countries to institutional factors that characterize both the labor market at large and the design of education systems. We find that these differences are lower in countries with a higher level of corporatism and higher in countries which have both experienced faster labor productivity growth and have a relatively low educational attainment. The educational system also matters, because countries with a more stratified system of secondary education have smaller differences in earnings growth by education. Needless to say, the uncovered associations do not imply the existence of a causal relationship and are only meant to provide a useful description of the existing differences in experience profiles and returns to education among European countries.

6 Data Appendix

Definition of the variables used in the paper:

y = real gross hourly earnings (net for Austria and Italy). Computed as nominal hourly earnings divided by the consumer price index CPI (source: OECD database)

x = potential experience. Computed as age minus years of schooling minus age when school starts

U = standardized unemployment rate (source: OECD database)

π = real output per head. Computed as real GDP divided by total employment (source: OECD database)

p = consumer price index CPI.

sh = educational attainment in 1992 (% of 25-64 year-olds with compulsory, upper secondary and tertiary education). Source: OECD (1998).

g_π = growth in real GDP per head. Source: OECD Economic Outlook, various issues.

Table A1: Data source by country

Country	**Data Source**	**Period**
Austria	Mikrozensus	81-97
Denmark	Longitudinal Labour Market Register	81-95
Finland	Labour Force Survey	87-93
France	INSEE Emploi	93-98
Germany	GSOEP	84-97
Italy	SHIW	84-95
Netherlands	OSA Panel	86-96
Norway	Survey on the Standards of Living	80-95
Portugal	Quadros de Pessoas	82-93
Switzerland	Swiss Labour Force Survey	92-98
UK	Family Expenditure Survey	78-95

Table A2. Means of the main variables. By country, cohort and school level.

	Potential Experience					
	Born 40-49			Born 50-59		
	Educational attainment*			Educational attainment*		
Country	COMP	US	TER	COMP	US	TER
Austria	30.62	28.83	21.66	19.96	17.83	11.28
Denmark	27.28	24.36	20.21	18.13	14.65	11.01
Finland	27.70	25.75	22.14	19.67	16.69	12.89
France	36.21	32.16	27.41	27.37	22.86	18.35
Germany	31.60	28.95	22.97	20.85	18.59	12.60
Italy	32.04	25.12	20.67	21.72	15.60	12.01
Netherlands	31.05	26.53	24.61	21.46	17.17	15.29
Norway	28.57	26.46	21.93	19.23	16.72	12.77
Portugal	31.36	24.87	20.15	21.47	14.61	10.63
Switzerland	35.21	31.97	28.24	25.09	21.82	18.04
UK	27.97	26.13	21.61	17.17	16.69	15.40
	Real log hourly wage					
	Born 40-49			Born 50-59		
	Educational attainment			Educational attainment		
	COMP	US	TER	COMP	US	TER
Austria	3.88	4.14	4.67	3.83	4.04	4.42
Denmark	4.17	4.30	4.47	4.14	4.21	4.36
Finland	3.72	3.85	4.28	3.70	3.77	4.14
France	3.85	4.05	4.40	3.78	3.95	4.32
Germany	2.75	3.04	3.53	2.73	2.95	3.40
Italy	1.79	2.05	2.26	1.74	1.91	2.14
Netherlands	2.62	2.79	3.03	2.56	2.66	2.86
Norway	3.63	3.75	3.96	3.62	3.69	3.88
Portugal	4.89	5.58	5.87	4.68	5.14	5.63
Switzerland	3.20	3.57	3.97	3.20	3.51	3.87
UK	1.77	2.01	2.30	1.71	1.89	2.29

* COMP = compulsory; US = upper secondary; TER = tertiary

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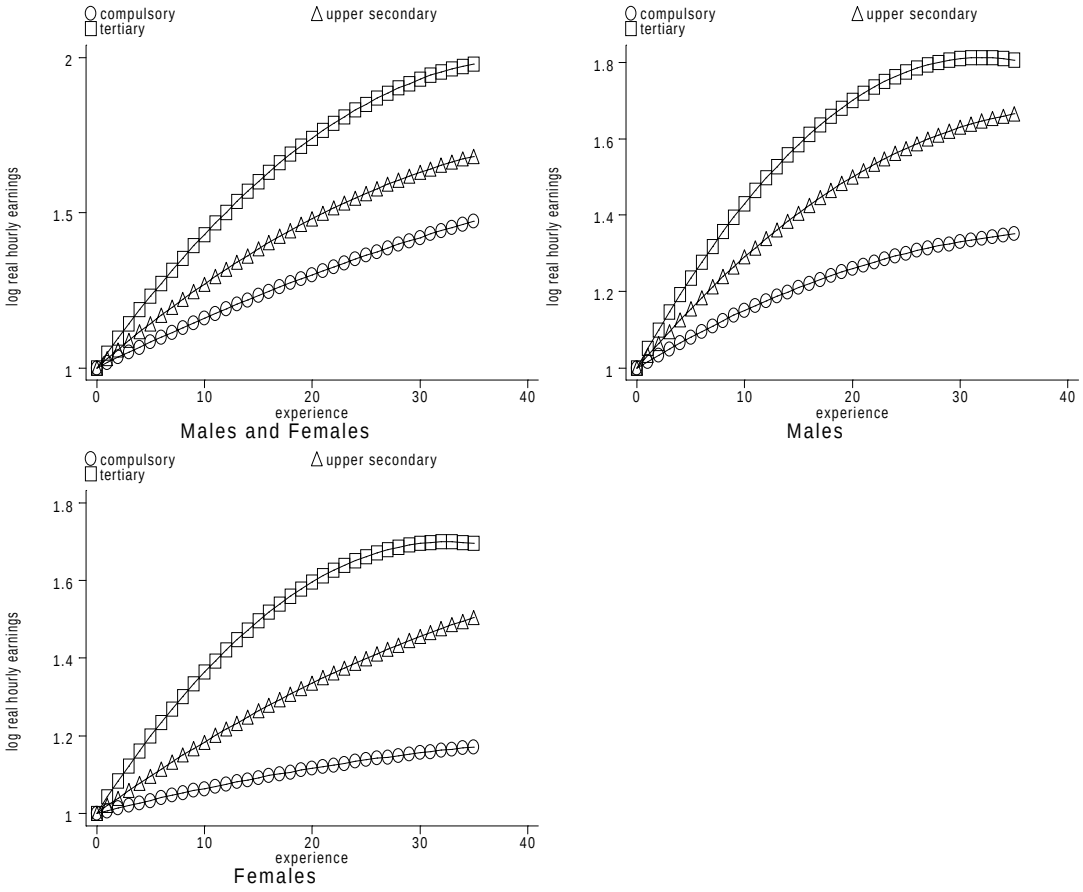

Figure 1: Earnings Growth by Educational Attainment and by Gender

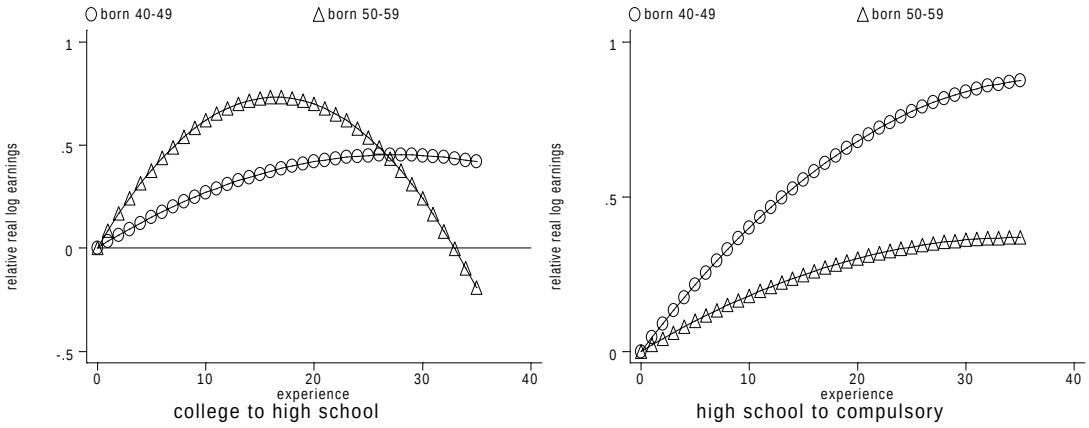

Figure 2: Relative Experience Profiles by School Level and Cohort

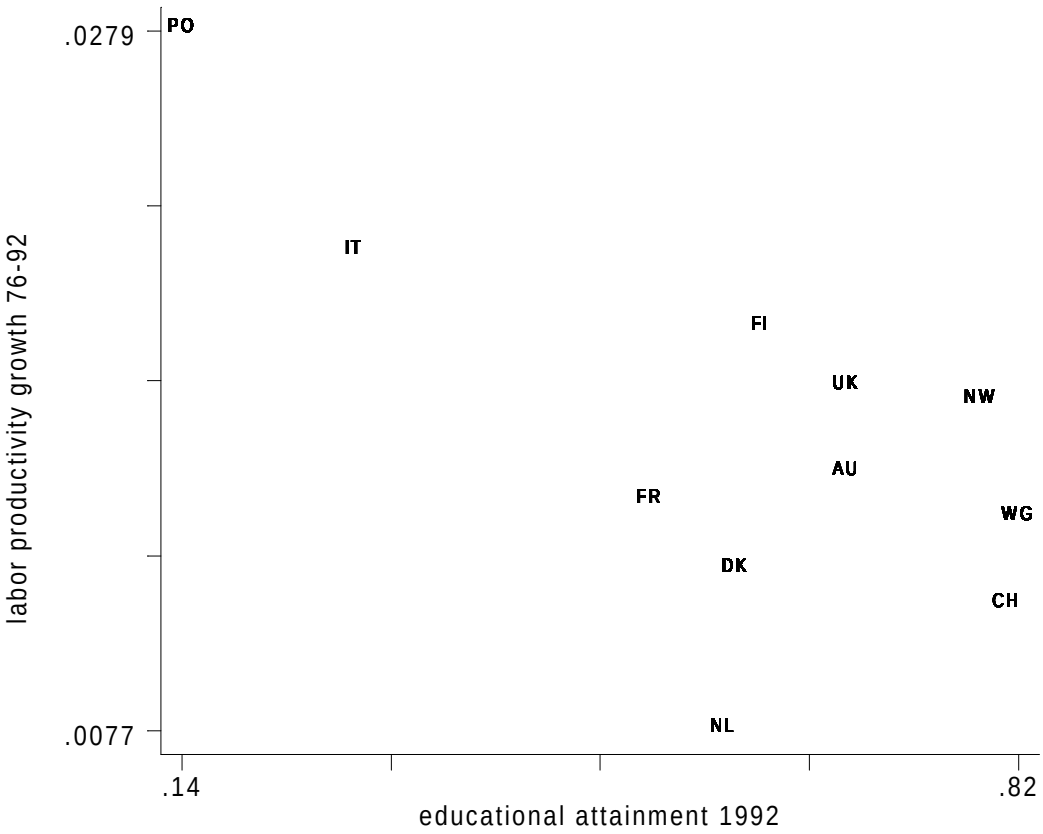

Figure 3: Labor productivity growth and educational attainment by country.