

WHEN DO ADULTS LEARN? A COHORT ANALYSIS OF ADULT EDUCATION IN EUROPE

**MIROSLAV BEBLAVÝ, ANNA-ELISABETH THUM
AND GALINA POTJAGAILO**

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Abstract

Adult learning is seen as a key factor for enhancing employment, innovation and growth, and it should concern all age cohorts. The aim of this paper is to understand the points in the life cycle at which adult learning takes place and whether it leads to reaching a medium or high level of educational attainment. To this end we perform a synthetic panel analysis of adult learning for cohorts aged 25 to 64 in 27 European countries using the European Labour Force Survey. We find, as previous results suggest, that a rise in educational attainment as well as participation in education and training happens mostly at the age range of 25-29. However, investment across the life cycle by cohorts older than 25 still occurs: in most countries in our sample, participation in education and training as well as educational attainment increases observably across all cohorts. We also find that the decline with age slows down or is even reversed for older cohorts, for both participation in education and educational attainment. Finally, we can identify a Nordic model in which adult learning is achieved through participation in education and training, a Central European model in which adult learning occurs in the form of increasing educational attainment and a liberal model in which both approaches to adult learning are observable.



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1. Introduction

Increasing skill levels is generally seen as a key tool to boost innovation, growth and employment:¹ the Europe 2020 strategy predicts that by 2020, 16 million more jobs will require high qualifications, while the demand for low skills will drop by 12 million jobs. In view of this rising demand for high skills, European policy-makers should encourage this process of skill increases to foster economic growth (O'Mahony, 2010; Wolf et al., 2006; Picchio and van Ours, 2011; Bassanini et al., 2005). Indeed, motivation for promoting lifelong learning in the European Union is manifold (Gallagher, 2001): structural changes in the economy imply the need for more or different skills and re-training; new market demand for new products requires different skills; the knowledge economy and the growth of the service sector require more skills; and finally, the complexity of democracy calls for more advanced skills on the part of individuals to understand their rights.

Consequently, it is believed that learning new and more skills at any stage of the life cycle is positive for the economy. However, to the best of our knowledge it is not yet fully clear from existing studies of adult learning the point during the life cycle at which adult learning can actually be observed. Neither is it fully clear whether this learning then usually leads to passing from a low to a medium education level or from a medium to a high education level. The aim of this paper is therefore primarily to obtain an understanding of when adult learning takes place and whether it leads to diplomas that allow individuals to pass from a low to a medium or from a medium to a high education level. To this end we consider two dimensions of adult learning: participation in education and training and the change in medium and high levels of educational attainment. In particular, we study

- participation rates in education and training across cohorts. We ask how the probability of engaging in education or training evolves over both the life cycle of a particular cohort and over time for fixed age groups;

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¹ The Lisbon Strategy as well as the Europe 2020 strategy set an increase in lifelong learning as an important goal for the future of Europe. The benchmark set in the Lisbon strategy is that an average of at least 12.5% of adults (age group 25-64) should participate in lifelong learning by 2010. The benchmark set in the Europe 2020 strategy (European Commission, 2010) is that an average of at least 15% of adults (age group 25-64) should participate in lifelong learning by 2020 (European Commission, Strategic framework for education and training, http://ec.europa.eu/education/lifelong-learning-policy/doc28_en.htm).

- changes in educational attainment in terms of ISCED (International Standard Classification of Education) levels across cohorts and how they change between 2000 and 2010. We measure educational attainment in percentage terms by age group per year. We ask whether countries and cohorts differ in percentages of upgrades in their formal ISCED levels over time; and
- comparisons of the two dimensions of skill increases, educational attainment (changes in ISCED levels) and participation in education and training.

We perform a cohort analysis for 27 European countries using the European Labour Force Survey (EU LFS). We also perform a synthetic panel analysis of cohort averages.²

We find that indeed there seems to be a decline in participation in education and training associated with age as well as a widening of the generational gap between those aged 25-29 and those aged 50-54 from 2000 to 2010. However, we detect two forces counterbalancing these dynamics: first, in most countries there is a general increase in participation in education and training that is observable across all cohorts; and second, the decline with age slows down or even reverses for cohorts older than 25-29. In terms of educational attainment, we can see that older cohorts still increase their levels of education towards high educational attainment – and in some countries (such as in Belgium, Denmark, Norway and Iceland) they do so even at the same speed as the younger cohorts.

Looking at both approaches to skill increases – participation and training and the increase of educational attainment levels – we find that participation in education and training is generally determined in a similar way as the upgrading to a medium or a high level of educational attainment. More specifically, a part-time contract has a similarly negative and significant effect on participation in education and training as it does on upgrading from a low to a medium education level. In addition, cohorts with more professionals and technicians are generally those with higher participation rates in education and training, as well as in upgrading to medium or to high levels of educational attainment. Variables measuring the composition of the cohort in terms of being foreign born and gender lose their significance as soon as we control for education variables.

Finally, in the light of a country comparison, we find that the Scandinavian countries and Switzerland fare well on the participation dimension but less well on the ISCED upgrading dimension. Possibly the ISCED upgrading after the age of 25 might be relatively low in these countries because ISCED levels reached before 25 are already high and call for only a little improvement at later age. Relatively high levels of ISCED upgrading but relatively low levels of participation in education and training can be found in Central and Eastern European (CEE) countries. We interpret this observation as a catching-up effect, which most likely stems from the fact that during the Communist regime, the high-skilled supply was historically suppressed, which meant that demand outstripped supply. Consequently, there is now a need for more highly skilled persons, and in addition – owing to a large supply of those with a medium education level – there is already a pool of persons eligible to enter tertiary education. Finally, two countries that fare well on both participation in education and training and the change in educational levels are the two liberal countries, Ireland and the UK.

This paper is structured as follows: section 2 analyses the previous literature and illustrates previous empirical findings. In section 3 we describe the data used, while section 4 continues with an outline of the empirical methodology, section 5 presents our findings and in section 6 we conclude.

² See section 5 for a detailed description of a synthetic panel.

2. Previous literature and empirical findings

Lifelong learning starts at the beginning of our life cycle: usually individuals go to school up to a certain ISCED³ level and complete their formal education.⁴ Then, from the age of 20-25 onwards, adults' participation in formal, non-formal or informal education is termed "adult learning", "adult education" or "lifelong learning".⁵ Formal education for adults includes organised instruction provided by formal educational institutions; non-formal education describes instruction that takes place either within or outside educational institutions.⁶ Finally, informal education refers to non-intentional learning resulting from life experience and individuals' activities (Field, 2005).

In the light of a rising demand for skilled labour and competition pressures from the global economy, numerous authors have stressed the necessity of fostering human capital in developed economies (OECD, 2004; Hyslop and Mare, 2009; Keeley, 2007; Mayhew et al., 2008; Ichino et al., 2008). Studies have demonstrated the existence of a link between adult learning and individual, firm and national income growth (Hamil-Luker, 2005; Blundell et al., 1999).

Increasing the skill levels of the labour supply is determined by various factors (Pituch et al., 2010; Lorenz, 2011). First, European countries display important regional cleavages (Bassanini et al., 2005 and Pont, 2004). Scandinavian countries and the UK are known to train more people than the rest of the OECD countries but at the cost of providing shorter training spells than southern European countries (Bassanini et al., 2005). Other geographical disparities can also be explained by structural factors, such as local economic density or orientation towards vocational education (Wolbers, 2005; Brunello and Gambarotto, 2004; Werquin, 2007). Figure 1 illustrates these findings: among a selected group of countries across Europe, participation in education and training is highest in the Scandinavian countries Denmark, Sweden and Finland, along with the UK, and lowest in the Mediterranean countries. **Nordic countries display higher rates of training participation** (see also Table 2 and Figures 5 to 7).

Second, the literature also finds multiple factors that account for disparities in training attendance among sectors of the economy. **Technological skills intensity and the level of innovative activities** (Antonioli et al., 2011; Bartel and Sicherman, 1998) have led to different evolutions of skill requirements among sectors and therefore training needs (see Figure 2).

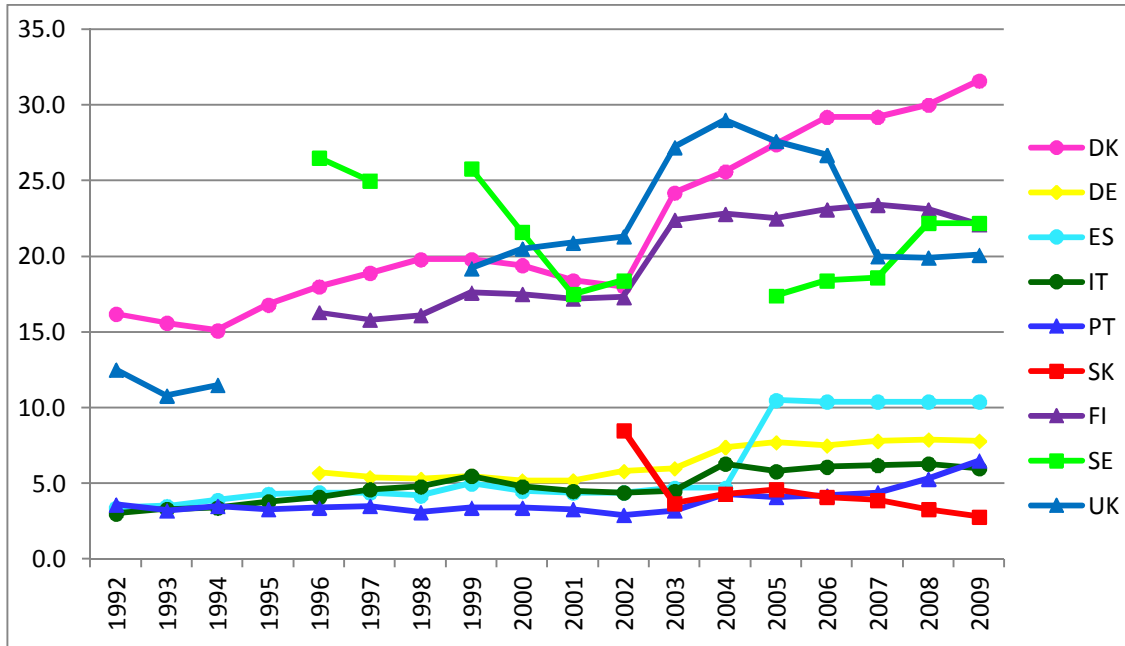
³ See ISCED (http://www.unesco.org/education/information/nfsunesco/doc/isced_1997.htm).

⁴ "Formal education is defined as education provided in the system of schools, colleges, universities and other formal education institutions that normally constitutes a 'continuous ladder' of full-time education for children and young people, generally beginning at the age of five to seven and continuing up to 20 or 25 years old." (See Eurostat, Adult Education Survey, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/trng_aes_esms.htm.)

⁵ Ibid.

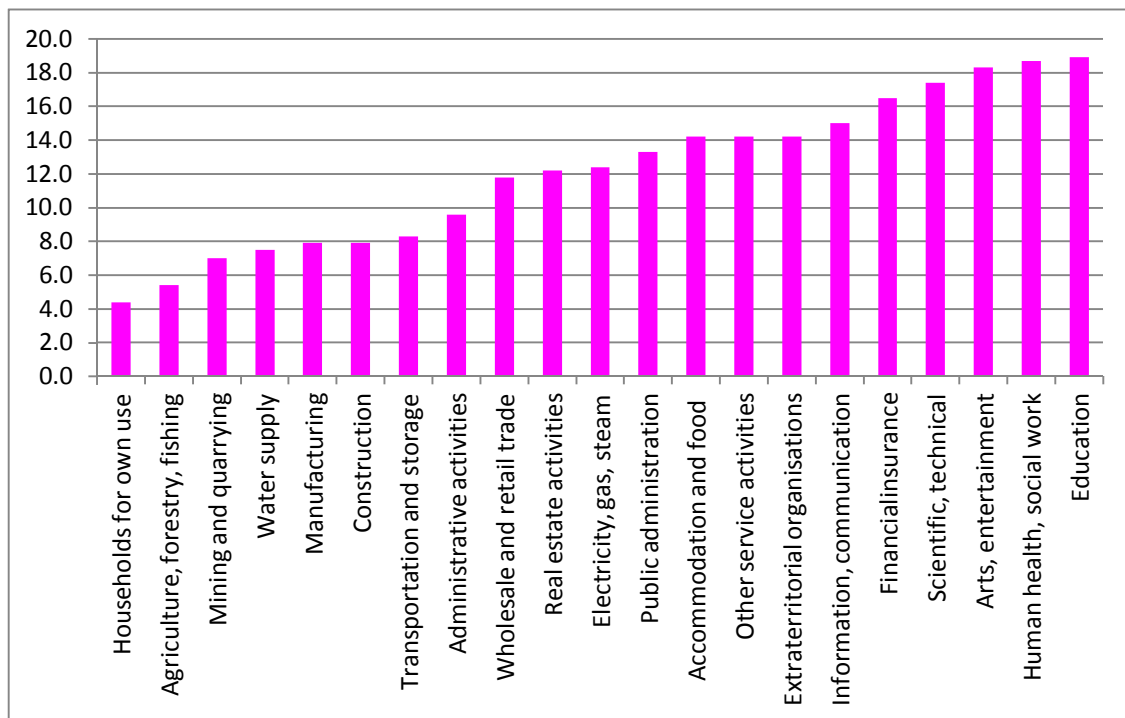
⁶ Ibid.

Figure 1. Participation in education and training: Development in selected EU countries, age 25-64 (%)



Source: Eurostat, LFS Main Indicators for lifelong learning: “Participated in training 4 weeks prior to survey date”.

Figure 2. Participation in education and training: Development in selected EU countries, age 25-64 (%)

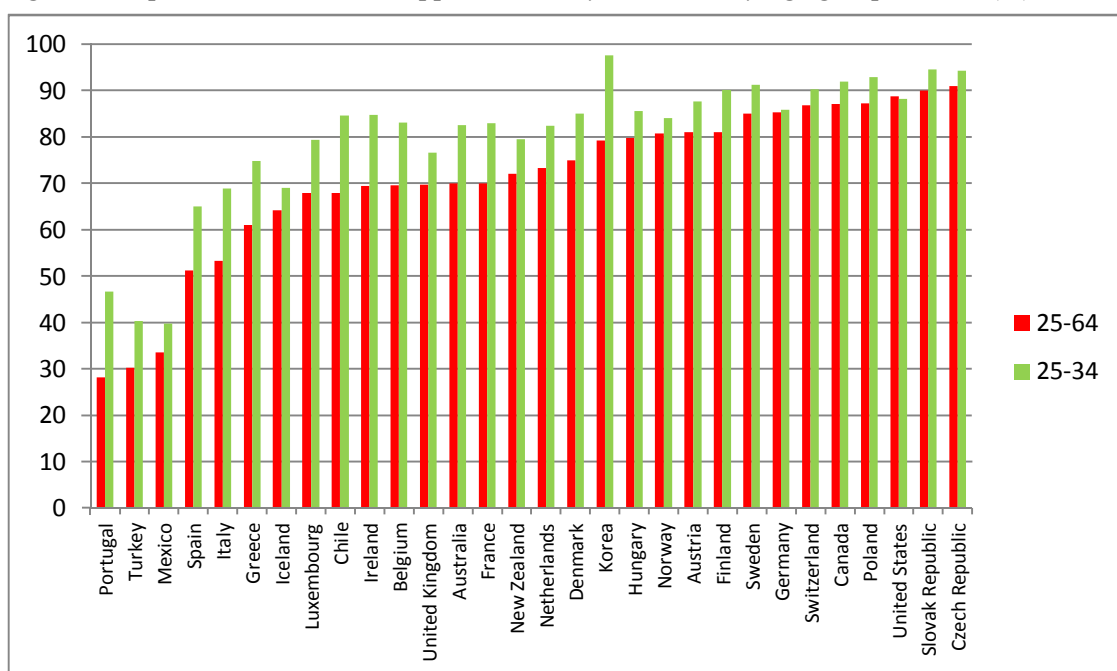


Source: Eurostat.

Workers' participation in training is also strongly influenced by their socio-economic background. Age and education levels are prominent factors determining formal and informal education attendance. For a start, younger generations are more educated than their predecessors (Brunello and Medio, 2001; OECD, 2010). Furthermore, young and highly educated workers are more likely to participate in training activities and tend to pursue education (Jenkins et al., 2003; Sousounis and Blanden-Hovell, 2009). The least educated in contrast show little interest in schooling (Fourage et al., 2010; Keeley, 2007; Rainbird, 2000). An absence of motivation among the workforce is in general the main reason for lack of training attendance (Pont, 2004). Figures 3 and 4 illustrate these findings. Figure 3 shows that across all 30 OECD countries in the sample a higher percentage of the younger generation (25-34) than of the older generation (25-64) have at least upper secondary education. **Younger cohorts are more educated** (see also Table 2 and Figures 4-8). Figure 4 shows that the percentage of participation in formal and non-formal education is highest among those with a higher educational attainment. **Education begets education** (see also Table 2).

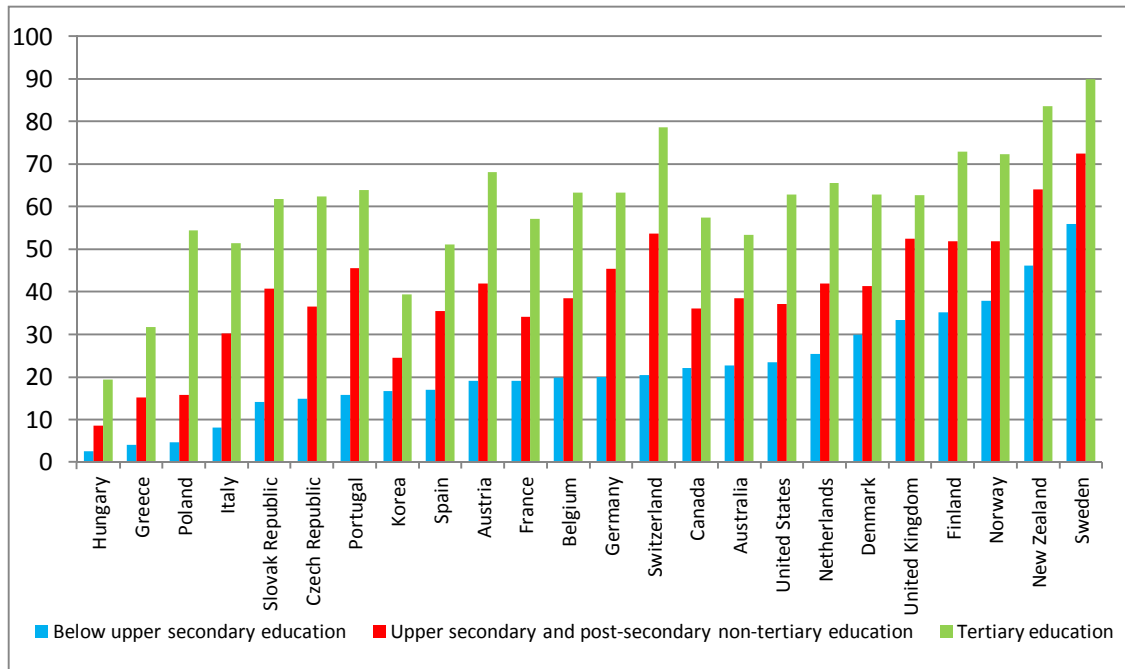
Research findings indicate important benefits from training for workers and firms that should be incentives for more active participation. Training attendance enhances intra-firm mobility and job stability (Sanders and de Grip, 2004; Ananiadou et al., 2004; Gritz, 1993). Studies also pinpoint the existence of wage returns for certain groups of workers, but this issue is still much debated in the literature (Leuven and Oosterbeek, 2002; Vignoles et al., 2004). The firms, however, reap the lion's share of the profits of training through increased workers' productivity (Acemoglu and Pischke, 1996; 1998). This underscores the value of training as an individual and corporate investment.

Figure 3. Population with at least upper secondary education by age group in 2008 (%)



Source: "To what level have adults studied?", *Education at a Glance* (OECD, 2009).

Figure 4. Participation in formal and non-formal education by educational attainment, age 25-64, in 2007 (%)



Source: “How many adults participate in learning?”, *Education at a Glance* (OECD, 2009).

The factors discussed above strongly influence the increase in skill levels of the labour force. Moreover, many of these characteristics also favour one channel of education (formal or informal) over the other, creating divergent patterns of increasing skill levels. What triggers these different paths, however, is largely unknown, in spite of a few isolated results in the literature. For instance, de Grip and Smits (2009) find that jobs requiring advanced technological knowledge involve more formal training. On the other hand, highly innovative segments tend to be more oriented towards informal education (Antonioli et al., 2011).

3. Data

In our empirical analysis we use the EU LFS microdata – a quarterly household sample survey of persons aged 15 and older living in private households.⁷ The sample covers – depending on accession dates – all EU member states, Switzerland, Iceland, Norway and three EU candidate countries. The dataset is harmonised across the EU member states. The first wave was produced in 1983 and the latest release included the 2011 wave. Sample size is increasing over time and the latest wave includes 15 million individuals across Europe.⁸

We restrict our sample to persons aged 25-64 in 27 European countries. These countries are namely 24 of the EU-25 states Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Spain, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Latvia, the Netherlands, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and the UK, along with

⁷ Excluded from the sample are persons in obligatory military or community service and persons living in institutions or collective households (Eurostat, European Union Labour Force Survey, <http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/lfs>).

⁸ Eurostat, European Union Labour Force Survey (<http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/lfs>).

three of the EFTA states – Iceland, Norway and Switzerland. Germany is not included in the sample because the German Microcensus law states that the interviewed persons should be informed about the fact that the information they provide can be used by researchers. This question was not asked before the regulation was adopted, so data referring to a date before 2002 cannot be published. Liechtenstein, the fourth EFTA state, is not surveyed in the EU LFS.

According to the definitions in Eurostat’s Adult Education Survey, full-time formal education for children and young persons usually begins at the age of 5 or 7 and ends at 20 or 25.⁹ To exclude as far as possible those who are still enrolled in education as part of their initial education, we exclude all persons younger than 25 from our sample. We further exclude those who are still in military service. Our sample therefore contains all persons aged 25-64 who are employed, unemployed or inactive. Missing observations for a specific variable are not utilised for calculating the mean of that variable per cohort.¹⁰ We use annual measurements of the variables outlined in Table 1:

Table 1. Variables used in the empirical analysis

Variable	Description
Participation in education or training (EDUC4WN)	EDUC4WN is the education or training received during the previous four weeks. This variable measures participation in the form of either regular education or training. From 2003 onwards, EDUC4WN is constructed on the basis of the variables EDUCSTAT (received regular education in the previous four weeks) and COURATT (attended courses, seminars, conferences or private lessons or instructions outside regular education). EDUC4WN equals one if either of the previous variables is positive. Before 2003, these variables separating training and regular education are not available. Given these data constraints we use EDUC4WN, which combines participation in training and regular education in one indicator.
Highest educational attainment (HATLEV1)*	HATLEV1 is the highest level of education or training successfully completed. This variable measures attainment of education rather than participation as the previous variable does.
Age (AGE)	Age is measured in five-year age bands and does not allow standard cohort analyses due to the anonymity criteria. It is only possible to compare cohorts at five-year intervals.
Gender (SEX)	This variable indicates the percentage of women in the sample.

⁹ Eurostat, Adult Education Survey Reference Metadata (http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/trmg_aes_esms.htm).

¹⁰ In the in-built STATA routine, to calculate the respective means of a set of variables, for each variable separately all observations with a non-missing value are added up and divided by the number of non-missing observations.

Years of residence (YEARESID)	YEARESID is years of residence in this country or ‘born in this country’. According to the atomisation criteria, codes 11 to 99 in five-year bands (11-14, 15-19, etc.) are in line with the standard aggregation of AGE. In the aggregation on the cohort level, this variable indicates the percentage of those who are born abroad.
Employment Status (ILOSTAT)	The ILO working status includes the categories employed, unemployed, inactive, compulsory military service or persons less than 15 years old. The variable is split into dummy variables for each status indicating – after the aggregation on the cohort level – the percentage in the cohort in each working status.
Full-time or part-time job (FTPT)	FTPT indicates the percentage of the cohort working part time.
Occupation (ISCO1D) – this variable takes into account the difference in speed of technological development across sectors (Wolbers, 2005)	This variable indicates the ISCO level (coded at the 1 digit level) of occupation. It is split into a set of dummy variables indicating – when aggregated across cohorts – the percentages in the cohort working in one of the following occupations: legislative manager, professional, technician, clerk, service-sales, agriculture or fishing, craft-trades, machine operator or armed forces (with elementary occupations as a base category).
Construction of country, year (2000, 2005, 2010) and cohort dummy variables	These variables measure the effect of unobservable factors specific to each country, year and cohort.

* The variable HATYEAR would allow identification of when the respective individual has finished his or her highest level of training or education, but this variable is only available from 2003.

Source: European Labour Force Survey.

4. Empirical methodology

To understand the dynamics of adult learning across age groups and time, we first perform a descriptive cohort analysis and subsequently a panel regression analysis using synthetic panel data (see below). We compute cohort averages across five-year age groups of participation rates in education and training and of educational attainment. We follow these cohorts from 2000 to 2010 in five-year steps to analyse changes within the same cohort and we compare the same age groups each year.

The European Labour Force Survey microdata can be considered a time series of independent cross-sections, but not a true panel because follow-up cannot be conducted on individuals mainly due to the anonymity agreement across the member states.¹¹ Therefore, changes in

¹¹ “The EU LFS is originally not designed as a panel, but most countries have a rotation scheme in place. The anonymised LFS micro data, however, do not contain the information which would allow tracking people across waves: the household numbers are randomized. This was agreed with Member States and might be revised in the future, but the feasibility of constructing longitudinal datasets and exploiting their information needs to be assessed beforehand for the individual countries” ([Eurostat, Criteria for the anonymisation of LFS microdata 2010 release, http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/lfs_main/anonymisation/Criteria%20for%20the%20anonymisation.pdf](http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/lfs_main/anonymisation/Criteria%20for%20the%20anonymisation.pdf)).

educational attainment levels and participation rates in education and training can be caused by several factors:

- upskilling (an increase in the ISCED level or participation rate in training among the original population);
- a change of composition of the cohorts (panel attrition, mortality or migration); or
- measurement error.

If we aim at identifying only those changes in education levels or in training participation rates, we experience identification problems. We argue that regression analysis allows some of these problems to be addressed as we control for cohort composition effects, such as the percentage of foreign-born persons per cohort.

We construct *synthetic cohorts* and analyse a *synthetic panel dataset*. Verbeek and Nijman (1992) analyse the case in which data on individuals measured repeatedly over several consecutive time periods are not available but in which one can construct cohort data and analyse the cohort averages as if they were repeated sample data. In other words, only a *synthetic panel*¹² is available. Usually, when cohorts are constructed using individuals with similar characteristics, the cohort measures may contain errors, since they are not formed using exactly the same individuals. Deaton (1985) has developed an ‘error-in-variables’ estimator to address this problem by taking the possible error stemming from the cohort construction into account. If repeated cross-sections are available but not repeated observations for the same individual, he suggests the construction of cohorts and proposes a consistent estimator, also for the case where individual-specific effects are correlated with the observable variables. If the cohort size is large, this error is treated as less important and a panel data regression method is used as if the cohort averages were individual data points (see Browning et al., 1985 and Blundell et al., 1989 in Verbeek and Nijmegen, 1992).

Verbeek and Nijman (1992) name the conditions under which it is possible to ignore the problem addressed by the error-in-variables methodology and use a conventional panel data estimation technique: using simulations and the Dutch Expenditure Index Panel, they show that the impact of the cohort construction on a bias in a fixed effects regression is small if the cohorts are large enough (between 100 and 200 individuals should suffice)¹³ and if the true cohort means show sufficient time variation.¹⁴

We therefore perform least squares dummy variable regressions¹⁵ using synthetic panel data. Our regression model can be outlined by the following equation:

$$Y_{ijt} = c + \alpha_i + \alpha_j + \alpha_t + \beta X_{ijt} + \varepsilon_{ijt} \quad (1)$$

¹² See for instance Shorrocks (1975) and Deaton (1985) for further references on the construction of synthetic panels when only a time series of cross-sectional data is available but not longitudinal data on the same individual, as is the case with the LFS microdata sample.

¹³ In our sample, the cohort sizes vary from around 2,000 to 17,000 observations.

¹⁴ We cannot test this assumption as the true cohort means are not observable, but we argue that as we observe changes over five-year gaps the time variation should be sufficient.

¹⁵ This is equivalent to an ordinary least squares regression controlling for time, country and cohort effects by including dummy variables. This is also equivalent to a fixed-effects panel regression with three levels.

with

$i = 1, \dots, 6$ cohorts (those aged 25-29, 30-34, 35-39, 40-44, 45-49, 50-54 in 2000)

$j = 1, \dots, 27$ countries (24 EU countries and Switzerland, Iceland and Norway)

$t = 1, 2, 3$ time periods (2000, 2005, 2010)

where c indicates the constant (the average education or training level across all three levels), $\alpha_i, \alpha_j, \alpha_t$ indicate the cohort-, country- and time-specific effects, β is a vector of coefficients on the set of explanatory variables (cohort characteristics), and X_{ijt} and ε_{ijt} indicate a random error term.

Y_{ijt} represents the dependent variable varying across cohorts, countries and time.

5. Results

5.1. Descriptive cohort analysis

Participation in education and training

Figures 5 to 7^{16, 17} show participation rates in education and training over the last four weeks across time, countries and cohorts. Figures 5 and 6 depict averages (for the age group 25-64) and levels of participation in education and training for the youngest cohort (aged 25-29) and an older cohort (aged 50-54) and the gap between them, shown per country in 2000 and in 2010. The figures are designed in the following way: the bar charts indicate average levels. On top of the bar charts we insert markers indicating the levels for the youngest cohort (aged 25-29) and an older cohort (aged 50-54). We choose the age range of 50-54 for the older cohort in order to smooth out differences across countries that might be due to differences in retirement ages.

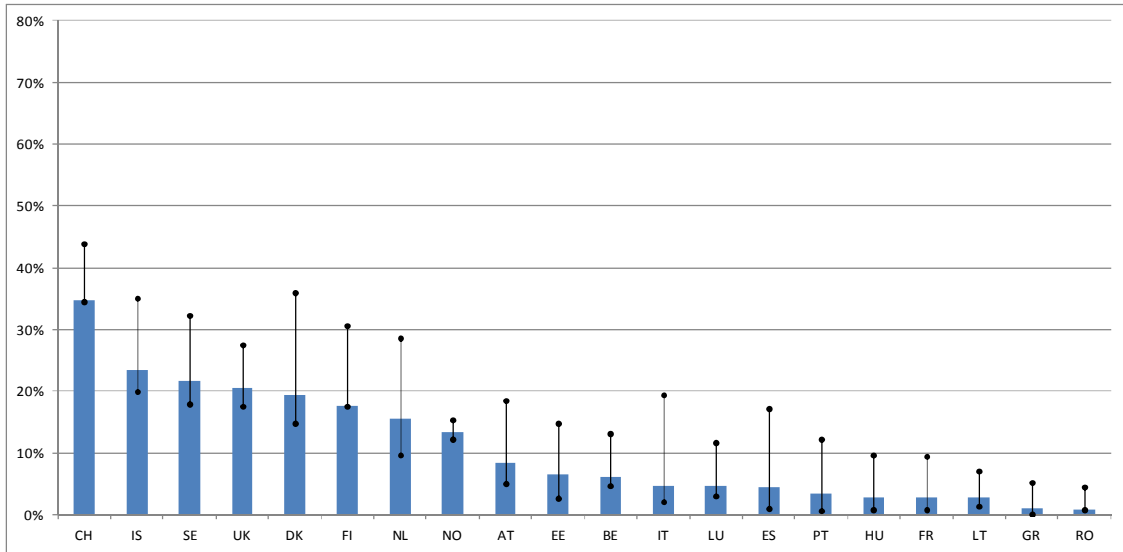
Figures 5 and 6 show that – similar to previous findings – the highest participation rates are found in Scandinavian countries, Switzerland and the UK, whereas the lowest rates are found in CEE, Mediterranean and Baltic countries. The figures further show that in all countries the younger generation participates more in education and training than the older cohort. The size of the generational gap varies among the countries and is persistently small only in the UK.

We can further observe that between 2000 and 2010 the generational gap widened and the young generation invested more rapidly in education and training than the older generation. When comparing the picture across countries, we see that the range of participation rates among countries slightly decreased between 2000 and 2010 both for the older generation (from a range of 0 to 35% to a range of 0 to 30%) and for the younger generation (from a range of 5 to 45% to a range of 35 to 70%). These observations provide evidence of a convergence among countries by age group.

¹⁶ Our data correspond to the data available on Eurostat's online dissemination tool on participation in education and training (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=trng_lfse_01&lang=en). The corresponding age groups are created by ten-year distances so the data are not directly comparable with our five-year averages.

¹⁷ Data on participation in education and training in 2000 are not available for Bulgaria, the Czech Republic, Ireland, Latvia, Poland or Slovakia.

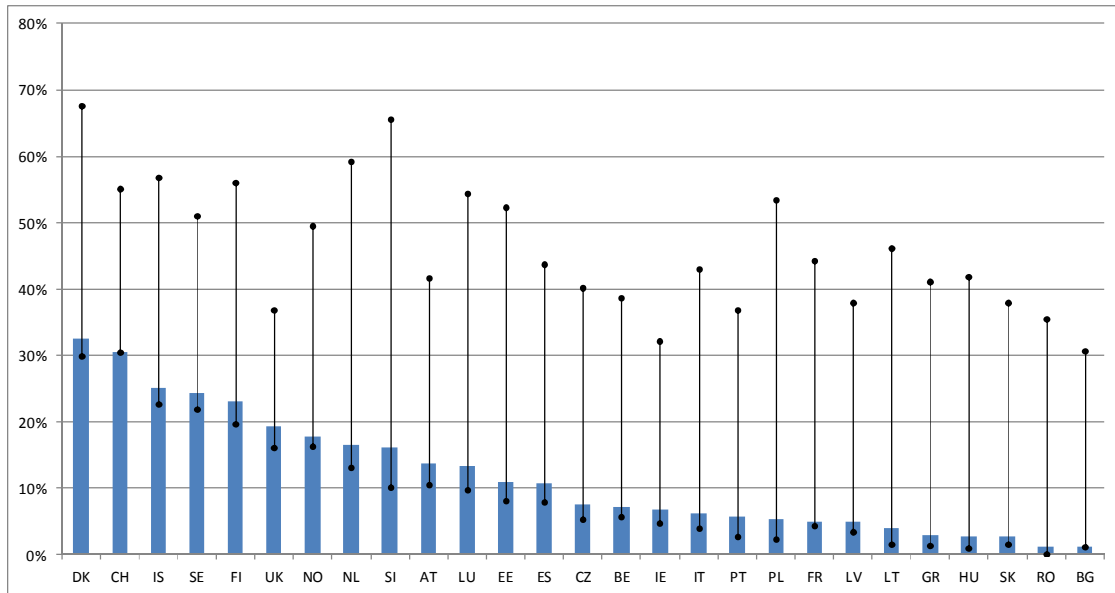
Figure 5. Participation in education and training in 2000 across selected European countries (cohorts 25-29 and 50-54 and average 25-64)*



* Data on participation in education and training in 2000 are missing for Bulgaria, the Czech Republic, Ireland, Latvia, Poland and Slovakia.

Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

Figure 6. Participation in education and training in 2010 (cohorts 25-29 and 50-54 and average 25-64)



Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

Figure 7 shows a more detailed picture of the development across cohorts in different countries. Each country graph shows the participation in education and training by cohort for the years 2000, 2005 and 2010. Cohorts are observed as they grow older: the cohort aged 25-29 in 2000 is observed in 2000, in 2005 when it is aged 30-34 and in 2010 at 35-39. Therefore, the following country graphs show a combination of dynamics across a year-specific path (2000–10) and across a cohort-specific path (each cohort as it grows older). We can observe for about two-thirds of the countries that there is an increase in 2005 for all cohorts in participation in education in training and a decrease in 2010. These dynamics hold both for when we follow the cohort as they grow older and for comparing constant age groups. These observations show that there was a general increase in participation in education and training over the years until the financial and economic crisis slightly curbed this effect. But apart from effects stemming from year-specific factors, the figures allow us to make further observations. First, in nearly all countries, investment in the education and training of the oldest generation stays relatively stable even as the cohort ages. This observation indicates that there is no evidence that as retirement approaches individuals no longer invest in training and education. Second, for the youngest generation we observe that in nearly all countries participation in education and training declines as the generation grows older – despite the year-specific effects that would push for an increase in participation in education and training over the years. These observations could indicate that there seems to be a decline in participation in education and training associated with age, but there are two forces counterbalancing these dynamics: first, there is a general increase in participation in education and training that is observable across all cohorts; and second, the decline slows down for all cohorts older than 25-29.

The countries in our sample can be grouped into different clusters displaying varying cohort dynamics in terms of participation in education. Countries can be grouped into the following clusters: Group 1 contains Austria, Estonia, Luxembourg, the Netherlands, Norway, Slovenia and Spain. This group includes countries with a relatively stable rate of participation throughout the periods studied (generally with a small variation in the year 2000 but without a sharp decline in the period observed). The overall level of participation of the highest age group reaches on average 5%, while the participation of the youngest reaches between 12 and 20% at the end of the period observed.

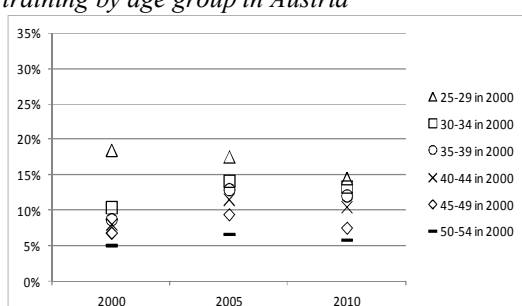
Group 2 contains the liberal and Nordic countries Switzerland, the UK, Denmark, Finland, Iceland and Sweden. Group 2 countries portray a very mild decline of participation over the period observed (with the small exception of Denmark). However, the main defining feature of the group is that the overall levels of participation in education of the youngest groups vary between 25 and 35%, and the participation of the oldest groups is always above 10%.

Group 3 consists of Latvia, Lithuania, Italy, Hungary, Greece, Romania, Slovakia and Bulgaria. Group 3 includes countries with the lowest rate of participation in education and training during the period measured, with only two instances of measured data reaching over 10%. There is a strong declining tendency in the participation of all groups (but specifically the youngest cohorts) over time. Another tendency is the overall convergence of participation in the last period measured, averaging well below 5% (even the participation of the youngest groups in any of the Group 3 countries is consistently below 5%).

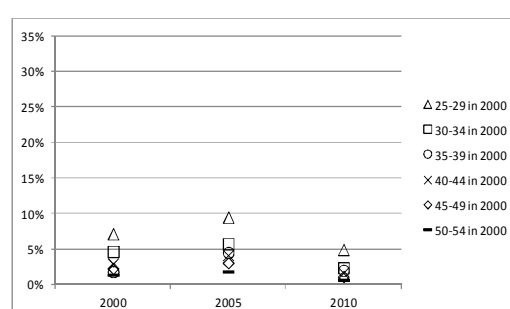
Group 4 comprises a mix of southern European, CEE and two continental European countries, namely Belgium, the Czech Republic, France, Ireland, Poland and Portugal. Group 4 countries do not show such levels of convergence among the levels of participation (except for the youngest category) or a distinct trajectory over time, and the declining tendencies do not apply to the Czech Republic or to a partial degree to Portugal. The average participation of the youngest groups is between 6 and 8% in 2010. The oldest cohorts' participation declined over time to between 1 and 3%.

Figure 7. Country examples of cohort dynamics in participation in education and training between 2000 and 2010 (cohorts aged 25-29 to 50-54 in 2000)

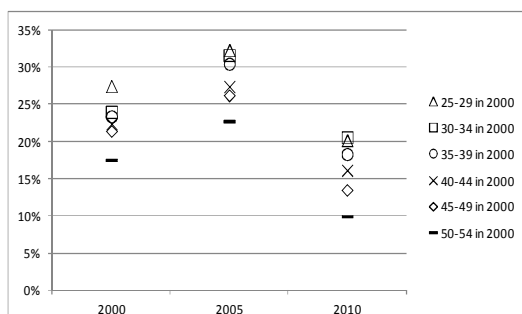
Group 1: Participation in education and training by age group in Austria



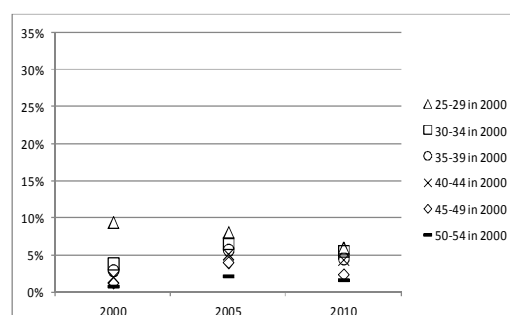
Group 3: Participation in education and training by age group in Lithuania



Group 2: Participation in education and training by age group in the United Kingdom



Group 4: Participation in education and training by age group in France



Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

Educational attainment: ISCED level upgrading

Educational attainment levels by cohort across time and country are shown in Figures 8 to 10.¹⁸ Our analysis distinguishes between upgrading from a low (lower secondary) to a medium (upper secondary education) education level and from a medium to a high (tertiary) education level. Assuming that those with a low level cannot achieve a high level of education in five year's time, we can identify movements from lower to upper-secondary education levels (referred to

¹⁸ Our data are comparable to data available on Eurostat's online data dissemination tool (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=edat_lfse_07&lang=en). The tool shows cohort averages for selected age groups across time and countries. The corresponding age groups are 20-24 and 30-34. Despite the different software used to compute the averages, the data correspond strongly.

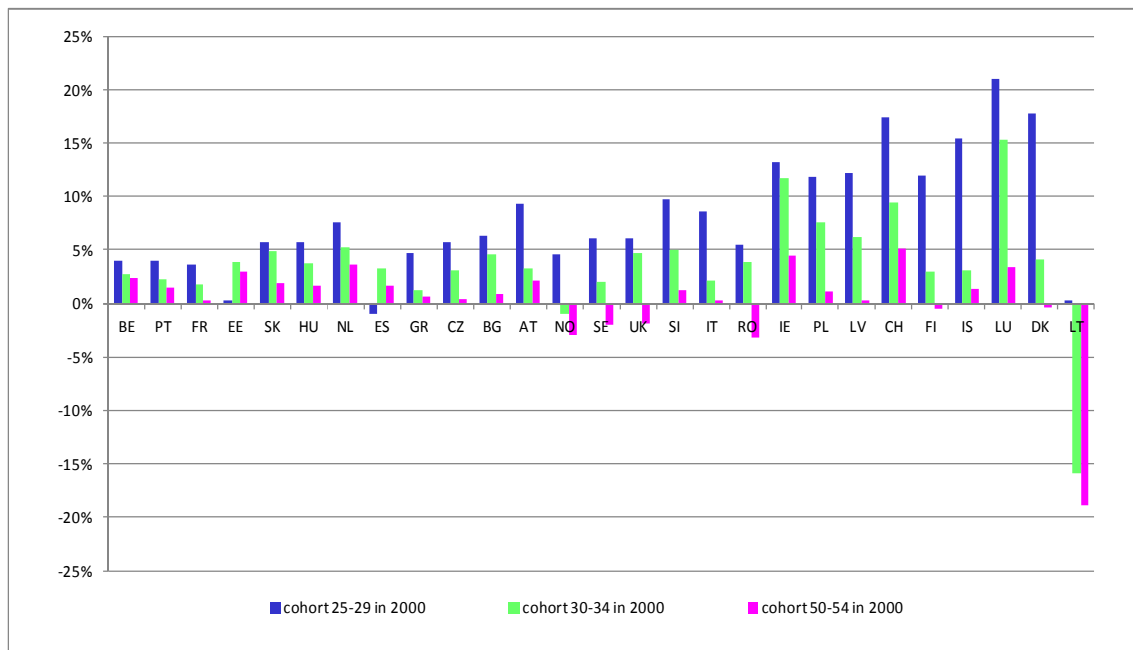
henceforth as ‘low education change’) and from upper secondary to tertiary education (referred to henceforth as ‘high education change’). The respective changes in educational attainment level by cohort can therefore be represented by

$$\Delta_{E(H,T)} = E(H,T) - E(H,T-1) \quad (2)$$

$$\Delta_{E(M,T)} = -(E(L,T) - E(L,T-1)). \quad (3)$$

Figures 8 and 9 show how three different cohorts change in terms of the percentage of tertiary educational attainment between 2000 and 2010, as they grow older over time. The figures are sorted by the variance between the generations. Negative changes indicate that the cohort is composed of less educated individuals than it was ten years ago. Figure 8 shows that adult learning not only happens through participation in education and training but also through an increase in educational attainment (ISCED upgrading). Differences in ISCED levels between 2000 and 2010 for the older generation are generally small. Countries with relatively large variance between generations are Nordic countries, Switzerland, Slovenia and Estonia; countries with low generational variance are CEE and Mediterranean countries. We conclude from Figure 8 that an increase in educational attainment at later stages in life happens less frequently in Nordic countries (these countries are characterised by a high level of education from the start) and that there is a catching-up effect of CEE and Mediterranean countries as cohorts grow older. This catching-up effect is mainly due to the fact that during the Communist regime the highly skilled supply was historically suppressed, which meant that demand outstripped supply. Consequently, there is now a need for more highly skilled persons, and in addition – due to a large supply of those with a medium education level – there is already a pool of persons eligible to enter tertiary education.

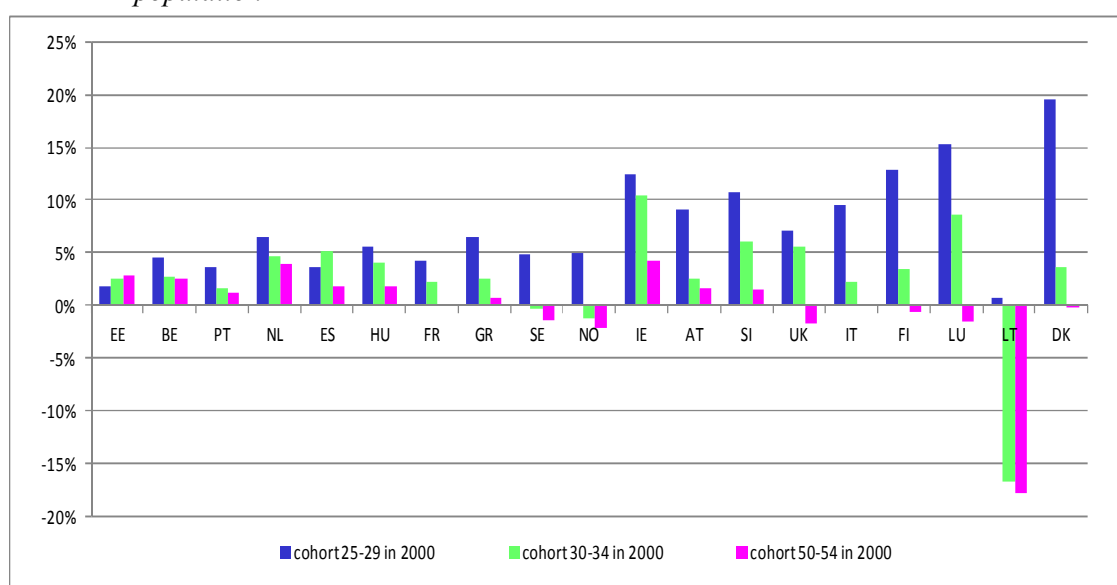
Figure 8. Percentage point increase in high educational attainment (ISCED upgrading) between 2000 and 2010, by cohort and country



Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

A considerable share of the variation may stem from migration – especially in countries such as Luxembourg, in which the rate of foreign-born persons reaches nearly 60% of the cohort aged 30-35 in 2010. Therefore, in Figure 9 we display the same numbers as in Figure 8, excluding the foreign-born population. Figure 9 shows that the cross-country dynamics do not change significantly. For the countries we can observe in both figures, the picture changes only for some countries: the numbers change significantly for Estonia, Spain, Sweden, the Netherlands, Luxembourg and Denmark, and for Italy and France with respect to the oldest cohort. In Estonia, the youngest cohort shows much higher participation rates in education and training when excluding the foreign-born population. Older cohorts display a slightly higher participation rate. In Spain, we can observe a similar picture. In Luxembourg, the participation rate of the youngest cohort is most affected, as it decreases from 20% to 15%. A similar change is observable in Denmark, where the participation rate for the youngest cohort drops from nearly 20% to around 17%. In France and Italy, it seems that among the oldest cohort it was mainly the foreign-born who display changes in educational attainment levels between 2000 and 2010.

Figure 9. Percentage point increase in high educational attainment (ISCED upgrading) between 2000 and 2010 by cohort and country – Excluding the foreign-born population*



* Data on 'foreign born' are not available for the years 2000, 2005 or 2010 in Bulgaria, Switzerland, the Czech Republic, Iceland, Latvia, Poland, Romania or Slovakia. We therefore do not include these countries in Figure 9.

Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

Figures 10 and 11 display the cohort dynamics of changes in educational attainment for selected countries. The countries were selected on the basis of a grouping of the countries in our sample according to different dynamics. As in Figure 7, the figures are organised in the following way: for each year (2000, 2005 and 2010) the cohort averages of education levels are shown. Cohorts are followed as they grow older: the cohort aged 25-29 in 2000 is observed in 2000, in 2005 when it is aged 30-34 and in 2010 at 35-39. Thus, the following country graphs show a combination of dynamics across a year-specific path (2000–10) and across a cohort path (each cohort as it grows older).

In Figure 10, we show the percentages of low educational attainment by cohort for selected countries. The figure shows that the youngest generation (aged 25-29 in 2000) displays the lowest percentage of low educational attainment, whereas the oldest cohort usually displays the highest percentage of low educational attainment. In terms of year-specific effects, there does not seem to be a strong year-specific effect. In terms of inter- and intra-cohort developments, the countries in our sample can be divided into particular groups. In the country grouping, the main differentiating features are 1) the percentage with low educational attainment, 2) the range of variation across age groups and 3) the degree of fluctuation across age groups over the years.

Group 1 includes a mixture of Baltic, Scandinavian and CEE countries, namely Denmark, Norway, Latvia, Lithuania, Estonia, Czech Republic and Slovakia. Finland and Sweden also belong to this group; however, the two oldest cohorts in Finland have levels of up to 40% of low educational attainment. Among these nations are countries whose levels of low educational attainment do not exceed 20%, with the exception of Denmark in 2010. In these countries, we observe a widening of the generational gap over time, which indicates that the younger cohorts are those that invest the most in education.

Group 2 comprises another set of CEE countries that can somewhat be linked to the Austro-Hungarian empire – namely Hungary, Poland, Slovenia and Austria. In these countries, the level of low educational attainment does not exceed 30%. There is a greater divergence among the various cohorts, reaching a range of nearly 20% between the lowest (13%) and highest values (30%). In these countries, the three youngest cohorts stay close together at around 15%, whereas the gap with older cohorts is wide. This shows that in these countries it is mainly the younger cohorts that will upgrade their ISCED levels rather than the older ones and differences between the young and old are relatively large compared with other countries.

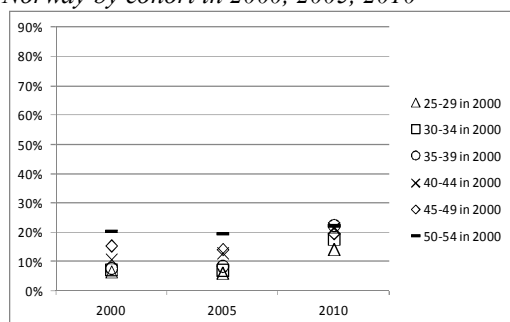
Group 3 consists of the Benelux countries and France joined by Iceland, Romania, Bulgaria and the UK. These countries have levels of low educational attainment of between 40 and 60%. One can observe two patterns among the countries in terms of the differences between the various age groups. Belgium, France and Romania show a relatively stable and considerable divergence between age groups, such that the youngest cohorts' attainment levels are nearly 30 percentage points lower than those of the oldest groups. This group has basically no variation between the age cohorts. The other countries in this group (the UK, the Netherlands, Luxembourg, Bulgaria and Iceland) show greater divergence between age cohorts and greater fluctuation in the period observed. The fluctuation usually proves better for the oldest age groups.

Group 4 includes countries that have been hit hardest by the crisis: Ireland, Spain, Italy, Greece and Portugal. In these countries, we can observe the largest shares of low educational attainment, ranging from 60 to 90%. This group also has the highest levels of divergence among age cohorts. There is relative stability throughout the period observed without any disproportionate rise or decline of any of the age groups.

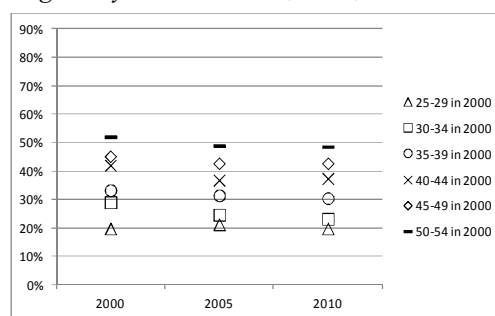
Figure 10 shows that the countries with low percentages of low educational attainment (mainly Nordic and CEE countries) are also those that show the highest clustering of low levels among the younger cohorts and a larger relative difference in relation to the older cohorts. In countries with higher levels of low educational attainment (mainly southern and crisis-stricken countries), we can observe a larger upgrading of older cohorts.

Figure 10. Country examples of cohort dynamics in changes in low educational attainment between 2000 and 2010 (cohorts aged 25-29 to 50-54 in 2000)

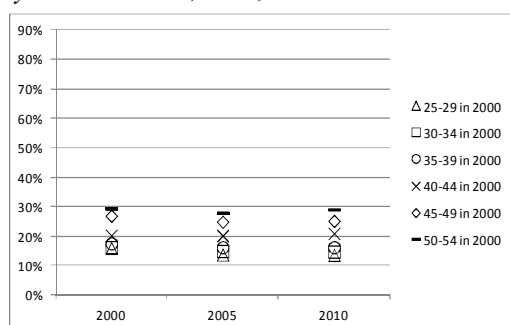
Group 1: Low educational attainment in Norway by cohort in 2000, 2005, 2010



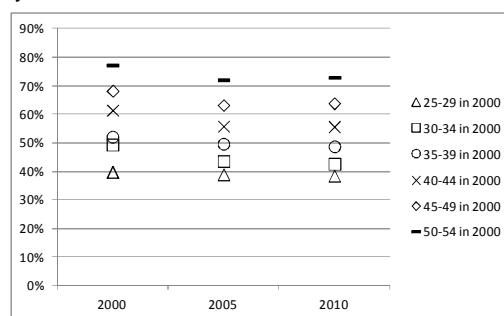
Group 3: Low educational attainment in Belgium by cohort in 2000, 2005, 2010



Group 2: Low educational attainment in Austria by cohort in 2000, 2005, 2010



Group 4: Low educational attainment in Spain by cohort in 2000, 2005, 2010



Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

Figure 11 shows the percentages of high educational attainment by cohort for selected countries. The figure shows that the youngest generation (aged 25-29 in 2000) displays the highest percentage of high educational attainment. Again, we can group countries into various clusters. The main differentiating feature in the spectrum of high educational attainment is the behaviour of the various age cohorts across time.

Group 1 countries are mainly the Central European countries joined by Italy and Austria. These countries are namely the Czech Republic, Hungary, Romania, Slovakia, Italy, Austria and Latvia. They show the lowest levels of high educational attainment of all the observed countries, generally below 20% for all the age groups and time periods (with a notable exception of Latvia, which reaches 25% in the last timeframe). The second defining feature of this group is an extremely small and practically unchanging variation among age groups over time, never exceeding 8 percentage points between the youngest and the oldest cohorts. Another noticeable factor is a very small but existing level of increase in values between 2000 and 2010 for all age groups.

Group 2 includes Bulgaria, Greece, Estonia, the Netherlands and Portugal. These countries are not similar in the levels achieved by the age cohorts. The values vary from very low in Portugal to relatively high in Estonia. The main defining feature of this group is a medium level of variation between the highest and lowest levels of around 10-15%, as well as growth between 2000 and 2005 combined with relative stability between 2005 and 2010.

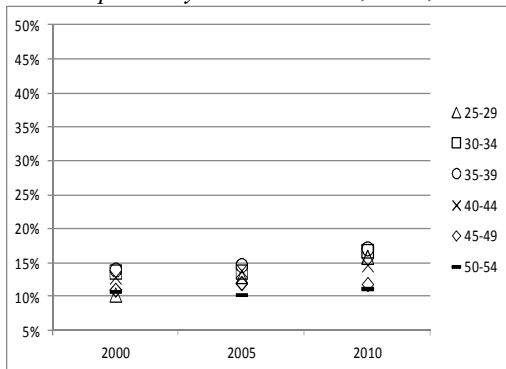
Group 3 countries include Nordic and liberal countries, namely Switzerland, Finland, Poland, Luxembourg, Sweden, Slovenia, the UK and Ireland. They show a greater pattern of divergence among the various age cohorts combined with uneven growth specifically between 2005 and 2010. The best levels are achieved by the youngest cohorts. In these countries, all cohorts upgrade their percentages in high educational attainment at the same speed.

Group 4 comprises Belgium, Spain, Denmark, France, Norway, Iceland and Lithuania. These countries show high levels in the highest educational attainment and at the same time the largest variation between the highest and lowest levels of high educational attainment. They also show general stagnation or even decline for most age groups in one of the periods examined. In contrast to the Group 3 countries, overall the gap tends to widen over time with the most successful being the youngest age cohorts.

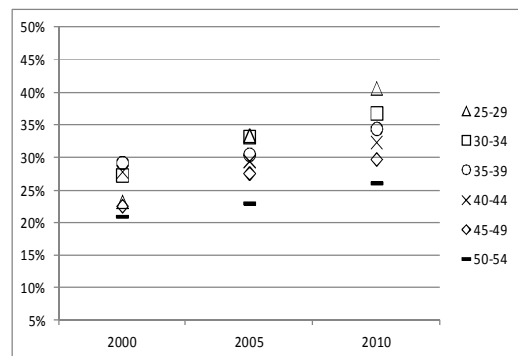
Figure 11 shows that countries with the highest percentage of high educational attainment are also those with the widest generational gaps. Countries with low levels of high educational attainment do not show large differences among the cohorts. However, countries with high educational attainment show more variation across cohorts: either the cohorts can stay close together as in Group 2 or the gap can widen as the cohorts grow older (Group 3), or the variation can be large and stay large as in the Group 4 countries. Furthermore, similar to Figure 7, we can see that older cohorts still increase their levels of educational attainment, and in some (Group 4) countries they do so even at the same speed as the younger cohorts.

Figure 11. Country examples of cohort dynamics in changes in high educational attainment between 2000 and 2010 (cohorts aged 25-29 to 50-54 in 2000)

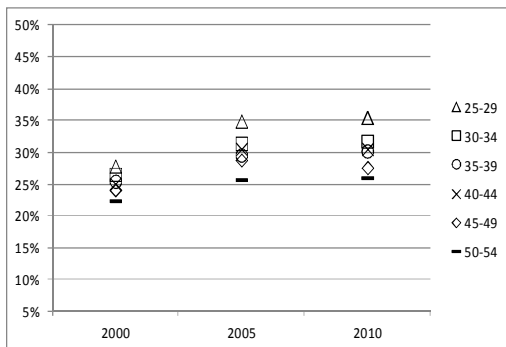
Group 1: High educational attainment in the Czech Republic by cohort in 2000, 2005, 2010



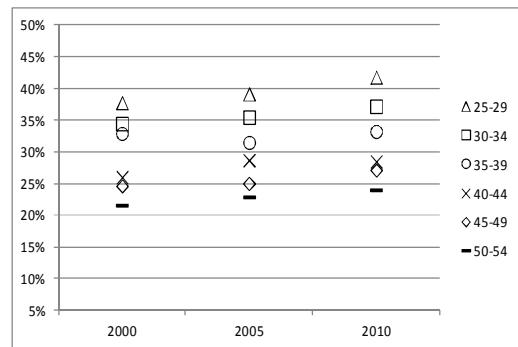
Group 3: High educational attainment in Switzerland by cohort in 2000, 2005 and 2010



Group 2: High educational attainment in the Netherlands by cohort in 2000, 2005, 2010



Group 4: High educational attainment in the Belgium by cohort in 2000, 2005, 2010



Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

5.2 Regressions

Table 2 shows our results from least squares dummy variable regressions of a synthetic panel.¹⁹ The regressions are performed for participation in education and training, change in educational attainment from the low (ISCED 0-2) to the medium ISCED level (ISCED 3-4) and change in educational attainment from the medium to the high ISCED level (ISCED 5-6).

The regression analysis allows us to control for various cohort composition variables, such as the percentage of foreign-born individuals. Regression analysis therefore allows us to overcome some of the identification problems outlined in section 4.

Participation in education and training

The first column in Table 2 shows the results of the least squares dummy variable regression for participation rates in education and training. As shown in Figures 5 and 6, across all cohorts participation rates in education and training are significantly higher in Switzerland, Denmark, Finland, Iceland, the Netherlands, Norway, Sweden and the UK than in other countries. Controlling for the explanatory variables, across all cohorts and in all countries participation in education and training is not significantly different for 2000, 2005 and 2010. The results show that cohorts with more women than men participate more in education and training and that cohorts with more foreign-born individuals participate less in training and education. Once controlling for education levels these differences are no longer significant. Cohorts with a higher percentage of high or medium education compared with a low educational attainment also display higher rates of participation in education and training. Furthermore, cohorts with a higher percentage in part-time employment display higher participation in education and training. We also control for ISCO codes and find that compared with elementary occupations, cohorts with more professionals, technicians, service workers, skilled agricultural and craft-related occupations show a higher rate of participation in training and education. This confirms the findings from previous studies reported in section 2.

Change in educational attainment

The second and third columns in Table 2 show the results for the least squares dummy variable regressions for change in educational attainment. In terms of the control variables, we find that similar to the results for the regression of participation in education and training, the coefficients for gender and country of birth become insignificant, as we add additional controls. Cohorts with higher rates of participation in education and training also display a positive change in the percentage of those who attained a high education level. There is no such significantly positive correlation between the percentage of participation in education and training and the percentage point increase in medium educational attainment. A part-time contract has a similarly negative and significant effect on participation in education and training as it does on upgrading from a low to a medium education level. Cohorts with more professionals and technicians are generally those with higher rates of participation in education and training and also in upgrading to medium or to high levels of educational attainment. In terms of the interpretation of the country dummy variables, we refer to our interpretation of Figure 12 below. The table shows that participation in education and training is generally determined in a similar way as upgrading to a medium or a high level of educational attainment.

¹⁹ As explained above, a synthetic panel can be understood as a panel in which cohorts are treated as individuals, where each observation for a cohort is computed as the average value of the cohort.

Table 2. Results of least squares dummy variable regressions for participation in education and training and change in educational attainment between 2005 and 2010

	(1) Participation in education and training	(2) Change to high educational attainment between 2005 and 2010	(3) Change to medium educational attainment between 2005 and 2010
Female	0.119 (0.167)	-0.120 (0.149)	-0.0195 (0.149)
Foreign born	-0.0302 (0.0508)	0.0475 (0.0520)	0.0666 (0.0412)
High education	0.194*** (0.0376)		
Medium education	0.124*** (0.0353)		
Participation in training and education		0.206** (0.0827)	-0.0861 (0.107)
Part-time contract	-0.168*** (0.0509)	0.00299 (0.0378)	-0.0616* (0.0359)
Legislators	-0.109 (0.130)	0.112 (0.118)	0.148 (0.131)
Professionals	0.370*** (0.113)	0.233* (0.119)	-0.0194 (0.115)
Technicians	0.649*** (0.105)	0.206** (0.0953)	0.353*** (0.123)
Clerks	0.0501 (0.152)	-0.220 (0.162)	-0.00963 (0.175)
Service and sales	0.626*** (0.127)	0.0578 (0.135)	-0.0440 (0.169)
Skilled agriculture and fishing	0.438*** (0.104)	0.110 (0.100)	0.0149 (0.101)
Craft and related	0.389*** (0.129)	0.218* (0.131)	-0.0820 (0.151)
Machine operator	-0.0288 (0.135)	0.260 (0.187)	-0.111 (0.149)
BE	0.0231 (0.0152)	0.0178 (0.0151)	0.0285 (0.0174)
BG	-0.119*** (0.0169)	0.00199 (0.0175)	0.0740*** (0.0180)

CH	0.137*** (0.0159)	-0.0314* (0.0180)	0.0234 (0.0182)
CZ	-0.125*** (0.0162)	-0.0181 (0.0155)	0.00116 (0.0196)
DK	0.0991*** (0.0146)	-0.0922*** (0.0183)	-0.0728*** (0.0250)
EE	-0.0466** (0.0180)	-0.0340 (0.0224)	0.0138 (0.0188)
ES	0.00996 (0.0179)	-0.0130 (0.0135)	0.0277** (0.0106)
FI	0.0587*** (0.0149)	-0.0346** (0.0155)	0.0231 (0.0140)
FR	-0.0494*** (0.00981)	0.00889 (0.00923)	0.00970 (0.00892)
GR	-0.0795*** (0.0162)	0.0123 (0.0182)	0.00560 (0.0190)
HU	-0.102*** (0.0137)	0.00904 (0.0152)	0.0461*** (0.0156)
IE	0.0240 (0.0218)	0.0528** (0.0209)	0.0713*** (0.0244)
IS*	0.105*** (0.0145)	0 (0)	0 (0)
IT	-0.0375*** (0.0142)	0.00602 (0.00922)	-0.00635 (0.00807)
LT	-0.121*** (0.0173)	-0.00408 (0.0207)	0.0452** (0.0175)
LU	-0.0154 (0.0226)	0.0108 (0.0186)	0.0686*** (0.0248)
LV	-0.0696*** (0.0143)	0.0305 (0.0214)	0.0386*** (0.0147)
NL	0.0891*** (0.0190)	-0.0237* (0.0123)	-0.000116 (0.0117)
NO	-0.0458*** (0.0150)	-0.0411*** (0.0151)	-0.0910*** (0.0274)
PL	-0.117*** (0.0159)	0.00579 (0.0155)	0.0436*** (0.0159)
PT	-0.00487 (0.0201)	0.00726 (0.0137)	0.0442*** (0.0157)
RO	-0.141*** (0.0189)	0.00276 (0.0183)	0.0174 (0.0204)

SE	0.0333** (0.0151)	-0.0484*** (0.0135)	-0.0471*** (0.0138)
SI	0.0107 (0.0139)	-0.0269* (0.0147)	0.0185 (0.0145)
SK	-0.132*** (0.0167)	-0.00881 (0.0168)	0.0182 (0.0191)
UK	0.179*** (0.0206)	0.0170 (0.0167)	0.0281 (0.0179)
2005	0.00647 (0.00426)		
2010	0.000132 (0.00572)		
Constant	-0.327** (0.140)	-0.0689 (0.125)	-0.0383 (0.120)
Observations	419	155	155
R-squared	0.924	0.747	0.875

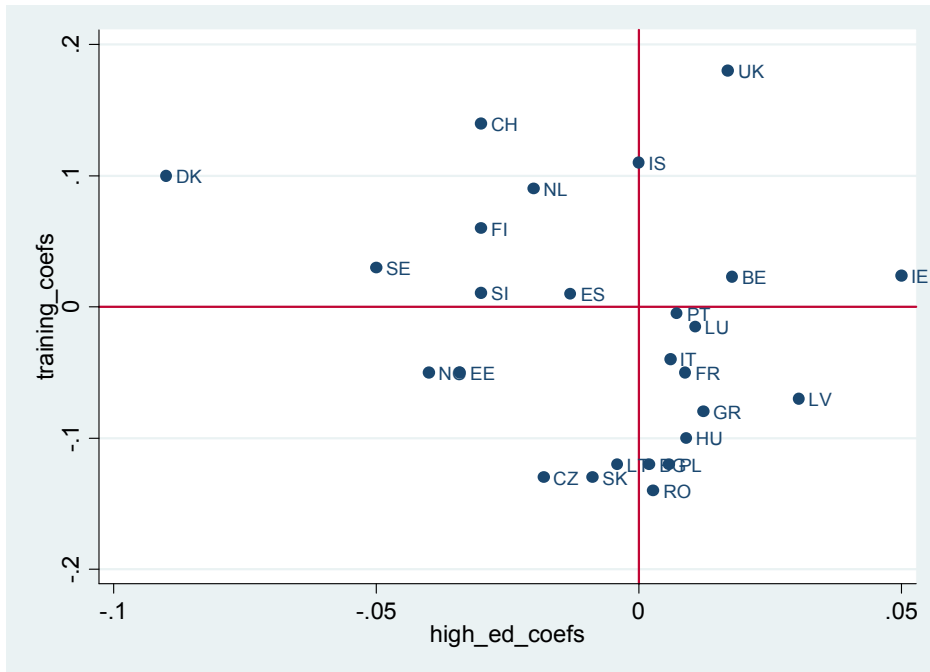
* Iceland was dropped in the regression of changes in educational attainment due to multicollinearity with the variable 'foreign born', which is missing for 2010.

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

Source: European Labour Force Survey microdata, cohort averages weighted with frequency weights.

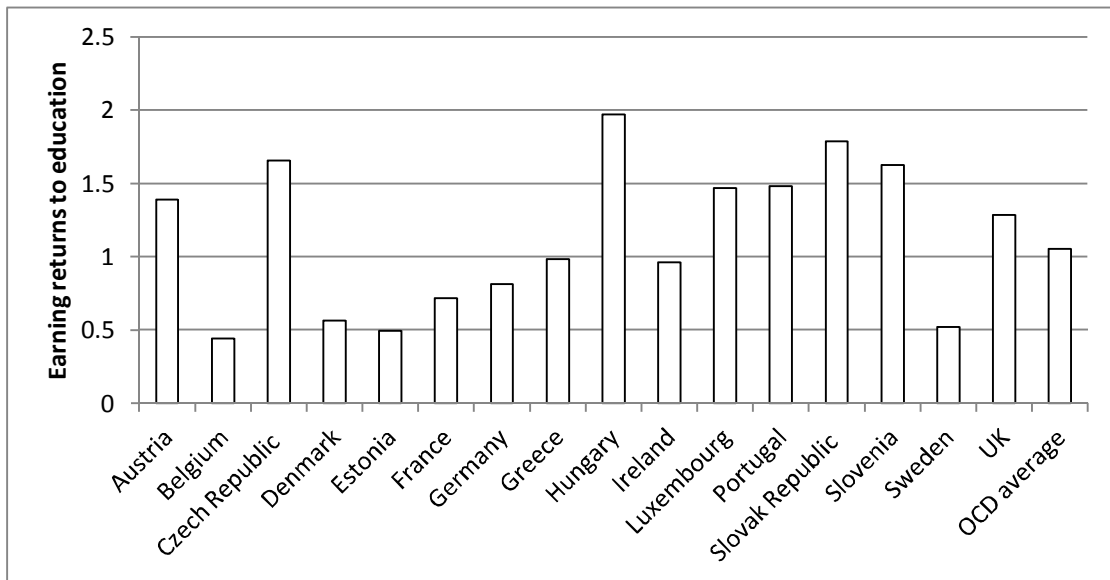
Finally, making use of the regression results in Table 2 we can compare how countries fare in terms of the combination of two different upgrading strategies. Figure 12 displays a scatter plot between the country coefficients on participation in education and training and the country coefficients on change in high educational attainment. We attempt to group countries into those with generally low levels of upgrading either through participation in education and training or through an increase in educational attainment (ISCED upgrading). We find that – relative to the base category country, Austria – a number of European countries fare well on both dimensions (see the upper right quadrant in Figure 12). Compared with other countries in the sample, they display high participation rates as well as high ISCED upgrading rates. This could indicate that in these countries participation in education and training generally leads to degrees that increase the ISCED levels. The Scandinavian countries and Switzerland fare well on the participation dimension (as shown for the Scandinavian countries in Figures 4 to 6) but less well on the ISCED upgrading dimension. Possibly the ISCED upgrading after the age of 25 might be relatively low in these countries because ISCED levels reached before 25 are already high and call for only a little improvement at later age. Relatively high levels of ISCED upgrading but relatively low levels of participation in education and training can be found in the Czech Republic, Italy, Poland, Slovakia and Austria. The main benefits of ISCED upgrading are increased gross earnings and job prospects. Figure 13 suggests that the benefits from getting a higher degree are the highest in Central European countries, where we also observe the higher levels in ISCED upgrading. The returns to education could be a possible explanation for why the ISCED upgrading is relatively higher in these countries. Finally, two countries that fare well on both dimensions – participation in education and training as well as a change in educational levels – are the two liberal countries, Ireland and the UK.

Figure 12. Training and ISCED upgrading towards high educational attainment in comparison, 2010 (the base category is Austria)



Source: Own calculations from Table 2.

Figure 13. Earning returns to education in 2009 (from upper secondary to a high education level)



Source: OECD indicators (*Education at a glance*, OECD, 2009).

6. Conclusion

In this paper we have set out to 1) measure participation in education and training across and within cohorts over time in 27 European countries, 2) measure actual changes in ISCED levels across and within cohorts over time in 27 European countries and 3) compare how countries fare in terms of the two dimensions of skill increases: educational attainment (changes in ISCED levels) and participation in education and training.

Our results are threefold:

- 1) We find that indeed there seems to be a decline in participation in education and training associated with age as well as a widening of the generational gap between those aged 25-29 and those aged 50-54 from 2000 to 2010. However, we detect two forces counterbalancing these dynamics. First, in most countries there is a general increase in participation in education and training that is observable across all cohorts. Second, the decline with age slows down or even reverses for cohorts older than 25-29. In terms of educational attainment, we can see that older cohorts still increase their levels in education towards high educational attainment – and in some countries (such as in Belgium, Denmark, Norway and Iceland) they do so even at the same speed as the younger cohorts.
- 2) Looking at both approaches to skill increases – participation and training and the increase of educational attainment levels – we find that participation in education and training is generally determined in a similar way as the upgrading to a medium or high level of educational attainment. More specifically, a part-time contract has a similar negative and significant effect on participation in education and training as on upgrading from a low to a medium education level. In addition, cohorts with more professionals and technicians are generally those with higher rates of participation in education and training as well as in upgrading to medium or to high levels of educational attainment. Variables measuring the composition of the cohort in terms of being foreign born and gender lose their significance as soon as we control for education variables.
- 3) Finally, in a country comparison, we find that the Scandinavian countries and Switzerland fare well on the participation dimension but less well on the ISCED upgrading dimension. Possibly the ISCED upgrading after the age of 25 might be relatively low in these countries because ISCED levels reached before 25 are already high and call for only little improvement at later age. Relatively high levels of ISCED upgrading but relatively low levels of participation in education and training can be found in CEE countries. We interpret this observation as a catching-up effect, which is most likely due to the fact that during the Communist regime the highly skilled supply was historically suppressed, which meant that demand outstripped supply. Consequently, there is now a need for more highly skilled persons, and in addition – owing to a large supply of those with a medium education level – there is already a pool of persons eligible to enter tertiary education. Finally, two countries that fare well on both participation in education and training and the change in educational levels are the two liberal countries, Ireland and the UK.

Our results show that adults learn at all ages and not necessarily in a linearly negative relation to age. The relationship between age and adult learning is far more complex as our paper has shown. Our results also provide evidence that adults learn in various forms; depending on the country, it either leads to a change from a low to a medium or from a medium to a high level of education or it merely leads to a change in participation rates.

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