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EDWIN

FINAL REPORT

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Education and Wage Inequality in Europe

EDWIN

Final report

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Preface

Within the Fifth Community RTD Framework Programme of the European Union (1998–2002), the Key Action 'Improving the Socio-economic Knowledge Base' had broad and ambitious objectives, namely: to improve our understanding of the structural changes taking place in European society, to identify ways of managing these changes and to promote the active involvement of European citizens in shaping their own futures. A further important aim was to mobilise the research communities in the social sciences and humanities at the European level and to provide scientific support to policies at various levels, with particular attention to EU policy fields.

This Key Action had a total budget of EUR 155 million and was implemented through three Calls for proposals. As a result, 185 projects involving more than 1 600 research teams from 38 countries have been selected for funding and have started their research between 1999 and 2002.

Most of these projects are now finalised and results are systematically published in the form of a Final Report.

The calls have addressed different but interrelated research themes which have contributed to the objectives outlined above. These themes can be grouped under a certain number of areas of policy relevance, each of which are addressed by a significant number of projects from a variety of perspectives.

These areas are the following:

- ***Societal trends and structural change***

16 projects, total investment of EUR 14.6 million, 164 teams

- ***Quality of life of European citizens***

5 projects, total investment of EUR 6.4 million, 36 teams

- ***European socio-economic models and challenges***

9 projects, total investment of EUR 9.3 million, 91 teams

- ***Social cohesion, migration and welfare***

30 projects, total investment of EUR 28 million, 249 teams

- ***Employment and changes in work***

18 projects, total investment of EUR 17.5 million, 149 teams

- ***Gender, participation and quality of life***

13 projects, total investment of EUR 12.3 million, 97 teams

- ***Dynamics of knowledge, generation and use***

8 projects, total investment of EUR 6.1 million, 77 teams

- ***Education, training and new forms of learning***

14 projects, total investment of EUR 12.9 million, 105 teams

- ***Economic development and dynamics***

22 projects, total investment of EUR 15.3 million, 134 teams

- ***Governance, democracy and citizenship***

28 projects; total investment of EUR 25.5 million, 233 teams

- ***Challenges from European enlargement***

13 projects, total investment of EUR 12.8 million, 116 teams

- ***Infrastructures to build the European research area***

9 projects, total investment of EUR 15.4 million, 74 teams

This publication contains the final report of the project 'Education and Wage Inequality in Europe', whose work has primarily contributed to the area 'The challenge of socio-economic development models for Europe'.

The report contains information about the main scientific findings of EDWIN and their policy implications. The research was carried out by nine teams over a period of 35 months, starting in November, 2002.

The abstract and executive summary presented in this edition offer the reader an overview of the main scientific and policy conclusions, before the main body of the research provided in the other chapters of this report.

As the results of the projects financed under the Key Action become available to the scientific and policy communities, Priority 7 'Citizens and Governance in a knowledge based society' of the Sixth Framework Programme is building on the progress already made and aims at making a further contribution to the development of a European Research Area in the social sciences and the humanities.

I hope readers find the information in this publication both interesting and useful as well as clear evidence of the importance attached by the European Union to fostering research in the field of social sciences and the humanities.

J.-M. BAER,

Director

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Acknowledgements

Our gratitude goes to ZEW in Mannheim and DG-Research in Brussels for valuable help in arranging the two policy-oriented workshops of the project.

Abstract

The EU and most national governments consider educational expansion as an important policy tool for reversing or slowing the rise in inequality observed in a growing number of European countries. At the same time, emerging evidence reveals that aggregate wage inequality is due not only to differences in educational attainment but also to disparities within educational groups. This 30-month project on *Education and Wage Inequality in Europe – EDWIN* (HPSE-CT-2002-00108) has addressed the key question of the interplay between educational expansion and wage inequality in Europe. It has aimed to understand and explain the observed patterns and trends and to study the practical implications for economic and social policy.

To further this aim, in-depth empirical analysis has been carried out on the relationship between education and wage inequality in Europe over the past few decades, up to the new millennium, with a focus on wage inequality not only between groups but also within groups (stratified according to education, gender, age, and sector). This research has contributed with new European-wide knowledge in the form of: (1) a broad-based literature review drawing together the 'pre-EDWIN' international as well as national evidence on the interplay between education and wage inequality; (2) new cross-European comparative evidence on the level, structure and inter-temporal changes of earnings inequality; (3) new cross-European comparative evidence on the economic effects of demographic and educational shocks both in terms of earnings and (un)employment; and (4) new comparative cross-European evidence on the private economic benefits from investing in education with particular emphasis on the extent and evolution over time of within-educational-group differences in returns and, hence, on the wage risk associated with investments in education, and, in the last resort, on the observed patterns of wage inequality.

Additionally, project research has explored major policy-relevant explanations for the observed patterns and trends in between-groups and, especially, within-groups wage inequality, thus proving: (5) new cross-European evidence on the role of labour market institutions and flexibility arrangements in shaping the economic impact of the boom in education and, especially in tertiary-level education; (6) new cross-European evidence on the relative importance of over-education; (7) new knowledge on European gender wage gaps with particular emphasis on the role played by women's changing attitudes towards educational investments and labour market participation; (8) highlights on the role of school quality in the production of educational skills during compulsory schooling; and (9)

new cross-European evidence on the role of labour market inefficiencies in explaining the large differences observed in training incidence.

A multitude of policy implications has been derived with respect to both education policies (quantity and quality) and labour market policies (institutions, equality, training). The future needs of research and data improving efforts have also been pointed to.

The project's web site at http://www.etla.fi/edwin provides details on objectives, participants, arranged events and published results. Contact person: Rita.Asplund@etla.fi

I. EXECUTIVE SUMMARY

1. Objective of the project

The overarching objective of the 30-month project on *Education and Wage Inequality in Europe – EDWIN* (HPSE-CT-2002-00108) has been to undertake in-depth analysis of the interplay between educational expansion and wage inequality in Europe over the past few decades, up to the new millennium. The novelty of the research is that it has analysed, using cross-country comparative data, the underlying patterns and trends in both between-groups and within-groups wage inequality within and across European countries, as well as looked for major policy-relevant explanations for the obtained findings. The research has been focussed to produce new knowledge that not only improves policy-makers' understanding of the link between educational expansion and wage inequality and its main consequences, but also identifies policy options to tackle and manage the ongoing changes.

For these purposes, the detailed aims of the project have been

1) to provide a *comprehensive literature review* on education and wage inequality that sets out the current state-of-the-art with respect to scientific results, policy implications and knowledge gaps;

2) to undertake in-depth analysis of the *structure and change in European wage inequality* in order to provide a broad-based European-wide picture of the static and dynamic nature of overall wage inequality and its between and within dimensions;

3) to further enhance the understanding of the *education–wage link between cohorts and its evolution over time* within and between the European countries, with special reference to intergenerational effects arising from the expansion in higher education;

4) to further enhance the analysis of the *education–wage link within cohorts and its evolution over time* within and between the European countries, with special reference to intragenerational effects arising from the expansion in higher education;

5) to draw together this multitude of results produced by means of several alternative but highly complementary approaches and methodologies in an attempt to evaluate the relative importance of the between and within

dimensions for overall wage inequality, and to analyse a number of possible *policy-relevant explanations for the observed patterns and trends*. Among the explanations investigated are: labour market institutions and flexibility arrangements; educational, skill and institutional quality differences; over-education and job competition; gender differences; and experience and training.

2. Concise summary of scientific results

The structure of and inter-temporal changes in wage inequality in Europe:

1) The level of earnings inequality varies considerably across EU countries.

2) In most countries the bulk of inequality emanates from differences within (rather than between) narrowly defined groups of workers.

3) Very substantial cross-country differences exist in the structure of earnings inequality.

4) The distribution of education is usually the factor most closely associated with earnings inequality (rather than age, sex or sector of employment).

5) In most countries the observed rise in earnings inequality was driven primarily by rises in inequality within (rather than between) groups of workers.

Economic effects of demographic and educational change:

6) Demographic changes – the so-called 'baby bust' – as well as long-term changes in the skill structure of the labour force – the 'educational boom' – have, ceteris paribus, played a significant role in improving overall employment performance and also in alleviating youth unemployment in Europe.

7) These demographic and educational shifts have had qualitatively different effects on young and adult workers. Previous studies have not provided a full picture of this phenomenon, because no distinction has been made between the two types of structural change.

8) Education matters. The long-term increase in educational achievement has reduced, ceteris paribus, the unemployment rate of the more educated. This finding, which stands in sharp contrast to the standard textbook supply–demand model, holds true also when skill-biased technological change and the endogeneity of educational choices are taken into account.

9) The overall effect of cohort size on European earnings is negative but rather modest. It varies, however, by education and age. Moreover, it is stronger in the Southern European countries than in Continental and Northern Europe.

The dynamics of changing wage distributions in Europe:

10) Investments in education have continued to provide a significant private return to individuals in the European labour market. Despite a strong increase in the relative proportion of high-educated workers, the wage premium has remained remarkably stable.

11) Educational investments are, however, associated with a significant amount of wage risk, which arises from the fact that individuals who otherwise perform better in working life tend to reap a higher return from their investments in education.

The role of labour market institutions and flexibility arrangements:

12) Effects on employment: Labour market institutions have contributed to the changing fortunes of the least protected workers and have influenced unemployment rates in various ways. In particular, unemployment benefits raise unemployment, while bargaining coordination and employment protection reduce it.

13) Effects on wages: Labour market institutions affect the wage distribution in various ways. Bargaining coordination tends to compress wages especially from the top of the wage distribution. Employment protection tends to compress wages especially from the bottom of the wage distribution. The relationship between union membership and wage compression remains ambiguous, although within-country evidence suggests that union membership has a wage compressing effect. Institutional factors reduce wage inequality in the covered sector, but increase it in the uncovered and less protected sector. These opposite effects are likely to be stronger in the Southern European economies, where the high institutional protection granted to the covered sector is offset by the conspicuous role played by the unprotected sectors.

14) Education-intensive companies have fewer unionised employees, are less likely to be covered by collective agreements, and, if they are, these agreements tend more often to be determined at the local level. Indeed, the use of individual performance based pay systems is more frequent in these companies. They are likely to be more innovative, to undertake organisational changes, to invest

more in on-the-job training, and to pay higher wages. All this evidence in support of the productivity-enhancing effects of education explains, at least partly, why wage dispersion is higher among the higher educated.

Does Europe face an over-education problem?

15) 'Over-education' – in the sense of working in jobs requiring less education than one has – is widespread in most European countries. Exactly how much over-education there is depends crucially on the precise definition that is used in the data which is examined. There is no evidence that the rate of over-education has been rising over the last 10 years in European countries.

16) A challenging issue is how to reconcile the presence of over-education with rapidly rising educational participation and the existence of substantial private returns to educational investment. A major reason for the co-existence of these contradictory phenomena is that much of the over-education is explained by occupational structure and labour force mobility, that is, concerns dynamic adjustment processes. Many individuals are moving from one geographical location to another and will not obtain jobs commensurate with their qualifications in the short term. Also, there are new recruits to the labour market who take some time to find a suitable job.

17) Looking across countries there is some limited evidence that over-education is higher when the educational participation rate rises and when unemployment is higher. In addition the rate of return to education is lower when over-education is higher. At the level of the individual the effect of over-education is to reduce earnings by 2 to 18 % depending on circumstances. These findings suggest that there is a genuine policy issue with respect to the level of educational provision.

Gender and labour market inequality:

18) Labour market prospects for men and women in European countries remain unequal. There are large differences across Europe in the size of the gender pay gap. In general this pay gap has been declining in most countries but at a differential rate in each.

19) The project examined the extent to which the gender pay gap can be explained by: gender differences in educational choices, occupational segregation and behavioural differences in the participation decision across countries. Each of these factors was found to be important in the explanation of the gender pay gap.

School quality and educational skills:

2) Student characteristics and family background are the most important determinants of student achievement, while the effects of school quality, as proxied by, for example, school resources, stand out as surprisingly weak.

21) The variation in educational skills across European countries seems to be explained more by differences in institutions and the process of skill formation than by differences in resources and student characteristics.

22) However, disadvantaged students do benefit from more resources, especially during earlier grades. This underlines the importance of distinguishing between students of different characteristics.

Market failures and the under-provision of training:

23) Workplace training policies can be justified both on equity and efficiency grounds. Equity refers to the distribution of training, while inefficiency depicts under-provision of training in the absence of policy intervention. Designing policies aimed at reducing under-provision of training requires that the causes of under-provision are correctly identified.

24) Training is not provided equally: the young and better educated face a significantly higher probability of receiving employer-provided training, and training is more likely in the public sector and among large firms.

25) Companies provide and pay for training, both general and specific, which can be taken as evidence that labour markets are not perfectly competitive.

26) There is no clear evidence that training is lower than the socially efficient level. Without such evidence, it is difficult to justify policy intervention which aims at restoring efficiency. By investing in training, firms can reduce worker turnover and attenuate the reasons for under-provision. The empirical evidence on this, however, is not uncontroversial.

27) Even in the absence of clear evidence of under-provision, policy intervention can be justified because of equity reasons.

3. Policy implications

3.1. The structure of and inter-temporal changes in wage inequality in Europe

There is a rapidly growing body of literature exploring and comparing earnings inequality across a varying number of European countries. Few of the studies are truly comparative in nature, though. The first task of the EDWIN project was to provide a comprehensive analysis of the level and structure of earnings inequality, as well as the patterns of observed changes in earnings inequality in a number of European countries.

Considerable cross-country differences were found to exist across Europe in both levels and structures of earnings inequality. A common feature of a majority of countries, however, is that of the four factors examined (education, age, sex and sector of employment), education and, to a lesser extent, age turned out to be most closely associated with inequality – a result broadly in line also with human capital theory. These effects are not uniform across countries, though. On the contrary, they differ not only in magnitude but also in their nature, that is, with respect to whether they arise primarily 'between groups' or 'within groups'. The results also demonstrate that, in most countries, the main factor behind the observed changes in earnings inequality over the past few decades has been changes in inequality 'within groups' irrespective of the partitioning criterion used, while the effect of changes in group mean earnings (the 'between groups' effect) has almost always been negligible. Changes in the composition of the labour force with respect to these same criterions have typically had a modest effect on earnings inequality, although the effect has differed both in magnitude and direction across countries. Only in a few of the investigated countries has the effect been relatively large, but by no means uniform, and mainly when the partitioning factor is education.

Taking into account this heterogeneity of European countries regarding trends in the level, structure and patterns of earnings inequality, it is rather unlikely that a given type of policy would have very similar effects across countries. Therefore, if – and this is a big 'if' – the stated aim of policy is to reduce earnings inequality, different policies for different European countries are likely to be appropriate.

3.2. Economic effects of demographic and educational change

Most European countries have, over the past decades, experienced substantial changes in the demographic as well as the educational composition of their populations. The main objective of this part of the EDWIN research was to investigate the effects of these 'baby bust' and 'educational boom' phenomena on age- and education-specific earnings and

unemployment patterns in Europe, and to search for explanations for the observed patterns and trends in economic factors and labour market institutions.

A major finding from this research was that demographic and educational shocks are qualitatively different for young and adult workers. While age-specific unemployment rates show that youth unemployment is, in general, two to three times higher than adult unemployment, young worker cohorts were found to have benefited more – they are less numerous and relatively more educated – in terms of employment opportunities from the demographic trends ('baby bust') that have characterised Europe in recent decades. This evidence is of particular relevance in view of an ageing Europe and deteriorating age-dependency ratios. Moreover, it stands in sharp contrast with models involving search externalities and age having a positive impact on the matching function. Indeed, most previous studies have been unable to account for the full picture as no distinction has been made between demographic changes and shifts in the educational composition. Finally, the 'baby bust' has without doubt flattened the European earnings–age profile, but the size of this effect has been small, on average, and completely driven by Southern European countries due to institutional differences. The minor negative effect of cohort size on earnings emphasises further the importance of analysing, in parallel, the potential effects of demographic changes on (un)employment patterns.

Due to the changing age structure of the European population, the burden of unemployment is increasingly shifting to adult workers, particularly women and the low skilled. Active labour market policy (ALMP) measures need to be targeted at the re-employment of these particular groups of displaced workers, although, admittedly, such measures have generally proved to be costly, in most cases only mildly effective, and when targeted at a specific group, can generate adverse effects on other vulnerable groups. Therefore, too much should not be expected even from ALMP measures as a therapy for demographic and skill shocks. Accordingly, equally important is to guarantee the provision of both publicly and employer provided education and training a more active role in this context.

3.3. The dynamics of changing wage distributions in Europe

The private rate of return to education is a useful indicator when trying to quantify the economic benefits of education in general and the incentives for individuals to invest in their own human capital in particular. Typically these pay-offs are characterised in terms of averages whereas little attention is paid to the fact that the dispersion around these averages might be substantial. The fact that individuals having acquired the same education are rewarded differently in the labour market introduces a non-negligible

within-groups dispersion component into the relation between education and wage inequality. Moreover, since within-group wage dispersion tends to increase with the level of education, an educational expansion at higher degree levels is likely to affect also within-group and, hence, aggregate wage inequality. Put differently, educational expansion as a policy tool for combating economic inequality may, under certain circumstances, instead work against economic equality. Equally important, variation in returns suggests that educational choices involve a certain amount of wage risk. This, in turn, might have implications for the demand of education.

The market price of education, as measured by the average annual return to education, was found not to have changed much in Europe over the past decade. However, the average annual rate of return to an additional year in schooling is surrounded by quite a substantial amount of variation, as are also the wage premiums associated with graduation at different educational levels. Moreover, the return to education is typically notably higher at the top as compared to the bottom end of the conditional wage distribution, and this tendency increases with the educational level. Equally important, this differential has increased over the past decade in a majority of the European countries under study. Put differently, while between-educational-group wage dispersion has remained approximately unchanged (or occasionally even decreased), within-educational-group wage dispersion and, thus, the educational-investment-related wage risk has displayed an increasing trend, especially at the tertiary level. Accordingly, educational expansion, not least at the tertiary level, is likely to have contributed to the increase in overall wage inequality observed in the European labour markets.

Hence, policies aimed at increasing educational attainment can be expected to raise average earnings but also wage inequality due to the wage risk associated with educational investments. This wage risk, which was found to be considerable – and increasing – at the tertiary level, may also affect the demand for education among at least certain groups of individuals. All these aspects indicate that new instruments might be required for improving the equity and efficiency of educational funding. This notion is important also from the viewpoint that the virtuous circle “more education – more job posting – more good jobs” is predominantly determined and sustained by the extent and mode of public funding of education.

3.4. The role of labour market institutions and flexibility arrangements

The diverse situation across European countries in terms of their labour market institutions and education systems can be expected to shape not only overall wage inequality but also between- and within-educational-group wage inequality both across and within cohorts. Indeed, the increasing trend in wage dispersion in Europe does seem to be the intertwined outcome of several factors having evolved in parallel. Major contributions to this process have been provided by expansive educational policies, changing labour market institutions and new management strategies. The expansion of higher education has resulted in a compositional effect, where an increasing share of the European workforce has shifted from lower to higher levels of education and, thus, from lower-wage-dispersion groups to higher-wage-dispersion groups. Contrary to this, there is no evidence whatsoever of this policy having widened further the wage differences observed among the higher educated in Europe, an important reason being that the demand for educated labour has kept pace with the supply of individuals having completed a tertiary-level degree. The results also indicate that a compressed wage structure and/or comparatively low returns to education do not depress the supply of educated labour as long as they are balanced by appropriate incentives provided by policy instruments built into the education system, such as student aid. Hence, when addressing the quest for greater labour market flexibility and a progressively weaker role for labour market institutions, a clear distinction should be made between ‘bad’ labour market institutions (which distort the functioning of the labour market) and ‘good’ labour market institutions (which are designed to correct market failures).

Differences in labour market institutions account for a large part of the observed differences and trends in between-educational-group and within-educational-group wage inequality across Europe. Moreover, since labour market institutions tend to compress wages both from the top and the bottom of the wage distribution, an increasing share of the labour force being highly educated is likely to put pressure on existing bargaining systems in Europe (less coordination, unionism and collective agreements), and to speed up the adoption and implementation of new management strategies especially in companies with a large share of high-educated labour.

3.5. Does Europe face an over-education problem?

A major determinant of educational and income inequality is that many people who acquire educational qualifications do not get to use them or are not paid for using them in their jobs. Moreover, there is an obvious possibility that the expansion in post-compulsory education has caused problems of increased over-education and job

competition, which could offer at least part of an explanation for the observed changes in within-group wage inequality across Europe.

A strict interpretation of the over-education hypothesis suggests that over-education would lead to high unemployment rates amongst qualified workers and falling wages of workers with higher educational qualifications. This deterioration of wages for those with higher qualifications would make investments in education less profitable and, accordingly, act as a disincentive to enrol in higher education. The available empirical evidence, in contrast, reveals that there have been unchanged or even increasing returns to higher education, as well as rising participation in tertiary-level education. This is running parallel with relatively high levels of over-education in many European countries, albeit much of this over-education turns out to be of a temporary rather than a stationary nature.

The main policy question in relation to the over-education problem is to establish to what extent it represents a real waste of resources. It is clear that a large fraction of the labour force works in jobs they are overqualified for, which has a modest negative effect on their earnings potential. It is possible that these negative effects fall disproportionately on the disadvantaged in society. Despite these findings it is far from clear that governments should discourage private investment in education as short-term private returns to education are high and the long-term social return to education may remain high.

Governments can attempt to deal with the problem of over-education by influencing the demand for and/or the supply of educated labour in the economy. They can implement policies aimed at affecting the demand for labour within the private sector through macroeconomic policies, for example, by providing tax incentives to companies for them to make better use of skilled workers. The government can also affect the overall demand for labour through policies that affect its own labour force or influence the educational attainment of individuals entering the labour market by changing the private cost of education. Simultaneously policy-makers need to be concerned about any policy change which impacts on the labour market adjustment mechanisms (formal qualifications, training, etc.).

3.6. Gender and labour market inequality

The main difficulty when trying to assess the progress made towards gender wage gap reduction is to disentangle that part of the progress that is due to policy from the part that is due to gender-specific behavioural changes over time and, finally, to identify the part that remains as a result of discrimination. The main objective of this line of the

EDWIN research was to both up-date (previous work in this area is from the early 1990s!) and broaden the existing knowledge on European gender wage gaps by making comprehensive cross-country comparisons of different measures of the gender wage gap and its components in search for major explanations for the observed trends in the gender wage gap in Europe and, especially, the role played by women's changing attitudes towards educational investments and labour market participation.

The results show that there are significant differences in the extent, as well as in the structure of the gender wage gap across EU member states. This suggests that although the equal treatment target should be common to all countries, the means of achieving it should be country-specific. The undertaken analysis adds new knowledge by shedding light on the importance of designing specific policies for the different countries, depending on which group(s) of female workers is(are) the most likely to experience unequal treatment. By exploring a number of crucial dimensions of the distribution of the male–female wage gap it was possible to identify such key groups: (1) unequal treatment by age differs across countries with some countries revealing a need to focus on older rather than younger workers, although the extent of wage discrimination at older ages is likely to reflect the discriminatory effect accumulated over the working career; (2) unequal treatment does originate in underpayment of women but not in all countries, indicating that targeting relative appreciation of women's salaries vs. relative depreciation of men's salaries is a crucial issue; (3) occupational segregation is an important factor for understanding the gender wage gap, but in some countries wage discrimination is most serious in occupations employing high shares of women whereas in other countries, the opposite holds true; (4) in most countries, wage discrimination stands out as a more serious problem among part-time than full-time workers, suggesting that the larger the share of part-timers, the more attention these countries should pay to this group of workers; (5) the extent of wage discrimination within different educational groups varies substantially across countries with some countries revealing more outstanding wage discrimination among the high educated, implying that exclusive focus on the low-educated would largely be wrongly targeted policies.

All in all, countries should look for ways of further reducing the gender pay gap. There is, however, more scope for promoting gender pay equality in some countries by the use of policies which encourage and facilitate: return to work after child rearing, free occupational and education choice. As women are free: to pursue more stable careers with better access to child care and fewer interruptions, to choose more flexible work hours and to have better access to educational and occupational choices, then the gender wage gap should fall. Better policies to promote these changes could be introduced in most EU countries although some countries are much more equitable already.

3.7. School quality and educational skills

Compulsory schooling constitutes the major part of people's investments in education. While higher secondary and tertiary education deepen the general knowledge and enable students to specialize in certain subjects, the basic cognitive skills are acquired in primary and lower secondary education. They constitute the foundation of human capital which individuals build upon for the further accumulation of skills. As a consequence, the production of educational skills during compulsory schooling can be seen as a crucial potential source of inequality between individuals in school and, later on, in labour market outcomes. Evidently, school quality has a notable influence on this process, thus contributing to the heterogeneity of educational outcomes across Europe. The aim of this part of the EDWIN research was, therefore, to identify the factors that most strongly improve the acquisition of education and skills, with a view to helping policy-makers allocate resources efficiently and conduct appropriate reforms.

Student characteristics and family background are well-established and crucial determinants of student achievement, while the evidence on school quality effects remains mixed and rather weak, especially for educational resources. Cross-European variation in educational skills can rather be explained by differences in institutions – notably central exams and school autonomy, which are strongly positively associated with a higher skills level while simultaneously being less cost intensive than most other school quality inputs. Some features of the basic education system, like streaming and private schools, seem rather to impact on the degree of equality of educational opportunities. Indeed, measures of school quality seem to benefit mainly disadvantaged students, an outcome which underlines the importance of distinguishing between students differing in characteristics. Additionally, the effects for earlier grades are typically stronger than those for higher grades, implying that the older the students are, the more difficult it is to improve their skills by use of school quality related measures.

Policies to improve the formation of educational skills should emphasise the provision of the right incentives to students and teachers by adjusting schooling institutions and by measuring achievement in a coordinated way. In other words, there is an obvious need for improved incentive systems and better monitoring mechanisms and accountability.

On the other hand, the low effect found for school quality on student performance may, at least partly, be explained by missing or imprecisely measured indicators for school quality. What is needed is high-quality, comparative longitudinal data on both past and present family and school inputs, but also on outcomes.

3.8. Market failures and the under-provision of training

Training policies can be motivated both on efficiency and equity grounds. Equity refers to the distribution of training, efficiency to its under-provision in the absence of policy intervention. Under-provision occurs when training is below the efficient level, where marginal social benefits equal marginal social costs. Empirical evidence on under-provision is, therefore, important for gaining a firm ground for the design of training policies. This part of the EDWIN research aimed at further highlighting the differences in training incidence across Europe and, especially, to explore whether the uncovered differences are the product of labour market inefficiencies, or whether they simply reflect differences in (social) costs and benefits that would persist even in perfectly competitive labour markets.

A prerequisite for any design of policies aimed at reducing eventual under-provision of training is that the causes of under-provision are well established. This is a challenging dimension on which the undertaken research failed to shed new convincing evidence. Hence, the current knowledge still does not provide much policy guidance for tackling (or for not tackling) the substantial differences in training outcomes that exist along several dimensions, including educational attainment level, age, industry, type of job, firm size – and country.

Since human capital is an important source of income and job satisfaction, a more equitable allocation would require some redistribution in favour of groups of individuals who are less likely to be trained. The key question here is whether economic policy should try to correct outcomes – differences in training – or to modify initial conditions which produce efficiently different outcomes, for instance differences in educational attainment.

Moreover, training policies aimed at increasing the level of training are ubiquitous and should be designed to affect either supply or demand, or both. Broadly speaking, supply policies can affect employer-provided training at the margin if they influence marginal benefits and/or marginal costs. The marginal benefits of training to the employer are influenced by the productivity of training, labour turnover, the degree of (absolute) wage compression and the inter-temporal discounting rate. Therefore, policies which aim at increasing the benefits of training should try to influence these variables, both by affecting structural and framework conditions and by direct targeting. Among training policies that could be classified as targeting marginal benefits are payback clauses and apprenticeship contracts. Levy/grant schemes, train or pay schemes, and tax deductions could be classified as policies targeting the marginal costs to employers. Levy/grant

schemes combine a tax levied on all firms – normally on payroll – with grants awarded to training projects presented by some company. 'Train or pay' schemes, in turn, involve levies which are payable only if the training investment falls below a legal minimum. Finally, tax deductions from turnover, which may cover some or all training costs, provide training incentives through reduced corporate taxes. The evaluation of these kinds of policies, which cost money to the taxpayer, is still in its infancy, and in several European countries we know too little – at least compared to what we know about the impact of these policies in the USA.

The project's web site at http://www.etla.fi/edwin provides details on participants, arranged events and published results.

II. BACKGROUND AND OBJECTIVES OF THE PROJECT

The overarching objective of the EDWIN project has been to undertake in-depth analysis of the interplay between educational expansion and wage inequality in Europe over the past few decades, up to the new millennium. The novelty of the research is that it has analysed, using cross-country comparative data, the underlying patterns and trends in both between-groups and within-groups wage inequality within and across European countries, as well as looked for major policy-relevant explanations for the obtained findings. The research has been focussed to produce new knowledge that not only improves policy-makers' understanding of the link between educational expansion and wage inequality and its main consequences, but also identifies policy options to tackle and manage the ongoing changes.

1. Background and rationale

The rationale for the focus of the EDWIN project was seen to be twofold, at least. First, the interplay between education and inequality has, in more recent years, been the focus of increased attention among both academic researchers and those in the political policy arena. In particular, with the expansion in public spending on education, the redistributive effects of governmental involvement in the production and financing of education must increasingly be balanced against the potential for educational policies to stimulate economic growth and competitiveness. Since this complex issue has been approached from a variety of angles, the re-distributional motives imbedded in educational subsidies have been judged differently. For instance, the literature focusing on the role of human capital in fostering technological development tends to stress the harmful impact of income redistribution policies on the adoption of new technology and thus on economic growth. The redistribution literature, in contrast, draws attention to the positive growth-related externalities that emerge from education-driven redistributive policies, externalities that provide a rationale for subsidisation also of higher (tertiary) education. Nevertheless, irrespective of the approach adopted, the conclusion of several studies is that educational policies can enhance productivity and output growth, while simultaneously improving the distribution of income and welfare in the society. In other words, educational subsidies can be justified on both equity and efficiency grounds.

The fact that educational policies serve a dual purpose advocates that reasonably high private and social returns on investments in education are a necessary but not a sufficient justification for governmental involvement in the production and financing of education. The economic benefit, in the form of higher individual future wages, gained by investment in further education are only one aspect of the issue. The analysis should also

be extended to account for the redistributive impact of increased educational attainment on wage inequality. Such research will contribute to the understanding of the link between economic and social inequality and, thus, will improve the policy-makers' alternatives in combating social deprivation and exclusion and enhancing social cohesion.

Second, the existing literature on wage inequalities as well as on individual wage effects from participating in education is fairly extensive. However, the ways these two phenomena and their various components factually interact are still largely unexplored. The dominant view leading European governments as well as EU policies is that educational expansion is an important policy tool when trying to reverse or, at least, slow down the rise in inequality observed in a growing number of European countries. At the same time, evidence from several countries reveals that aggregate wage and income inequality is due not only to differences between educational groups but, to a very considerable extent, arises from differences within these groups. Cross-country differences in wage and income inequality can, therefore, be expected to be the outcome of differences in within-skill-group inequality rather than differences in the distribution of skills. There is also growing concern about the dispersion around the widely used and accepted average private return to individuals from investments in education. Indeed, the scarce evidence available so far points to the presence of a notable degree of variation around this mean, and thus to a non-negligible 'wage risk' associated with investment in further education.

2. Original objectives and their rationale

The detailed objectives originally stated for the project guided the undertaken research throughout the project's 30-month duration. At no stage was there any need to depart from them. In brief, the original objectives were the following:

1) Comprehensive literature review on education and wage inequality that sets out the current state-of-the-art with respect to scientific results, policy implications and knowledge gaps. (Workpackage 1)

2) In-depth analysis of the structure and change in European wage inequality in order to provide a broad-based European-wide picture of the static and dynamic nature of overall wage inequality and its between and within dimensions. (Workpackage 2)

3) To further enhance the understanding of the education-wage link between cohorts and its evolution over time within and between the European countries,

with special reference to intergenerational effects arising from the expansion in higher education. (Workpackage 3)

4) To further enhance the analysis of the education-wage link within cohorts and its evolution over time within and between the European countries, with special reference to intragenerational effects arising from the expansion in higher education. (Workpackage 4)

5) To draw together this multitude of results produced by means of several alternative but highly complementary approaches and methodologies in an attempt to evaluate the relative importance of the between and within dimensions for overall wage inequality. (Workpackage 5, initial stage)

6) To analyse a number of possible policy-relevant explanations for the observed patterns and trends. Among the explanations to be investigated are: labour market institutions and flexibility arrangements; educational, skill and institutional quality differences; over-education and job competition; gender differences; and experience and training. (Workpackage 5: Tasks 1 – 5)

The literature review was aimed to serve several purposes: (1) provide the project partners with the opportunity to survey, in reasonable detail, national as well as international literature on the topic, and share information on experiences, findings and ideas; (2) make also national research results, only hitherto unavailable in non-English publications, available to an international audience of field experts, students, and policy-makers; (3) draw together, in a comprehensive way, existing theoretical hypotheses and empirical evidence on the interplay between education and wage inequality, its consequences and underlying explanations.

Although several claims have routinely been made in the literature regarding the causes of the widening inequality in the distribution of wages, for most European countries little empirical research had been carried out based on comparable data. This lack of comprehensive information on the nature and trends of wage inequality was seen to mitigate against the policy-makers' propensity to combat social deprivation, since economic inequality often stands out as a pre-stage to social inequality. The second objective aimed at filling this knowledge gap by providing detailed analysis of similarities and differences in wage inequality patterns across European countries. This analysis was also to lay the basis for and complement in an important way the in-depth between- and within-cohort education–wage analyses that were to be undertaken in the next stages of the project.

There are strong a priori reasons why cohort effects for returns to education might be present in Europe: birth rates have changed over the post-war period; educational attainment has improved dramatically; female labour force participation has increased substantially. Existing studies of cohort effects were seen not to have fully covered all policy-relevant aspects, the broad spectrum of European countries and the second part of the 1990s into the new millennium. The third objective aimed at filling this knowledge gap by investigating how (un)employment and wages have changed over time with changes in cohort sizes and educational attainment levels.

Although increased educational attainment evidently contributes to a more equal distribution of incomes and wages, there might also be factors at work, related to the characteristics of the education system and the labour market and their interaction, that tend to increase rather than decrease inequality. The fourth objective aimed at assessing the potential presence of such conflicting effects of educational expansion, their relative strength and, thus, the direction of the effective impact of increased educational attainment on inequality. More precisely, the research was intended to provide European-wide evidence, up to the new millennium, on average returns to education, as well as on dispersions of returns to highlight the wage risks associated with individuals' investments in education.

The comprehensive picture that emerges from combining and comparing the multitude of results produced for a broad range of European countries [objectives (2) to (4)], and from contrasting them against the current knowledge base [objective (1)], provides both the research community and the political arena with broad-based new knowledge on the impact of educational expansion on economic inequality. This was the explicit rationale for the fifth detailed objective of the project.

The sixth objective, finally, pursued the aim of uncovering education and labour market related explanations for the observed patterns and variations in wage inequality within and across European countries, the rationale being that most of these explanations had, despite their political relevance, at most been analysed for a single country and in isolation from eventual concomitant influence from some other major contributing factor(s). More specifically: (a) the diverse situation across European countries in terms of their labour market institutions and education systems can be expected to have shaped – and will evidently continue to shape – not only overall wage inequality but also between- and within-educational-group wage inequality both across and within cohorts; (b) the expansion in post-compulsory education might have caused problems of increased over-education and job competition, thus offering at least part of an explanation for the observed changes in within-group wage inequality; (c) if quality

differences, which may arise from a change in the quality of education over time and/or from quality differences between educational institutions, affect the labour market outcomes of individuals, then they might, at least in part, explain the observed differences between and within cohorts; (d) women's increased acquisition of human capital have had dramatic consequences for the labour markets of all European countries, which may have affected also observed gender wage differentials and, hence, both between- and within-cohort education–wage relationships; (e) if the opportunities to accumulate work experience of high demand in the European labour markets are correlated with key characteristics of the individual, particularly his/her educational level and age, this circumstance may be reflected in the observed variation in wage outcomes between and within educational groups and cohorts.

III. SCIENTIFIC DESCRIPTION OF PROJECT RESULTS AND METHODOLOGIES

1. State-of-the-art – a literature review (WP1)

This section reproduces the introduction and the conclusions from the project's literature review, with a view of briefly highlighting the 'pre-EDWIN' state-of-the-art in the field of education and wage inequality in Europe.

1.1. Introduction

This book presents an overview of the recent empirical literature on education and wage inequality in 10 European countries: Finland, France, Greece, Germany, Italy, Norway, Portugal, Spain, Sweden and the UK. The national chapters include brief discussions of the present education system, overall trends in educational and wage inequality, as well as important aspects of the current debate in each country. The main body of the chapters reviews the existing empirical evidence on the interdependency between education and wage inequality while simultaneously displaying troublesome knowledge gaps. This country-specific evidence is preceded, in Section 2, by an overview of the more macro-oriented literature dealing with the role of education for income inequality and its evolution over time.

In this introductory chapter, we attempt to clarify the relationship between education and wage inequality along several important dimensions. Furthermore, we summarise some of the main trends that emerge from the subsequent national literature reviews. Apart from a few recent cross-country comparisons replicated in this chapter, we refer the reader to the country-specific chapters for references to studies on each particular country.

The interplay between education and income is manifold. First of all, higher educated individuals have higher labour market participation rates. Education is also positively correlated with measures of good health, as well as with longer careers in working life. Secondly, the probability of being unemployed is notably lower for persons with higher levels of education. For the employed, there is a positive correlation between working hours and educational attainment levels. All of these factors contribute to the positive correlation observed between education and income, although not all of them can be regarded as a causal effect from education to income. The most fundamental relationship between education and income, however, is the positive interdependence between hourly wages and education. This basic measure of productivity differences between differently educated individuals is also the starting point for any effect of education on income. Except for the macroeconomic chapter (Section 2), which explores primarily the

aggregate link between education and income, the main focus of the subsequent literature reviews is on the relationship between individual-level education and earnings/wages.

1.2. Conclusions

In this introductory chapter, we have attempted to clarify some dimensions of the relationship between education and wage inequality. We first considered that part of overall wage inequality which arises from the distribution of and rewards to education. The dispersion of education seems to contribute with something between 10 and 15 per cent to the overall distribution of wages. Hence, differences in the distribution of skills do not explain very much of the differences in wage dispersion observed across countries. The same appears to hold true over time, since the impact of the educational boom on the distribution of education goes in the direction of higher wage dispersion in some countries and lower wage dispersion in other countries. Furthermore, as demand has kept pace with the expansion in the supply of higher educated labour, there has been little impact on wage dispersion from changes in relative skill prices (the return to education), at least when looking at the development over the past few decades in the European countries reviewed in this volume.

The remaining effects of changes in educational attainment levels are mediated along other dimensions of the wage distribution. Higher education may result in higher residual wage dispersion. There exists some evidence pointing in this direction, but more research is certainly needed within this field. Moreover, the mechanisms behind this phenomenon are weakly understood and have not been tested empirically.

We continued by reviewing the consequences of more and higher education on intra-personal wage dispersion. A key question is whether the increase in residual wage dispersion, as observed in cross-section analyses over time, reflects a larger dispersion in some individual fixed skill component or a higher variance in transitory wage effects. Related to this issue is the relationship between education and the return to work experience. A higher return to work experience means a higher cross-sectional variance and more variance within individuals, but may leave the dispersion of the average wage level between different individuals unaffected. Also in this field, more research is required.

There is a clear correlation between parents' economic, social and/or educational background and the educational choices as well as labour market outcomes of the children. High correlations imply less equality in opportunity, while small correlations point to more equality of opportunity. There are only a few internationally comparable

studies in this field, though. This is mainly due to lack of internationally comparable data, but also to a plethora of methods and measures used within this research field. Again the gains could be high from undertaking careful cross-country comparative analyses.

In sum, our current knowledge on the interplay between education and wage inequality is rather scarce and scattered. Moreover, a large majority of the available evidence is country-specific while cross-country comparative analyses are still mostly lacking.

2. The structure of earnings inequality in Europe: Evidence from ECHP data (WP2)

2.1. Objective of the research

There is a rapidly growing body of literature exploring and comparing earnings inequality across a varying number of European countries. Few of the studies are truly comparative in nature, though. The first task of the EDWIN project was to provide a comprehensive analysis of the level and structure of earnings inequality in the European Union using truly comparable data reflecting genuine cross-country differences rather than data idiosyncrasies. In doing so, the project has also contributed to filling the aforementioned gap in the international literature on earnings inequality.

2.2. Data and methodology

Similarities and differences in the level and structure of earnings inequality across EU member states are explored by use of the European Community Household Panel (ECHP). More specifically, the data come from the last two waves of the ECHP (7^{th} wave, year 2000, and 8^{th} wave, year 2001, with the income information of the 8^{th} wave, which refers to the previous year (2000), being matched with the characteristics of the individual in that particular year). All EU-15 countries are covered with the exception of the Netherlands and Sweden, for which data on the number of months in employment during the previous year is not available in the ECHP (and, hence, monthly and hourly wage rates cannot be computed). Moreover, due to problems with a number of key variables, the data for France and the UK refer to earlier waves (4^{th} wave (1997) for the UK, 5^{th} wave (1998) for France).

The sample used in the analysis comprises all employees aged 18 to 64, employed outside the agricultural sector of the economy, and working between 15 and 84 hours per week ('regular employment' in ECHP). The sample was truncated in the tails with employees earning less than 0.1 or more than 10 times the mean earnings being

excluded. The concept of earnings used in the analysis is net hourly earnings after income taxes and social security contributions ('regular earnings' in ECHP).[1] The analysis was also performed using distributions of monthly earnings but the overall results remained roughly unchanged.[2]

The structure of earnings inequality is analysed by means of three additively decomposable inequality indices: the index of Theil (T), the Mean Logarithmic Deviation (N, also known as the second index of Theil) and the Variance of Logarithms (L) of earnings. Occasionally, results are reported also for the most commonly used index of inequality, that is, the Gini index. The use of several indices provides a more varied picture, since each index is relatively more sensitive to different types of inequality and, hence, changes in the distribution of earnings. While T is relatively more sensitive to changes at the top of the distribution, N and L are more sensitive to changes close to the bottom of the distribution, G being more sensitive to changes around the median.

Using both one-way and multivariate earnings inequality decomposition by population sub-groups, aggregate earnings inequality is further decomposed into inequality emanating from differences 'between groups' and inequality emanating from differences 'within groups'. More precisely, the wage and salary earners of each country are grouped according to four criteria: educational level (3 groups: 'Less than upper secondary', 'Upper secondary' and 'Tertiary'), age as a proxy for work experience (5 groups: '18 to 24', '25 to 34', '35 to 44', '45 to 54' and '55 to 64'), sex (2 groups: 'Males' and 'Females') and sector of employment (2 groups: 'Industry', including employment in construction and public utilities such as electricity, gas and water, and 'Services').

[1] For two countries – France and Finland – the earnings data are gross of income taxes. They were converted to net earnings using the net-to-gross factors provided by EUROSTAT with the data of the ECHP.

[2] Monthly earnings are, perhaps, more important from a policy point-of-view since, to a considerable extent, they determine the shape of the overall income distribution, with profound welfare implications. However, the distribution of monthly earnings is the distribution of a product with respect to both prices (the wage rate or hourly wages) and quantities (hours worked per month). Wage rates are determined in the labour market without any influence from individual workers. In the institutional settings encountered in European countries, individual workers, however, have some degree of control over the number of hours they work. Therefore, the corresponding results should be interpreted accordingly. In general, the results of the decomposition of monthly earnings inequality were not substantially different from those of the decomposition of hourly earnings, with one important exception. Due to the fact that in several countries a considerable proportion of female employees work part-time, the importance of differences between males and females in shaping the overall monthly earning inequality appeared to be much higher in comparison with its importance in shaping inequality in the distribution of hourly wages.

2.3. Main findings[3]

The analysis reveals that the *level* of aggregate inequality in the distribution of hourly earnings varies substantially across the EU, irrespective of the index of inequality used (Table A1 of the separate annex attached to this final report). The ranking of the countries does not change dramatically with the index of inequality, either. Denmark appears to have the most equal distribution, followed by Belgium and Austria. The most unequal distribution of hourly earnings is obtained for Portugal, followed by Greece, the UK and Luxembourg. The rest of the countries lie in intermediate positions. Based on these results, it is hard to discern a clear pattern linking earnings inequality and labour market organisation or welfare state regime.

The results obtained from the one-way decomposition of earnings inequality suggest that also the *structure* of earnings inequality varies widely across EU member states. This holds true when it comes to the overall proportion of inequality that is attributable to disparities 'between groups' as opposed to 'within groups', as well as to the proportion of earnings inequality emanating from differences between educational groups, age groups, gender and sector of employment. Moreover, in most cases the various indices again mediate a similar picture. In Portugal, as much as some 40% of hourly earnings inequality appear to emanate from disparities between educational groups, while the corresponding share is less than 10% in Belgium, Denmark, Finland and the UK (Table A2 of the separate annex attached to this final report). The cross-country differences are quite large, although less substantial, when the employees are split according to their age, gender or sector of employment. Broadly speaking it appears that the higher the overall level of inequality in the distribution of hourly earnings, the higher is the proportion of aggregate inequality attributable to differences across educational (and, to a lesser extent, age, gender and sector) groups. Indeed, when attempts were made to try to identify the contribution of each individual partitioning factor to the determination of earnings inequality, education was found to be the factor most closely associated with inequality. Only in two countries – Belgium and the UK, ceteris paribus, age turned out to account for a higher proportion of hourly earnings inequality than education (Table A4 of the separate annex attached to this final report).

A multivariate decomposition analysis – in order to determine the combined effect of the four criteria (education, age, sex and sector) on hourly wage inequality – shows that differences 'between groups' typically account for a much smaller share of total earnings inequality than differences 'within groups' even when the sample of each country is

[3] Detailed results displayed in tables are presented in the separate annex attached to this final report.

partitioned into 60 very fine homogenous groups using simultaneously the four aforementioned grouping factors (Table A3 of the separate annex attached to this final report). But the results also demonstrate that, once again, the cross-country differences are considerable. The contribution of 'between groups' disparities to earnings inequality is less than 20% in Denmark, Finland and the UK, between 20% and 35% in Austria, Belgium, France, Germany and Italy, around 40% in Ireland and Spain, and between 40% and 50% in Greece and Luxembourg. Only in Portugal do 'between groups' disparities account for over 50% of aggregate inequality. The fact that, even when multivariate analysis of inequality is attempted, in most countries over two-thirds of inequality is attributed to differences 'within groups' may, of course, well imply that other factors, not controlled for in the analysis, play an important role in the determination of hourly earnings inequality. Among these factors are unobservable personal characteristics (such as ability) and labour market institutions.

2.4. Concluding remarks

Considerable cross-country differences exist across the EU in both levels and structures of earnings inequality. A common feature of a majority of countries, however, is that of the four factors examined (education, age, sex and sector of employment), education and, to a lesser extent, age turn out to be most closely associated with inequality – a result broadly in line also with human capital theory. These effects are not uniform across countries, though. On the contrary, they differ not only in magnitude but also in their nature, that is, with respect to whether they arise primarily 'between groups' or 'within groups'.

3. Inter-temporal trends in earnings inequality in eight European countries (WP2)

3.1. Objective of the research

The aim of this research was to supplement the previously outlined static inequality decomposition analysis by trying to identify the factors behind the observed trend in hourly earnings inequality. Put differently, it explored the dynamics of inequality in the distribution of hourly (and monthly) earnings during the most recent decades in a number of European countries, thus adding important knowledge to a rather scarcely researched field.

3.2. Data and methodology

So-called 'trend inequality decomposition analysis' was applied to data from eight EDWIN countries (Finland, France, Germany, Greece, Italy, Norway, Sweden and the UK). Due to the ECHP being a relatively short panel (eight waves only) and the fact that the outlined type of dynamic analysis requires comparable data for longer periods of time, the study relied entirely on national data sources.[4] Although these data sets differ, to some extent, across countries and cover periods of different length, they are truly comparable within countries.

The estimating data was defined in the same way as in the static analysis. In other words, the samples consisted of employees aged 18 to 64, employed outside the agricultural sector of the economy, and working between 15 and 84 hours per week. Employees with hourly earnings less than 0.1 or more than 10 times the mean earnings were excluded from the analysis. Now, however, the concept of earnings referred to gross hourly earnings, except for Greece and Italy for which only net hourly earnings after income taxes and social security contributions were available.

The technique of inequality trend decomposition analysis allows the observed *change* in total earnings inequality to be attributed to changes in inequality 'within groups', changes in group mean earnings (proxy for changes in inequality 'between groups') and changes in population shares. Accounting also for structural changes in the population is paramount in this context as the level of earnings inequality can be expected to have been affected by the profound structural changes that the labour force of most of the countries under study has undergone in the past few decades: a notable improvement in the educational attainment level, ageing, increased participation of women, and a shift in employment from manufacturing to services (Table A5 of the separate annex attached to this final report). The inequality trend decomposition analysis was carried out using all three decomposable inequality indices from the static analysis above. For reasons of economy of space, however, only results derived using the Mean Logarithmic Deviation (N) are presented here.

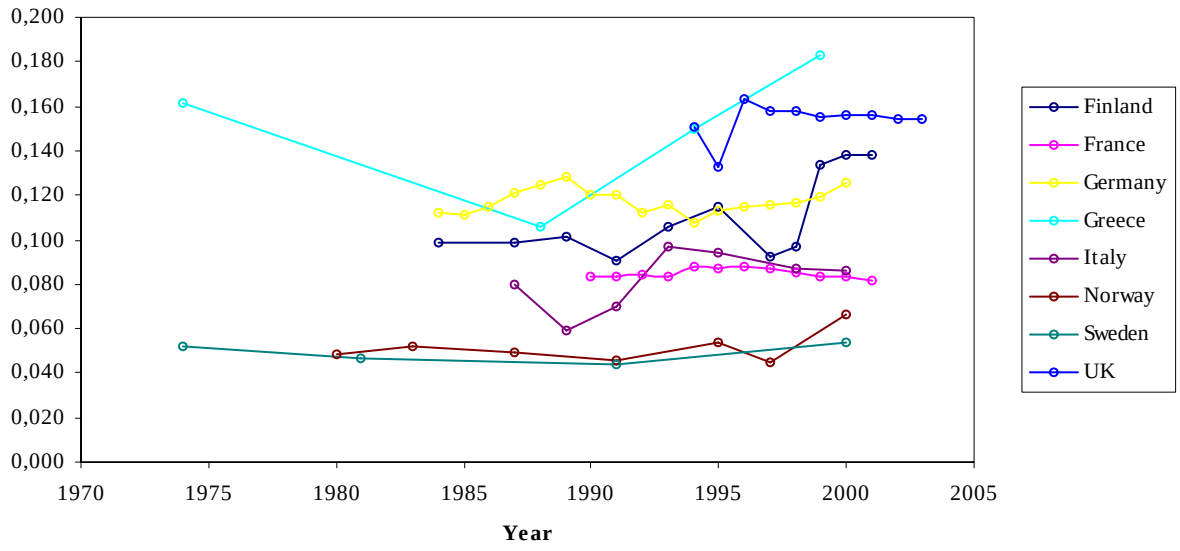
[4] Finland: Labour Force Survey 1984 to 1998; France: Labour Force Survey 1990 to 2001; Germany: German Socio-Economic Panel 1984 to 2000; Greece: Household Budget Survey 1974 to 1999; Italy: Survey of Households' Income and Wealth 1987 to 2000; Norway: Level of Living Survey 1980 to 2000; Sweden: Level of Living Survey 1974 to 2000; the UK: Labour Force Survey 1994 to 2003.

3.3. Major findings

Figure 1 illustrates the changes in hourly earnings inequality having occurred in each of the eight countries under study using the Mean Logarithmic Deviation (N) index.

Additional information is provided in Table A5 of the separate annex attached to this final report, which reports changes in hourly earnings inequality for the longest period covered for each country using all four inequality indices (T, N, L and G). None of the countries has experienced a monotonic trend in earnings inequality. Nevertheless the results indicate that inequality at the end compared to the beginning of the period under investigation was higher in four countries (Germany, Greece, Italy and, especially, Norway) and marginally lower in two countries (Finland and France). For two of the countries (Sweden and the UK) the outcome is ambiguous, albeit it might be argued that hourly wage inequality seems to reveal a modest increasing rather than declining trend.

Figure 1. Inter-termporal trends in hourly earnings inequality (Mean log deviation)



Since the inequality indices differ in their sensitivity to different changes in earnings inequality, comparison of the proportional changes in earnings inequality recorded by the various indices provides an indication of the nature of the major differences having taken place in the distribution of hourly earnings. For example, the UK experienced an increase in the relative earnings – relative to the mean earnings – of those with very high and extremely low hourly earnings. The first change implies a rise in inequality, the second a decline. In the case of T, which is relatively more sensitive to changes close to the top of the distribution, the combined effect is an increase in inequality. In the case of L, which

is sensitive to changes close to the bottom end of the distribution, the combined effect is a modest decline in inequality. The results for the other countries can be interpreted similarly (Sweden: explanation similar to the one for the UK; Germany: changes driven primarily by changes at the top end of the distribution; Greece and Italy: changes driven primarily by changes at the bottom end of the distribution).

Table 1 presents the results obtained when the aggregate change in hourly earnings inequality (reported in Table A5 of the separate annex attached to this final report) is split into changes in inequality 'within groups', changes in inequality 'between groups', and changes in population shares for the four characteristics of education, age, gender and sector.

If looking at the estimates in the first row of the table (Finland), the percentages indicate the following. Given that, during the period under examination, the educational qualifications of the labour force, as well as the average hourly earnings of each educational group relative to the mean earnings had remained unchanged while the inequality 'within groups' had changed the way it did, then hourly earnings inequality in Finland would have been 7.4% higher in the end of the period (1998) than in the beginning of the period (1984). Likewise, the changes that occurred in the relative shares of the education groups would, ceteris paribus, have reduced inequality by 9.0%. Other things being equal, the net effect of the changes in group mean earnings would have been a marginal decline in earnings inequality by 0.4%.

Table 1. Trend decomposition of hourly earnings inequality (Index of inequality: Mean log deviation, N)

Country / Grouping criterion	Change in hourly earnings inequality due to (%)		
	Changes in inequality 'within groups'	Change in population shares	Change in group mean earnings
Education group			
Finland	7.4	-9.0	-0.4
France	1.9	-3.4	0.5
Germany	34.3	-24.3	2.5
Greece	12.8	1.0	-0.1
Italy	6.4	2.3	-1.2
Norway	31.3	6.3	-0.1
Sweden	-6.6	10.9	-0.4
UK	3.0	1.9	-2.9
Age group			
Finland	-1.4	-0.7	0.1
France	-3.8	2.7	-0.1
Germany	20.8	-9.4	1.2
Greece	12.4	1.0	0.2
Italy	12.2	-0.4	-4.3
Norway	40.0	-3.0	0.5
Sweden	-2.3	6.0	0.1
UK	0.5	1.9	-0.4
Sex			
Finland	-0.6	-0.2	-1.3
France	-1.0	-0.2	0.0
Germany	13.2	0.0	-0.7
Greece	12.4	1.5	-0.2
Italy	7.4	0.2	0.0
Norway	41.1	-3.0	-0.6
Sweden	5.7	-1.4	-0.4
UK	2.7	-0.1	-0.6

Sector			
Finland	-4.1	2.0	0.1
France	-1.9	0.7	0.0
Germany	10.6	1.8	0.1
Greece	16.1	-2.5	0.1
Italy	8.8	-1.4	0.1
Norway	34.9	2.5	0.1
Sweden	-1.8	5.4	0.2
UK	1.0	0.9	0.1

All in all, the results presented in Table 1 seem to suggest that the main factor underlying especially larger changes in hourly earnings inequality were changes in inequality 'within groups', irrespective of the criterion used for the partitioning of the labour force. In all countries, except for Sweden, the recorded changes in inequality 'within education groups' resulted in increased levels of earnings inequality. For some countries, the changes were quite large (34.3% in Germany, 31.3% in Norway). Changes in group mean earnings have played a minor role, while changes in population shares appear to have had a significant impact only in a few countries and mainly when the partitioning criterion was education. Indeed, the improvements in the educational attainment level of the labour force caused, ceteris paribus, a substantial decline in hourly earnings inequality in Germany (-24.3%) and Finland (-9.0%), but a notable rise in inequality in Sweden (10.9%) and Norway (6.3%).

3.4. Concluding remarks

The results demonstrate that, in most countries, the main factor behind the observed changes in earnings inequality over the past few decades has been changes in inequality 'within groups' irrespective of the partitioning criterion (education, age, sex and sector of employment) used, while the effect of changes in group mean earnings (the 'between groups' effect) has almost always been negligible. Changes in the composition of the labour force with respect to these same criterions have typically had a modest effect on earnings inequality, although the effect has differed both in magnitude and direction across countries. Only in a few of the investigated countries has the effect been relatively large, but by no means uniform, and mainly when the partitioning factor is education.

4. Relative unemployment, skill gaps and cohort effects in Europe: Economic factors and labour market institutions (WP3)

4.1. Objective of the research

Most European countries have, over the past decades, experienced substantial changes in the demographic as well as the educational composition of their populations. The increase in the ratio of the youth to the adult population that occurred in the 1970s and 1980s has been followed by a steady decline in later decades. The decline was particularly evident in the southern European countries in the latter half of the 1990s. Concomitantly both the relative and absolute shares of those with a post-compulsory education have increased quite remarkably. This holds true especially for countries traditionally characterised by comparatively low levels of educational attainment.

The ageing of the population and the upgrading of its skills have affected the economy and the labour market in various ways. Unemployment rates for young people increased substantially and then decreased slightly while adult unemployment varied only marginally. Unemployment rates by educational levels showed significant variation with more educated workers facing much lower risks of becoming unemployed than the less educated, and with relative unemployment rates diverging over the business cycle.

The extent to which demographic and educational shocks affect labour force participation, employment and unemployment depends, among other things, on labour market imperfections and the degree of (real) wage flexibility. In competitive labour markets, large supply shocks – because of stronger competition – are expected to change the relative earnings of young vs. adult and more educated vs. less educated workers. In imperfectly competitive market, where wages are set through centralised collective bargaining while other labour market institutions interact with market forces, large supply shocks are more likely to show up in rising unemployment and a less clear-cut (un)employment–earnings trade-off.

Relevant policy questions in this context are: To what extent do these shocks affect labour market outcomes? What can be done to reduce adverse effects leading to increased inequality across individuals? Typically, the effects operating via the labour market are: (1) changes in the level and structure of (un)employment; (2) changes in the structure of earnings and, hence, in the personal income distribution; (3) changes in the incentives for human capital accumulation and labour supply; and (4) changes in company labour demand, recruitment policies and organisation of work.

The main objective of this part of the EDWIN research was to investigate the effects of the 'baby bust' and 'educational boom' phenomena on age- and education-specific unemployment patterns in Europe, and to search for explanations for the observed patterns and trends in economic factors and labour market institutions. Sub-section III. 5 focuses on the corresponding earnings effects. Human capital and labour supply effects are touched upon in sub-section III. 6, and labour demand aspects in sub-section III. 7.

4.2. Data and methodology

The analysis of unemployment effects builds on national data provided by the EDWIN partners, complemented with data obtained from the Bank of Italy and the OECD. The estimation data is structured as a panel disaggregated by gender, cohort (forming three age groups: 15–24, 25–54 and 55–64) and educational levels (primary, upper secondary and tertiary according to the international ISCED definition) and contains information on population, employment, labour force, business cycle, and labour market institutions for ten European countries (Finland, France, Germany, Greece, Italy, Norway, Portugal, Spain, Sweden and the UK) from 1975 to 2002 (depending on the country).[5]

The basic specification for analysing the effects of both the demographic and the educational composition of the population on the unemployment rate *(U)* is

$$\ln U_{sjict} = s_s + c_j + e_i + C_c + T_t + \alpha \ln YOUTHSHARE_{ct} + \beta \ln EDUCSHARE_{ct} + \gamma \ln DEM_{ct} + \varepsilon_{sjict},$$

where the dependent variable ln*U*, the natural logarithm of the unemployment rate, is specified at the most disaggregated level available, that is, according to a breakdown by gender (s), cohort (j), education (i), country (c) and time (t). Furthermore, *s, c* and *e* are sets of dummy indicators for, respectively, gender, cohort and education. *C* stands for a country fixed effect, *T* for a common time effect, and *ε* captures the residuals. *DEM* is a country- and time-specific demand shifter.

The (aggregate) demographic term *(YOUTHSHARE)* is defined as the number of individuals in the 15 to 24 age interval (the young cohort) over the number of individuals in the 15 to 54 age interval. The changes in the educational composition, in turn, are accounted for by use of two different definitions. The first one *(EDUCSHARE1)* measures the share of those with an upper secondary education or more in the whole population

[5] Finland: Labour Force Survey 1984 to 2002; France: Labour Force Survey 1983 to 2001; Germany: German Socio-Economic Panel 1991 to 2002; Greece: Labour Force Survey 1987 to 2002; Italy: Labour Force Survey 1978 to 2001; Norway: Labour Force Survey 1975 to 2002; Portugal: Labour Force Survey 1989 to 2002; Spain: Labour Force Survey 1977 to 2002; Sweden: Labour Force Survey 1986 to 2002; the UK: Labour Force Survey and General Household Survey 1980 to 2000.

(in the age interval 15 to 54), and can be interpreted as the share of skilled individuals – those with a post-compulsory education – in the stock of human capital. Hence, this educational variable captures the competition between differently-aged individuals having completed the same educational degree level. The second variable *(EDUCSHARE2)* measures the share of those with an upper secondary education or more within the young cohort (i.e. the 15–24 age interval), thus proxying for the distribution of skills among the youths. Here, the key source of competition is that between differently-educated individuals belonging to the young cohort, whereas the competition between young and adult workers equipped with the same education is assumed to be of less relevance. A notable difference between the two educational variables is that while E*DUCSHARE1* mixes the effects coming from demographics with those from shifts in the educational composition, *EDUCSHARE2* captures exactly the effect of the educational composition of the young cohort conditional on demographics *(i.e. YOUTHSHARE).* This explicit distinction between the pure effect of educational compositional changes and age compositional changes is a noteworthy advantage over previous research.

4.3. Major findings

Both demographic and educational shocks were found to affect unemployment rates. Demographic shocks – e.g. an increased share of a certain age group – raise unemployment rates, and the effect is stronger for that particular age cohort than for the other cohorts. Conversely, educational shocks – e.g. an increased share of a certain educational category – lower unemployment rates, and the effect is stronger for that particular education category than for the other categories. Thus, both findings lend support for the so-called imperfect substitutability hypothesis.

More importantly, the results showed that demographic and educational shocks have qualitatively different impact on young (relative to adult) workers, as well as on more (relative to less) educated workers. Although adults and the more educated typically experience lower unemployment, young cohorts were found to have benefited relatively more – in terms of lower unemployment rates – from the ‘baby bust’ than the adult cohort. The elasticity was estimated to be close to one, implying that a one per cent decrease in the share of young people in the population lowers the unemployment among the 15 to 24 cohort by an equal amount (having almost no effect on the unemployment of adults).

Likewise – and contrary to theoretical expectations, the ‘educational boom’ was found to have reduced the rate of unemployment and more so for the higher than the less educated: a one percentage increase in the share of the population with a post-

compulsory education was estimated to decrease, ceteris paribus, the unemployment rate of the skilled by more than half a percentage point, on average. Moreover, this effect remained also after control for skill-biased technological change and endogeneity of educational choices.

Furthermore, the positive 'baby bust' effect was found to be stronger in the Southern European countries, while no clear cross-country pattern was observable when it comes to the educational composition. It is noteworthy that despite the higher wage elasticity in Southern European countries (see Sub-section III. 5), these countries also tend to experience larger effects of demographic shocks on unemployment. This evidence, too, may be the outcome of the prevailing 'dual' system with a large non-protected sector operating in parallel with the protected sector.

Finally, labour market institutions were found to have influenced unemployment rates in different ways. In particular, ceteris paribus, unemployment benefits tend to increase unemployment while bargaining coordination and employment protection reduce it. When institutions were interacted with demographic terms, institutional changes (such as a decline in union density, lower generosity in unemployment benefits, and less employment protection) were found to have a larger impact on adult unemployment.

4.4. Concluding remarks

A major finding from this research thus is that demographic and educational shocks are qualitatively different for young and adult workers. While age-specific unemployment rates show that youth unemployment is, in general, two to three times higher than adult unemployment, young worker cohorts have benefited more in terms of employment opportunities from the demographic trends ('baby bust') that have characterised Europe in recent decades. This evidence is of particular relevance in view of an ageing Europe and deteriorating age-dependency ratios.

The finding that young cohorts, face to the 'baby bust', do relatively better, is due to the fact that they are less numerous (and relatively more educated), an outcome that is not compatible with models involving search externalities and age having a positive impact on the matching function. Indeed, most previous studies have been unable to account for the full picture as no distinction has been made between demographic changes and shifts in the educational composition.

5. Are Wages in Southern Europe more Flexible? The Effects of Cohort Size on European Earnings (WP3)

5.1. Objective of the research

Europe is ageing, and the ageing phenomenon is more pronounced in Northern than in Southern Europe. The decline in the birth rate, as well as in child and old age mortality rates since the 1970s, has substantially changed the age structure of the EU-15 population. At the same time, the educational structure has changed with the educational expansion having varied substantially across European countries. Nevertheless empirical evidence on the response of real earnings to changes in demographics is scarce for Europe, mainly because of lack of comparative earnings data. The aim of this part of the EDWIN research was to provide empirical evidence on the impact of cohort size on real earnings in Europe, using comparable European data. Here, the relevant cohort is the population group with which the individual competes in the labour market, that is, individuals sharing a similar level of experience (or age), and a similar level of education. It is hypothesized that the larger the size of the relevant cohort, the worse are the labour market prospects due to increased competition. At this background, the study aimed, more specifically, to explore whether the size of the cohort that an individual belongs to significantly affects his/her earnings, and whether these effects vary with education, age and country.

5.2. Data and methodology

To study how cohort size has affected real earnings in Europe, the responsible research team exploited the cross-country and time variation in the demographics and educational structure of 11 European countries (Austria, Belgium, Denmark, Finland, Germany, Greece, Ireland, Italy, Portugal, Spain and the UK), using seven waves (1995 to 2001) of the European Community Household Panel.[6] Broadly speaking the sample covered individuals – employed and unemployed – between 20 and 55 years of age (25 to 55 for those with a tertiary education).

Initially it is shown that the definition of cohort size typically used in the literature can be conveniently decomposed into a demographic effect and a relative education effect. Disentangling the education from the age effect is important because the impact on real earnings of the size of the relevant cohort might differ depending on the degree of

[6] Because of comparatively high attrition and, consequently, reduction in the sample size, the first wave (1994) of ECHP was excluded from the analysis. Sweden was excluded because of no wage data. France and the Netherlands were excluded because of rather poor quality of the information on completed education.

substitutability between age and educational groups (cf. the discussion in the previous III.4 sub-section). This is especially relevant when it comes to the Northern versus Southern Europe divide. Indeed, data analysis revealed that: (a) the observed changes in cohort size in the investigated EU-11 in the 1996 to 2001 period have been driven by both demographic and educational shifts, and (b) there is substantial heterogeneity both in the level and the dynamics of cohort size across Europe.

For the econometric exercise a two-step approach was adopted, which allows analysis of the relationship between cohort size and earnings while simultaneously controlling for observed and unobserved individual heterogeneity (including non-random selection into paid employment). In the first step, the relationship between individual earnings and time-by-age effects was estimated for each country and level of education using the fixed-effects estimator, after controlling for other individual factors. In the second step, the time-by-age effects of each country and educational level were pooled together and regressed on cohort size and a number of additional control variables. This method has two advantages: (a) it provides a convenient reduction of the data, and (b) the dependent variable in the second stage as well as the explanatory variable (cohort size) are at the same level of aggregation implying that clustering problems are avoided.

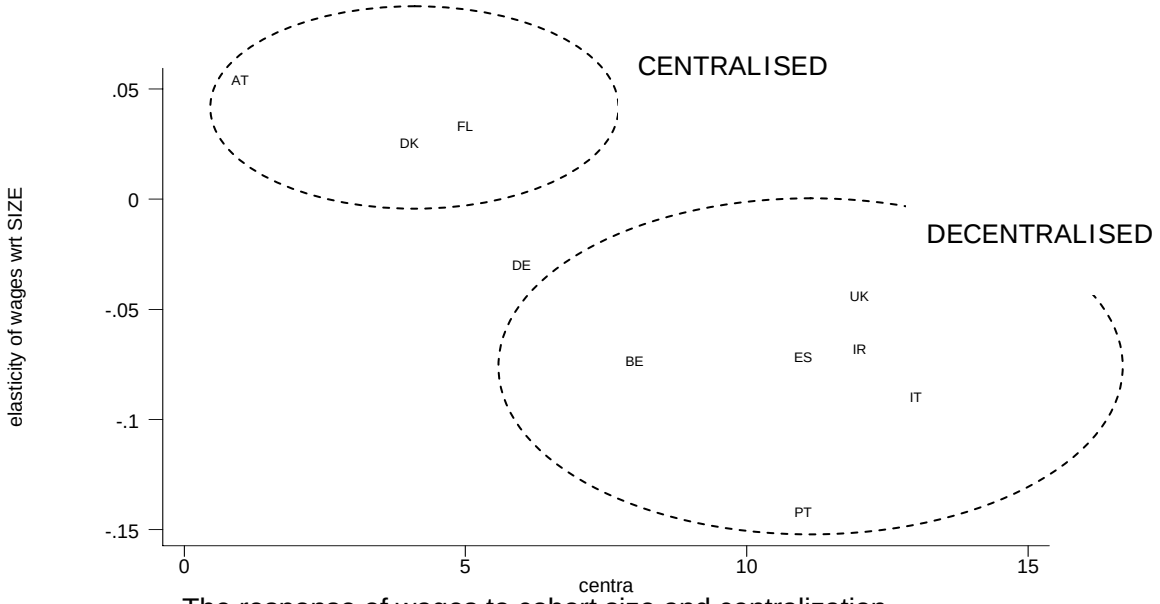
5.3. Major findings

Overall, the impact of changes in demographic trends on real earnings was found to be modest. The share of individuals aged 20 to 34 in the population aged 20 to 54 has declined in the EU-11 countries by 10.20 per cent between 1991 and 2001. At the same time, the percentage of individuals aged 35 to 54 has increased by 9.32 per cent. The estimation results suggest that, despite of these significant changes and conditional on the relative education effect, the real earnings of the younger cohort have increased by a tiny 0.06 per cent while the earnings of the older cohort have fallen by a modest 0.93 per cent. Hence, real earnings appear to be rather inflexible to changes in demographics (and, in fact, even less so to changes in educational structures).

However, the average effect of changes in demographic trends on real earnings obtained when pooling all countries, education categories and age groups not only takes a modestly negative value but is, moreover, measured imprecisely. Allowing the effect of cohort size to vary by age, education and group of countries revealed that the negative effect of cohort size on earnings is entirely driven by Southern European countries. This result was shown to be attributable to differences in labour market institutions such as the degree of employment protection, the minimum wage and the coordination of the wage bargain, suggesting that economies with higher protection have relatively large

unprotected sectors characterised by more flexible earnings. All in all, the responsiveness of real earnings to changes in cohort size tends to be negatively related to the degree of centralisation, suggesting that coordination reduces wage competition between individuals belonging to the same age group (see Figure 2).

Figure 2. The response of real earnings to cohort size and centralised wage bargaining



The response of wages to cohort size and centralization

Furthermore, the response of real earnings to cohort size was noted to be significantly larger among the older age groups. There was also no evidence in support of the view that a 'baby bust' increases the earnings of the young relative to the old to a larger extent among college graduates, as has been found for the USA. If anything, the opposite holds true.

5.4. Concluding remarks

When pooling the data of EU-11 countries, it was found that cohort size has a negative and statistically significant effect on the earnings of the older cohorts – aged between 35 and 54 – but no statistically significant effect on the earnings of younger cohorts – aged 20 to 34. The negative effect of cohort size on earnings is completely driven by Southern European countries due to institutional differences. The notable demographic changes – the 'baby bust' – under way in EU-11 have without doubt flattened the earnings–age profile, but the size of this effect has been small, on average. This finding emphasises further the importance of analysing, in parallel, the potential effects of demographic changes on (un)employment (cf. the analysis and results outlined in the previous sub-section). An additional dimension, now ignored in both analyses, is the gender aspect, which raises a number of additional policy issues of considerable importance.

6. Education and wage dispersion: New evidence for Europe (WP4)

6.1. Objective of the research

The private rate of return to education is a useful indicator when trying to quantify the economic benefits of education in general and the incentives for individuals to invest in their own human capital in particular. Typically these pay-offs are characterised in terms of averages whereas little attention is paid to the fact that the dispersion around these averages might be substantial. Nevertheless existing evidence – albeit still scarce – indicates that the returns to education are subject to an important amount of variation across individuals. The fact that individuals having acquired the same education are rewarded differently in the labour market introduces a non-negligible within-groups dispersion component into the relation between education and wage inequality. Moreover, since within-group wage dispersion tends to increase with the level of education, an educational expansion at higher-degree levels is likely to affect also within-group and, hence, aggregate wage inequality. Put differently, educational expansion as a policy tool for combating economic inequality may, under certain circumstances, instead work against economic equality. Equally important, variation in returns suggests that educational choices involve a certain amount of wage risk. This, in turn, might have implications for the demand for education.

This part of the EDWIN research aimed to provide new comparative cross-European evidence on these crucial aspects of the private economic benefit from investing in education; that is, on the extent and evolution over time of within-educational-group differences in returns and, hence, the wage risk associated with investments in education, and, in the last resort, on the observed patterns of wage inequality. In doing so, the analysis also differentiates between the private and the public sector. Such a distinction is useful for highlighting important differences in wage inequality, returns and wage risks across different types of workers.

6.2. Data and methodology

This cross-European empirical analysis was based on comparable national data for nine European countries: Germany, Greece, Finland, France, Italy, Norway, Portugal, Sweden and the UK.[7] The reported cross-sectional evidence refers to the most recent year

[7] Finland: Labour Force Survey 1984 to 2001; France: Labour Force Survey 1990 to 2001; Germany: German Socio-Economic Panel 1984 to 1999; Greece: Household Budget Survey 1974 to 1999; Italy: Survey of Household Income and Wealth 1987 to 1998; Norway: Level of Living Survey 1984 to 2000; Portugal: Labour Force Survey 1993 to 2000; Sweden: Level of Living Survey 1974 to 2000; the UK: Labour Force Survey 1994 to 2003.

available for each country.[8] In addition to overall patterns, the research also traced changes over time in these patterns with the time period ranging from 26 years for Sweden (1974 to 2000) to 7 years for Portugal (1993 to 2000).

The sample was restricted to male[9] workers aged 18 to 60, employed in the non-agricultural private sector (except for Greece and Portugal for which a distinction between sectors could not be made) and working normally for 35 to 85 hours per week. Results were reported both for monthly earnings and hourly wages, with monthly earnings being the preferred measure. The wage concept refers to earnings before taxes for Germany, Finland, France, Norway and the UK, and to earnings after taxes for Greece, Italy, Portugal and Sweden. Although the comparisons across countries are to some extent affected by this difference in the dependent variable, it was not considered to be a fundamental problem in this context. Education was measured both in years of schooling and by level of education with a distinction made between four levels (in line with the ISCED-97 classification): primary education or less, lower secondary education, upper secondary education and tertiary education.

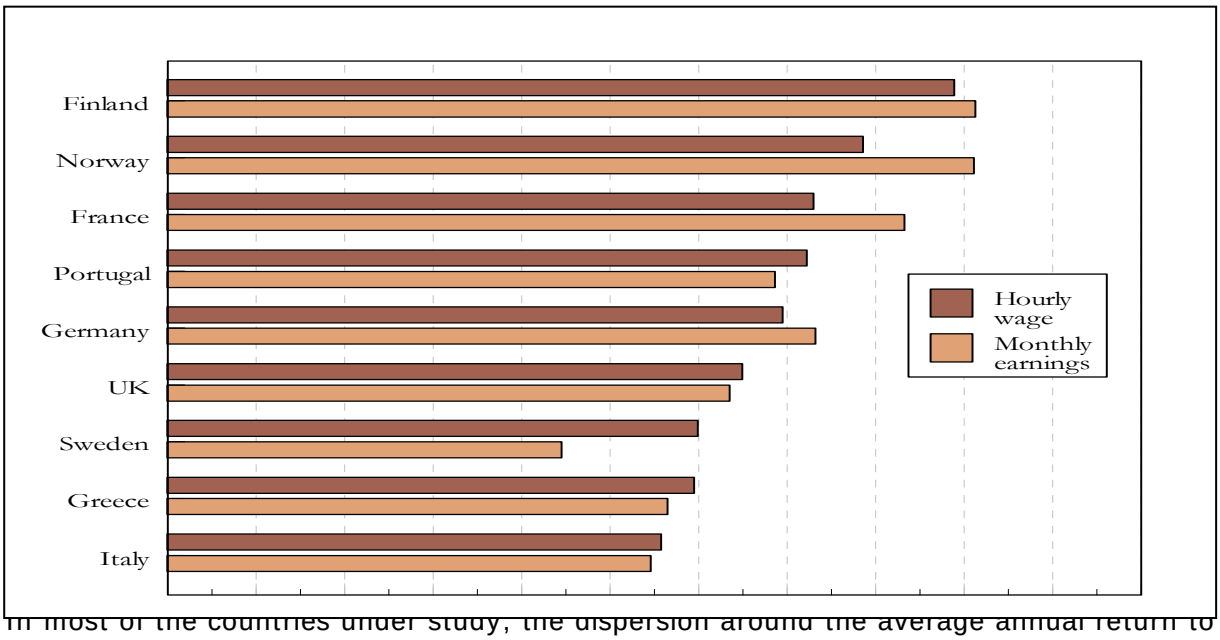
The analysis utilised two complementary statistical approaches for calculating returns to education: the Ordinary Least Squares (OLS) and the Quantile Regression technique. Estimations using OLS build on the assumption that the marginal effect on wages of educational investments is constant over the wage distribution. More precisely, the wage effect of acquiring one additional year of schooling (or a higher educational degree) can be represented by a shift (to the right) of the conditional wage distribution. Quantile regression, in turn, produces returns that measure the wage effect of schooling at different points of the conditional wage distribution, thus describing potential changes not only in the location but also in the shape of the distribution. Combining OLS and quantile regression results allows the impact of education on wage inequality both between and within groups to be assessed: while OLS returns measure the average differential between individuals differing in educational assessment levels, quantile returns measure the differential between individuals who belong to the same educational category but are, nevertheless, located at different points of the conditional wage distribution.

[8] The most recent year available for each of the nine European countries under study was: Finland, 2001; France, 2001; Germany, 1999; Greece, 1999; Italy, 1998; Norway, 2000; Portugal, 2000; Sweden, 2000; UK, 2003.
[9] The case of women was disregarded because of the additional complication caused by the potential presence of a selectivity bias problem.

6.3. Major findings

The *average annual rate of return to education* has remained high despite a dramatic increase in the fraction of the population and, thus, of the labour force having completed a tertiary-level education. At the turn of the millennium, the average return to an additional year in schooling ranged from some 6% for Greece, Italy and Sweden to 9% for Finland when using hourly wages, and from 4.5% in Sweden to 9.2% in Finland and Norway when using monthly earnings (Figure 3).

Figure 3. Average annual return to an additional year in schooling (estimated coefficient) at the turn of the millennium for nine European countries



In most of the countries under study, the dispersion around the average annual return to an additional year in schooling is notable (Table 2). The only conspicuous exception is Greece. A common feature of all the other countries is that the return increases over the conditional wage distribution. The size of the increase, as well as its evolution differs, however, markedly across countries. The difference between the top and the bottom end of the wage distribution is as large as 7 percentage points in France, but decreases to less than 3 percentage points for Finland and the UK, and is practically non-existent in Greece. Likewise, in some countries the return increases steadily over the whole distribution (Sweden), in some countries the increase is stronger in the upper part of the wage distribution (Finland, Italy, Norway), and in some countries the increase is concentrated more to the lower part of the wage distribution (Germany, France, Portugal, the UK).

This evidence suggests that higher-paid workers reap a higher return from their investments in education than do lower-paid workers, a pattern that, moreover, typically turns out to be much more outstanding in the private than in the public sector. Put

differently, if individuals that are seemingly equal but, nevertheless, located differently along the wage distribution, acquire an additional year of schooling, then their wages are likely to become more dispersed. Hence, in most European countries, wage dispersion tends to increase with the educational attainment level, implying that more educated individuals experience larger within-group wage inequality and, thus, more substantial wage risks than less educated individuals.

Table 2. Annual returns to an additional year of schooling (estimated coefficient * 100) at three points of the conditional wage distribution at the turn of the millennium for nine European countries (dependent variable: monthly earnings)

	Quintile return			**Difference**		
Country	10^{th}	50^{th}	90^{th}	$90^{th} - 10^{th}$	$90^{th} - 50^{th}$	$50^{th} - 10^{th}$
Greece	6.1	5.8	5.9	-0.2*	0.1*	-0.3*
Germany	4.5	6.7	8.2	3.7	1.5	2.3
Finland	8.0	8.8	10.7	2.7	1.8	0.8
France	4.1	8.3	11.4	7.3	3.1	4.2
Italy	4.0	4.7	7.5	3.4	2.7	0.7
Norway	7.2	8.7	11.5	4.3	2.8	1.6
Portugal	4.6	7.0	7.7	3.1	0.7	2.4
Sweden	2.5	4.6	6.8	4.2	2.1	2.1
UK	4.6	6.8	7.3	2.7	0.5	2.3

Notes: The overall pattern is much the same when using hourly wages instead of monthly earnings.* Statistically insignificant difference according to an F-test.

This contention is further corroborated by empirical evidence obtained from analysing *educational degree levels* instead of average numbers of years in schooling. First, in most countries earnings inequality tends to increase when moving up the educational scale, whether measured by the Gini index or the P90/P10 ratio, that is, the ratio between the top 10% and the bottom 10% of the wage distribution (see Figures A1 and A2 of the separate annex attached to this final report). Second, the wage premium associated with completing a tertiary-level educational degree is substantial in a majority of the countries under study, with Sweden being a notable exception, though (see Figure A3 of the separate annex attached to this final report). Third, the quintile returns increase over the

conditional wage distribution at all educational degree levels, and notably more so at higher than at lower degree levels (see again Figure A3 of the separate annex attached to this final report). Hence, educational expansion – especially at the tertiary level – tends to increase within-group wage dispersion: since the return to education increases over the wage distribution, shifting seemingly equal but in the conditional wage distribution differently located individuals up the educational scale will make their wages more dispersed. The only exceptions to this pattern are Germany, Greece and Italy, where the estimated returns turn out to be roughly constant over the conditional wage distribution also at the tertiary level.

Analysis of *changes over time* indicates the following (Table 3). First, in a majority of the investigated countries, the average annual return to an additional year in schooling – that is, between-educational-group wage inequality – has changed only marginally over the past decade. The largest change has occurred in Portugal, where the average return was found to have declined with over 3 percentage points. Second, the difference between the top quintile and the bottom quintile return – that is, within-educational-group wage inequality – has increased in all but one country. The largest increase in the education-related wage risk has occurred in Norway. In other words, education seems to have contributed to increased within-group inequality in at least some of the investigated countries and in Norway in particular.

Table 3. Change (percentage points) in average and conditional annual returns to an additional year in schooling over the last decade for nine European countries

Country	Time period	Change in average return	Change in (90^{th} – 10^{th})	Change in the 90^{th} quintile	Change in the 10^{th} quintile
Greece	1988 to 1999	1.68	0.30	1.86	1.56
Germany	1989 to 1999	0.14	0.25	0.39	0.13
Finland	1990 to 2001	-1.44	1.62	-0.84	-2.46
France	1993 to 2001	-0.31	0.57	-0.31	-0.88
Italy	1991 to 2000	0.44	1.26	1.23	-0.03
Norway	1991 to 2000	1.07	2.73	2.05	-0.68
Portugal	1993 to 2000	-3.37	-0.24	-3.72	-3.47
Sweden	1991 to 2000	0.06	1.23	0.59	-0.64
UK	1994 to 2003	0.19	1.67	0.06	-1.61

A corresponding analysis of changes over time by educational degree levels produced the results gathered into Table A6 of the separate annex attached to this final report. Based

on the changes in average wage premiums, the nine countries divide into four categories: (1) decreasing trend at all educational degree levels with the decline rising with the educational level (France, Portugal, Sweden); (2) opposite trends across educational degree levels with decline at the tertiary level and increase at the lower level(s) (Finland, Germany, the UK); (3) opposite trends across educational degree levels with increase at the tertiary level and decline at the lower level(s) (Norway); (4) increasing trend at all educational degree levels with the increase growing with the educational level (Greece, Italy).

Also the changes in within-educational-group inequality divide the nine countries into four categories: (1) decline in the top-to-bottom-quantile-returns difference at two out of the three educational degree levels (Sweden, especially Portugal); (2) opposite but small and practically outweighing changes in the top-to-bottom-quantile-returns difference at the different educational levels (Finland, the UK); (3) opposite, relatively large and only partly outweighing changes in the top-to-bottom-quantile-returns difference at the different educational levels with increasing trend at the tertiary level and declining trend at the lower levels (Germany, France); (4) increase in the top-to-bottom-quantile-returns difference at all educational levels (Greece, Italy, Norway). Hence, a common feature of the countries in the two latter categories is increasing wage dispersion among high-educated workers due to tertiary education having become increasingly more valued in high-paid jobs. In these countries, at least, the expansion in tertiary education seems to have contributed to raising European wage inequality through the within dimension.

Finally, when this exercise was repeated for three different age groups – 18 to 30, 31 to 45, and 46 to 60 year-olds – the following results emerged. First, for a majority of the countries under study, the wage effect of additional schooling is increasing over the conditional wage distribution for all three age groups. The only exception is the youngest age group in Germany, Greece and Finland, for which the highest effect is obtained for those located at the bottom end of the distribution. In these three cases, and in contrast to the common situation, additional schooling tends to reduce within-group wage dispersion. Second, the difference between the top and the bottom end of the conditional wage distribution was found to be largest in the oldest age group (in Sweden among the 31 to 45 year-olds), with this increasing pattern over the age distribution being particularly evident for the private sector. Only France and Portugal no marked differences across age groups were observed.

6.4. Concluding remarks

The research has produced several key results. First, the market price of education, as measured by the average annual return to education, has not changed much in Europe over the past decade. Second, the average annual rate of return to an additional year in schooling is surrounded by quite a substantial amount of variation, as are also the wage premiums associated with graduation at different educational levels. Moreover, the return to education is typically notably higher at the top as compared to the bottom end of the conditional wage distribution, and this tendency increases with the educational level. Equally important, this differential has increased over the past decade in a majority of the European countries under study. Put differently, while between-educational-group wage dispersion has remained approximately unchanged or decreased, within-educational-group wage dispersion and, thus, the educational-investment-related wage risk has displayed an increasing trend, especially at the tertiary level. Accordingly, educational expansion, not least at the tertiary level, can be expected to have contributed to the increase in overall wage inequality observed in the European labour markets.

Furthermore, the fact that investment especially in higher education is subject to a considerable (and increasing) amount of wage risk that, typically, has not been accompanied by a compensating increase in average returns, may turn or may already have turned education into a less attractive investment for at least certain groups of individuals. The effect on the overall demand for education that an increased wage risk might cause is still an open question, though.

7. Education and wage inequality: the role of labour market institutions and flexibility (WP5 – task 1)

7.1. Objective of the research

The diverse situation across European countries in terms of their labour market institutions and education systems can be expected to shape not only overall wage inequality but also between- and within-educational-group wage inequality both across and within cohorts. This part of the EDWIN project aimed at exploring the role of labour market institutions and flexibility arrangements in explaining the observed trends in wage dispersion in Europe over the past decade or so.

7.2. Data and methodology

The analysis was based on comparative longitudinal data for 12 European countries: national data for eight EDWIN countries (Greece, Germany, Finland, France, Italy, Norway, Sweden, UK) supplemented with ECHP data for four additional countries (Austria, Belgium, Denmark and Spain).

The variations in trends between the 12 countries were used for calculating the predicted wage for both the top 10th decile and the 10th bottom decile *within* each educational category conditional on a given set of background factors (such as work experience and sector of employment).

7.3. Major findings

Conspicuous stability in returns to education in Europe: No signs of an overall decline in educational returns up to the new millennium; some degree of convergence in returns between countries due to convergence in supply; all in all, no consistent cross-European trend in between-group wage inequality as measured by the private rate of return to education, despite the tremendous increase in tertiary-level education.

No clear cross-European pattern between educational expansion and wage inequality: Some of the most expansive countries have been those with the initially lowest returns to education. Thus, a compressed wage structure does not seem to limit the supply of educated labour. Obviously it can be compensated for by other policy instruments such as student aid.

Increasing trend in within-group wage inequality across Europe: This trend is, at least partly, explained by the expansion in tertiary-level education, simply because wage dispersion is larger among higher than among lower educated employees (= compositional effect). In other words, improvements in the educational attainment level tend to automatically cause an upward trend in within-group wage dispersion. In contrast to this, there is no evidence indicating that labour markets having experienced a boom in education also reveal a particularly large increase in within-group wage dispersion.[10] Put differently, as such the expansion of tertiary-level education has *not* resulted in widening wage inequality among the higher educated.

[10] The obtained point estimates are small, wrongly signed (among the higher educated wage compression was found to have been strongest at the bottom end of the distribution) and statistically insignificant.

These findings suggest that demand has kept pace with supply. The expansion of tertiary-level education has neither resulted in an erosion of skills among the higher educated, which many observers have expressed worries about. The labour market seems willing to continue to absorb, to a remarkable extent, also 'the bottom of the skills distribution' within higher education. Moreover, these observations can be interpreted as a strong indication for over-education not being a serious problem in Europe (see further Sub-section III. 8), as well as for the quality of education not having been hampered by the scale of the education system (see further Sub-section III. 11).

Cross-European differences in between-educational-group as well as within-educational-group wage inequality are to a notable extent explained by differences in labour market institutions in general and bargaining regimes in particular. Likewise, changes in these cross-European patterns can largely be traced to changes in institutional settings. The following findings can be put forth in support of these contentions:

- *Bargaining coordination affects the wage distribution:* a higher degree of coordination in wage bargaining results in less wage dispersion with wages being compressed particularly from the top. Hence, this result concerns especially those having completed a tertiary-level education.

- *Employment protection affects the wage distribution:* a higher degree of employment protection tends to compress wages but, here, the effect is strongest at the bottom end of the wage distribution.

- *Union membership affects the wage distribution:* evidence from within countries suggests that union membership has a wage compressing effect. From cross-country comparative data it is, however, difficult to obtain robust results on the relationship between union membership and wage compression, probably because the relationship between union density and collective coverage varies considerably between countries.

The undertaken analysis indicates that about half of the positive trend in wage dispersion is explained by changing policies and labour market institutions. The unexplained part of the trend can be taken to emerge from, inter alia, new management strategies, changing norms, and increasing within-firm wage inequality. In order to shed new light on these aspects, more detailed analysis was undertaken using Norwegian data on knowledge-intensive companies. The key results may be summed up as follows:

- *Knowledge-intensive companies tend to have fewer unionised employees.* They are also less likely to be covered by collective agreements and, if they are, these are

more likely to be determined at the local level. These findings are in line with the idea that, since bargaining institutions involving unions and coordination tend to compress wages, the incentives for higher-educated employees to unionise are smaller than for employees with a lower education. With a growing share of the workforce having completed a higher education pressure will, thus, be put on existing bargaining systems in Europe.

- *Knowledge-intensive companies are more likely to use individual performance based pay systems.* They are also more likely to undertake organisational changes (such as more flexible work practices and more autonomy), as well as to adopt and implement both product and process innovations. They provide more on-the-job training and pay higher wages (also after control for the compositional effects).

All these findings point in the direction of productivity enhancing effects of education, and may contribute to the explanation of the continued rise in the demand for higher-educated labour in Europe. At the same time they point in the direction of higher wage dispersion, thus offering part of an explanation for the larger wage dispersion in higher-education labour markets.

7.4. Concluding remarks

The increasing trend in wage dispersion in Europe seems to be the intertwined outcome of several factors having evolved in parallel. Major contributions to this process have been provided by expansive educational policies, changing labour market institutions and new management strategies. The expansion of higher education has resulted in a compositional effect, where an increasing share of the workforce has shifted from lower to higher levels of education and, thus, from lower-wage-dispersion groups to higher-wage-dispersion groups. Contrary to this, there is no evidence whatsoever of this policy having widened further the wage differences observed among the higher educated, an important reason being that the demand for educated labour has kept pace with the supply of individuals having completed a tertiary-level degree.

Differences in labour market institutions account for a large part of the observed differences and trends in between-educational-group and within-educational-group wage inequality across Europe. Moreover, an increasing share of the labour force being highly educated is likely to put pressure on existing bargaining systems in Europe (less coordination, unionism and collective agreements), and to speed up the adoption and implementation of new management strategies especially in companies with a large share of high-educated labour.

8. Education and wage inequality: the role of over-education (WP5 – task 2)

8.1. Objective of the research

One of the most important determinants of educational and income inequality is that many people who acquire educational qualifications do not get to use them or are not paid for using them in their jobs. Despite of the increasing body of literature providing evidence on the over-education phenomenon at the level of individual countries, the lack of comparable data sets has made it difficult to undertake meaningful cross-country comparisons. Moreover, most of the existing evidence is based on various cross-section data with no control being made for the potential bias arising from unobserved heterogeneity (skills, ability, etc.) across individuals. This part of the EDWIN research aimed to overcome these shortcomings by use of two different European household surveys in search for an answer to the relative importance of over-education in today's Europe.

8.2. Data and methodology

The analysis was based on two European household surveys which ask respondents across the covered countries identical questions. More precisely, the research used information both from the so-called E-living survey and the ECHP. The analysis based on the E-living survey used the first wave, which was collected in 2001.[11] The survey was mainly designed to provide valuable data on the uptake and usage of information and communications technology at a domestic level in six countries (Bulgaria, Israel, Germany, Norway, Italy and the UK). But the data also provide information on worker's self-evaluation of educational requirements in a job, thus allowing comparisons of over-education on a cross-country consistent basis (with due allowance for the fact that the high heterogeneity of the education sector across countries is only partly solved by the ISCED classification). Further empirical evidence on over-education across Europe is provided by use of the eight waves (1994 to 2001) of the ECHP, the panel structure of which makes it possible to control for the potential impact of unobserved individual heterogeneity. The sample, however, had to be restricted to just eight countries (Denmark, France, Greece, Ireland, Italy, Portugal and Spain) due to the lack of information for the rest of countries in some waves on the questions relevant for the analyses. For both data sets, the sample was restricted to employees aged 16 to 64 (self-employed, retired and unpaid family workers were excluded), working between 15 and 84 hours per week out of the agricultural sector.

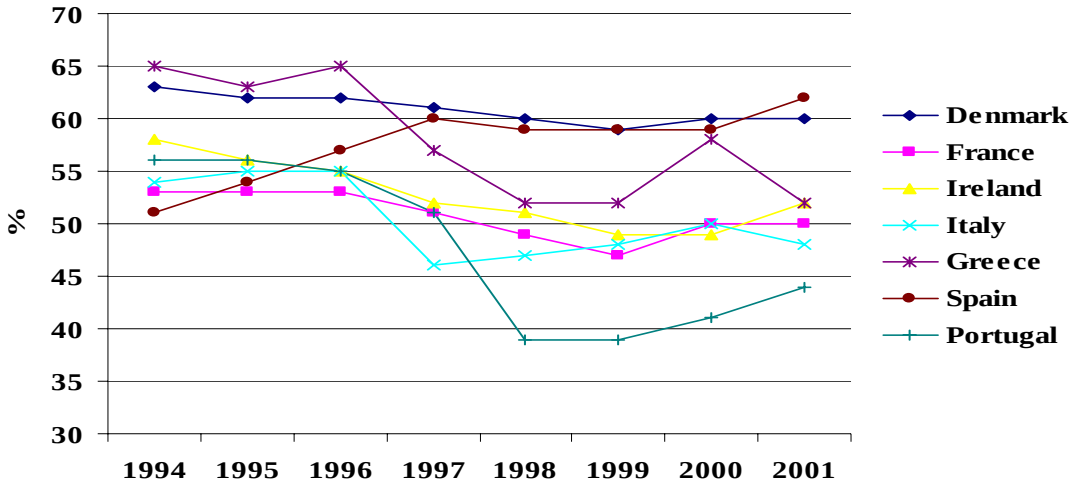
[11] This year was chosen to allow a comparison of the results stemming from E-living and ECHP estimations, as this is the only year appearing in both surveys.

The measurement of over-education is a controversial issue. Moreover, the different measures used in the existing literature are poorly correlated as individuals are classified differently depending on the measure used. Accordingly, the choice of measure for over-education will largely affect the outcome of the analysis, as will also the control or no-control of unobserved individual heterogeneity. Likewise, the estimated effect on over-education of various explanatory variables has been shown to vary strikingly between the measures, implying that such analyses tell more about the process of measuring over-education than about the factors that actually contribute to the existence of over-education in the labour market. An additional problem in this context is the obvious interdependence between the process shaping the individual's education–job match and the one determining his or her earnings, which makes it necessary to look for a determinant (instrument) of the education–job mismatch that is independent of the statistical process of earnings determination.

The E-living survey asks the individual about "What qualification does s/he *usually need* to be *able* to do his/her job?" By comparing this indirect worker's self-assessment of over-education in terms of job content to the answer of the following question "What is the *highest qualification* that you *have*?", dummy variables can be constructed to define the three possible situations of 'over-educated', 'under-educated' and 'adequately educated'. This definition of over-education can be classified as 'strong' in the sense that it requires confirming evidence of two kinds in order to classify an individual as over-educated. Consequently, it gives rise to a fairy low proportion of workers being defined as over-educated (around 27% over all countries).

The ECHP allows a 'weak' definition of over-education through a positive answer of the employee to the following question: "Do you feel that you have *skills or qualifications* to do a *more demanding* job than the one you have now?" The wording of the question has remained unchanged over the years, and it provides a direct self-assessment measure of the worker's over-education status. However, as a positive response to this question requires only a vague idea of one's own abilities or even some notion of what one could do in terms of job in the future, it is not surprising that a high fraction of people (54%) think they could do a better job. Particularly high fractions are observed for Denmark and Spain (Figure 4). Italy, which is the only country appearing in both data sets, had in 2001 an over-educated share of 48% according to the ECHP but of only 15% according to the E-living survey, which underlines the huge difference between the two data sets in the way over-education is measured.

Figure 4. Trends in over-education across Europe



Source: ECHP 1991–2001

The impact of over-education on the individual's earnings is estimated by use of an earnings function, where the logarithm of gross weekly wages are regressed on a vector of dummies controlling for the individual's educational level, and a vector of other variables potentially affecting wages. In a first step, this earnings function is augmented with a dummy variable that take the value of 1 if the individual is overeducated. In a second step, a distinction is made between over- and under-educated workers (the Duncan and Hoffman or ORU model). By controlling for the attained educational level, the model compares over-educated (and under-educated) workers to *adequately* educated workers with a similar education. Moreover, as the model specification includes the respondent's actual instead of required level of education, the assignment theory predicts a *negative* effect of over-education (here, over-education implies a job at a lower level) and a (somewhat smaller) *positive* effect of under-education.

8.3. Major findings

Descriptive analysis of the ECHP data indicates that although more than half of the workers classify themselves as (weakly) over-educated for their jobs, less than one-fifth of them have remained overqualified during all the years they are observed in the data. Hence, over-education tends to most part to be a temporary rather than a stationary state with people shifting in and out of over-education over their life-course. The cross-tabulations made possible by the panel structure of the ECHP, however, also reveal that the year-to-year shares of workers moving out from and into a state of over-education have increased substantially from 1994 to 2001, except for Denmark. The increase has

been most conspicuous for Spain, where these year-to-year shares increased from 2% in 1994/95 to 16% in 2000/01.

Based on the set of countries sampled in the E-living survey, the average impact of over-education on earnings amounts to -17.6% when controlling for education, but diminishes to -11.2% when other explanatory variables are added. A similar estimation based on the 2001 ECHP data produces an earnings effect of over-education of only -1.9%, which, moreover, disappears when controls for industry, occupation and firm size are included. Hence, stronger (weaker) definitions tend to produce higher (lower) effects of over-education on earnings. Put differently, surplus education gives *a lower* economic return than required education[12], with this effect varying widely across European countries, but the extent of the effect depends largely on how over-education is measured. Furthermore, much of the measured effect of over-education dissipates when account is made of other wage-affecting factors. Last but not least, the over-education effect is weakened further when the dynamic dimension of workers moving in/out of the over-education state is accounted for as well. Accordingly, much of the over-education effect seems to be about occupational structure and mobility.

8.4. Concluding remarks

A strict interpretation of the over-education hypothesis suggests that over-education would lead to high unemployment rates amongst qualified workers and falling wages of workers with higher educational qualifications. This deterioration of wages for those with higher qualifications would make investments in education less profitable and, accordingly, act as a disincentive to enrol in higher education. The available empirical evidence, in contrast, reveals that there have been unchanged or even increasing returns to higher education, as well as rising participation in tertiary-level education. This is running parallel with high reported levels of over-education in many European countries, albeit much of this over-education seems to be of a temporary rather than a stationary nature.

Several arguments can be put forth in an attempt to explain the compatibility of both over-education and high rates of return to education: (1) inequality of opportunities for individuals with the same educational qualification but working in different occupations, resulting in different earnings premiums and job opportunities; (2) shortage and surplus of different types of educational qualifications due to imperfect student information on job opportunities; (3) labour market flexibility with job requirements changing with the

[12] Although the result implies that over-educated workers are at a relative disadvantage compared to their adequately educated counterparts, it does *not* imply a *negative* return to years of surplus educational investment.

skills of the workers actually doing the job; (4) possible trade-off between satisfaction and earnings with employees accepting jobs with less qualification requirements in order to get other life compensations; (5) location mismatch in the supply and demand for skilled workers; (6) dynamic adjustment due to family and job mobility or acceptance of lower-qualified jobs enabling future internal promotions; (7) over-education is a substitute for experience, tenure and/or on-the-job training.

Although the focus was on the earnings effects of over-education, it should be stressed that over-education may also have implications in terms of psychological costs (job dissatisfaction), social costs and long-term changes in occupational choices. Limited evidence obtained from the ECHP, however, provided no evidence in support of a difference in job satisfaction between workers who are overeducated and those who are not.

9. Education and wage inequality: the role of gender (WP5 – task 3)

9.1. Objective of the research

Most western countries now have equal treatment legislation as a means of reducing gender differentials in labour market outcomes. The EU countries are no exception. For example, women featured prominently in the Presidency Conclusions of the European Union Council in Lisbon 2000, which set the agenda for employment in the Union for the next ten years. In particular, as part of this Lisbon strategy, the EU requires equality of employment opportunities and wage earnings, and has set targets for the male–female gap in earnings. As shown by Pissarides *et al.* (2005)[13], the remaining distance to reach the Lisbon targets was still significantly variable across EU member states in 2004. Yet, there is evidence that ratification of international conventions supporting equal treatment of men and women has a strong and significant impact on the gender wage gap (Weichselbaumer and Winter-Ebmer, 2002)[14].

The main difficulty when trying to assess the progress made towards gender wage gap reduction is to disentangle that part of the progress that is due to policy from the part that is due to gender-specific behavioural changes over time and, finally, to identify the part that remains as a result of discrimination. The main objective of this line of the EDWIN research was to both up-date (previous work in this area is from the early

[13] Pissarides, C., P. Garibaldi, C. Olivetti, B. Petrongolo and E. Wasmer (2005), Women in the labour force: How well is Europe doing? in Tito Boeri, Daniela del Boca and Christopher Pissarides, *Women at work: an economic perspective:* A report for the Fondazione Rodolfo Debenedetti, Oxford University Press.
[14] Weichselbaumer, D. and R. Winter-Ebmer (2002), The effects of markets, politics and society on the gender wage differential: A meta-analysis. University of Linz. Mimeo.

1990s!) and broaden the existing knowledge on European gender wage gaps by making comprehensive cross-country comparisons of different measures of the gender wage gap and its components in search for major explanations for the observed trends in the gender wage gap in Europe and, especially, the role played by women's changing attitudes towards educational investments and labour market participation.

Indeed, during the last three decades, most EU countries have experienced a continuous rise in educational enrolment with enrolment rates having increased faster for women than for men. Typically, women have also outperformed men in terms of educational achievements in school and university examinations. Has increasing educational enrolment of women affected the gender wage gap? In particular, has the pay gap diminished as younger and more educated cohorts have entered the labour market?

The increase in women's educational attainment levels has been accompanied by other behavioural changes. Women's participation in the labour market has increased markedly as has, however, also the proportion of women working part-time. Have these changing patterns of females' labour market participation affected the gender wage gap?

Young high-educated women could be expected to have access to a wider range of job opportunities. Have occupational changes, if any, influenced the gender wage gap? Do younger cohorts of women face less discrimination in the labour market?

9.2. Data and methodology

The analysis was based on all eight waves (1994 to 2001) of the ECHP data for 12 countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Portugal, Spain and the UK).[15] The dependent variable referred to log of gross hourly wage, and the explanatory variables included educational level dummies, age and its square, tenure and its square, foreigner, married, number of children under 16, private-sector employment, residence in capital city, part-time job, year dummies. The sample covered workers aged 16 to 65.

The so-called Oaxaca–Blinder method was used to decompose the raw gender gap in hourly wages into one part that is due to differences in observed individual endowments and another part that reflects wage discrimination. The Neumark's approach was adopted to infer the wage distribution that would have been observed had there been no gender wage discrimination. The latter was decomposed into two components measuring how much men earn above the no-discrimination wage and how much women earn below it.

[15] Sample size or missing information led to the exclusion of Luxembourg, the Netherlands and Sweden.

Next, the above decompositions were extended to account for the effect of occupational segregation. Besides the endowment and wage discrimination components, the Brown–Moon–Zoloth decomposition method facilitates identification of the part of the raw gender wage gap that is due to men and women being differently distributed across occupations. It thus allows examination of the sensitivity of the gender wage gap decomposition to the occupational segregation structure.

The Oaxaca–Blinder decomposition was also extended to account for behavioural gender differences in terms of labour market participation. For each gender, a distinction was made between three categories – those not participating at all, those working part-time, and those working full-time, which were treated as the observed counterparts of a latent labour supply variable (a modelling strategy initially adopted by Ermisch and Wright). In this context, it allowed correction of the gender wage gap estimates and its different components for any selectivity bias. Indeed, not only are there significant gender differences in labour supply choices, but it might well be the case that non-participants or part-timers are actually potential low-wage earners. If this is the case, then failure to account for participation behaviour is likely to result in downward-biased estimates of the gender wage gap.

Attempts were also made to account for the possibility of educational choices being endogenously determined with wages and the impact of this on the measurement of the gender wage gap. A selectivity approach to endogeneity was adopted, allowing specific decompositions of the gender wage gap at each educational level. Hence, this approach not only helped to correct for the potential presence of an endogeneity bias problem, but also allowed examination of how the gender wage gap varies across educational groups.

Each of the aforementioned analyses was performed separately for each country, using the available ECHP samples of individuals. In addition, the analyses were also undertaken for each of three age cohorts – born 1925–45, 1946–65, 1966–85 – in order to show how the gender wage gap has changed over time in the different countries under study.

9.3. Major findings

There are huge cross-country differences in the size of the overall ‘raw’ gender wage gap. The largest gaps are found for Austria, Germany and the UK – all well above the 20% mark. The smallest gap (5%), by some margin, is obtained for Italy. The other countries cluster around 10% (Belgium, Denmark and Portugal), 15% (France, Greece and Spain) and 18% (Finland and Ireland). However, when the average female wage is positioned at the appropriate point of the male wage distribution, an inverse ordering of countries emerges compared to that based on the total raw wage gap. This suggests that

the countries in which women fare the best are those in which the gender wage gap is smallest, notably Denmark, France and Italy. The countries in which women fare the worst are Austria, Germany and the UK.

A more in-depth analysis of the wage structures of men and women in the EU-12 countries showed that the overall frequency distribution of wages looks very similar for men and women in a number of countries including Italy, Portugal and Spain. This, in turn, is reflected in the (unconditional) age–earnings profile of these countries, which does not differ much between men and women. In sharp contrast to this, several countries are characterised by a clear difference in the age–earnings profiles of men and women, notably Austria, Denmark, Finland, France, Germany, Ireland and the UK, and this also shows up in their frequency wage distributions. Moreover, although in many countries the age–earnings profile is fairly steep in the early years of the life-cycle (notably Belgium, Denmark, France, Germany, Ireland and the UK), this is not where the largest differences between men and women within a country are found. In some countries (e.g. Belgium and France), the male–female wage gap increases with age while in other countries (e.g. Germany and the UK), it remains relatively constant over the age profile.

By estimating separate earnings functions for men and women for each country, and conditioning on all the relevant background information available in the ECHP data, the age-specific wage schedule can be predicted while holding all other factors constant. The resulting conditional age–earnings profiles by gender reveal the gap that exists between men and women as they age after control for all observable differences. Such an analysis is instructive as it shows where the differences between men and women are when following the whole spectrum of their lives. This is to be compared with standard decompositions at the mean, which present only a limited view on the male–female wage gap. The results revealed substantial diversity between countries. For Italy and Portugal, there is relatively little difference between the pay of working men and women. The position is similar for Spain, although working women tend to earn more than men over the 24 to 40 age range. A similar pattern of early female advantage was observed for Belgium, Denmark, Finland, France and Greece, but in all these countries, men earn more in the latter part of their lives, in their 50s and 60s. In Austria, Germany, Ireland and the UK, women never earn more than men and for long periods in their lives they earn considerably less. It is this large gap over most of their working lives that contributes to the overall size of the gender wage gap that prevails in these countries.

Oaxaca–Blinder decompositions provide measures of discrimination that can be compared to the raw gender wage gap. For many countries, the overall gap is similar in size to the

amount due to measured discrimination (Finland, France, Italy and Spain). In other countries, the raw gender wage gap is appreciably larger than the amount that is attributable to discrimination. This holds true for Austria, Belgium, Denmark, Germany, Greece, Ireland and the UK. There is only one country for which the raw gender wage gap is smaller than the gap due to discrimination – namely Portugal, which is due to women being on average better endowed than men (as is also the case in Italy). When next distinguishing between the amount of discrimination arising from men being overpaid, on the one hand, and women being underpaid, on the other, overpayment of men (in relation to their characteristics) shows up as the major source of discrimination in a majority of countries (Austria, Finland, France, Germany, Portugal and the UK). In a few countries (Belgium, Greece, Ireland and Spain), the largest part of discrimination comes from underpayment of women (in relation to their characteristics).

Analysis of the extent to which the conditional gender wage gap (net of characteristics and endowments) differs between age cohorts indicated that it is larger for the oldest than for the youngest cohort. This finding, which holds true for all 12 countries, stands in sharp contrast with the raw gender wage gap being (in all countries, except for Portugal) largest for the youngest rather than the oldest cohort.

According to the ECHP data, the raw gender wage gap is largest among the more educated in Greece, Portugal and Spain. In other countries (Austria, Denmark, France and Germany), the pattern is reversed with the least educated experiencing the largest gender wage gap. In some countries, those with upper-secondary qualifications experience the largest gap. In still other countries, there is no significant difference between educational groups. Decomposition of the gender wage gap by educational level can highlight the degree of discrimination underlying these education-specific patterns. The results point to three groups of countries. Low-educated women are the most discriminated ones in Belgium, Greece, Ireland, Italy, Portugal and Spain. The most discriminated women are found among the high educated in Denmark, Finland and Germany. In Austria, France and the UK, there are no significant differences across educational groups in the extent of wage discrimination, although there are differences in terms of the position of men and women with respect to the no-discrimination wage level.

A distinction between part-time and full-time workers showed that only in Austria and Belgium is the extent of wage discrimination in the same range for both categories of workers. Wage discrimination is higher for part-time workers in France, Greece, Ireland, Portugal and Spain, and higher for full-time workers in Denmark, Finland, Germany, Italy and the UK. Decomposing the gender wage gap separately for part-time and full-time

workers highlighted an important and robust result: in all countries, wage discrimination among full-time workers is due mainly to underpayment of women rather than to men being overpaid. The opposite situation prevails among part-time workers. Finally, there are crucial differences between part-time and full-time workers in that part of the gender wage gap which can be attributed to gender differences in individual endowments. Only in Austria and Greece are women's endowments lower than those of men whether they hold part-time or full-time jobs. The opposite holds in Finland, France and Spain where for both categories of workers, women seem to be better endowed than men. In Denmark, Germany, Ireland and the UK, only among full-time workers do men have higher individual endowments. The opposite situation prevails in Italy and Portugal.

One important dimension of the male–female wage gap relates to considerable occupational segregation with women crowded into particular kinds of jobs – notably secretarial, retail and caring professions. Comparison of results concerning discrimination in the absence of occupational segregation and with allowance for such segregation revealed that discrimination is higher if occupational segregation is ignored in Belgium, Germany, Greece, Ireland, Italy, Portugal and Spain), but higher if it is allowed for in Denmark, Finland, France and the UK. This finding suggests that in the former group of countries, discrimination is highest in occupations employing the largest shares of women whereas in the latter group, feminine occupations are where discrimination is the lowest.

9.4. Concluding remarks

In line with a number of other comparative studies, the above results show that there are significant differences in the extent, as well as in the structure of the gender wage gap across EU member states. This suggests that although the equal treatment target should be common to all countries, the means of achieving it should be country-specific. The undertaken analysis adds new knowledge by shedding light on the importance of designing specific policies for the different countries, depending on which group(s) of female workers is(are) the most likely to experience unequal treatment. By exploring a number of crucial dimensions of the distribution of the male–female wage gap it was possible to identify such groups: (1) unequal treatment by age differs across countries with some countries revealing a need to focus on older rather than younger workers, although the extent of wage discrimination at older ages is likely to reflect the discriminatory effect accumulated over the working career; (2) unequal treatment does originate in underpayment of women but not in all countries, indicating that targeting relative appreciation of women's salaries vs. relative depreciation of men's salaries is a crucial issue; (3) occupational segregation is an important factor for understanding the gender wage gap, but in some countries wage discrimination is most serious in

occupations employing high shares of women whereas in other countries, the opposite holds true; (4) in most countries, wage discrimination stands out as a more serious problem among part-time than full-time workers, suggesting that the larger the share of part-timers, the more attention these countries should pay to this group of workers; (5) the extent of wage discrimination within different educational groups varies substantially across countries with some countries revealing more outstanding wage discrimination among the high educated, implying that exclusive focus on the low-educated would largely be wrongly targeted policies.

10. Education and wage inequality: the role of school quality (WP5 – task 4)

10.1. Objective of the research

Compulsory schooling constitutes the major part of people's investments in education. While higher secondary and tertiary education deepen the general knowledge and enable students to specialize in certain subjects, the basic cognitive skills are acquired in primary and lower secondary education. They constitute the foundation of human capital which individuals build upon for the further accumulation of skills. As a consequence, the production of educational skills during compulsory schooling can be seen as a crucial potential source of inequality between individuals in school and, later on, in labour market outcomes. Evidently, school quality has a notable influence on this process, thus contributing to the heterogeneity of educational outcomes across Europe. The aim of this part of the EDWIN research therefore was to identify the factors that most strongly improve the acquisition of education and skills, with a view to helping policy-makers allocate resources efficiently and conduct appropriate reforms.

10.2. Data and methodology

Because of an unfortunate lack of cross-country comparative data on relevant measures of school quality, the adopted approach departed from a comprehensive review of the current state of knowledge extended with the new empirical evidence produced within the framework of the EDWIN project for those countries for which appropriate data was available.

The commonly used theoretical framework for assessing student achievement is an educational production function where the 'product' – generally the cognitive skills of students – is the outcome of various input factors. Due to the complex nature of educational production, these theoretical models mostly focus on a limited set of potential input factors: student ability and effort, family and social background, educational resources, school and class characteristics, teachers' characteristics and the

institutional setting in which the process of educational production takes place. The production of cognitive skills in school can either be viewed as a cumulative process, which starts in early childhood and continues up to the date when educational achievement is measured, or as a value-adding process focusing on the additional skills acquired within a certain time period by means of inputs into educational production in this specific period. The value-added model allows the researcher to control for innate ability and other unobserved factors and to focus on the inputs of a well-defined time period. Major shortcomings, however, are that the lagged impact of previous inputs remains unknown and that the results cannot be generalized to other periods.

When it comes to empirical estimation of the impact of school quality on educational outcomes, several potential methodological problems need to be solved, which might otherwise bias the estimated impact of school quality: (1) endogeneity of school quality inputs; (2) selection effects; (3) omitted variables; (4) the possibility of a hierarchical structure of the available data; (5) the choice of functional form; (6) estimation at the mean instead of at different points of the educational distribution. Apart from these estimation-related options, also the choice of indicators for educational outcomes (test scores, educational credentials, years of schooling, enrolment rates, graduation rates, between-educational-level transitions, etc.) and/or school quality will, of course, influence the empirical findings.

10.3. Major findings

The following may be noted when characterising school quality according to four dimensions: educational resources, teachers' characteristics, school and class characteristics, and institutional setting.

Educational resources: Descriptive statistics show no clear simple correlations between, for instance, PISA reading test score results (proxy for educational outcomes) and, respectively, total annual expenditure per pupil in primary and secondary education, the pupil-to-teacher ratio in primary and lower secondary education, or total intended instruction time (in hours) per year for 9 to 14 year-olds. The empirical evidence on the impact of resources on educational performance is mixed but points to most part to small, if any, effects. More significant effects of smaller classes and other resource measures can be found for students in lower grades and for disadvantaged students. All in all, resources alone seem to be no guarantee for a higher quality of education. On the other hand, both theoretical considerations and empirical evidence underline the great difficulty in consistently estimating the causal relationship between class size, pupil-to-teacher ratio or financial resources and student performance.

Teachers' characteristics: The empirical evidence on the impact on student performance of the formal education of teachers is mixed, as well; some studies find no support for such an influence while others report a small but significant effect with especially high achieving students benefiting from well-educated teachers. The experience (and hence the age) of teachers is found to have a small positive but declining effect on student performance with the gains thus being largest during the first years of the teacher's career. Opposite to performance-related incentive pay, teachers' ordinary salaries stand out as a rather poor measure of their quality and are also weakly, if at all, related to student achievement. The level of teachers' salaries compared to those in other professions may, however, affect the attractiveness of the profession and, thus, the ability of the school system to attract good teachers. Indeed, the recruitment of high quality teachers has become more difficult in most countries. All in all, the relationship between teachers' characteristics and student achievement seems to be rather loose, but this conclusion might simply result from the available indicators being poor proxies for teachers' quality.

School and class characteristics: Most evidence points to no significant differences in student performance between private and public schools in lower secondary education. The evidence on the impact of streaming is scarce, but seems to indicate that a more selective school system has a significantly positive effect only for students selected into high-level tracks. When the effect of school type is taken to be mediated through class composition rather than teaching, the average performance of peers is found to exert a strong positive influence on especially low-performing students, while there is little evidence of any effect of class heterogeneity. All in all, the evidence on school type and class composition effects is still rather weak.

Institutional setting: Compared to the existing evidence in relation to resources and teacher/class characteristics, the evidence concerning the institutional setting is quite promising with strong support for student performance benefiting both from school autonomy, especially under external standards, and central exit exams. Hence, setting the right incentives seems to improve student performance (given resources) and to also be a prerequisite for effective use of further spending on education.

On the whole, the empirical evidence on the effect of school quality on student performance is rather ambiguous, with most resource measures and school characteristics having at best a small positive effect. A more detailed analysis of two EDWIN countries, whose students performed very differently in the 2000 PISA study – Germany and Finland, was undertaken in order to shed further light on the impact of observable differences in school quality on cross-country differences in student

performance. While Finland achieved top-rankings in all test subjects, German students performed significantly below the international average. Moreover, the gap in test scores between Finnish and German students increases when moving down the test score distribution; that is, it is largest between the lowest performing students. Based on the estimation of educational production functions and Juhn–Murphy–Pierce decompositions of the test score gap into, respectively, a characteristics, return, characteristics-return and residual effect, it was found that differences in resources and teacher characteristics can explain only a tiny part of the score gap and, moreover, merely at the bottom of the distribution.[16] A major part of the overall score gap between the two countries is due to unobservable factors.

10.4. Concluding remarks

Student characteristics and family background are well-established and crucial determinants of student achievement, while the evidence on school quality effects is mixed and rather weak, especially for educational resources. Cross-European variation in educational skills can be ascribed mainly to differences in institutions – notably central exams and school autonomy, which are strongly positively associated with a higher skills level while simultaneously being less cost intensive than most other school quality inputs. Some features of the basic education system, like streaming and private schools, seem rather to impact on the degree of equality of educational opportunities. A fairly common result, however, is that measures of school quality benefit mainly disadvantaged students, which underlines the importance of distinguishing between students differing in characteristics. Additionally, the effects found for earlier grades are typically stronger than for higher grades, implying that the older the students are, the more difficult it is to improve their skills by use of school quality related measures.

The low effect of school quality on student performance may, at least to some degree, be explained by incorrectly specified statistical models or by missing or imprecisely measured indicators for school quality. What is needed is high-quality, comparative longitudinal data on past and present family and school inputs. Recent international studies on student performance (e.g. PIRLS, PISA and TIMSS) do provide better insight into the educational production process, but information is still lacking on prior inputs and outcomes and is still too limited on home and school inputs.

[16] Note, however, that this framework allows only institutions that differ within countries to be accounted for. Institutional features like streaming that concern the whole schooling system of a country cannot be reasonably analyzed in a comparison of two countries.

11. Education and wage inequality: the role of training (WP5 – task 5)

11.1. Objective of the research

Training policies can be motivated both on efficiency and equity grounds. Equity refers to the distribution of training, efficiency to its under-provision in the absence of policy intervention. If the opportunities to accumulate work experience of high demand in the European labour markets are correlated with key characteristics of the individual, particularly his/her educational level and age, this circumstance may be reflected in the observed variation in wage outcomes between and within educational groups and cohorts. Under-provision occurs when training is below the efficient level, where marginal social benefits equal marginal social costs. Empirical evidence on under-provision is, therefore, important for gaining a firm ground for the design of training policies. While there is a growing body of empirical evidence on the unequal provision of training opportunities and its effects (see further e.g. Asplund (2005a and 2005b) and the references therein), our knowledge about the under-provision of training is still scarce. This part of the EDWIN research aimed at further highlighting the differences in training incidence across Europe and, especially, to explore whether the uncovered differences are the product of labour market inefficiencies, or whether they simply reflect differences in (social) costs and benefits that would persist even in perfectly competitive labour markets.

11.2. Data and methodology

The undertaken analyses were based on ECHP data, waves 1995 to 2001. The type of training recorded in the ECHP is formal and includes vocational courses taken at schools and vocational colleges, as well as training courses in companies. The key question on training included in the ECHP is: “Have you at any time since January in the previous year been in vocational education or training, including any part-time or short-courses?” While informative on training incidence, this question is silent on the duration of training spells. Unfortunately, the information on the duration of training in the ECHP is completely missing for the Netherlands and Sweden, and largely missing for the UK. Therefore, the focus was turned on the incidence rather than the intensity of training. But even then, the data causes problems in the form of omitted spells. This shortcoming appears to be particularly serious in the data for Germany, which also miss crucial information on employer-provided training, as well as on industry affiliation. Also Germany was, therefore, dropped from the estimation sample, as was also Sweden for much the same reasons. The sample was further restricted to individuals aged between 25 and 64, working at least 15 hours per week, not employed in agriculture, present in at

least two consecutive waves, and not in apprenticeships or in special employment training schemes.

The analysis of training incidence in Europe was, thus, based on ECHP data for 12 EU countries.[17] Apart from simple cross-tabulations of the underlying data, aggregate as well as country-specific probit models were estimated, associating individual training events to a vector of individual controls including gender, education, age, marital status, firm size, industry, occupation and type of job.

The point of departure for the analysis of training inefficiency (under-provision) in Europe, based on ECHP data for 11 EU countries[18], was the following. If companies invest in training, important evidence on under-provision can be obtained by looking at the effects of training on turnover. On the one hand, a positive effect on turnover reduces the marginal benefits of training with respect to the first best, with negative effects on training. On the other hand, a negative effect can compensate for other sources of under-provision and close or even eliminate the gap between efficient and actual training outcomes.

The empirical relationship between training (general) and turnover rates (voluntary quits)[19] was investigated using the following framework, with a view to answering the question: Does turnover decline among trained employees? For this purpose, those individuals were selected who had received employer-provided general training during the time of the survey (between January in year $t - 2$ and year t), and by examining whether or not they had quitted their last job in year $t + 1$, conditional of no turnover in year t. General training includes off-the-job training in vocational schools and training that provides both work experience and complementary instruction elsewhere. To eliminate the risk of having separations taking place before the training event, the turnover of interest was chosen to be that having occurred one year after the survey rather than in the same year. The empirical model was specified as

$$q_{it} = \alpha + \beta X_{it} + \gamma \tau_{i,t-1} + f_i + \varepsilon_{it}$$

where q is turnover – a dummy equal to 1 in the event of turnover and 0 otherwise; X a vector of time varying controls, τ the training dummy, c an individual fixed effect and ε a random error orthogonal to training. If more able individuals are less likely to quit and

[17] Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal, Spain and the UK.
[18] Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Portugal, Spain and the UK.
[19] Voluntary turnover behaviour was captured by two questions in the ECHP, viz. the ones that ask workers to indicate (1) the year when they stopped working in their previous job, and (2) the reason of the separation.

more likely to receive training, failure to account for unmeasured individual fixed effects could seriously bias the estimates downwards, for which reason the linear probability model was estimated using fixed effects estimation techniques. The vector *X* included age and its square, year dummies and five dummies representing the time varying degree of job satisfaction.

11.3. Major findings

Cross-tabulations of ECHP data revealed the unequal distribution of training across occupations (and thus educational levels), industries as well as countries, documented in many previous studies on training incidence. A more accurate description of correlations (albeit not of causal relationships) was obtained by estimation of both aggregate and country-specific probit models. The aggregate results were as expected: the probability of training is higher for the more educated, for females (all training, not for employer-provided training), for public-sector employees, in full-time jobs, in permanent jobs, and in companies with more than 100 employees. The relationship between training and age is increasing in age for the youngest age group (25 to 30), and decreasing for the older age groups. Controlling for individual, job, country and time effects narrowed the cross-industry and cross-occupation gaps in training incidence but did not eliminate them. The country effects, however, turned out to account for most part (almost one-half) of the explained variation in aggregate EU training participation. In view of this, it is hardly surprising that the country-specific estimates display considerable cross-country heterogeneity in the contribution of certain explanatory variables (especially education and gender) to explaining training incidence.

Empirical investigation of the relationship between training and turnover indicated that 7 to 10 trained workers out of 100 tend to quit between one or two years after training. The estimation results, however, allowed no unambiguous conclusions to be drawn when it comes to the influence of training on quitting behaviour; the estimated relationship was negative but statistically insignificant.

11.4. Concluding remarks

Training plays an important role in the European strategy for higher employment and competitiveness, as documented in a number of European Council resolutions. An implicit argument behind this strategy is that private agents are not capable or willing to reach the socially optimal level of training. A prerequisite for any design of policies aimed at reducing eventual under-provision of training is that the causes of under-provision are well established. The existing empirical evidence suggesting that under-provision is a serious problem is dramatically scarce and broadly unconvincing, however. The role

played by employer and employee behaviour in this context is also not well understood. Hence, the current knowledge does not provide much policy guidance for tackling (or not tackling) the substantial differences in training outcomes that exist along several dimensions, including educational attainment level, age, industry, type of job, firm size – and country.

IV. CONCLUSIONS AND POLICY IMPLICATIONS

1. Advancement of the state-of-the-art by intense collaboration

The comprehensive research undertaken within the framework of the EDWIN project has, as outlined in the previous section, contributed with new European-wide knowledge on several crucial aspects of the complex interplay between education and wage inequality, as well as on several major policy-relevant factors underlying the observed trends in this intricate relationship. Among the many contributions to the state-of-the-art within the field of education and wage inequality, the following should be mentioned, at least:

1) broad-based literature review drawing together both international and national evidence, and pointing to still existing knowledge gaps, part of which the EDWIN project has aimed to fill;

2) new cross-country comparative evidence on the level, structure and inter-temporal changes of earnings inequality in Europe up to the new millennium based on an informative body of statistical approaches;

3) new cross-country comparative evidence on the economic effects of demographic and educational changes in Europe up to the new millennium, while simultaneously displaying the importance of distinguishing the impact of demographic shocks from that of educational shocks;

4) new comparative cross-European evidence on the private economic benefits from investing in education with particular emphasis on the extent and evolution over time of within-educational-group differences in returns and, hence, on the wage risk associated with investments in education, and, in the last resort, on the observed patterns of wage inequality in Europe;

5) new European-wide evidence on the role of labour market institutions and flexibility arrangements in shaping the impact of the boom in education and, especially in tertiary-level education, on wage structures with emphasis on both between-educational-group and within-educational-group wage inequality;

6) new cross-European evidence on the relative importance of over-education in today's Europe;

7) new knowledge on European gender wage gaps based on comprehensive cross-country comparisons of different measures of the gender wage gap and its components with particular emphasis paid to the role played by women's

changing attitudes towards educational investments and labour market participation;

8) comprehensive overview of existing and new EDWIN evidence on the role of school quality in the production of educational skills during compulsory schooling – one potentially crucial source of inequality between individuals in school and, later on, in labour market outcomes, with the aim to identify the factors that most strongly improve the acquisition of education and skills and, hence, to help policy-makers allocate resources efficiently and conduct appropriate reforms of the school system;

9) new European-wide evidence on the role of labour market inefficiencies in explaining the large differences observed in training incidence both within and across European countries.

These highly different but intimately connected lines of research and the multitude of results that these research efforts have produced would not have been possible without explicit division of responsibilities and tasks among the EDWIN partners coupled with successful collaboration, and the general as well as specific knowledge that all partners have invested in the project when it comes both to optimal choice of theoretical frameworks, statistical models and econometric techniques, to the provision of national data, and to the interpretation of overall as well as country-specific outcomes.

2. Summary of key findings

The structure of and inter-temporal changes in wage inequality in Europe:

1) The level of earnings inequality varies considerably across EU countries.

2) In most countries the bulk of inequality emanates from differences within (rather than between) narrowly defined groups of workers.

3) Very substantial cross-country differences exist in the structure of earnings inequality.

4) The distribution of education is usually the factor most closely associated with earnings inequality (rather than age, sex or sector of employment).

5) In most countries the observed rise in earnings inequality was driven primarily by rises in inequality within (rather than between) groups of workers.

Economic effects of demographic and educational change:

6) Demographic changes – the so-called 'baby bust' – as well as long-term changes in the skill structure of the labour force – the 'educational boom' – have, ceteris paribus, played a significant role in improving overall employment performance and also in alleviating youth unemployment in Europe.

7) These demographic and educational shifts have had qualitatively different effects on young and adult workers. Previous studies have not provided a full picture of this phenomenon, because no distinction has been made between the two types of structural change.

8) Education matters. The long-term increase in educational achievement has reduced, ceteris paribus, the unemployment rate of the more educated. This finding, which stands in sharp contrast to the standard textbook supply–demand model, holds true also when skill-biased technological change and the endogeneity of educational choices are taken into account.

9) The overall effect of cohort size on European earnings is negative but rather modest. It varies, however, by education and age. Moreover, it is stronger in the Southern European countries than in Continental and Northern Europe.

The dynamics of changing wage distributions in Europe:

10) Investments in education have continued to provide a significant private return to individuals in the European labour market. Despite a strong increase in the relative proportion of high-educated workers, the wage premium has remained remarkably stable.

11) Educational investments are, however, associated with a significant amount of wage risk, which arises from the fact that individuals who otherwise perform better in working life tend to reap a higher return from their investments in education.

The role of labour market institutions and flexibility arrangements:

12) Effects on employment: Labour market institutions have contributed to the changing fortunes of the least protected workers and have influenced unemployment rates in various ways. In particular, unemployment benefits raise unemployment, while bargaining coordination and employment protection reduce it.

13) Effects on wages: Labour market institutions affect the wage distribution in various ways. Bargaining coordination tends to compress wages especially from the top of the wage distribution. Employment protection tends to compress wages especially from the bottom of the wage distribution. The relationship between union membership and wage compression remains ambiguous, although within-country evidence suggests that union membership has a wage compressing effect. Institutional factors reduce wage inequality in the covered sector, but increase it in the uncovered and less protected sector. These opposite effects are likely to be stronger in the Southern European economies, where the high institutional protection granted to the covered sector is offset by the conspicuous role played by the unprotected sectors.

14) Education-intensive companies have fewer unionised employees, are less likely to be covered by collective agreements, and, if they are, these agreements tend more often to be determined at the local level. Indeed, the use of individual performance based pay systems is more frequent in these companies. They are likely to be more innovative, to undertake organisational changes, to invest more in on-the-job training, and to pay higher wages. All this evidence in support of the productivity-enhancing effects of education explains, at least partly, why wage dispersion is higher among the higher educated.

Does Europe face an over-education problem?

15) 'Over-education' – in the sense of working in jobs requiring less education than one has – is widespread in most European countries. Exactly how much over-education there is depends crucially on the precise definition that is used in the data which is examined. There is no evidence that the rate of over-education has been rising over the last 10 years in European countries.

16) A challenging issue is how to reconcile the presence of over-education with rapidly rising educational participation and the existence of substantial private returns to educational investment. A major reason for the co-existence of these contradictory phenomena is that much of the over-education is explained by occupational structure and labour force mobility, that is, concerns dynamic adjustment processes. Many individuals are moving from one geographical location to another and will not obtain jobs commensurate with their qualifications in the short term. Also, there are new recruits to the labour market who take some time to find a suitable job.

17) Looking across countries there is some limited evidence that over-education is higher when the educational participation rate rises and when unemployment is higher. In addition the rate of return to education is lower when over-education is higher. At the level of the individual the effect of over-education is to reduce earnings by 2 to 18 % depending on circumstances. These findings suggest that there is a genuine policy issue with respect to the level of educational provision.

Gender and labour market inequality:

18) Labour market prospects for men and women in European countries remain unequal. There are large differences across Europe in the size of the gender pay gap. In general this pay gap has been declining in most countries but at a differential rate in each.

19) The project examined the extent to which the gender pay gap can be explained by: gender differences in educational choices, occupational segregation and behavioural differences in the participation decision across countries. Each of these factors was found to be important in the explanation of the gender pay gap.

School quality and educational skills:

20) Student characteristics and family background are the most important determinants of student achievement, while the effects of school quality, as proxied by, for example, school resources, stand out as surprisingly weak.

21) The variation in educational skills across European countries seems to be explained more by differences in institutions and the process of skill formation than by differences in resources and student characteristics.

22) However, disadvantaged students do benefit from more resources, especially during earlier grades. This underlines the importance of distinguishing between students of different characteristics.

Market failures and the under-provision of training:

23) Workplace training policies can be justified both on equity and efficiency grounds. Equity refers to the distribution of training, while inefficiency depicts under-provision of training in the absence of policy intervention. Designing policies aimed at reducing under-provision of training requires that the causes of under-provision are correctly identified.

24) Training is not provided equally: the young and better educated face a significantly higher probability of receiving employer-provided training, and training is more likely in the public sector and among large firms.

25) Companies provide and pay for training, both general and specific, which can be taken as evidence that labour markets are not perfectly competitive.

26) There is no clear evidence that training is lower than the socially efficient level. Without such evidence, it is difficult to justify policy intervention which aims at restoring efficiency. By investing in training, firms can reduce worker turnover and attenuate the reasons for under-provision. The empirical evidence on this, however, is not uncontroversial.

27) Even in the absence of clear evidence of under-provision, policy intervention can be justified because of equity reasons.

3. Key policy implications

1) Taking into account the heterogeneity of European countries regarding trends in the level, structure and patterns of earnings inequality, it is rather unlikely that a given type of policy would have very similar effects across countries. Therefore, if – and this is a big 'if' – the stated aim of policy is to reduce earnings inequality, different policies for different European countries are likely to be appropriate.

2) Due to the changing age structure of the European population, the burden of unemployment is increasingly shifting to adult workers, particularly women and the low skilled. Active labour market policy (ALMP) measures need to be targeted at the re-employment of these particular groups of displaced workers, although, admittedly, such measures have generally proved to be costly, in most cases only mildly effective, and when targeted at a specific group, can generate adverse effects on other vulnerable groups. Therefore, too much should not be expected even from ALMP measures as a therapy for demographic and skill shocks. Accordingly, equally important is to guarantee the provision of both publicly and employer provided education and training a more active role in this context (see further bullet (10) below).

3) When addressing the quest for greater labour market flexibility and a progressively weaker role for labour market institutions, a clear distinction should be made between 'bad' labour market institutions (which distort the

functioning of the labour market) and ‘good’ labour market institutions (which are designed to correct market failures).

4) Labour market institutions tend to compress wages both from the top and the bottom of the wage distribution. This weakens the incentives of higher-educated employees to unionise. Accordingly, an increasingly better educated workforce will put pressure on European bargaining systems.

5) Policies aimed at increasing educational attainment can be expected to raise average earnings but also wage inequality due to the wage risk associated with educational investments. This wage risk may also affect the demand for education. All these aspects might require the development of new instruments to improve the equity and efficiency of educational funding. This notion is important also from the viewpoint that the virtuous circle “more education – more job posting – more good jobs” is predominantly determined and sustained by the extent and mode of public funding of education.

6) The main policy question in relation to the over-education problem is to establish to what extent it represents a real waste of resources. It is clear that a large fraction of the labour force works in jobs they are overqualified for, which has a modest negative effect on their earnings potential. It is possible that these negative effects fall disproportionately on the disadvantaged in society. Despite these findings it is far from clear that governments should discourage private investment in education as short-term private returns to education are high and the long-term social return to education may remain high.

Governments can attempt to deal with the problem of over-education by influencing the demand for and/or the supply of educated labour in the economy. They can implement policies aimed at affecting the demand for labour within the private sector through macroeconomic policies, for example, by providing tax incentives to companies for them to make better use of skilled workers. The government can also affect the overall demand for labour through policies that affect its own labour force or influence the educational attainment of individuals entering the labour market by changing the private cost of education. Simultaneously policy-makers need to be concerned about any policy change which impacts on the labour market adjustment mechanisms (formal qualifications, training, etc.).

7) Countries should look for ways of further reducing the gender pay gap. There is more scope for promoting gender pay equality in some countries by the use of policies which encourage and facilitate: return to work after child rearing, free

occupational and education choice. As women are free: to pursue more stable careers with better access to child care and fewer interruptions, to choose more flexible work hours and to have better access to educational and occupational choices, then the gender wage gap should fall. Better policies to promote these changes could be introduced in most EU countries although some countries are much more equitable already.

8) Policies to improve the formation of educational skills should emphasise the provision of the right incentives to students and teachers by adjusting schooling institutions and by measuring achievement in a coordinated way. In other words, there is an obvious need for improved incentive systems and better monitoring mechanisms and accountability.

9) Training opportunities are not equally distributed. Since human capital is an important source of income and job satisfaction, a more equitable allocation would require some redistribution in favour of groups of individuals who are less likely to be trained. The key question here is whether economic policy should try to correct outcomes – differences in training – or to modify initial conditions which produce efficiently different outcomes, for instance differences in educational attainment.

10) Training policies aimed at increasing the level of training are ubiquitous and should be designed to affect either supply or demand, or both. Broadly speaking, supply policies can affect employer-provided training at the margin if they influence marginal benefits and marginal costs. The marginal benefits of training to the employer are influenced by the productivity of training, labour turnover, the degree of (absolute) wage compression and the inter-temporal discounting rate. Therefore, policies which aim at increasing the benefits of training should try to influence these variables, both by affecting structural and framework conditions and by direct targeting. Among training policies that could be classified as targeting marginal benefits are payback clauses and apprenticeship contracts. Levy/grant schemes, train or pay schemes, and tax deductions could be classified as policies targeting the marginal costs to employers. Levy/grant schemes combine a tax levied on all firms – normally on payroll – with grants awarded to training projects presented by some company. ‘Train or pay’ schemes, in turn, involve levies which are payable only if the training investment falls below a legal minimum. Finally, tax deductions from turnover, which may cover some or all training costs, provide training incentives through reduced corporate taxes. The evaluation of these kinds of policies,

which cost money to the taxpayer, is still in its infancy, and in several European countries we know too little – at least compared to what we know about the impact of these policies in the USA.

4. Future needs for research efforts

The future needs for research efforts divide into two distinct categories: one relating to the availability and quality of comparative cross-European data, and one relating to the research topic as such. The subsequent listings are by no means exhaustive; they rather point to those selective dimensions that presently stand out as most urgent in view of the experiences gained from the EDWIN project.

Future needs to improve the availability and quality of comparative cross-European data:

1) The EDWIN project has extensively used the ECHP data. Unfortunately, the quality of this data has occasionally weakened the quality of the undertaken research or even severely restricted the possibilities of the research teams to follow up interesting and important digressions to the basic – and originally outlined – research within the framework of the project's five workpackages. Although no new waves are to be added to the current version of the ECHP, it is of utmost importance to continue to correct the data for the most obvious mistakes and shortcomings, at least. One option would be to add to Eurostat's web-site in relation to the ECHP database some kind of 'Discussion Forum', where researchers could point to clear-cut and/or potential mistakes in the data, where other researchers would have the possibility to react based on their own experience and knowledge, and where, most importantly, Eurostat itself should provide answers to the posed questions and indicate potential measures to be taken accordingly.

2) Apart from just reporting basic figures and indicators, Eurostat might consider the option of also calculating, on a regular basis, fairly simple but informative indices for the level and structure of – not least – overall as well as gender wage inequality and its major components. The research undertaken within the EDWIN project in these respects would provide an excellent framework for such an effort.

3) Both nationally and at the EU level, education as well as innovation and economic policies pay increasing attention to the quality of education. Simultaneously the available information on crucial aspects of school quality is

very limited or totally missing. There is an obvious need to improve existing school quality indicators but to also develop new ones.

Future research needs at a cross-European basis:

4) Low achievement in school and early school-leaving are among the most important factors explaining inequality and social exclusion. Simultaneously there is a conspicuous lack of comparative research in terms of methodology, data, and significant coverage at a European scale on the reasons for and consequences of these phenomena.

5) Training policies which aim at increasing the level of training above the market level are typically designed to affect either supply or demand, or both. Moreover, all these policies are motivated by the presumption that under-provision of training is a real problem in the European labour markets. The effectiveness of European training policies is, however, hampered by the fact that our knowledge on the extent and causes of under-provision is still rather scarce. Europe is lacking a broad-based evaluation of its training policies.

V. DISSEMINATION AND EXPLOITATION OF RESULTS

1. Strategy for dissemination of results during the life-time of the project

The results produced within the framework of the EDWIN project have been disseminated and exploited in the following ways:

1) Creation and regular up-date of the project's web site http://www.etla.fi/edwin

2) Arrangement of two policy-oriented workshops: the first one at ZEW in Mannheim on June 24, 2004, and the second at the Centre des Conferences Albert Borschette in Brussels on September 22, 2005, in close co-operation with DG-Research. Details on these events can be found at the project's web site.

3) Workshop, organised by the French partner at the Université Panthéon-Assas (Paris 2), on *Labour Market Outcomes of Educational Attainments*, November 10, 2003. Of the six papers presented four were by EDWIN partners: Ali Skalli (FR), Giorgio Brunello (IT), Claudio Lucifora (IT) and Peter Dolton (UK).

4) Comprehensive literature review on *Education and wage inequality in Europe*, published in the form of a book in the series of the co-ordinating organisation. For details, see Section III. 1 of this final report and also the project's web site.

5) The main contributions of the project will be summarised into a book to be offered to an international publisher. The contributions of EDWIN partners appear in the subsequent table. In addition, the book will include a few chapters written by non-EDWIN partners.

6) Continuous dissemination of information about both the project and its major results to potential users such as the national ministries of education as well as other both national and international stakeholders.

7) Disseminations by the coordinator and partners in the form of invited speeches, interviews, conference/workshop/seminar presentations and publications (working papers, book chapters, journal articles, etc.) are listed in the subsequent Annex.

2. Results foreseen by partners after the completion of the EDWIN project

Title	Partners involved	Exploitation intention
Education and Wage Inequality in Europe	Rita Asplund (FI), Erling Barth (NO) and Peter Dolton (UK) (eds)	EDWIN book by international publisher
Wage inequality in an international perspective	Rita Asplund (FI) and Erling Barth (NO)	Chapter in the EDWIN international book
Earnings inequality in Europe: Structure and patterns of inter-temporal changes (WP2)	Panos Tsakloglou and Ioannis Cholezas (GR)	Chapter in the EDWIN international book
Education and income inequality: lessons from international macroeconomic evidence	Rita Asplund (FI)	Chapter in the EDWIN international book
Education and wage inequality in Finland (WP3&WP4)	Rita Asplund (FI)	Book (in Finnish in the series of RIFE/ETLA)
Economic effects of demographic and educational change: a review of recent findings (WP3)	Claudio Lucifora (IT)	Chapter in the EDWIN international book
Education, gender and earnings (extension of an EDWIN WP4 study on Germany and France to Finland)	Rita Asplund (FI)	Working Paper
Education and Wage Dispersion: New Evidence for Europe (WP4)	Santiago Budría and Pedro Telhado Pereira (PT)	Chapter in the EDWIN international book
Returns to Education, Endogeneity and Quantile Regression: Evidence from the European Community Household Panel (WP4)	Corrado Andini and Santiago Budría (PT)	Working Paper + journal article
Education as a Risky Asset: How Much to Invest? (WP4)	Corrado Andini (PT)	To be submitted to *Economics Letters*
Endogeneity of Education, Wage Inequality and Quantile Regressions: What is Really the Story with Portugal? (WP4)	Corrado Andini (PT)	Working Paper + journal article
Returns to Education for Working-Students in Portugal (WP4)	Corrado Andini and Pedro Telhado Pereira (PT)	Working Paper + journal article
The determinants of access to further education in Portugal (WP4)	Santiago Budría (PT)	Working Paper + journal article
Wage Dispersion, Markets and Institutions. The effects of the	Erling Barth (NO), Claudio Lucifora (IT) and Panos	IZA Working Paper + journal article

boom in education on the wage structure (WP5-1)	Tsakloglou (GR)	
Explaining changes in within group wage dispersion (WP5-1)	Erling Barth (NO)	Chapter in the EDWIN international book
On the estimation of fixed worker and employer effects: Applications from wage regressions (WP5-1)	Erling Barth, Harald Dale-Olsen, Max Grütter and Rafael Lalive (NO)	IZA Working Paper + journal article
Performance-related pay and the intrafirm wage structure (WP5-1)	Erling Barth, Bernt Bratsberg, Oddbjørn Raaum and Torbjørn Hægeland (NO)	Working Paper + journal article
Firms and Worker Effects in Norway (WP5-1)	Erling Barth and Harald Dale-Olsen (NO)	IZA Working Paper + journal article
Employer Strategies in the Knowledge Society (WP5-1)	Erling Barth (NO)	Working Paper
Over-education across Europe (WP5-2)	Peter Dolton and Oscar Marcenaro (UK)	Chapter in the EDWIN international book
Educational Standards and Qualification Inflation - Does it Matter? Evidence for Britain (WP5-2)	Peter Dolton and Oscar Marcenaro (UK)	Working Paper + journal article
Are Educational Mismatches Behind the Positive Association Between Education and Within-Groups Wage Inequality? (WP5-2)	Corrado Andini and Santiago Budría (PT)	To be submitted to *Economics Letters*
School Quality and Educational Outcomes in Europe (WP5-3)	Andreas Ammermüller and Charlotte Lauer (GE)	Chapter in the EDWIN international book
Pupils' performance at school: Household vs. school characteristics (WP5-3)	Oussama Ben Abdelkarim (FR)	Working Paper + journal article
Use IT or Lose IT (WP5-3)	Peter Dolton, Gerry Makepeace and Helen Robinson (UK)	Working Paper + journal article
Measuring Occupational Success over the Life Cycle using Panel Data (WP5-3)	Peter Dolton, Gerry Makepeace and Oscar Marcenaro (UK)	Working Paper + journal article
Educational funding policies in Europe (WP5-3)	Rita Asplund (FI), Oussama Ben Abdelkarim (FR) and Ali Skalli (FR)	Chapter in the EDWIN + submitted for presentation at the Society of Labour Economists' annual conference, Cambridge MA., 6-7 May, 2006.

Student loans and students' investment behaviour in tertiary education: Evidence from Finnish Cohort data (WP5-3)	Rita Asplund (FI), Oussama Ben Abdelkarim (FR), Mika Maliranta (FI) and Ali Skalli (FR)	Journal article + submitted for presentation at the Society of Labour Economists' annual conference, Cambridge MA., 6-7 May, 2006.
Gender Wage Differentials in Europe (WP5-4)	Peter Dolton (UK), Oscar Marcenaro-Gutierrez (UK) and Ali Skalli (FR)	Chapter in the EDWIN international book
Male-female earnings differential across Europe: Evidence from the ECHP (WP5-4)	Ioannis Cholezas and Panos Tsakloglou (GR)	Working Paper + journal article
University enrolment, family income and gender in Italy (WP5-4)	Simona Comi (IT)	Working Paper
Parental education, gender and the returns to education in Europe (WP5-4)	Simona Comi (IT)	Working Paper
Intergenerational education transmission in Europe: are daughters and sons different? (WP5-4)	Simona Comi (IT)	Working Paper
Training in Europe: efficiency issues (WP5-5)	Giorgio Brunello and Maria De Paola (IT)	Chapter in the EDWIN international book
The benefits of undertaking vocational education in Madeira (WP5-5)	Santiago Budría and Pedro Telhado Pereira (PT)	Working Paper + journal article
Productivity and wage effects of employer-financed training in Finland (WP5-5)	Rita Asplund and Edvard Johansson (FI)	Working Paper
Education, job satisfaction and overall well-being	Peter Dolton (UK), Joseph Lanfranchi (FR) and Ali Skalli (FR)	Chapter in the EDWIN international book

VI. REFERENCES AND BIBLIOGRAPHY

1. WP 1

Rita Asplund and Erling Barth (eds) (2005), *Education and Wage Inequality in Europe – A Literature Review.* The Research Institute of the Finnish Economy ETLA, Series B212, Helsinki. (Project Deliverable D1.)

2. WP 2

Panos Tsakloglou (2005): *Structure of and inter-temporal changes in wage inequality in Europe.* Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Panos Tsakloglou (2005): *Structure of and inter-temporal changes in wage inequality in Europe.* Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Panos Tsakloglou and Ioannis Cholezas (2005): *Earnings inequality in Europe: Structure and patterns of inter-temporal changes.* EDWIN Project Deliverable D6 and Chapter in the forthcoming international book of the EDWIN project.

Panos Tsakloglou and Ioannis Cholezas (2005): *Earnings inequality in Europe: Structure and patterns of inter-temporal changes.* Project Deliverable D6 and Chapter in the forthcoming international book of the EDWIN project.

3. WP 3

Claudio Lucifora (2005): *Economic effects of demographic and educational change.* Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Claudio Lucifora (2005): *Economic effects of demographic and educational change.* Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Claudio Lucifora (2005): *The Economic Effects of Demographic and Educational Change: Empirical Evidence and Policy Implications.* Project Deliverable D7 and Chapter in the forthcoming international book of the EDWIN project.

Claudio Lucifora (2005): *The Economic Effects of Demographic and Educational Change: Empirical Evidence and Policy Implications.* Project Deliverable D7 and Chapter in the forthcoming international book of the EDWIN project.

Federico Biagi and Claudio Lucifora (2005): *Demographic and Education Effects on Unemployment in Europe: Economic factors and Labour Market Institutions.* IZA DP No. 1806, October 2005. Downloadable at http://www.etla.fi/edwin Project Deliverable D7(Annex1).

Giorgio Brunello and Charlotte Lauer (2004): *Are Wages in Southern Europe more Flexible? The Effects of Cohort Size on European Earnings.* IZA Discussion Paper 1299 (2004) and ZEW Discussion Paper No. 05-45. Project Deliverable D7(Annex2). Downloadable at http://www.etla.fi/edwin

4. WP 4

Santiago Budría and Pedro Telhado Pereira (2005): *Education and Wage Dispersion: New Evidence for Europe.* Project Deliverable D8 and Chapter in the forthcoming international book of the EDWIN project.

Pedro Telhado Pereira (2005): *The dynamics of changing wage distributions in Europe.* Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Santiago Budría and Pedro Telhado Pereira (2005): *Educational Qualifications and Wage Inequality: Evidence for Europe.* IZA Discussion Paper No. 1763. Project Deliverable D8(Annex). Downloadable at http://www.etla.fi/edwin

Santiago Budría (2005): Wage Risk and Schooling in Europe: Differences between the Private Sector and the Public Sector. Forthcoming as a CEEAplA Working Paper.

5. WP 5

Andreas Ammermüller (2004): *PISA: What makes the difference? Explaining the gap in PISA test scores between Finland and Germany*. ZEW Discussion Paper No. 04-04, Mannheim. Downloadable at http://www.etla.fi/edwin

Andreas Ammermüller (2005): *Educational opportunities and the role of institutions.* ZEW Discussion Paper No. 05-44, Mannheim. Downloadable at http://www.etla.fi/edwin

Andreas Ammermüller and Charlotte Lauer (2005): *School Quality and Educational Outcomes in Europe.* Project Deliverable D10(part4) and Chapter in the forthcoming international book of the EDWIN project.

Andreas Ammermüller, Hans Heijke and Ludger Wössmann (2005): Schooling quality in Eastern Europe: Educational production during transition, *Economics of Education Review* 24(5), 579–599.

Erling Barth (2005): *Explaining changes in within group wage dispersion.* Chapter in the forthcoming international book of the EDWIN project.

Erling Barth (2005): Major policy-relevant explanations for the observed patterns and trends: The role of labour market institutions and flexibility arrangement. Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Erling Barth, Claudio Lucifora and Panos Tsakloglou (2005): Wage Dispersion, Markets and Institutions: The effects of the boom in education on the wage structure. Project Deliverable D9 and D10(task1).

Giorgio Brunello (2005): *Market failures and the under-provision of training.* Presentation at the final policy-oriented workshop of the EDWIN project.

Giorgio Brunello and Maria De Paola (2005): *Training in Europe: efficiency issues.* Project Deliverable D10(part5) and Chapter in the forthcoming international book of the EDWIN project.

Peter Dolton (2005): *Major policy-relevant explanations for the observed patterns and trends: The role of over-education, school quality and gender*. Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Peter Dolton (2005): *Major policy-relevant explanations for the observed patterns and trends: The role of over-education, school quality and gender*. Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Peter Dolton (2005): *Major policy-relevant explanations for the observed patterns and trends: The role of over-education, school quality and gender*. Presentation at the final policy-oriented workshop of the EDWIN project. Downloadable at http://www.etla.fi/edwin

Peter Dolton and Oscar Marcenaro-Gutierrez (2005): *Overeducation across Europe.* Project Deliverable D10(part2) and Chapter in the forthcoming international book of the EDWIN project.

Peter Dolton, Oscar Marcenaro-Gutierrez and Ali Skalli (2005): *Gender Wage Differentials in Europe.* Project Deliverable D10(part3) and Chapter in the forthcoming international book of the EDWIN project.

Rita Asplund (2005a): The Provision and Effects of Company Training – A Brief Review of the Literature. *Nordic Journal of Political Economy* 31(1), pp. 47–73.

Rita Asplund (2005b): Employers and training: What do we know and what do we not know?, in Marx, I. & W. Salverda (eds), *Low-wage Employment in Europe: Perspectives for Improvement.* Acco, Leuven.

VII. ANNEXES

This annex includes complete lists of co-ordinator's and partners' contributions during the whole life-time of the project in the form of publications (of various status); presentations at conferences, seminars or workshops; and invited speeches.

The annex also provides a full listing of the agreed deliverables and their status (according to the alternatives of completed, partially completed or abandoned).

1. Partner reports of various status during the life-time of the project

Ammermüller, A. (2004), *PISA: What Makes the Difference? Explaining the Gap in PISA Test Scores Between Finland and Germany*. ZEW Discussion Paper 04-04. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Ammermüller, A. (2005), *Poor Background or Low Returns? Why Immigrant Students in Germany Perform so Poorly in PISA.* ZEW Discussion Paper No. 05-18, Mannheim. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Ammermüller, A. and A.M. Weber (2005), Education and Wage Inequality in Germany: Review of the Literature, in Asplund, R. and E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA The Research Institute of the Finnish Economy, Series B212, Helsinki.

Ammermüller, A., H. Heijke and L. Wößmann (2005), Schooling Quality in Eastern Europe: Educational Production During Transition, *Economics of Education Review* 24(5), 579–599. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Andini, C. (2005), *Returns to Schooling in a Dynamic Model.* CEEAplA Working Papers, n. 04/2005, Centro de Estudos de Economia Aplicada do Atlântico, Universidade da Madeira and Universidade dos Açores. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Andini, C. (forthcoming), Returns to Education and Wage Equations: a Dynamic Approach, *Applied Economics Letters*.

Andini, C. (2005) *A Dynamic Mincer Equation and an Application to Portuguese Data.* Mimeo. (submitted to *Empirical Economics*)

Asplund, R. (2005), Employers and training: What do we know and what do we not know?, in Marx, I. & W. Salverda (eds), *Low-wage Employment in Europe: Perspectives for Improvement.* Acco, Leuven.

Asplund, R. (2005), The Provision and Effects of Company Training – A Brief Review of the Literature, *Nordic Journal of Political Economy* 31(1), pp. 47–73.

Asplund, R. (2005), Education and Wage Inequality in Finland: A Review of the Empirical Literature (co-author: Liisa Leijola), in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki

Asplund, R. (2005), A Macroeconomic Perspective on Education and Inequality, in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki.

Asplund, R. and E. Barth (eds)(2005), *Education and Wage Inequality in Europe: A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki.

Asplund, R. and E. Barth (2005), Education and Wage Inequality: An Introduction to the National Literature Reviews, in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki.

Barth, E. (2004), Hvorfor så store forskjeller i lønnsstruktur mellom land? (Why such large differences in the wage structure between countries?), *Søkelys på arbeidsmarkedet (Spotlight on the labour market)* 21(2), 285–288. (in Norwegian) Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Barth, E. and A. Mastekaasa (2005), Education and Inequality in Norway: A Review of the Literature, in in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki.

Ben Abdelkarim, O. and A. Skalli (2005), Education and Economic Inequality in France: A Survey of the Literature, in Asplund, R. and E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA The Research Institute of the Finnish Economy, Series B212, Helsinki.

Ben Abdelkarim, O. and A. Skalli (2005), *Wage Inequality in France: The Role of Education.* LEM Working Paper #05-3, University of Paris 2. (submitted for publication to *Labour*) Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Biagi, F. and C. Lucifora (2005), *Demographic and Education Effects on Unemployment in Europe: Economic factors and Labour Market Institutions.* IZA DP No. 1806. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Brunello, G. (2005), *On the Complementarity between Education and Training.* Mimeo. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Brunello, G. (2005), *Unemployment, Education and Earnings Growth.* Mimeo. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Brunello, G. and M. De Paola (2004), *Market Failures and the Under-Provision of Training.* CESifo Working Paper No. 1286. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Brunello, G. and C. Lauer (2005), *Are Wages in Southern Europe more Flexible? The Effects of a Cohort Size on European Earnings.* IZA Discussion Paper No. 1299/ZEW Discussion Paper No. 05-45. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Brunello, G., S. Comi, C. Lucifora and E. Scarpa (2005), Inequality in Education and Wages in Italy: A Review of the Empirical Literature, in in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA The Research Institute of the Finnish Economy, Series B212, Helsinki.

Budría, S. (2004) *An Exploration of Asset Returns in a Production Economy with Relative Habits*. CEEAplA Working Paper 07/2004. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Budria, S. (2005), Education and Inequality: Evidence from Spain, in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA The Research Institute of the Finnish Economy, Series B212, Helsinki.

Budría, S. (2005), *Can over-education account for the positive association between education and within-groups wage inequality?* Mimeo. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Budria, S. (forthcoming), Wage Risk: Differences between the Public Sector and the Private Sector. Mimeo. (CEEAplA Working Paper)

Budria, S. and P.T. Pereira (2004), *On the Returns to training in Portugal*. IZA Discussion paper No. 1429. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Budría, S. and A. Díaz (2005), *Risk Aversion and Equity Premium in Economies with Habit Formation.* Mimeo.

Budría, S. and A. Moro Egido (2005), *Education, Over-education, and Wage Inequality: Evidence for Spain.* Mimeo. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Budria, S. and C.L. Nunes (2005), Education and Wage Inequality in Portugal, in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA The Research Institute of the Finnish Economy, Series B212, Helsinki.

Budría, S. and P.T. Telhado (2005), *Educational Qualifications and Wage Inequality: Evidence for Europe.* IZA Discussion Paper 1763. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Cholezas I. and P. Tsakloglou (2005), *Male-female earnings differential across Europe: Evidence from the ECHP.* University of Athens, Chapter in PhD thesis. (in Greek)

Cholezas I. and P. Tsakloglou (2005), *Male-female earnings differential in Greece*. University of Athens, Chapter in PhD thesis. (in Greek)

Cholezas I. and P. Tsakloglou (2005), *Private returns to education in Greece.* University of Athens, Chapter in PhD thesis. (in Greek)

Cholezas I. and P. Tsakloglou (2005), *Testing the screening hypothesis using the ECHP*. University of Athens, Chapter in PhD thesis. (in Greek)

Cholezas I. and P. Tsakloglou (2005), *Returns to education or education as a screening device? Evidence from Greece.* University of Athens, Chapter in PhD thesis. (in Greek)

Cholezas I. and P. Tsakloglou (2005), *Private returns to education along the wage distribution in eleven European countries.* University of Athens, Chapter in PhD thesis. (in Greek)

Cholezas I. and P. Tsakloglou (2005), *Quantile regression estimates of the private returns to education in Greece.* University of Athens, Chapter in PhD thesis. (in Greek)

Dolton, P. (2004), The Economic Assessment of Training Schemes, in Johnes, G. and J. Johnes (eds), *International Handbook on the Economics of Education.* Edward Elgar Publishing Ltd.

Dolton, P. and O. Marcenaro (2005), Education and Income Inequality in the UK: A Current Perspective, in Asplund, R. and E. Barth (eds), *Education and Wage Inequality in Europe. A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki.

Dolton, P., G. Makepeace and O. Marcenaro (2005), Career Progression: Getting-On, Getting-By and Going Nowhere, *Education Economics* 13(2), 239–257. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Evälä, A. (2004), Koulutuksen panokset ja tuotokset – Suomi kansainvälisessä vertailussa (Educational inputs and outputs – Finland from an international perspective). ETLA Research Institute of the Finnish Economy, Discussion Paper No. 922, Helsinki. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Galindo-Rueda, F. and A. Vignoles (2005), The Declining Relative Importance of Ability in Predicting Educational Attainment, *Journal of Human Resources* 40(2), pp. 335–353. (previously published as CEE Discussion Paper 0032 (2004) under the title *Class Ridden or Meritocratic? An Economic Analysis of Recent Changes in Britain*. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Lauer, C (2004), Education, gender and earnings in France and Germany: Level and dispersion effects, *Brussels Economic Review* 47(3), pp. 505–541. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

le Grand, C., R. Szulkin and M. Tåhlin (2004), *Over-education or Lack of Skills? Job Matching on the Swedish Labour Market 1974–2000.* Mimeo. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

le Grand, C., R. Szulkin and M. Tåhlin (2004), Working life is slipping behind: the simple jobs are not disappearing, *Sociological Research* (Journal of the Swedish Sociological Association) 41(1), 27–33. (in Swedish)

le Grand, C., R. Szulkin and M. Tåhlin (2004), Overeducation or skill shortage? Matching in the Swedish labor market 1974-2000, in Bygren, M., M. Gähler and M. Nermo (eds), *Family and Work. Everyday Life in Transition.* SNS Forlag, Stockholm. (in Swedish)

le Grand, C., R. Szulkin and M. Tåhlin (2005), Education and Inequality in Sweden: A Literature Review, in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA The Research Institute of the Finnish Economy, Series B212, Helsinki

Machin, S. and A. Vignoles (2004), Educational Inequality: The Widening Socio-Economic Gap, *Fiscal Studies* 25(2), 107–128. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Pereira, P.T. and S. Budria (forthcoming), The Wage Effects of Training in Portugal: Differences across skill groups, genders, sectors, and training, *Applied Economics*.

Skalli, A. (forthcoming), Are Successive Investments in Education Equally Worthwhile? Endogenous Schooling Decisions and Non-linearities in the Earnings-Schooling Relationship, *Economics of Education Review*. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Szulkin, R. and J.O. Jonsson, *Ethnic segregation and educational outcomes in Swedish comprehensive schools: A multilevel analysis.* Mimeo. Downloadable at the EDWIN web site at http://www.etla.fi/edwin

Tsakloglou P. and I. Cholezas (2005), Education and Inequality in Greece: A Literature Review, in Asplund, R. & E. Barth (eds), *Education and Wage Inequality in Europe: A Literature Review.* ETLA, The Research Institute of the Finnish Economy, Series B212, Helsinki.

Tsakloglou P. and I. Cholezas (2005), *Earnings inequality in Europe: Structure and patterns of inter-temporal changes.* Athens University of Economics and Business, Department of International and European Economic Studies. Mimeo.

2. Partner conference presentations during the life-time of the project

Ammermüller, A.: *Schooling Quality in Eastern Europe: Educational Production During Transition.* Presentation at a seminar of the Research Centre for Education and the Labour market (ROA), Maastricht, 13.05.2003; EALE annual conference, Seville, 18.-21.09.2003

Ammermüller, A.: *PISA: What Makes the Difference? Explaining the Gap in PISA Test Scores Between Finland and Germany.* Paper presented at the IZA Summer School 2004, Buch/Ammersee, 19–25.4.2004, at the ESPE Annual Conference, Bergen, 10–12.6.2004;

at the EALE Annual Conference, Lisbon, 9–10.9.2004; at the Verein für Socialpolitik Annual Conference, Dresden, 29.9–1.10.2004.

Asplund, R.: *Education and Wage Inequality in Europe*, International Conference on Research into Vocational and Adult Training, Budapest, 18.11.2004.

Ben Abdelkarim, O. and A. Skalli: *Wage Inequality in France: The Role of Education.* Paper presented at ERMES seminar, Department of Economics, University of Paris 2, April 14, 2005; LoWER Annual Conference 2005, European Low Wage Employment Research Network, Mannheim, April 15–16, 2005; 22èmes Journées de Micro-économie Appliquée, Hammamet (Tunisia), May 26–27, 2005.

Barth, E.: *Lønnsforskjeller mellom kvinner og menn. Betydningen av utdanning (Wage differentials between men and women).* Speech at a seminar arranged by the Ministry of Labour and Administration in November 2003 in Oslo.

Barth, E.: *Institutions for growth.* Speech at the Leankollen seminar, Norwegian Research Council, Leangkollen, June 2004.

Barth, E.: *Fører kunnskapssamfunnet til større lønnsforskjeller? Norske og internasjonale erfaringer (Larger Wage Differences in the Knowledge Society? Norwegian and International Experiences).* Paper presented at the Norwegian Research Council Conference "The New Labour Market", Oslo, November 2004.

Barth E.: *On the estimation of fixed worker and employer effects. Applications from wage regressions.* (co-authors: H. Dale-Olsen, M. Grütter and R. Lalive). Paper presented at an IZA-seminar in Bonn, April 2005.

Barth, E.: *Wage Dispersion, Markets and Institutions.* (co-authors: C. Lucifora and P. Tsakloglou) presented at a Research Seminar in the Department of Economics, University of Oslo, April 2005.

Barth, E.: *Wage Dispersion, Markets and Institutions. The effects of the boom in education on the wage structure*. (co-authors: C. Lucifora and P. Tsakloglou) Paper presented at the SOLE/EALE conference in San Francisco, June 2005.

Brunello, G. (co-author: M. de Paola): *Workplace training in Europe: equity and efficiency issues*. Paper presented at EC-OECD Seminar on Human Capital and Labour Market Performance: Evidence and Policy Challenges, Brussels 8 December 2004, and Workshop on Education and Training, University of Milan, 19 January 2005.

Budría, S.: *Asset Prices Under Non-Additive Habits*. Paper presented at U. de Malaga, February 2003; U. del Pais Vasco, February 2003.

Budría, S.: *EDWIN research.* Jornadas Beticas de Macroeconomia Dinamica, Malaga, 21–22.5.2004.

Budría, S.: *On the Returns to Training in Portugal.* Paper presented at the SPIE 2004 conference, Lisbon, and at the Department of Economics of the University Carlos III.

Budría, S.: *Risk Aversion and Equity Premium in Economies with Habit Formation.* Paper presented at, BEMAD (Jornadas Béticas de Economía Dinámica), Malaga; Encontro Xovenes Investigadores; Santiago; University Carlos III; ASSET, Barcelona; XXIX Simpósio de Análisis Económico, Pamplona, 2004.

Dolton, P.: *Public and Private Sector Pay Differences.* Presentation to the HMTreasury in London on 25th April, 2003.

Dolton, P.: *Career Progression.* Presentation at the Society of Population Economics Conference, June 2003, New York.

Dolton, P.: *Career progression: Getting on, getting by and going nowhere.* Paper presented in the Human Capital Workshop (Maastricht, December'03) and the Royal Economic Society conference (Swansea, April'04).

Dolton, P.: *Overeducation across Europe: some preliminary evidence.* Paper presented at the EDWIN policy-oriented work in Mannheim on June 24, 2004.

Dolton, P.: *Measuring Occupational Success over the Life Cycle using Panel Data.* Paper presented in the EALE conference in Lisbon, September'04.

Dolton, P. and M. Silles: *The Determinants and Consequences of Overeducation*. Presentation at the Berlin Conference on Overeducation 21-23 Nov 2002.

Dolton, P. and G. Makepeace: *Computer Use and Earnings in Britain*. Presentation at the Royal Economic Society, University of Warwick, 2003.

Dolton, P., G. Makepeace and O. Marcenaro: *Career progression*. Presentation at the QCA in London, 31.3.2003.

Galindo-Rueda, F. and A. Vignoles: *Class Ridden or Meritocratic?: An Economic Analysis of Recent changes in Britain.* Presentation at the Paris CEPR Conference on Education and Inequality, 16/17th May, 2003.

Jonsson, J.O. and R. Szulkin: *Ethnic segregation and educational outcomes in Swedish comprehensive schools: A multilevel analysis.* Paper presented at a seminar at the Swedish Institute for Social Research on 25 January, 2004, and at a seminar at the Swedish Board of Education on 22 April, 2004.

Korpi, T. and M. Tåhlin: *Skill mismatch and wage growth*. Paper presented at a seminar at the Swedish Institute for Social Research in November 2004.

Lauer, C.: *Are Wages in Southern Europe more Flexible? The Effects of Cohort Size on European Earnings*. Paper presented at the EDWIN Policy-oriented Workshop, Mannheim, 24.6.2004.

Lauer, C.: *Gender and Earnings in France and Germany: Level and Dispersion Effects*. Paper presented at ZEW, Mannheim, 18.8.2004; at the EALE Annual Conference, Lisbon, 9–10.9.2004; at the University of Zürich, 23.11.2004.

Lucifora, C.: *Relative unemployment, skill gaps and cohort effects in Europe: Economic factors and labour market institutions.* Paper presented at SIEP (Societa' italiana economia pubblica), Pavia, 7–8.10.2004.

Lucifora, C. (co-author: F. Biagi): *Baby Bust, Educational Boom and Unemployment In European Countries.* Paper presented at ERMES, University of Paris II, and DELSA-OECD, University of Lyon II.

Pereira, P.T: *On the Returns to Training in Portugal.* Department of Economics, Univ. Autonoma de Barcelona.

Portuguese team: *The benefits of undertaking vocational education in Madeira*. Presentation at the European Research Network on Transitions in Youth Workshop, Funchal, September 2003.

Skalli, A.: *Are Successive Investments in Education Equally Worthwhile? Endogenous Schooling Decisions and Non-linearities in the Earnings-Schooling Relationship.* Paper presented at the "Labour Market Outcomes of Educational Investments" workshop, Paris, November 10, 2003; 16th annual conference of the European Association of Labour Economists, Lisbon, September, 2004.

Swedish team: *Matching in the Swedish labour market 1974-2000: Overeducation or skill shortage?* Seminar presentation at the Dept. of Economics, Stockholm University, June 2003.

Tsakloglou, P.: *Short-term poverty dynamics in Europe: A comparative analysis*. Presentation at the 17th Annual Meeting of the European Society for Population Economics, New York, USA, June 2003.

Tsakloglou, P. and I. Cholezas: *Earnings inequality in Europe: Evidence from the ECHP.* Paper presented at the 2nd Annual Research Conference of the European Panel Users' Network (EPUNet), June 2004, Berlin, Germany, and at the 18th Annual Meeting of the European Society for Population Economics, June 2004, Bergen, Norway.

Tsakloglou, P. (co-author: I. Cholezas I.): *Education and inequality in Greece*. Paper presented at The European Institute, London School of Economics, U.K., January 2005.

Tåhlin, M.: *Education and job demands – overqualification or skill shortage?* Lecture held at Statistics Sweden's (SCB) labour market conference, December 2003, and at the Swedish Association's of Local Authorities labour market conference, February 2004.

3. EDWIN disseminations by the coordinator

Education, careers and earnings. Invited speech at the seminar "Female perspectives in the post-modern society", University of Helsinki, Finland, 3.11.2003.

Education, Training and Active Labour Market Policy. Invited speech at the conference "Impulses for European Employment Policy - Impulses for Germany. Report of the European Employment Task Force", Berlin, Germany, 8.12.2003.

Quantitative goals of education – Is quantity the decisive aspect? Invited session at the seminar "Kansantaloustieteen päivät" 5-6.2.2004, Kuopio, Finland.

The economy and education. Speech for the President of Finland's Economic Policy Group 19.2.2003.

Education and the economy. Speech at the Finnish Ministry of Finance, Economics Unit, 12.3.2004.

Learning at work from the perspective of education, economy and well-being. Invited speech at the conference "Life as learning", Dipoli, Finland, 2.6.2004.

Education economics and the theory of human capital. Invited speech at the Finnish Student Organisation's 3rd education policy meeting, Siuntio, Finland, 13.9.2004

EDWIN-related speech at a high-level International Conference on Research into Vocational and Adult Training held in Budapest on November 18–19, 2004.

Koulutus tulevaisuuden menestymisen avaimena (Education as a key for future success). Invited speech at the Osaava työvoima – Keski-Suomen menestystekijä -seminar, TE-keskus, Jyväskylä, 15.9.2005.

Koulutuksen kannattavuus yksilöiden ja yhteiskunnan näkökulmasta (The profitability of education from an individual and societal perspective). Invited speech at the Education Investments Pay Back -seminar, Ministry of Education, Helsinki, 21.09.2005.

4. List of agreed project deliverables and their status

Deliverable No	Deliverable title	Delivery date	Nature	Dissemination level	Status
D1	Education and wage inequality in Europe – A Literature Review (final), including a Mapping of Competencies	8	R	PU	Completed
D2	Wage inequality in Europe (draft)	18	R	RE	Completed
D3	Cohort effects on wages and (un)employment in Europe (draft)	19	R	RE	Completed
D4	Returns to education and wage inequality in Europe (draft)	20	R	RE	Completed
D5	User-oriented seminar I	20	W	PU	Completed June 24, 2004
D6	Wage inequality in Europe (final)	21	R	RE	Completed
D7	Cohort effects on wages and (un)employment in Europe (final)	22	R	RE	Completed
D8	Returns to education and wage inequality in Europe (final)	23	R	RE	Completed
D9	Education and wage inequality in Europe – main findings and conclusions (final)	33	R	RE	Partially completed

D10	Education and wage inequality in Europe – nature, implications and explanations (draft)	34	R	RE	Completed (in the form of separate parts)
D11	User-oriented seminar II	35	W	PU	Completed Sept. 22, 2005
D12	Education and wage inequality in Europe –nature, implications and explanations (final)	35	R	PU	Partially completed: International book in progress
D13	Final Report	35	R	CO	Completed

5. Separate Annex

Table A1. Inequality in the distribution of net hourly earnings (echp, 7th wave)

Country	Index of inequality			
	Gini (G)	Theil (T)	Mean log deviation (N)	Variance of logarithms (L)
Austria	0.195 [12]	0.065 [12]	0.064 [12]	0.128 [12]
Belgium	0.200 [11]	0.073 [11]	0.069 [11]	0.135 [11]
Denmark	0.161 [13]	0.055 [13]	0.049 [13]	0.092 [13]
Finland	0.225 [9]	0.095 [9]	0.091 [8]	0.184 [8]
France	0.280 [5]	0.142 [4]	0.132 [5]	0.249 [5]
Germany	0.225 [10]	0.086 [10]	0.086 [10]	0.175 [9]
Greece	0.289 [2]	0.147 [3]	0.136 [3]	0.254 [4]
Ireland	0.266 [7]	0.122 [7]	0.116 [7]	0.223 [6]
Italy	0.227 [8]	0.096 [8]	0.089 [9]	0.171 [10]
Luxembourg	0.286 [3]	0.136 [5]	0.132 [4]	0.258 [2]
Portugal	0.326 [1]	0.197 [1]	0.171 [1]	0.293 [1]
Spain	0.267 [6]	0.122 [6]	0.116 [6]	0.221 [7]
United Kingdom	0.285 [4]	0.148 [2]	0.136 [2]	0.256 [3]

Notes: 4th wave for the UK; 5th wave for France. Ranks are in brackets.

Table A2. One-way inequality decomposition (proportion of aggregate inequality due to 'between-group' disparities)

	EDUCATION (3 groups)			AGE (5 groups)			SEX (2 groups)			SECTOR (2 groups)		
	T	N	L	T	N	L	T	N	L	T	N	L
Austria	14.0	13.9	11.9	9.4	9.8	8.7	5.6	5.8	5.6	0.3	0.3	0.4
Belgium	6.6	6.9	5.9	11.4	12.3	11.6	4.9	5.2	4.8	na	na	na
Denmark	6.6	7.5	8.6	2.9	3.4	5.1	3.9	4.4	3.4	na	na	na
Finland	8.5	8.7	8.6	2.6	2.7	4.7	3.4	3.6	2.8	na	na	na
France	13.6	14.1	13.3	5.4	6.0	7.0	1.7	1.8	1.9	0.2	0.2	0.0
Germany	12.4	11.9	9.7	5.5	5.9	5.0	6.2	6.3	5.9	0.4	0.4	0.4
Greece	25.3	26.1	22.5	18.8	22.3	21.3	1.6	1.8	2.1	2.2	2.5	1.9
Ireland	18.1	18.1	13.3	11.6	12.8	10.0	4.0	4.2	4.4	1.2	1.2	0.3
Italy	22.1	22.1	18.2	11.9	13.4	12.2	0.4	0.5	0.4	3.7	4.1	3.5
Luxembourg	29.4	29.4	27.6	13.5	14.4	12.6	4.5	4.7	5.6	3.2	3.5	2.1
Portugal	42.9	42.0	36.4	9.6	11.7	8.8	0.1	0.1	0.6	6.9	8.4	4.8
Spain	17.4	18.1	15.4	14.7	16.0	13.1	1.4	1.5	1.9	1.6	1.7	1.0
United Kingdom	6.8	7.4	7.0	4.7	5.5	7.5	2.4	2.6	3.0	0.1	0.1	0.0

Table A3. Multivariate decomposition of inequality (proportion of aggregate inequality due to 'between-group' disparities)

	Index of inequality		
	Theil (T)	**Mean log deviation (N)**	**Variance of logs (L)**
Austria	28.3	27.4	24.6
Belgium	26.9	27.6	26.1
Denmark	14.1	16.0	17.4
Finland	16.6	16.6	17.4
France	27.0	27.2	28.6
Germany	22.9	22.3	19.7
Greece	46.7	49.3	47.4
Ireland	42.4	41.3	36.8
Italy	36.3	36.4	33.0
Luxembourg	48.6	48.6	46.7
Portugal	59.0	57.9	52.1
Spain	42.0	41.8	38.6
United Kingdom	15.6	17.0	18.8

Table A4. Multivariate decomposition of inequality (proportion of hourly earnings inequality due to 'between-group' disparities at each level of analysis – L)

	Main effects							Interactions				Model
	EDU	AGE	SEX	SECT	Covar.	Total		2-way	3-way	4-way		
Austria	7.6	4.2	3.7	0.2	5.7	21.4		-	-	-		21.4
Belgium	9.3	11.7	4.6	na	-1.5	24.0		1.7	0.4	na		26.1
Denmark	8.0	4.3	3.7	na	0.6	16.6		0.6	0.2	na		17.4
Finland	7.6	3.6	4.0	na	0.5	15.7		1.2	0.5	na		17.4
France	15.7	9.0	2.4	0.0	-2.3	24.8		2.3	0.8	0.6		28.6
Germany	7.6	2.9	4.0	0.1	3.4	17.9		1.1	-	-		19.1
Greece	18.8	18.0	2.4	0.2	4.9	44.2		2.4	0.6	0.1		47.4
Ireland	15.3	10.6	5.2	0.0	-1.0	30.0		4.9	1.4	0.4		36.8
Italy	15.5	9.4	1.4	0.4	3.6	30.3		2.2	-	-		32.5
Luxembourg	22.8	9.9	4.4	1.1	5.0	43.3		1.5	-	-		44.9
Portugal	34.8	7.6	3.9	0.5	2.0	48.8		2.9	0.4	0.0		52.1
Spain	17.8	13.7	3.3	0.0	-1.1	33.7		3.8	0.8	0.2		38.6
United Kingdom	5.7	7.3	2.1	0.0	1.4	16.6		1.7	0.5	0.1		19.0

Table A5. Inter-temporal changes in hourly eanings inequality and employee characteristics in eight european countries

Country (period)	Change in hourly earnings inequality according to (%)				Change in the sample share of (%)			
	G	T	N	L	Tertiary education graduates	Employees aged 45-64	Female employees	Employees in services
Finland (1984-1998)	-1.3	-2.9	-2.0	-1.5	8.4	11.0	2.9	10.9
France (1990-2001)	-1.3	-3.4	-1.2	-1.3	8.4	8.9	2.6	5.2
Germany (1984-2000)	8.8	18.2	12.5	6.9	10.1	0.0	4.9	11.0
Greece (1974-1999)	3.2	9.9	13.7	21.1	12.2	2.1	10.4	-7.1
Italy (1987-2000)	1.8	3.5	7.5	12.6	2.5	4.0	1.8	-5.0
Norway (1980-2000)	13.0	51.0	37.5	32.3	16.5	-8.5	7.3	12.8
Sweden (1974-2000)	1.7	6.9	3.8	-0.1	22.4	7.4	7.9	16.0
UK (1994-2003)	1.3	5.8	2.0	-0.3	22.4	7.4	7.9	16.0

Figure A1. Gini index by educational degree level for nine European countries

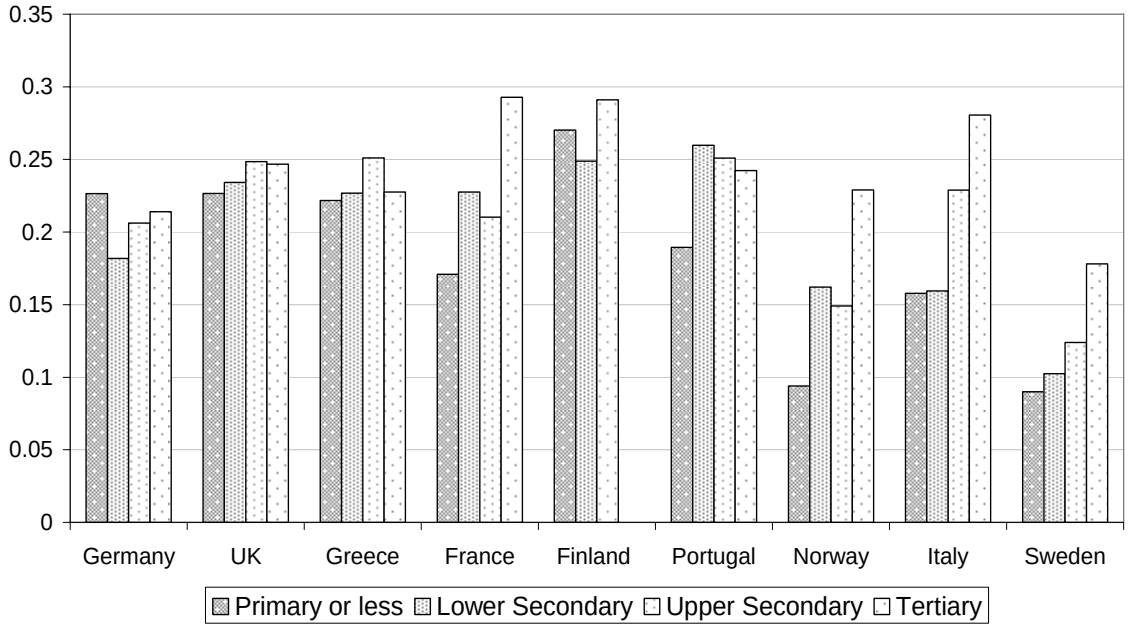


Figure A2. P90/P10 ratio by educational degree level for nine European countries

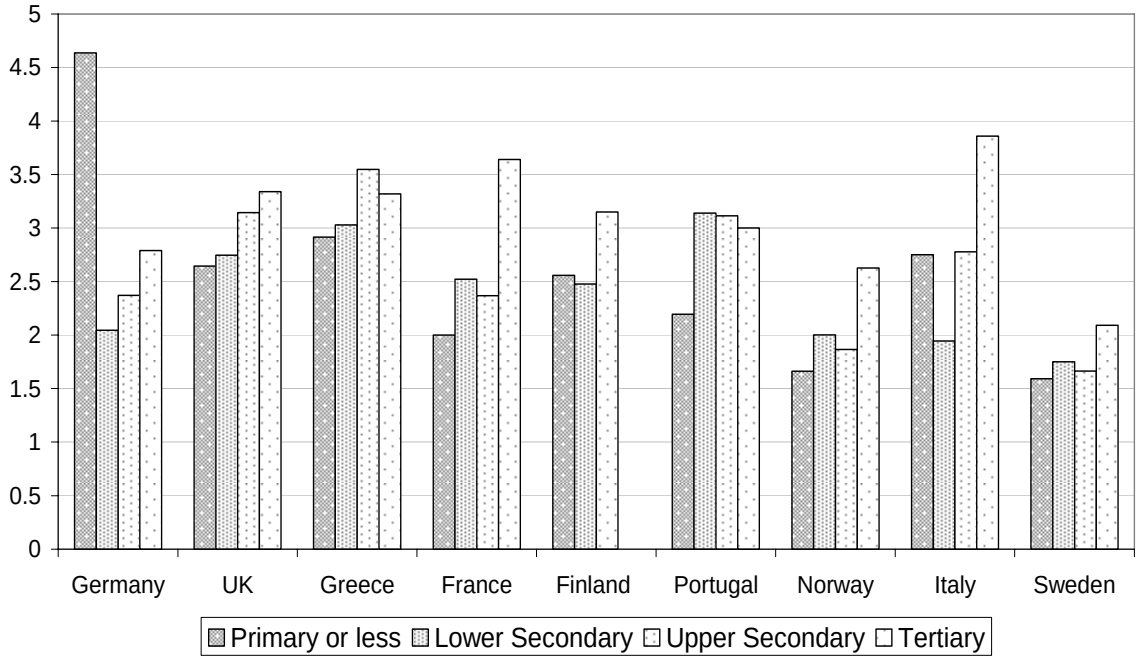
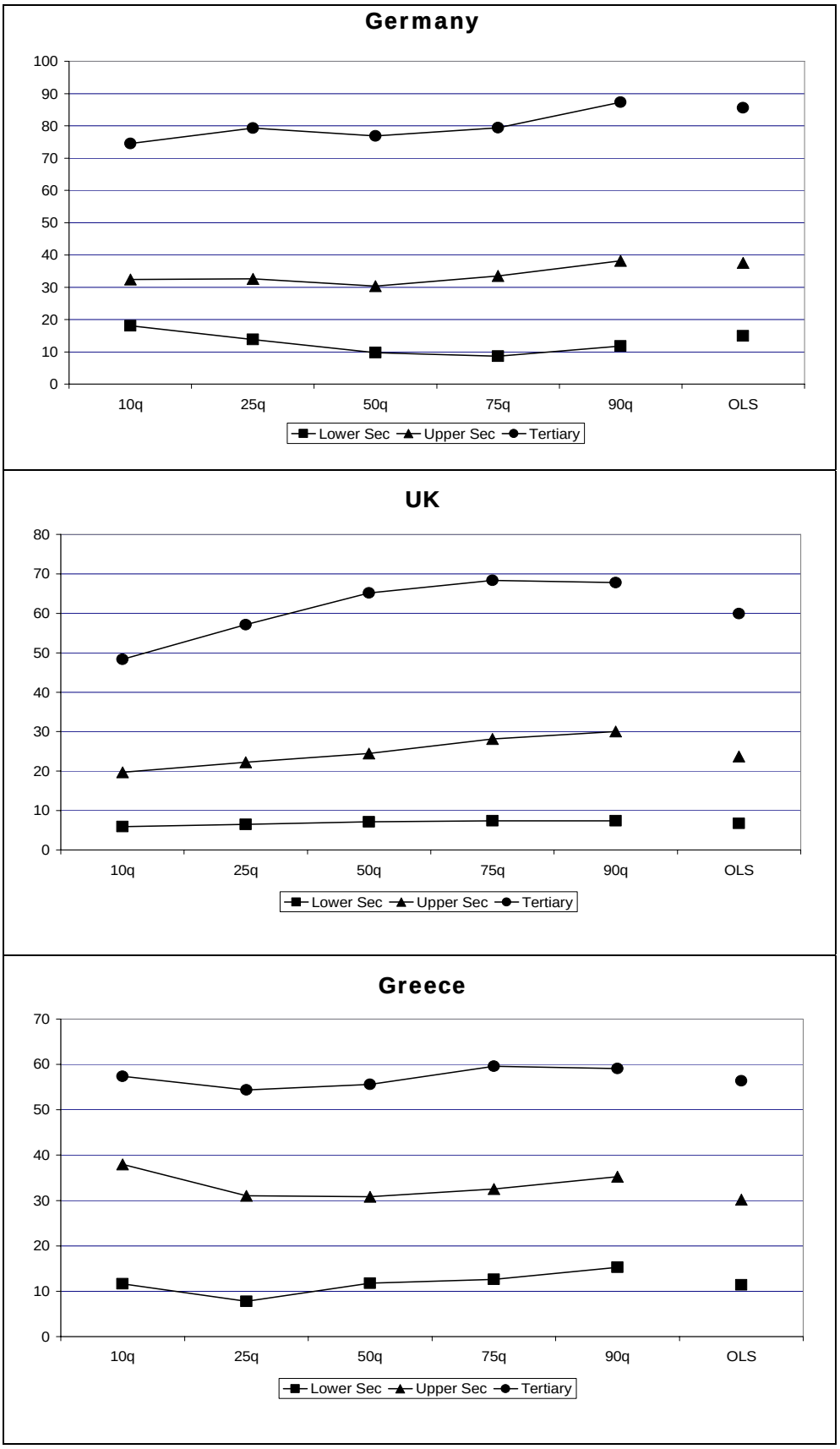
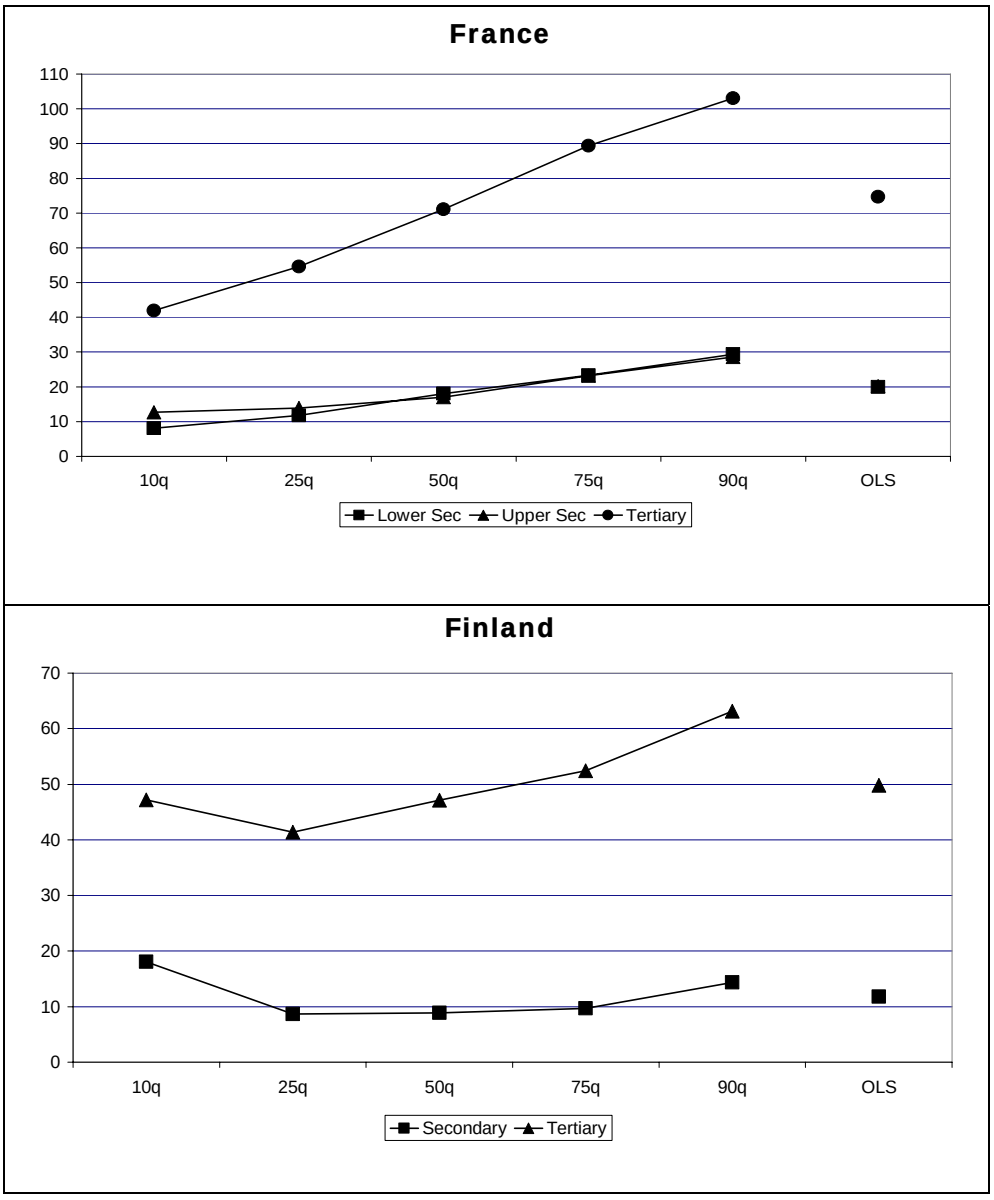


Figure A3. Quantile-regression-return profiles by educational levels

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Finland
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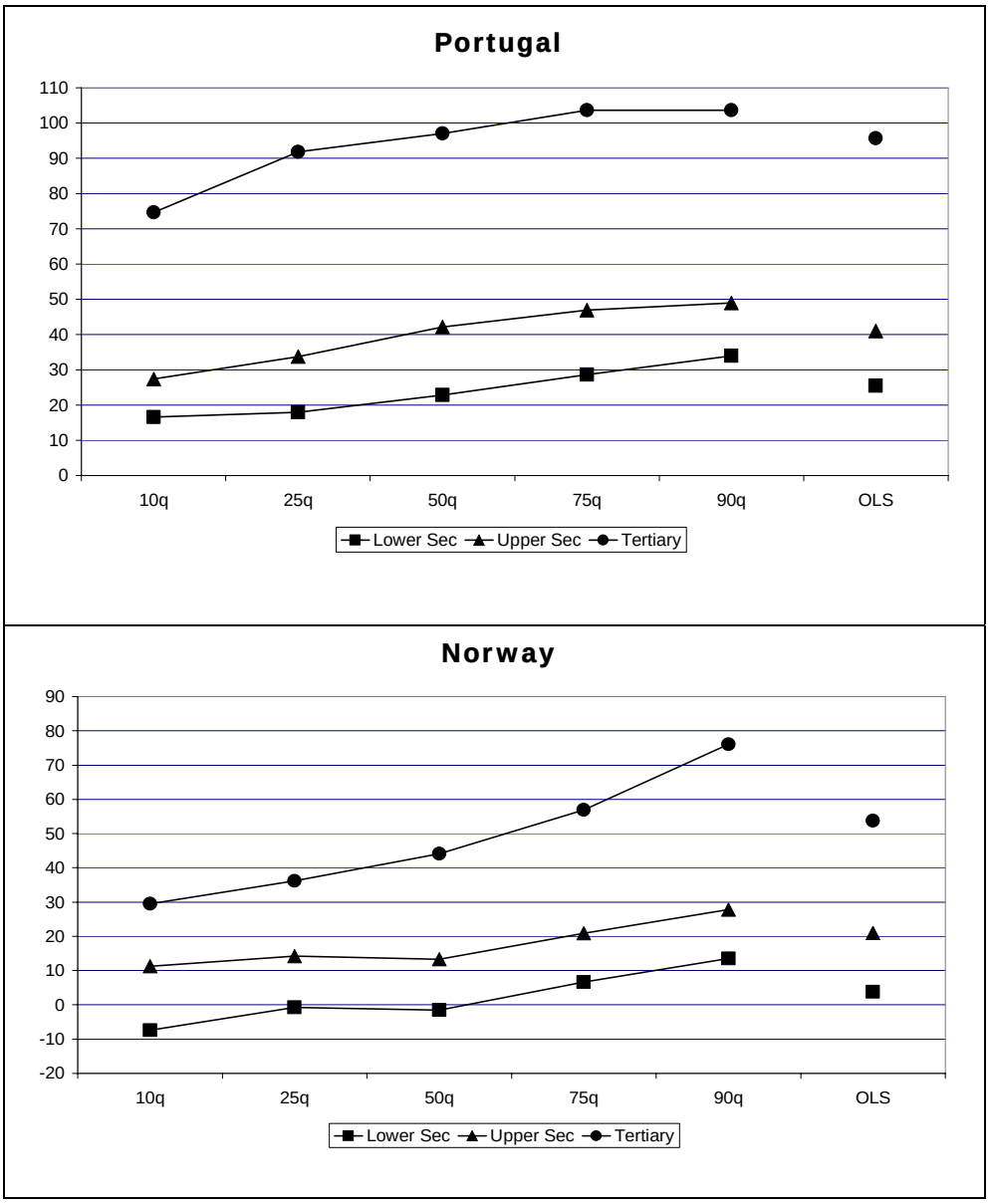
Tertiary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Norway
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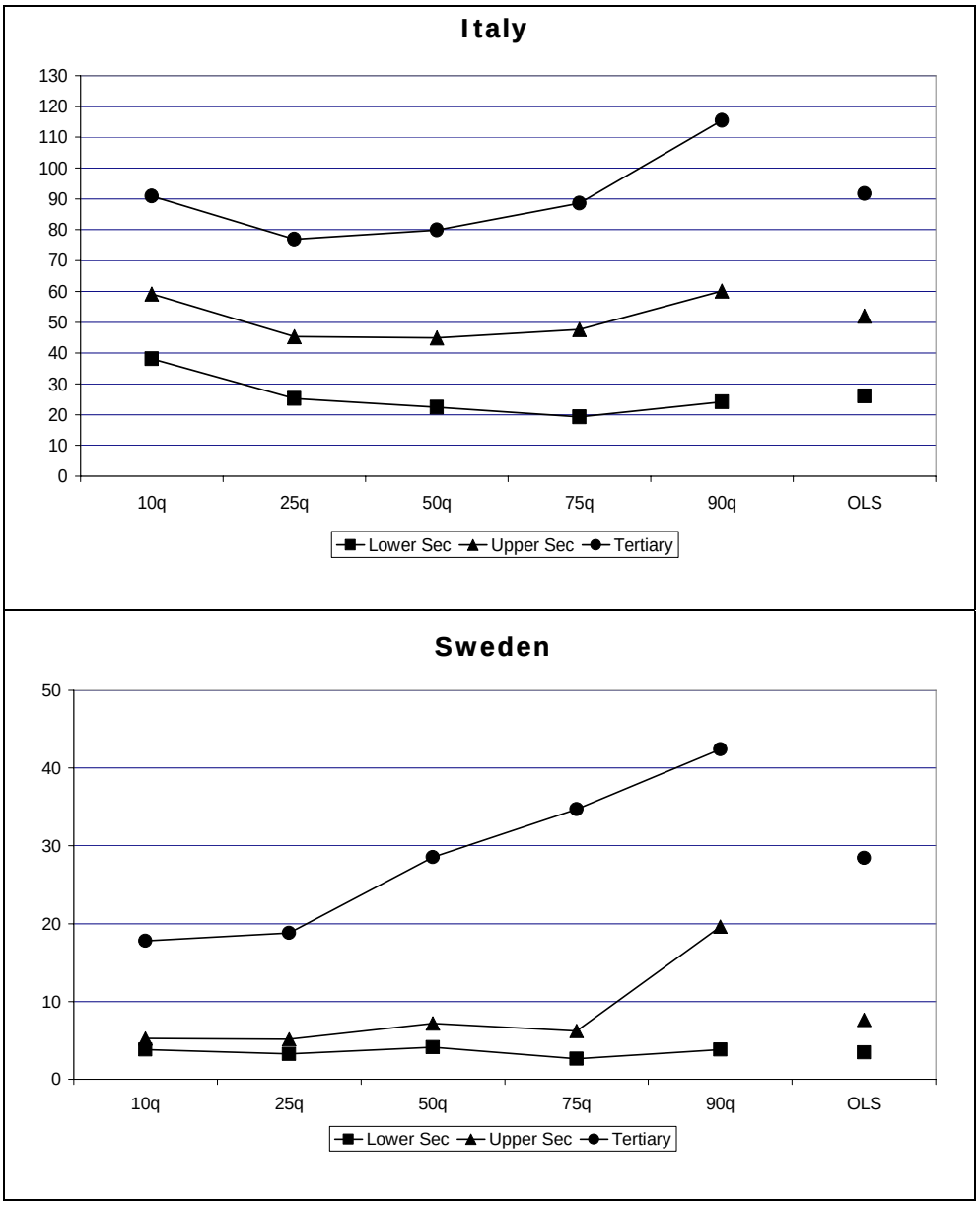
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Table A6. Change (percentage points) in conditional wage premiums at three educational degree levels relative to less than a lower secondary education, over the last decade for nine European countries

		Change in "average" (50th quintile) premium	Change in (90th – 10th)	Change in the 90th quintile premium	Change in the 10th quintile premium
Germany (1989-1999)	Lower Sec	-1.23	-3.94	-0.21	3.73
	Upper Sec	5.89	-5.80	4.74	10.54
	Tertiary	-8.13	9.82	-2.01	-11.83
UK (1994-2003)	Lower Sec	4.82	-1.57	4.20	5.77
	Upper Sec	-1.53	2.03	-3.22	-5.26
	Tertiary	-3.10	-1.39	-9.87	-8.48
Greece (1988-1999)	Lower Sec	-0.88	7.40	5.50	-1.89
	Upper Sec	8.00	1.39	14.11	12.72
	Tertiary	14.56	8.10	19.44	11.34
France (1993-2001)	Lower Sec	-8.38	-1.02	-9.35	-8.33
	Upper Sec	-2.34	-4.47	-5.39	-0.92
	Tertiary	-9.10	12.96	-1.75	-14.71
Finland (1989- 1997)	Lower Sec	2.57	1.59	6.66	5.07
	Upper Sec	-3.40	3.11	0.12	-2.99
	Tertiary	-11.80	-1.98	-18.09	-16.11
Portugal (1993-2000)	Lower Sec	-14.37	7.34	-8.76	-16.09
	Upper Sec	-28.06	-17.97	-38.20	-20.23
	Tertiary	-35.37	-23.19	-49.66	-26.47

Norway (1991-2000)	Lower Sec	-3.88	9.41	2.21	-7.20
	Upper Sec	1.28	9.88	4.41	-5.47
	Tertiary	10.87	20.44	18.06	-2.39
Italy (1989-1998)	Lower Sec	21.53	11.58	38.76	27.17
	Upper Sec	25.91	15.62	45.31	29.69
	Tertiary	37.28	13.86	58.09	44.22
Sweden (1991-2000)	Lower Sec	-9.48	-9.40	-12.95	-3.55
	Upper Sec	-11.99	1.43	-5.81	-7.23
	Tertiary	-18.69	-3.45	-18.05	-14.61

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