PUBLIC FUNDING

AND

PRIVATE RETURNS TO EDUCATION

PURE

Final Report

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Abstract:

The TSER-financed project on *Public funding and private returns to education – PURE* started in November 1, 1998, and ended in October 31, 2000. The project has involved 15 European countries (Austria, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom) with Finland as the co-ordinating partner.

The project has produced, on a comparable basis, cross-country evidence *at a European level* on a broad set of policy-relevant issues related to private returns to education. Starting from a comprehensive analysis of individual returns to education across the 15 countries, the project expanded to investigate the interplay between education and work experience, including differences between cohorts; the productivity-enhancing versus the signalling role of education; the interaction between education and wage inequality; the relationship between education and unemployment; the importance of the supply of and the demand for highly educated labour as well as of labour market institutions for individual returns to education; the influence of public funding and enrolment into higher education on educational outcomes; and the structure of student loan systems.

In brief, some of the main findings are as follows. The private returns to education, as well as the so-called college wage gap, vary considerably across Europe, and there are no signs of a convergence of returns to education across the European countries. One possible consequence in the future might be higher mobility across national boarders, particularly of highly educated people trying to exploit these cross-country differences in the rewarding of individual investment in education.

Throughout Europe social groups that commonly acquire little education face a potentially higher than average return to education. Thus it would be of considerable importance to identify these groups and to provide them with incentives to continue in school. More generally, improving the educational attainment level of the less educated can be expected to reduce wage inequality, since education still contributes substantially to the wage differences observed in the European labour markets. However, there are also forces working in the opposite direction because within-educational-level wage inequality is found to increase with the educational level. This means that the link between educational expansion and wage inequality is not so straightforward as is often claimed in the political debate. The interrelation between within- and between-educational-level wage inequality definitely deserves further research.

This European-wide finding of rising wage inequality with the educational level also reveals that the European labour markets are characterised by a notable wage risk associated with further education, which might affect individuals' incentives and decisions to invest in higher education. Other aspects of crucial European importance that are likely to influence individual schooling decisions are employment prospects and unemployment benefits. The findings indicate that what matters is the difference in unemployment rates between educational levels rather than the absolute unemployment rate, and that employment expectations affect incentives to invest in further education more at the lower end than higher up the educational scale.

At a European level, the relative wages of highly educated employees are found to have displayed an increasing rather than a decreasing trend, which is explained by an even more rapid expansion in the demand for than in the supply of highly educated labour. Furthermore, public funding, entry exams in the high-school system, and tuition fees are detected to strongly influence enrolment into higher education and thus the supply of highly educated labour. In contrast, current returns to education and current unemployment rates for younger age groups seem to leave current enrolment into higher education unaffected.

For detailed information about the project, please visit the project's web-site www.etla.fi/PURE

Content:

1.   THE PURE PROJECT – EXECUTIVE SUMMARY

Rita Asplund

1.1   Introduction

This final report of the project *Public funding and private returns to education – PURE* presents the research undertaken during its two-year duration, starting in November 1, 1998, and ending in October 31, 2000. In particular, this introductory chapter of the final report, which also serves as an executive summary, highlights the objectives and activities of the project as well as draws together the main findings and points to possible policy implications.

The final report of the project is divided into three parts. The first part, covering Chapters 2 to 10, summarises a major part of all the research work done within the project. More precisely, each chapter provides a concise summary of the motivation for the performed analysis, the methodology used, the results obtained, and the conclusions and policy implications that can be drawn based on these results. In each case, more details can be found in the scientific report underlying the summary chapter.

An important feature of these chapters and the reported results is that throughout they cover all or almost all the 15 European countries involved in the project, that is, Austria, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, and Finland as the co-ordinating partner. In other words, these nine chapters provide, on a comparable basis, cross-country evidence *at a European level* on a broad set of policy-relevant issues related to private returns to education.

Chapter 2 summarises and compares the findings on returns to education at the individual level across and within the 15 countries. The impact of investments in education on individuals' lifetime earnings – that is, the interplay between education and work experience – is examined in Chapter 3. Particular emphasis is thereby paid to potential differences between the "baby boom" cohort and other cohorts. The productivity-enhancing role of education underlying the well-known human capital theory is in Chapter 4 contrasted against the signalling role of education as stated by the so-called screening hypothesis. The interaction between the economic benefit of investment in education and the dispersion in wages (wage inequality) and its development is investigated in Chapters 5 and 6, while Chapter 7 is concerned with the relationship between education and unemployment. The importance of the supply of and the demand for highly educated labour as well as of labour market institutions for the trend in individual returns to education is explored in Chapter 8. Chapter 9, in turn, focuses on the influence of public funding and enrolment into higher education on

educational outcomes. Finally, Chapter 10 discusses student loan systems in use in Europe.

Chapters 2 to 10 thus give a comprehensive European picture of private returns to education, factors underlying their levels and trends, and their possible link with wage inequality and unemployment, two topics of considerable importance in today's Europe. As explicitly documented for each chapter, some of the research has already been finalised and the scientific papers underlying the summary chapters are available at the project's web-site www.etla.fi/PURE. Some of the research is still in progress but will be concluded during the next few months.

The second part of the final report presents a few of the large number of country-specific studies that have been undertaken in relation to the PURE project. Most of these concern a single country, but quite a few also compare the situation in two countries. Moreover, these single- and two-country studies complement the multi-country analyses with several highly relevant aspects that, because of the data requirements, can be investigated for a very limited number of countries only.

The third part of the final report highlights the considerable contribution of each partner to the PURE project. It lists the names of all researchers having been involved in the project as well as all the research done and still in progress. Apart from information on country-specific research, these listings also provide information on the on-going cross-country research that is not presented elsewhere in the final report. As is evident from the country-specific contributions, PURE research results have been largely disseminated mainly through presentations at a large number of conferences, seminars and workshops, including the two user-oriented seminars arranged by the project itself.

1.2   Background and objectives

The rationale for the project was outlined in the following way. "While national systems of education are fairly similar across Europe, there are many crucial differences in details. Furthermore, in all European countries the direct outlays on education are mostly financed by the government, although here also, there exist differences not least in the mix of tuition charges, grants and loans given, and fiscal compensation allowed to parents. Moreover, in many countries the share of costs borne by students and/or their parents has shifted over the last decades. Simultaneously there is a political debate on the most desirable system of financing, a debate that bounces between the negative impulse of government deficits and budget cuts and the positive impulse of the increased knowledge-intensity of production and the role of knowledge in maintaining the European competitive edge."

The overarching objective of the PURE project, as stated in the Technical Annex, was to study the impact of different systems of public financial support for school attendance on observed outcomes in the labour market, particularly in terms of the levels and dispersion of private returns to education and education-related inequality in earnings. The project here intended to move into a territory not yet studied from the perspective of optimal investment in human capital, the role of student finance systems, school admission rules (free or selective entry) and school differentiation.

The project was originally divided into several distinct but closely related issues that were to be addressed in detail:

- Analysis and comparison of wage and human capital structures and private returns to education between countries and within countries over time in order to uncover distinct trends as well as similarities and dissimilarities across countries.
- Analysis of the impact on country-specific trends in educational returns of changes over time in underlying market forces (supply-side and demand-side factors).
- Analysis of the impact on country-specific trends in educational returns of carefully differentiated measures of returns by type and level of education in order to highlight and compare national systems of education.
- Analysis of the structure and evolution of the national systems of education, admission rules and systems of financial support for school attendance to be used as input in other parts of the project.
- Analysis of the effects of differing systems of public support for cost of education to individuals and admission rules on the private returns to education and on earnings inequality related to differences in educational attainment.

As is evident from the final report of the project, all these aspects have been addressed. In addition to these stated objectives, the research work of the PURE team expanded to cover other crucial aspects as well, not least the unemployment perspective.

1.3 Activities and dissemination

The activities of the PURE team of researchers have been outlined in detail in the three Progress Reports that have been delivered during the lifetime of the project and are, therefore, not repeated here. This section points to major milestones only.

The principle having guided the research work performed by the PURE team has been active participation – quantitatively as well as qualitatively – of all partners in all research activities undertaken within the project. Apart from having taken responsibility for different sub-projects, all partners have contributed with national data and results to the wide variety of exercises having been conducted. The only limit to partner participation has been the lack of required data. On the other hand, partners have been confronted with this limit only in the case of more specialised and/or sophisticated PURE-relevant analyses. In addition, partners have contributed generously with their specialist knowledge on the different topics analysed within the project. The strong influence of this "working principle" on the research undertaken by the PURE team is also reflected in the outcome of the project – in the multitude of European-level analyses reported in Part I of the final report as well as in the cross-country analyses still in progress (and listed in Part III).

The broad-based objectives set out for the PURE project required frequent project meetings during the first year of the project. In retro-perspective it is, however, obvious that these frequent meetings also greatly stimulated to an enormous number of complementary analyses, which is highly evident from the three parts of the final report. The most important cross-country deliverables so far are:

- *Returns to Human Capital in Europe – A Review of the Literature* (ETLA, Series B 156, Helsinki, 1999) edited by Rita Asplund and Pedro Telhado Pereira, a book that reviews country-by-country the current state-of-the-art of the research field covered by the PURE project.
- The forthcoming PURE book *Education and Earnings in Europe: A Cross Country Analysis of the Returns to Education* (Edward Elgar Publishing Ltd., March 2001) edited by Colm Harmon, Ian Walker and Niels Westergaard–Nielsen. The book

contains a comprehensive introductory chapter on returns to education written by the three editors, and 15 nation-specific chapters. In other words, the content covers both extensive PURE cross-country comparisons and national chapters giving more details on the various empirical results produced within each partner country. Chapter 2 of the final report gives a summary of the main findings.

Apart from these two PURE books, several working papers have been published in the form of articles in national and international journals, several working papers have been submitted to journals, and several are still in progress. The summary chapters in Part I and Part II of the final report draw together the content of several of these working papers, while PART III provides extensive listings of published and forthcoming reports as well as of reports in progress. There are also preliminary plans for additional PURE books.

The research work of the PURE project has been presented both at national and international conferences, workshops and seminars. (For details, see Part III of the final report.) In addition, the PURE project has arranged two user-oriented seminars where all the cross-country analyses summarised in Chapters 2 to 10 of the final report have been presented and discussed. The first user-oriented seminar was held in Paris in October 1999, and the second in Lisbon in October 2000. The programmes are attached to this executive summary chapter.

The PURE web-site has been a most important dissemination channel. The web-site has continued to report on PURE research results and publications also after the official closing of the project.

1.4   Main results, conclusions and policy implications

This section offers a brief listing of the main findings of the PURE project and also points to possible policy implications of these outcomes. Throughout references are made, in parentheses, to the chapter of the final report that presents and discusses the topic in question in more detail.

q   The estimated private *returns to education differ* considerably across Europe. Broadly speaking, the European countries can be classified into three groups: countries with a low average return to education (Scandinavian countries and the Netherlands), countries with a high return to education (Ireland and the UK), and countries that fall in-between these two extremes. (Chapter 2)

q   Equally important, there are *no signs of a convergence of returns to education* across the European countries. Some countries show a downward trend in rates of return, others are characterised by an upward trend, while still others display no time trend whatsoever. Furthermore, the trend may differ for men and women within a country. (Chapter 2) One possible consequence in the future of this finding might be higher mobility across national boarders, particularly of highly educated people trying to exploit these cross-country differences in the rewarding of individual investment in education. The rapid expansion of the use of information technologies could be expected to boost such a development, since the possibility of working and living in separate places becomes reality, an aspect pointed to also in the overview of student loan systems in Chapter 10.

q   Separate analysis of the wage differentials between college-educated and high-school educated employees, the so-called *college wage gap*, also displays considerable variation across PURE countries. Substantial cross-country differences

exist both in the absolute level of the college wage gap and in its development over time and *cohorts*. Specifically, the growth in the college wage gap is shown not to have been restricted to the younger cohorts, as stated in previous studies. On the contrary, in a number of PURE countries the college wage gap has grown at a faster rate for the older than for the younger cohorts. (Chapter 3)

q   Evidence for a limited number of PURE countries indicates that by investing in education individuals not only raise their productivity in working life, as stated by the human capital theory. Investments especially in higher education also seem to provide them with a signal to employers about their innate productive capabilities, as predicted by the so-called screening hypothesis. The productivity-enhancing effect of educational investments still dominates the empirical scene, however. (Chapter 4, also see Chapter 11)

q   Throughout Europe social groups that commonly acquire little education face a potentially higher than average return to education. Thus it would be of considerable importance to identify these groups and to provide them with incentives to continue in school. (Chapter 2) The problem of early school leaving has been much debated not least in the UK and is, therefore, one of the special country-specific topics paid attention to in the final report of PURE. (Chapter 13)

q   More generally, improving the educational attainment level of the less educated can be expected to reduce *wage inequality*, since education still contributes substantially to the wage differences observed in the European labour markets (Chapter 5). This conclusion is further supported by the finding that a higher education not only secures the individual a higher entry wage, but also guarantees a more advantageous life-cycle wage profile as compared to the less educated. (Chapter 3) There are, however, wage-inequality-related factors that potentially may work in the opposite direction. Among these factors are the concomitant development of within-group wage inequality and the balance between supply and demand.

q   Reduced between-educational-level inequality is a necessary but not a sufficient condition for *overall* wage inequality to decline due to more people acquiring a better education. A further condition is that *within-educational-level inequality* decreases with the educational level. In other words, the dispersion in wages would need to be larger among the less educated than among the higher educated. The results for the great majority of PURE countries point in the opposite direction, however; that is, within-educational-levels wage differences tend to be the higher the higher the educational level. (Chapter 6) Put differently, the differences in the return (in terms of wages) that individuals manage to reap from their investment in education are found to increase rather than decrease when moving up the educational scale. This means that the link between educational expansion and wage inequality is not so straightforward as is often claimed in the political debate. This within-educational-level inequality may seriously mitigate or even outweigh the decline in overall wage inequality that is commonly expected to arise from increased schooling. The interrelation between within- and between-educational-level wage inequality definitely deserves further research.

q   Moreover, this European-wide finding of rising wage inequality with the educational level, reveals the presence of a notable *wage risk* associated with further education. The European labour markets are, in other words, characterised by considerable uncertainty with regard to the actual return that individuals can get from their investment in higher education. The obtained results further suggest that returns are riskier (more dispersed) the higher the country's average return to

education. Presumably this schooling-level correlated wage risk also affects individuals' incentives and decisions to invest in higher education. (Chapter 6)

q Other aspects of crucial European importance that are likely to influence individual schooling decisions are *employment prospects* (the risk of becoming unemployed) and *unemployment benefits*. Accordingly, attempts should be made to adjust "conventional" rates of return to education for these realities. When such adjustments are undertaken for the PURE countries, the results allow for certain important generalisations to be made. First, what matters is the *difference* in unemployment rates between educational levels rather than the absolute unemployment rate for differently educated employees. Second, the adjustment mostly leads to an *increase* in the rate of return to education, and this effect is in most cases larger for medium-level than for high-level education. In other words, employment expectations affect incentives to invest in further education more at the lower end than higher up the educational scale. Finally, the degree of adjustment in the rate of return to education varies quite substantially between PURE countries. This outcome reflects cross-country differences in the size of the unemployment differentials between educational levels (that is, in employment prospects) but also in the generosity of the unemployment benefit system. A minor difference between adjusted and unadjusted rates of return to education may, in effect, simply be the outcome of the benefit system outweighing the better employment expectations that are usually associated with a higher education. (Chapter 7)

q The enormous expansion in *public funding of higher education*, particularly in the 1990s, resulted in a substantial growth in the supply of highly educated employees. The real value of public expenditure on higher education grew by more than 80% in the PURE countries between 1980 and 1996. Over the same time period the *supply* of employees with a higher (tertiary) education relative to those with a secondary or lower education roughly doubled. Nevertheless the *relative wages* of highly educated employees have displayed an increasing rather than a decreasing trend when aggregating over all 15 PURE countries. The reason for this is obvious: aggregate demand for highly educated labour has expanded at an even faster rate. The reported calculations give a shift of 5.6% per year in aggregate demand for highly educated labour compared to a shift of 4.7% per year in aggregate supply. (Chapter 8)

q Simultaneously, however, the analysis reveals notable variation across PURE countries both in the level and the growth rate of public expenditure on higher education, with countries having started from a lower level showing higher growth rates. This development, in turn, has resulted in a clear convergence in the relative supply of differently educated employees across PURE countries, but nonetheless cross-country differences in the educational composition of the labour force are still substantial. Also the trend in the demand for highly educated labour displays conspicuous variation across countries, albeit demand has risen at least as much as supply in 11 of the 15 PURE countries. These differences in supply and demand, coupled with marked differences in labour market institutions, are without doubt important factors underlying the observed variation in levels and trends of average returns to education across Europe, and consequently also in wage inequality. (Chapter 8) Supply, demand and institutions are shown to have exerted a strong influence on the growth of the college wage gap as well. (Chapter 3)

q A more thorough examination of the link between *public expenditure* on higher education and the supply of highly educated labour – that is, *enrolment into higher*

education – provides further support for the finding in Chapter 8 of a strong positive impact of increased public expenditure on higher education on the supply of highly educated labour. In addition to public funding, also entry exams in the high-school system as well as tuition fees are detected to influence enrolment. In contrast, current returns to education and current unemployment rates for younger age groups seem to leave current enrolment into higher education unaffected. (Chapter 9)

q This finding of enrolment into higher education being rather insensitive to the rewarding of education in the labour market as well as to youth unemployment is, moreover, in line with results obtained in other studies of the PURE project. Specifically, Chapter 8 reports no significant effect of relative wages on relative supply when contrasting tertiary education against secondary and lower education. In Chapter 7, in turn, employment expectations are found to play a much less important role in steps from medium to high levels of education than from compulsory to non-compulsory education. Of course, these European-level results may detect even considerable variation across countries. Especially in countries with an extremely low return to education, there is an obvious risk that a growing number of youths decide not to invest in higher education, as speculated in Chapter 2.

q Finally, attempts to explain differences in public expenditure across PURE countries and within countries over time reveal that especially government ideology but also the type of government have played an important role. (Chapter 9)

q The empirical analyses undertaken within the PURE project have throughout been based on national individual data. This approach necessarily raises problems of comparability of data across countries, which may to a varying degree affect the reported results. However, so far Europe can provide sufficient and consistent cross-national data in rare cases only. Increased efforts are needed to produce Trans-European data on individuals and also to make these data easily available to researchers.

q Another serious data shortcoming is the surprisingly scarce and scattered availability of detailed country-specific information on public expenditure on education, not least on higher education and on student support (grants, subsidised loans) in particular. The lack of such data on a comparable basis mitigates any attempt to undertake comprehensive analysis of European educational systems and private and social returns to investment in education. It also prevents private funding aspects to be properly included in the analysis of private returns to education.

APPENDIX: PURE USER-ORIENTED SEMINARS

1st user-oriented seminar – Paris 29.10.1999

Université Panthéon-Assas (Paris 2)

Centre de Vaugirard

391, rue de Vaugirard

8:30   Registration, coffee
9:30   *Returns to education in Europe: What can we learn from PURE results?*
      Introduction by Niels Westergaard-Nielsen
11:00   *Schooling, ability and family background: the PURE evidence*
      Introduction by Ian Walker
12:30   Lunch
14:00   *Drawing together the evidence on returns to schooling: What do we know?*
      Introduction by Colm Harmon?
15:15   The role of schooling: Screening versus human capital
      Introduction by Ali Skalli
16:00   Coffee break

16:30   Social returns and private gross/net returns to education
      Introduction by Ian Walker
17:30   End of seminar
19:30   Cocktail–dinner

2nd user-oriented seminar – Lisbon 28.10.2000

Universidade Nova de Lisboa

9:00   *Opening session*

Returns to education and public funding in 15 European countries:

9:15   *Returns to education – a cross-country comparison*
      presentation by Niels Westergaard-Nielsen

9:40 *Education, earnings growth and cohort effects*
      presentation by Simona Comi

9:55 *Education and wage inequality*
      presentation by Pedro Martins

10:15 *Education and the income distribution*
      presentation by Joop Odink

10:25 *Coffee break*

10:40 *Returns to education and unemployment*
      presentation by José Luis Roig

11:00 *The labour market for higher education*
      presentation by Erling Barth

11:20 *Public funding and enrolment into higher education*
      presentation by Rudolf Winter–Ebmer

11:40 *Special topic 1: The public credit market of education*
      presentation by Marianne Guille

11:55 *Special topic II: Early school leaving*
      presentation by Ian Walker

12:10 *Lunch*

Discussion of PURE results:

13:30 *Comment by Lord Richard Layard*

14:15 *Panel discussion:* Hilary Steedman, Roberto Carneiro and Simo Juva

15:30 *Coffee break*

15:45 *Open discussion*

16:45 *Closing session*

PART I

CROSS-COUNTRY ANALYSES

2. RETURNS TO EDUCATION IN EUROPE [1]

Colm Harmon, Ian Walker and Niels Westergaard–Nielsen

This chapter gives a general overview of the basic rates-of-return results of the PURE project. Specifically, it deals with one of the fundamental points of the project's research agenda; that is, analysis and comparison of wage and human capital structures and private returns to education between countries and within countries over time in order to uncover distinct trends as well as similarities and dissimilarities across countries.

Return to education is defined as the extra income earned as a result of completing one more year of education. The benchmark model for the development of empirical estimation of the returns to education is the key relationship derived by Mincer (1974). The typical human capital theory (Becker 1964) assumes that education, s, is chosen to maximise the expected present value of the stream of future incomes, up to retirement at date t, net of the costs of education. So, at the optimum level of schooling, the present value of the sth year of schooling just equals the costs of the sth year of education. For the simple estimation, the schooling measure is treated as exogenous, although education is the endogenous choice variable in the underlying human capital model. This, however, complicates the analysis and various econometric approaches have to be taken in those cases. This will be discussed later in this summary chapter.

2.1 Data and specification

Within the PURE project it was possible to evaluate this relationship between wages and education across Europe. The necessary tool in this process is access either to cross-national individual data, or to national individual data that can be analysed by researchers from all countries involved. Since Europe can still only in rare cases provide sufficient cross-national data, we had to rely on the latter method.

A further condition is that the data has to be more or less comparable across countries; i.e. wage, experience and years of schooling should be calculated in a similar fashion. Since each country uses their own national surveys or register data, this condition is hard to maintain. However, for the purpose of this review we formulated a common specification across our research partners and collected estimates of the return to schooling from each. All PURE partners have estimated the return to education using log of the hourly gross wage where available (with the exception of Austria, Greece, Italy, Netherlands and Spain who use net wages).

2.2   Estimates of the return to education

The returns to education seem to fall into three different classes. The lowest return to one extra year of education is found in the Scandinavian countries (Norway, Sweden and Denmark), while the highest returns are found in Ireland and the UK. West Germany, Portugal and Switzerland are leading the third group of in-between countries. Furthermore, we find that for some countries like the UK, Ireland, Germany, Greece and Italy there is a substantial variation in returns between gender, i.e. returns to women are significantly higher than returns to men.

Figure 2.1.   Returns to education
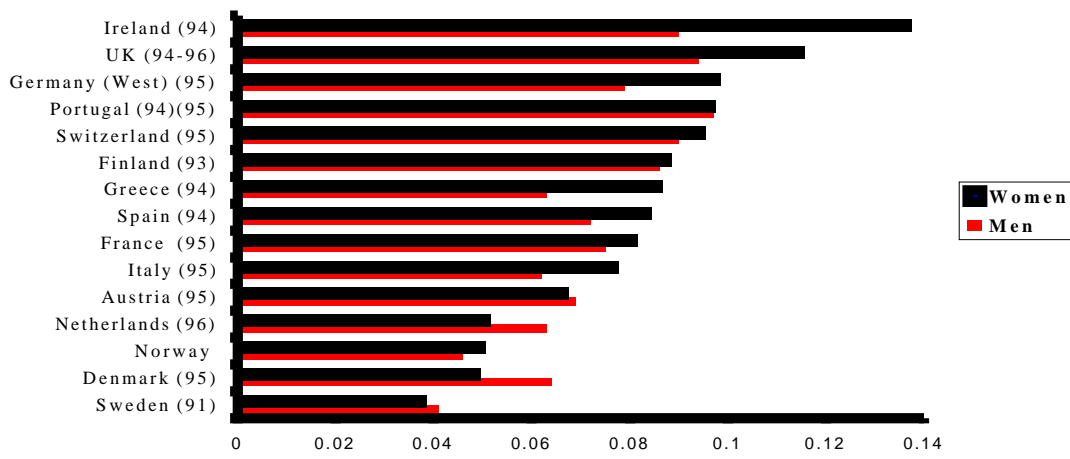
2.3   Are there trends?

Most partners had access to longitudinal data (or at least a combination of cross-sections) for human capital variables (schooling and experience) and earnings, which gives us the opportunity to identify trends in returns to human capital for men and women in the European countries. There does not seem to be a clear pattern in the trends, however. In total there appears to be 15 cases of no trend, 7 cases of increasing returns, and 7 cases of decreasing returns. Countries characterised by decreasing returns for both males and females are Austria, Switzerland and Sweden. Countries characterised by increasing returns are Denmark, Portugal, Finland and Italy. The remaining PURE countries are either characterised by no trend or by different male–female trends.

Figure 2.2 shows the three countries with the downward trend. Sweden differs from the other countries because the downward trend is based on very early years, which cannot be matched for other countries. The reduction for the comparable years in Sweden is seen to be very modest. The possible common reasons for the downward trend are an increasing number of educated people and more participating women.

Furthermore, these findings raise the question whether there are any tendencies to convergence in the returns to education across the different European nations, as you would expect with increasing mobility. The answer is rather mixed. Some countries move from low to higher returns (Denmark, Italy, UK (men) and Spain (men)), while

one country (Austria) moves from high to lower, others move from high to higher (Portugal and Finland (men)), and finally Sweden moves from low to lower. The conclusion is that there are few general trends and rather confusing signs with no general tendency, at least so far.

One of the crucial elements in a cross-country study of returns to education is the impact of different measurements of work experience, since various countries have access to different measures. Because of the common data set-up we have been able to investigate this impact for a large number of countries. The main conclusion is that it does not matter whether actual or potential work experience is used, whereas using age as a proxy for accumulated work experience in the human capital function gives a substantial downward bias in the return to education.

Figure 2.2.   Countries with a downward trend in the return to education
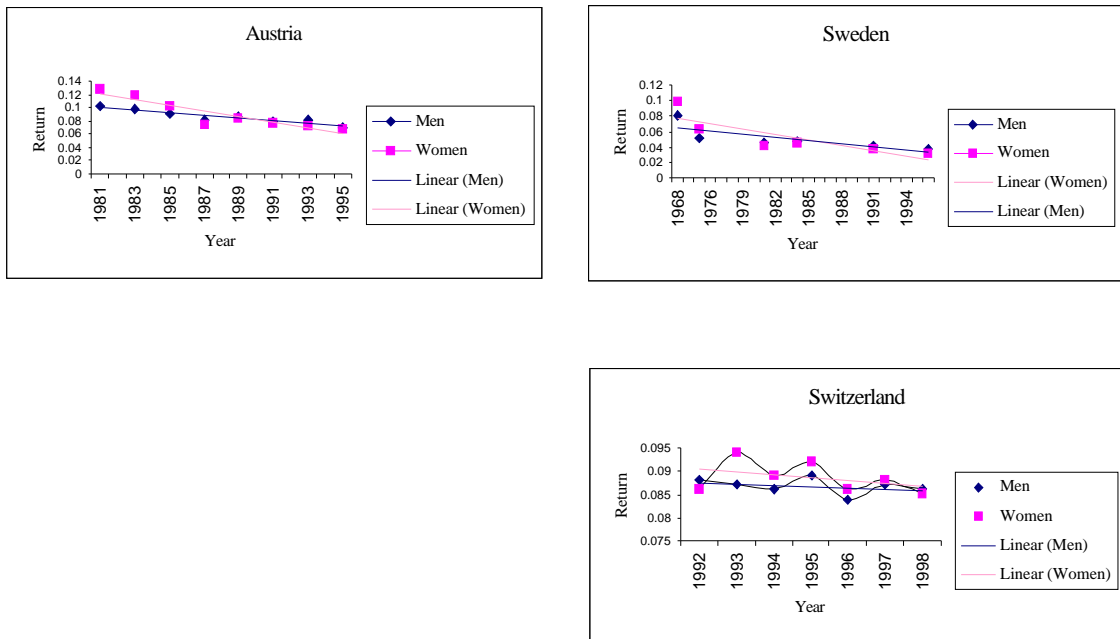
Figure 2.3.   Countries with an upward trend in the return to education

Denmark

Return

0.08
0.06
0.04
0.02
0

1981 1983 1985 1987 1989 1991 1993 1995

Year

◆ Men
■ Women
— Linear (Men)
— Linear (Women)

Portugal

Return

0.12
0.1
0.08
0.06
0.04
0.02
0

1982 1984 1986 1988 1990 1992 1994

Year

◆ Men
■ Women
— Linear (Women)
— Linear (Men)

Italy

Return

0.1
0.08
0.06
0.04
0.02
0

1977 1980 1983 1986 1989 1992

Year

◆ Men
■ Women
— Linear (Men)
— Linear (Women)

Finland

Return

0.095
0.09
0.085
0.08
0.075
0.07

1987 1988 1989 1990 1991 1992 1993

Year

◆ Men
■ Women
— Linear (Men)
— Linear (Women)

2.4 Participation and returns to education

Another source for bias in the returns to education is that the samples used for estimations are not representative. This is especially important when comparing returns to education for women between countries where the participation rate is quite different. As a consequence, countries with a high participation rate for women appear to have a low rate of return and vice versa. This finding suggests that increasing female labour force participation reduces the return to education. The reason is undoubtedly that the group of women participating in countries with a low participation rate, is dominated by women with high ability. This domination is clearly reduced with higher participation.

Figure 2.4.   The relationship between participation and returns to education for females

0.04

48

45

67

43

45

61

67.5

71.1

62

0   40   60   71   77   80

58

74

Female Participation Rate

-0.04
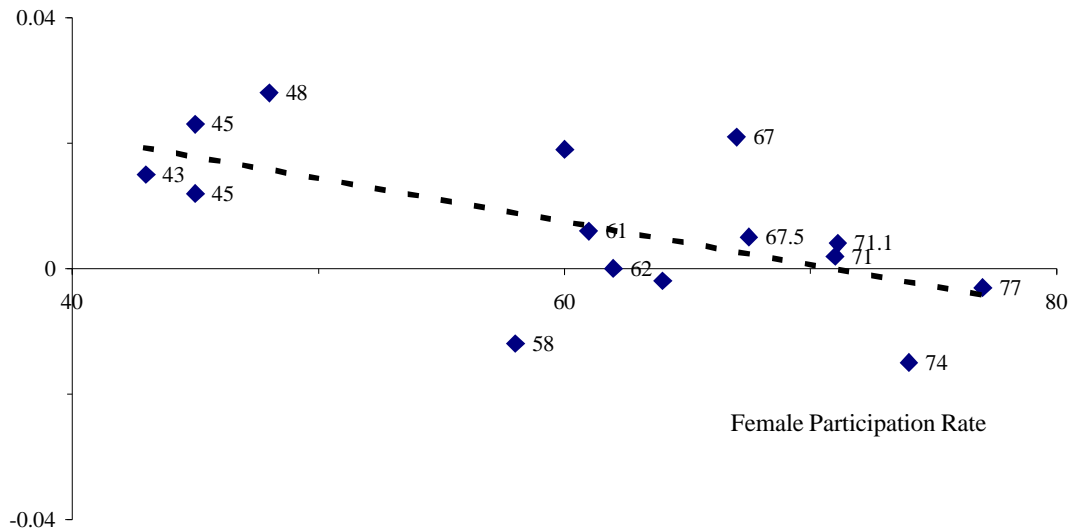
2.5   Quantile regressions [2]

It is possible that the returns to schooling are different for individuals in the upper part of the wage distribution compared with individuals in the lower portion of the distribution. Quantile regression allows us to estimate the return to a particular level of education within different quantiles of the (hourly) wage distribution. The OLS results show that over the observed period average returns to schooling have in general increased. There is, however, a clear implication from comparisons between the 90th and the 10th percentile of the wage distribution that the returns to schooling are, indeed, higher for those at the top of the wage distribution compared with those at the bottom (although for some countries the profiles of returns to education are flat across a range of the wage distribution). There is also some suggestion that returns to education have risen at the top of the wage distribution.

One factor influencing the distribution of wages is the distribution of inherent ability with low-ability individuals predominating in the bottom half of the distribution. Thus, education may have a bigger impact on the more able than the less able, and this complementarity between ability and education is either getting stronger or slightly weaker over time.

2.6   Meta analysis

To summarise the various issues discussed above we use the methods common in meta analysis to provide some structure to our survey of returns to schooling and a framework for determining whether our inferences are sensitive to the chosen specification. A meta analysis combines and integrates the results of several studies that share a common aspect so as to be "combinable" in a statistical manner. The methodology is typical in the clinical trials in the medical literature.

Well over 1,000 estimates were generated across the PURE project on three main types of estimated return to schooling – existing published work (labelled PURE1), existing unpublished work (PURE2), and new estimates produced within the PURE project (PURE3). A number of findings emerge from this comparison. Despite the points raised earlier in this chapter there is a remarkable similarity in the estimated return to schooling for a number of possible cuts of the data with an average return of around 6.5% capturing to a large extent the returns for different countries and different model specifications. There are some notable exceptions, though. The Scandinavian countries generally have lower returns to schooling together with Italy, Greece and the Netherlands. At the other extreme, the returns for the UK and Ireland are indeed higher than average. (See Figure 2.5.)

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[2] For a more detailed presentation of PURE quantile regression results, see summary chapter 6 of this volume.

Figure 2.5.   Meta analysis of the return to education
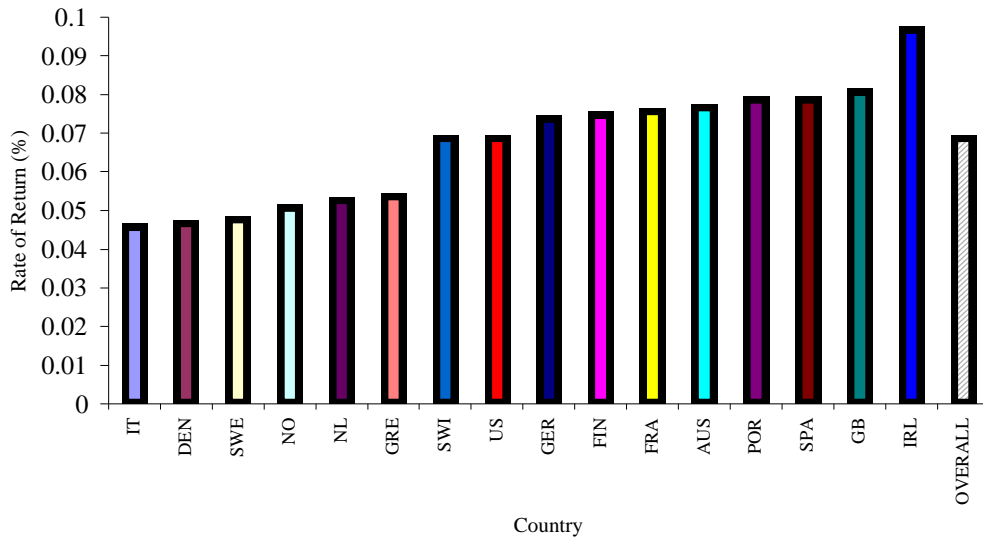
Figure 2.6.   Meta analysis of the return to education, different specifications
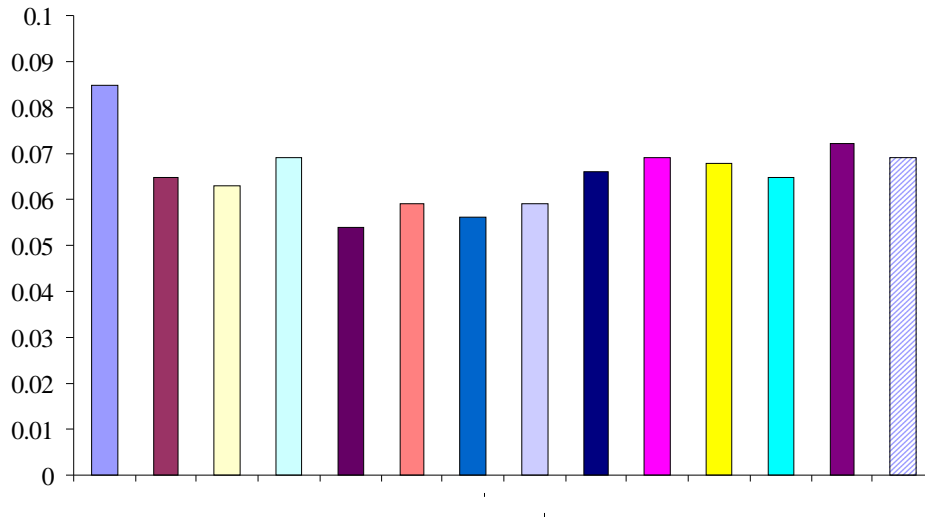
In addition, we find that estimates in data from the 1960s give a clearly higher return to education than similar estimates from the 1970s. After a further drop in the 1980s, the return rises in the 1990s. Estimated returns from studies of public-sector workers, and from studies where net (of tax) wages only are available average about 5% (though we would expect the net returns to be lower than those from gross earnings by an amount approximately equal to the average tax rate).

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2.7   Endogeneity of schooling

Finally we investigated for some countries the question of endogeneity in the schooling decision. Using the instrumental variables technique (IV) is one way of dealing with endogeneity. In brief, the idea of this technique is that one uses exogenous factors that are not correlated with income to predict the level of education. Returns to education obtained in this way are commonly somewhat larger compared to those where schooling is considered to be exogenous. However, the size of the extra return depends markedly on the choice of instruments.

The results from the PURE project seem to be in line with what has been obtained in other similar studies. Figure 2.7 summarises the return to education using different IV-estimators. Overall, it can be seen that the return to education based on IV exceeds the conventional OLS-based estimates. This will happen if the instrument affects sub-groups with a relatively high marginal return to education. And this is to a large extent what the IV-estimates based on experiments actually does, because most of the experiments affect groups with lower levels of education and refer to situations where the variation in ability between the control group and the treatment group is small. Likewise, family controls produce only slightly higher returns because the educational levels of siblings do not differ so much.

Figure 2.7.   Instrumental variables (IV) estimates using different types of instruments
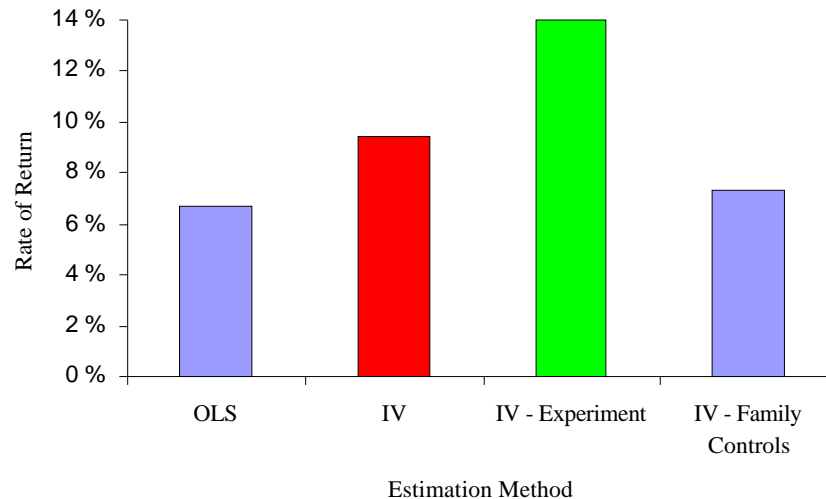
2.8   Conclusion

The evidence on private returns to the individual is compelling and despite some of the subtleties involved in estimation there is still an unambiguous positive effect on the earnings of an individual from participating in education.

We have found that returns to education differ somewhat across Europe, with the Scandinavian countries and the Netherlands lowest, and Ireland and the UK highest. We have also found that the marginal return to females is often highest in countries where the female participation rate is lowest. Though the returns differ, we find no signs of convergence between the European countries in the sense that the high-return countries

experience a decreasing trend in returns. Nor do the low-return countries seem to experience a clearly increasing trend in returns.

These findings of the PURE project raise the following policy-relevant issues. First, although we have not yet seen any convergence in returns to education across Europe, the existing differences could lead to higher mobility between countries in the future. Especially, the highly educated are expected to exploit cross-country differences in returns to education in the future because electronic communication makes it possible to work and live in different places. At the same time, the low returns in some countries might have severe incentive effects with respect to the choice of education. As a consequence of the low return, a growing number of youths in these countries may decide not to take further education.

Second, the high wage premium to female education in countries with low female participation may disappear when more women start working. Finally, our attempts to produce instrumental variables estimates indicate a high potential return to educating social groups who tend to acquire little education. Further research might identify those groups. A necessary condition for an increased research effort is better access to Trans-European data on individuals.

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　　　　Reference to Education. New York: Columbia University Press.

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3. EDUCATION, EARNINGS GROWTH AND COHORTS [3]

Giorgio Brunello, Simona Comi and Claudio Lucifora

3.1 Education and earnings growth

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

According to Mincer (1974) the experience profiles of weekly earnings by education are parallel, suggesting that the relative "skill" differentials in wage rates do not change with years of experience. From then on a large body of literature has provided evidence that the relationship between wage and education is not affected by experience. Psacharopoulos and Layard (1979) showed that experience profiles are steeper for individuals with higher education. They interpreted their results in light of the human capital model as evidence that education and training are complements: since training increases productivity and individuals with higher education are more likely to receive additional training over their working life, experience profiles are steeper for the more educated.

While higher education can be conducive to more training during working life, Neuman and Weiss (1995) argue that schooling-specific obsolescence of human capital is faster for the highly educated. They use this argument to explain their findings that wage differentials by education decrease with labour market experience. Converging experience profiles can also be explained by the screening hypothesis: if higher education is a signal and firms learn about the (time-invariant) ability of their

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[3] This chapter summarises the main findings from two separate PURE studies: *Education and Earnings Growth. Evidence from 11 European Countries* by Giorgio Brunello and Simona Comi, and *The College Wage Gap in 10 European Countries: Evidence from Two Cohorts* by Giorgio Brunello, Simona Comi and Claudio Lucifora. Both papers are available at the PURE web-site www.etla.fi/PURE.

employees over time, then the partial effect of education on earnings is bound to fall with experience (Layard and Psacharopoulos 1974).[4]

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

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

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

The evidence suggests that experience profiles are not parallel but steeper for higher attained education. Figure 3.1 plots the simulated profiles obtained by letting potential experience x vary from 0 to 35 years and by assigning to each profile the same starting value, equal to 1. Note that experience profiles are generally steeper for males, independently of the level of attained education. On the other hand, the earnings growth gap between college graduates and high-school graduates is larger for females.

Figure 3.1.   Earnings growth by educational attainment and gender

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[4] For PURE evidence on the screening hypothesis, see Chapter 4 of this volume.

Males and Females

Males

Females
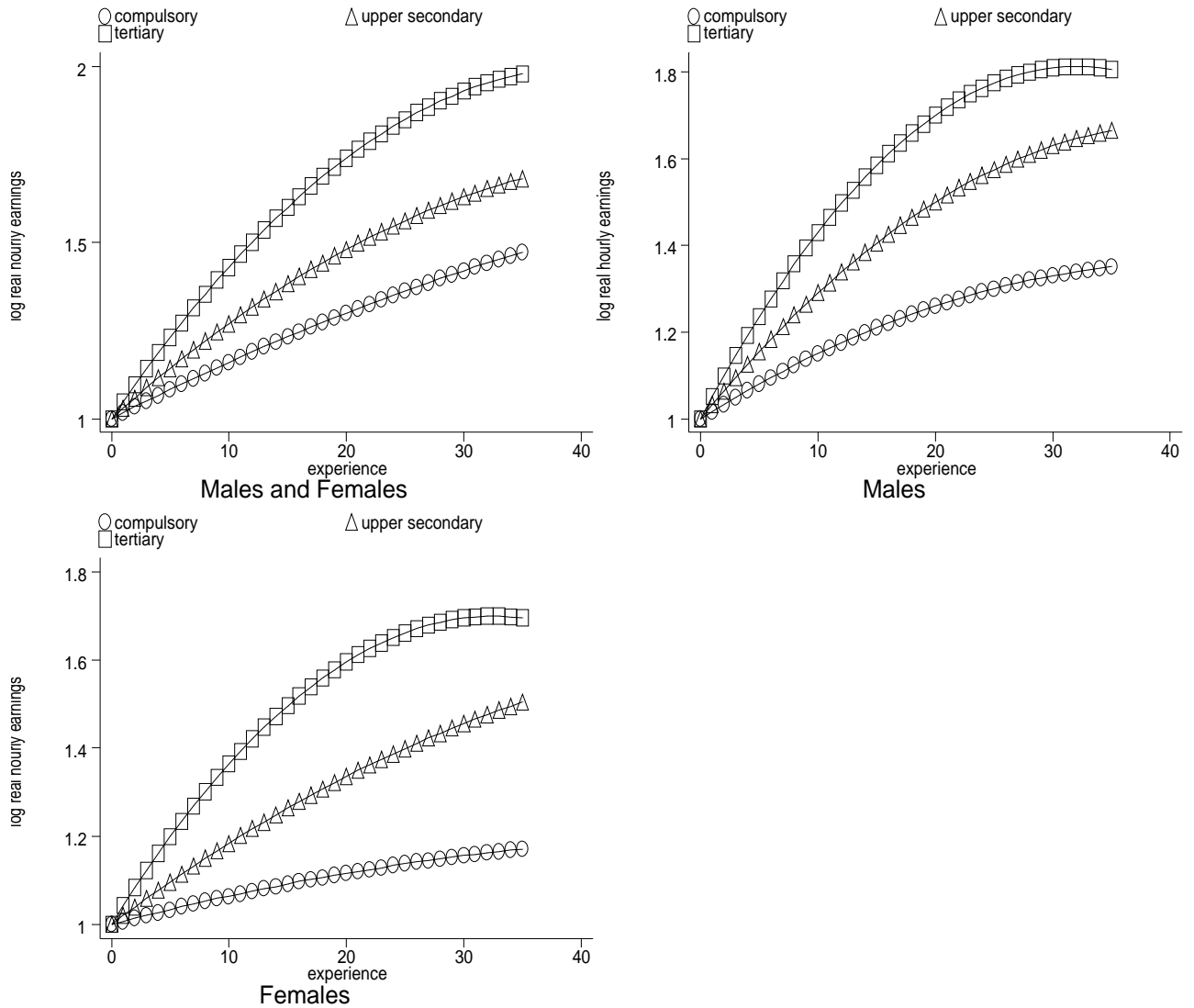
The findings in Figure 3.1 are based on the assumption that experience profiles do not vary by cohort of birth. We now relax this hypothesis and consider the two cohorts separately. In Figure 3.2 we plot both the experience profiles of college graduates relative to high-school graduates and the experience profiles of high-school graduates relative to employees with only compulsory education. In each panel of the figure, relative earnings at zero experience have been normalised at zero.

We find that the earnings differential between college and upper secondary school graduates increases faster with experience for the younger than for the older cohort during the first fifteen years of potential experience. For longer potential experience, however, the difference in relative earnings growth between the two cohorts declines and eventually relative earnings growth becomes smaller for the younger cohort. This observed pattern in the dynamics of relative earnings is consistent with college graduates of the younger cohort investing relatively more in human capital than college graduates of the older cohort during the former part of their working life and relatively less during the latter part.

Figure 3.2.   Relative experience profiles by school level and cohort

The observed slowdown in relative net investment later in working life could also be
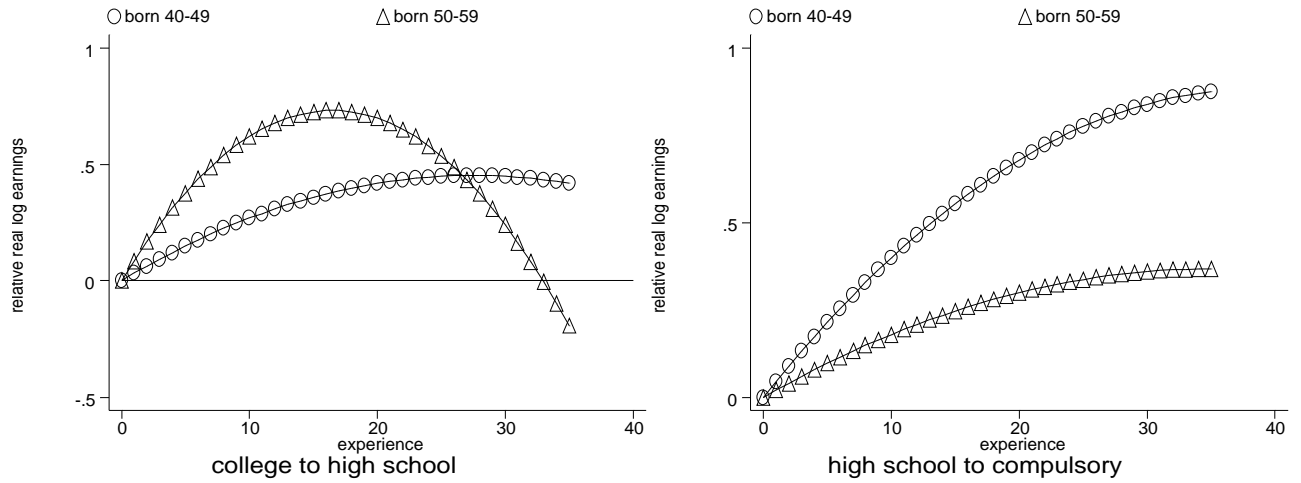
attributed to faster depreciation of human capital. Following Card and Lemieux (2000), the higher rate of net investment by the younger cohort could be explained by the fact that younger cohorts of college-educated individuals have higher levels of computer skills. Because of their stronger complementarity with computer-intensive technologies, productivity and earnings grow faster for them, relative to high-school graduates, than for older college graduates.

It is an open question, however, why skills should grow at a slower rate or depreciate faster for college graduates of the younger cohort in the later part of working life. We try to answer this question in the next section. We also find that the earnings differential between upper secondary school graduates and individuals with only compulsory education grows faster for the older cohort. For this cohort, the experience profile of individuals with only compulsory education has a negative slope.

3.2   The college wage gap

The wage structures of several OECD countries experienced, over the last decades, significant changes. Overall wage inequality and wage differentials across different

groups of workers showed a marked departure with respect to the trends that had characterised earlier periods. In this respect, various factors, both of economic and institutional source, contributed to re-shaping the distribution of wages. Major changes occurred in the distribution of the labour force by educational level and by labour market skills, partly driven by the educational choices of the "baby boom" generation and partly due to the changing structure of employment following the diffusion of computer technologies.

Two leading explanations have been offered to account for the observed changes in relative wages: one story has emphasised the role of market forces and the evolution of (relative) supply and demand; another story has stressed the role of labour market imperfections and institutional arrangements. The former approach focuses mainly on demographic changes, adverse shifts in supply and demand for products, skill-biased technological change, and the increased globalisation of trade. The latter approach advocates the importance of trade unions, collective bargaining practices, and product and labour market regulations.

Changes have had different impact on younger and older cohorts. Card and Lemieux (2000), for instance, use data on workers of different age groups to show that in the USA much of the rise in the college–high-school wage gap can be attributed to changes in the relative earnings of younger college-educated workers. They also show that this shift in the structure of returns to college graduates shares a common pattern in the UK and Canada, where educational wage differentials have risen for younger men while remaining stable or even declining for older men.

While there is an extensive literature investigating the evolution of the college wage gap in the North American and British experiences, relatively little is known about the (continental) European experience. We believe that a better understanding of the European case is interesting not only in itself, but also because the PURE countries show a relatively high degree of variation in the evolution of relative prices and quantities for different skills and also exhibit significant institutional diversity.

Figures 3.3 and 3.4 compare, for each selected cohort, the college wage gap at the beginning and at the end of the sample period and highlight the significant heterogeneity in the behaviour of the gap across cohorts and countries. In Austria and the Netherlands, for instance, the college wage gap was lower at the end of the sample period for the older cohort and higher for the younger one. Interestingly, the increase in the college wage gap between the end and the start of the sample period has been higher for the younger generation in half of the countries in our sample (Austria, Denmark, Netherlands, Switzerland, UK) and higher for the older generation in rest of the sample countries (Finland, France, Germany, Italy, Portugal).

In practice, the college–high-school wage gap can be decomposed into two parts: the first part varies by country and cohort only (time invariant); the second part varies by country, cohort and time (time variant). Using a linear trend to capture time effects and pooling the available data, we adopt the following empirical specification:

$$r_{cjt} = \sum_c \alpha_c D_c + \beta\, C + \sum_c \gamma_c C * D_c + \delta\, t + \sum_c \xi_c D_c * t + \sum_c \theta_c D_c * C * t$$

where D are country dummies, C a cohort dummy, and t a linear time trend. We allow for two sets of interactions, one involving time and country dummies and the other time, cohort and country dummies. Whilst the former set captures differences in the linear trend across countries, the latter picks up further differences between cohorts.

Figure 3.3.   College wage gap, cohort born 1940–49
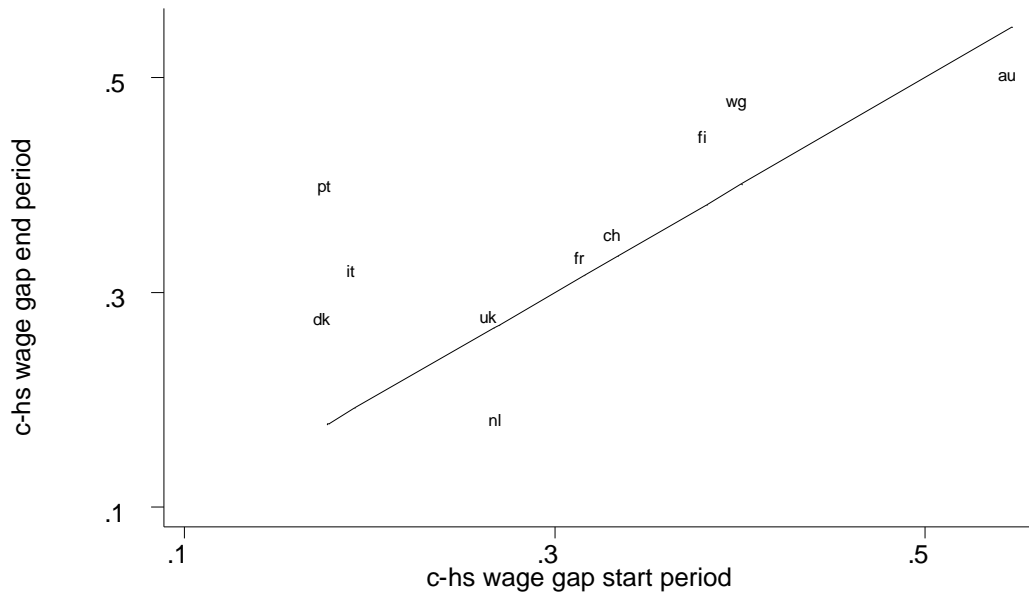
Figure 3.4.   College wage gap, cohort born 1950–59
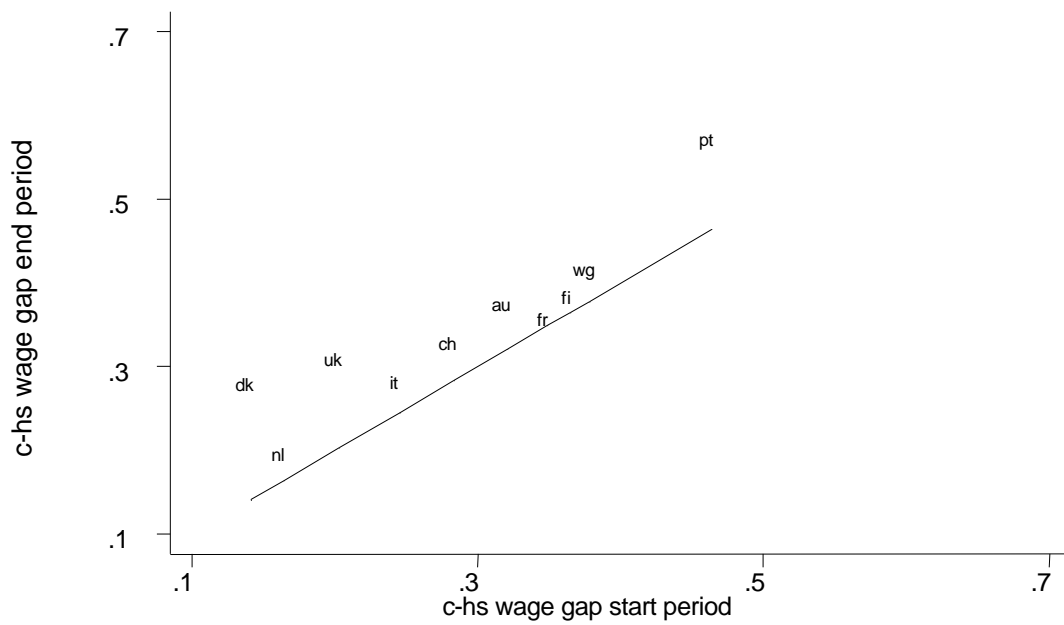
Estimating the above equation we find that:

q   the cohort effect is relatively high in Austria and Germany for the cohort born
    between 1940 and 1949;

q   the cohort effect is significantly lower for the cohort born between 1950 and 1959 in Austria, Denmark and the Netherlands, and significantly higher in France and Portugal;

q   the older cohort has experienced a positive trend in the college wage gap in all countries but the Netherlands; this trend has been particularly pronounced in Finland, Italy and Portugal;

q   the estimated rate of growth in the college wage gap is higher for the younger cohort in Austria, Denmark, the Netherlands, Switzerland and the UK (see Figure 3.5), albeit the difference to the older cohort is not statistically significant in the last two countries, and lower in the rest of the sample countries.

We stress two results in particular. First, and contrary to the evidence presented by Card and Lemieux (2000) on three Anglo-Saxon countries, the growth in the college wage gap has not been restricted to the younger cohort. Second, in a number of PURE countries the college wage gap has risen faster for the older than for the younger cohort. We also find that there is a negative correlation (–0.356) between the estimated time-invariant country-by-cohort effect (intercept) and the time-varying country-by-cohort aggregate effect (trend) (see Figure 3.6). This suggests that countries that started with relatively high college wage gaps have also experienced a slower growth in the gap during the sample period.

The observed heterogeneity in the behaviour of the college wage gap among countries, between cohorts and over time begs the question whether these differences can be associated to differences in the levels and changes of relative supply, relative demand and institutional set-ups.

Figure 3.5.   *Estimated growth in the gap for the two cohorts*
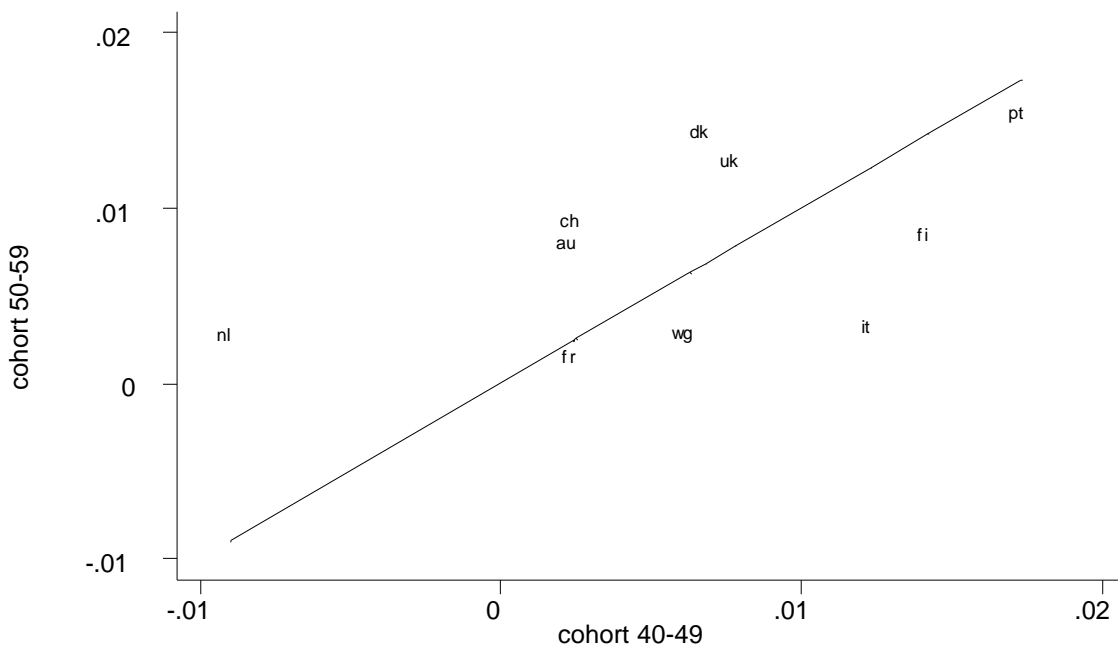
Figure 3.6.   Estimated intercept and trend in the college wage gap

A model that combines labour market competition with non-competitive rents implies that cross-country differences in the college wage gap should be correlated with differences in relative demand, relative supply and institutional set-ups. Correlation does not imply a causal relationship, however, because relative prices and quantities are jointly determined in competitive markets and institutions themselves could vary in response to price and quantity signals (see the discussion in Fortin and Lemieux (1997)).

In order to study this subject in more depth, we summarise the discovered differences in college wage gaps using two indicators: (1) the estimated coefficient of the country dummy (level), which varies between cohorts and captures time-invariant effects on the college wage gap; and (2) the estimated coefficient of the time trend (trend), which varies by country and cohort and captures aggregate time effects. Next we relate each indicator to measures of relative supply, relative demand and labour market institutions. We associate the former indicator to *levels* of relative supply, relative demand and institutional constraints affecting the wage gap. The latter indicator relates to *changes* in relative supply, demand and institutional constraints (since institutions vary over time, we distinguish, when possible, between institutional levels at the start of the sample period and institutional changes).[5]

Starting with levels, the first panel of Figure 3.7 shows the expected negative relation between the estimated level of the trend and the considered measure of relative supply, the relative cohort size.[6] As expected, the time-invariant country effect is negatively correlated also with the Kaitz index, defined as the ratio of the minimum wage to the

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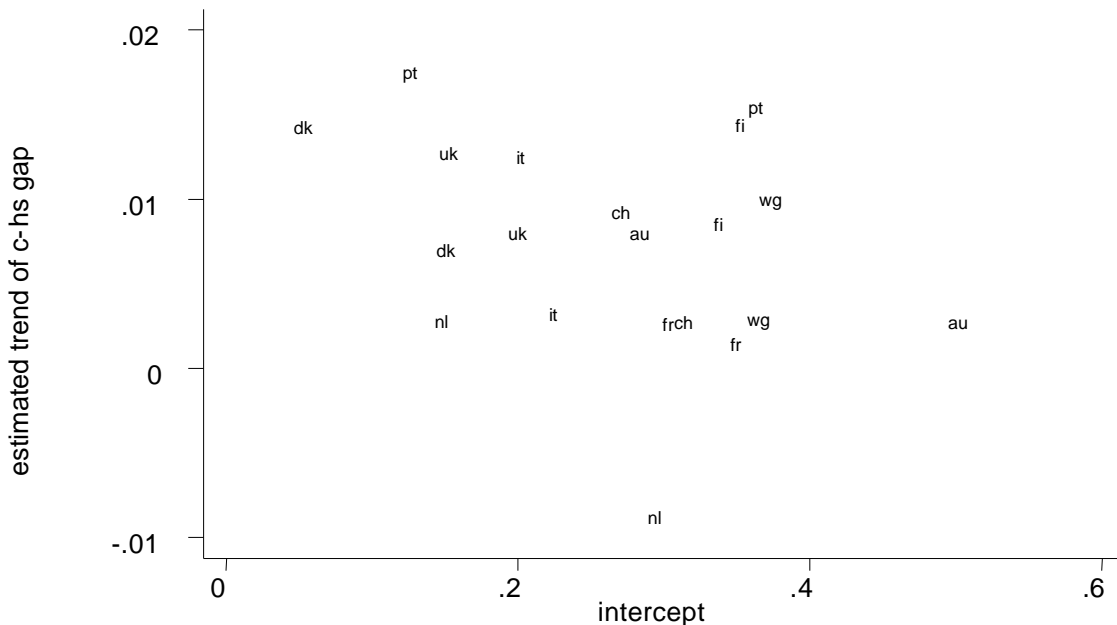
[5] See Brunello et al. (2000) for a more detailed and technical analysis and for a more extensive description of the variables considered.

average wage. In fact, a relatively high minimum wage can raise wages at the lower end of the wage distribution and thus affect the denominator of the gap. The third panel shows the positive relation existing between the estimated level of the gap and an index of the relative strictness of employment protection measures, for the early 1980s.[7] Finally, the positive correlation with age at start of the sample period is also as expected and suggests that college graduates have steeper earnings profile than high-school graduates, as already shown in section 3.1 above (see panel 4 of Figure 3.7).

Figure 3.7.   Relations between the estimated level of the gap and selected variables
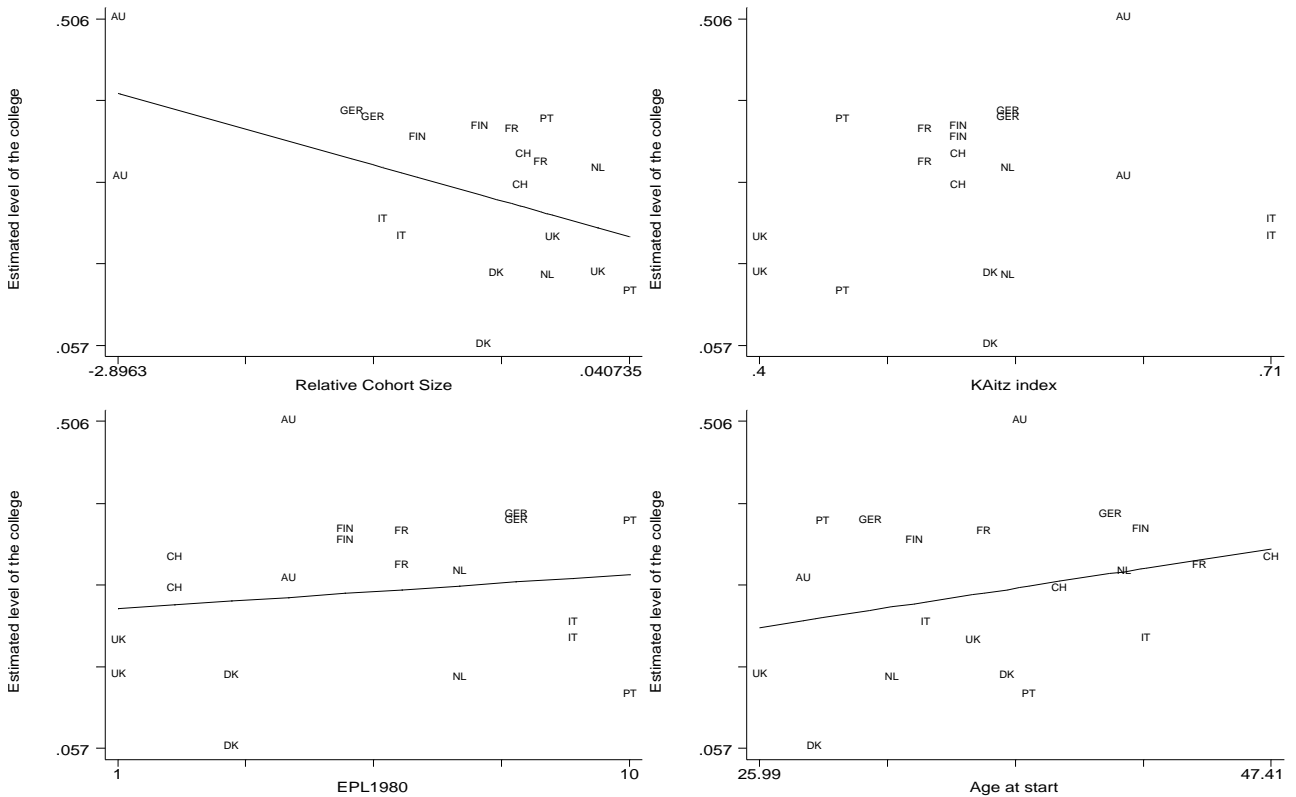
Turning to the estimated growth of the college gap, in Figure 3.8 we illustrate the relationship between the estimated value of the trend for each cohort and the changes in relative supply, relative demand, productivity growth and union density. We measure changes in relative supply using the average annual rates of change in relative attainment of the population. This measure turns out to be negatively correlated with the growth of the gap (see panel one of Figure 3.8). In the literature, the standard measure of relative demand shifts is based on Katz and Murphy (1992), and from a simple inspection this index is positively correlated with the growth of the college gap (panel two of Figure 3.8).

It has been shown recently that relative wages by education and skills can be affected by the rate of technical progress. By introducing new vintages of techniques, technical progress has both a productivity effect and an erosion effect on skills and wages.

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[6] For a more detailed description of these indexes, see Brunello et al. (2000).

[7] For a more detailed analysis, see Brunello et al. (2000).

Erosion occurs because accumulated skills depreciate with the introduction of new techniques and the progressive demise of old techniques. If the skills of high-school graduates depreciate faster than the skills of college graduates, the college wage gap increases when technical progress accelerates. As shown in panel three of the figure, in our data there is a positive correlation between the growth in the gap and the rate of productivity growth. Finally, union density is a measure of union influence on relative wages. Traditionally, stronger unions have compressed wage differentials by skills and education and, as expected, this measure is negatively correlated with the time-variant component of the college wage gap (see the fourth panel of Figure 3.8).

Figure 3.8.   Relations between the estimated trend of the gap and selected variables
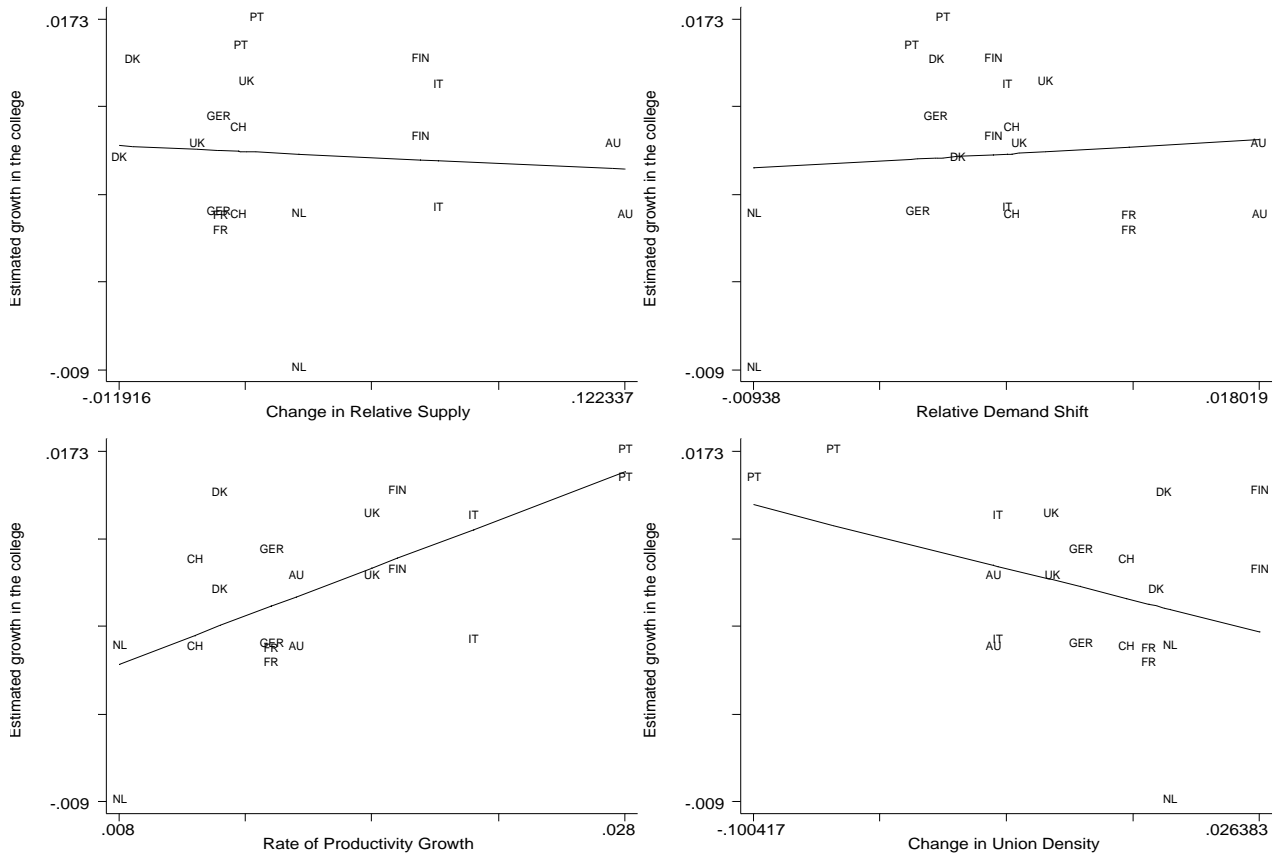
3.3   Policy implications

We find evidence of significant cross-country differences in the level and growth of the college wage gap. There is also evidence that both the level and the growth of the college wage gap differ significantly between cohorts. Estimated growth turns out to be negatively correlated with changes in relative supply and positively correlated with an index of between-industry demand shocks as well as the long-run rate of labour productivity growth. The latter finding is consistent with different demand-side explanations, including skill-biased technical change and capital–skill complementarity.

Institutional changes matter as well. We find that countries having experienced a decline in union density, have also had a faster growth in the college wage gap.

Our results show the importance of education not only as securing a higher entry wage but also in affecting the life-cycle wage profile. Significant differences emerge across cohorts suggesting that different age groups experience different labour market patterns. Educational and labour market policies directed at specific age groups should take this into account.

Finally, there seems to be significant heterogeneity across countries both in the level and in the evolution of the college wage gap, stressing once more the role of institutions. Policy intervention should account for institutional variety in the educational as well as in the labour market.

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4.   THE ROLE OF SCHOOLING: SCREENING VERSUS HUMAN CAPITAL [8]

Ali Skalli

There is at least one reason why it is important to discriminate between screening theory and human capital theory. The screening hypothesis implies that private returns to education do not reflect a productivity augmenting role of education, implying that social returns to education may be less than private returns or even negative. However, a test that discriminates between the human capital theory and the screening hypothesis is difficult to perform via the estimation of earnings functions, since the two hypotheses are observationally equivalent as they both imply a positive effect of education on earnings. Fortunately, there remains the possibility of testing predictions of the screening hypothesis. To the extent that appropriate data are available, PURE partners have tested some of these predictions. This chapter summarises the results.

A first prediction of the screening hypothesis is that self-employed employees would, in comparison to other employees, benefit from lower returns to education. Indeed, as self-employed, these individuals do not need a signal about their own productive capabilities. The country-specific results highlight a positive signalling value for women in Austria and West Germany, for men as well as for women in Greece, and for men only in Spain and the UK.

This approach raises two problems, however. First, individuals' employment status is not random and its determinants should be taken into account. This is why, for the UK, the endogeneity of self-employment has been controlled for using information on whether or not one's parents were self-employed and on housing equity. The results indicate that the value of education as a signal is rather low and, once its endogeneity is controlled for, the estimated values are not statistically significant neither for men nor for women.

A second problem that arises is that when comparing employees and self-employed individuals, one is comparing two types of income that are different in nature. In particular, not only are the earnings of the self-employed more variable, but clearly, business owners have more earnings opportunities not directly dependent on their educational qualifications. As a means of avoiding this difficulty, we have restricted the French sample to those self-employed who are salaried of their own businesses. The results indicate that there is a positive and statistically significant signalling value for men, but not always for women.

The screening hypothesis also implies that some aspects of a person's educational record are very informative for employers. A possible test to discriminate between the human capital theory and the screening hypothesis may rely on two predictions of the latter: (i) that more rapid completion of a degree signals greater ability and should

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[8] This chapter reports on work in progress.

therefore lead to higher earnings, and (ii) that years spent in education without obtaining a degree should not increase earnings.

Using French data, we are able to divide actual years of schooling into effective years, repeated years, skipped years, inefficient routing years and drop-out years. The results indicate that for men as well as for women

ꝗ   the returns to effective years of schooling – those that would have been observed had all years been successful for all individuals – are higher than the returns to actual years of schooling;

ꝗ   there is a bonus return for completing a degree, since the returns to non-graduating years are lower than the returns to successful years of schooling, hence suggesting the existence of sheepskin effects;

ꝗ   repeated years do not have a significantly negative effect on wages (except for men), nor do skipped years have a significantly positive effect on wages;

ꝗ   inefficient routing years have no significant effect on wages.

Note that, if sheepskin effects are indeed at work, then the log-linear relationship so commonly assumed to exist between earnings and schooling is clearly doubtful. Indeed, one should then expect to observe non-linearities in the earnings–schooling profile for the years of schooling that are typically required to obtain qualifications. This is also the approach that has been adopted for Ireland, Sweden and the UK.

For Ireland as well as for Sweden, significant non-linearities appear mainly for the highest level grades. The results obtained for the UK also strongly reject the linear hypothesis and highlight marked non-linearities in the relationship, especially between the age 18 and 21 and after 22 years of age.

A perhaps less parsimonious but interesting specification is that proposed by Park, which consists in crossing qualification levels with years of schooling. It has been replicated for Spain, Sweden and France. It is interesting since it clearly shows how the returns to degrees fall with the number of years spent at school to complete them.

5. THE INEQUALITY OF THE WAGE DISTRIBUTION IN 15 EUROPEAN COUNTRIES [9]

Joop Odink and Jeroen Smits

5.1 Introduction

The distribution of incomes has always played an important part in economic theory as well as in economic policy. In the 18th and 19th centuries the distribution of the national product over the different classes was a major issue. This distribution is knows as the *categorical distribution*. Income shares are calculated as aggregates over all people belonging to each of the socio-economic classes. According to Ricardo, wages, profits and rents are attributed to labourers, entrepreneurs and landowners, respectively. According to Marx the struggle between the bourgeois (profits) and the proletariat (wages) determines the wage rate and the profit rate. So not only the income distribution matters, but also the remuneration or price ratio(s).

In the 20th century the distribution of incomes over persons – be it individuals, tax payers or households – became a major issue: the so-called *personal income distribution.* The income of a person is the aggregate of all the income components of that person. For many persons or households labour income is by far the most important income component. Accordingly it makes sense to analyse the personal distribution of wages only.

In this chapter the wage distribution of the 15 PURE countries is analysed. Strictly speaking we will analyse the distribution of hourly wages. For full-timers the distributions of hourly wages and annual earnings are the same. In our data this is the case for males (for females, also part-timers are included). One of the focuses of the analysis is the contribution of education and work experience (or age) to total wage inequality.

5.2 Wage inequality and inequality of the wage distribution

Inequality has several aspects. It is necessary to make a clear distinction between wage inequality based on differences in hourly wages (or wage ratios) and inequality in the distribution of wages. Wage inequality focuses on *wages*, that is, wage differences (prices only). It can be measured using the *wage equation***.** For inequality in the distribution of wages, both prices and quantities, resulting in income shares, matter. For the measurement of wage distributions *inequality indexes* could be used.

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[9] This chapter is partly based on PURE work in progress: Jeroen Smits and Joop Odink, *Differences among countries, trends, and decompositions of earnings inequality in 15 European countries*.

The following example further illustrates the difference between the two approaches. In a society with low-educated people earning 10 per hour, and high-educated people earning 20 per hour, the wage ratio is 2 irrespective of the population share of the highly educated. The inequality of the wage distribution, in contrast, will (in principle) be the higher the closer this population share is to 50%!

In the PURE project the wage equation has been the centre piece of the analysis. It is used to examine the rate of return on investments in education. An example of the wage equation for the Netherlands in 1996 is:

$$lnWage = 1.583 + 0.063\ Schooling + 0.326\ lnExperience - 0.132 D_{Female} \qquad (R^2 = 0.531)$$

The wage equation thus also produces information about wage inequality: wages and wage ratios according to education, experience (or age), gender, etc. According to the estimated wage equations for the 15 PURE countries, about 25% to over 50% (e.g. 53.1% for the Netherlands) of the observed differences in hourly wages can be attributed to years of schooling, age or years of work experience, and gender. All coefficients are highly significant with all standard errors being exceptionally low. According to the Dutch wage equation, the hourly wage increases by, on average, 6.3% with each additional year of schooling, while the wage rate at 10 years' experience rises with 3.3% for one additional year of experience. The hourly wage of females is, ceteris paribus, about 13.2% lower than for males.

5.3   Income inequality coefficients

There has been a great variety in *income inequality coefficients* throughout the economic literature. The choice of a measure has always been a tricky question. Also in several fields of economic analysis the choice of the right measure is a difficult question, for example the choice of a CPI. As the income distribution is an emotional subject, many papers have been written about the merits and shortcomings of the different inequality indexes. However, almost all authors agree about three basic axioms (postulates, criteria) that a decent index or coefficient should fulfil. Specifically, the index *(I)* should fulfil the criteria of *homogeneity, symmetry, and Pigou–Dalton.* Homogeneity implies that if all incomes are multiplied by the same constant, *I* does not change. An important consequence is that *I* can be expressed as a function of income shares only. Symmetry means that a change of income between two persons does not effect inequality. According to *Pigou–Dalton* (see Kakwani 1980) a transfer from a high income to a low income will reduce the inequality index.

Most of the existing indexes do not satisfy these criteria. However, a few well-known remain: the Gini index, the Theil index and Theil-related indexes, and the coefficient of variation. The Gini and Theil indexes typically have been developed for income inequality measurement, while the coefficient of variation is a general statistical measure.

If an additional criterion was added, only a few or even none of the indexes would remain. Kakwani (1980) adds measurement in a 0–1 scale as an additional criterion, which is met only by the Gini index. Foster (1983), in turn, proves that only Theil-related indexes combine the three aforementioned criteria plus the *additive decomposability criterion.* Additively decomposable means that the index is equal to the inequality between different groups plus the sum of the weighted within-group inequalities.

$I = I$ between groups $+ \Sigma w_\mathrm{i} * I$ within groups

As decomposability is an important aspect in our analysis, we choose to use the Theil indexes. Because in our data the criterion of Pigou–Dalton is not violated for the variance of the log income, which is also a decomposable index, this measure is adopted as well. Moreover, Theil (1967) proves that, if the distribution is log-normal, the Theil index is equal to half the variance of log incomes.

The results for three different inequality indexes of the wage distributions in the 15 PURE countries are shown in Figure 5.1.

Figure 5.1.   Theil T, Theil N, and Variance of log income on the basis of hourly wages for the 15 PURE countries around 1995
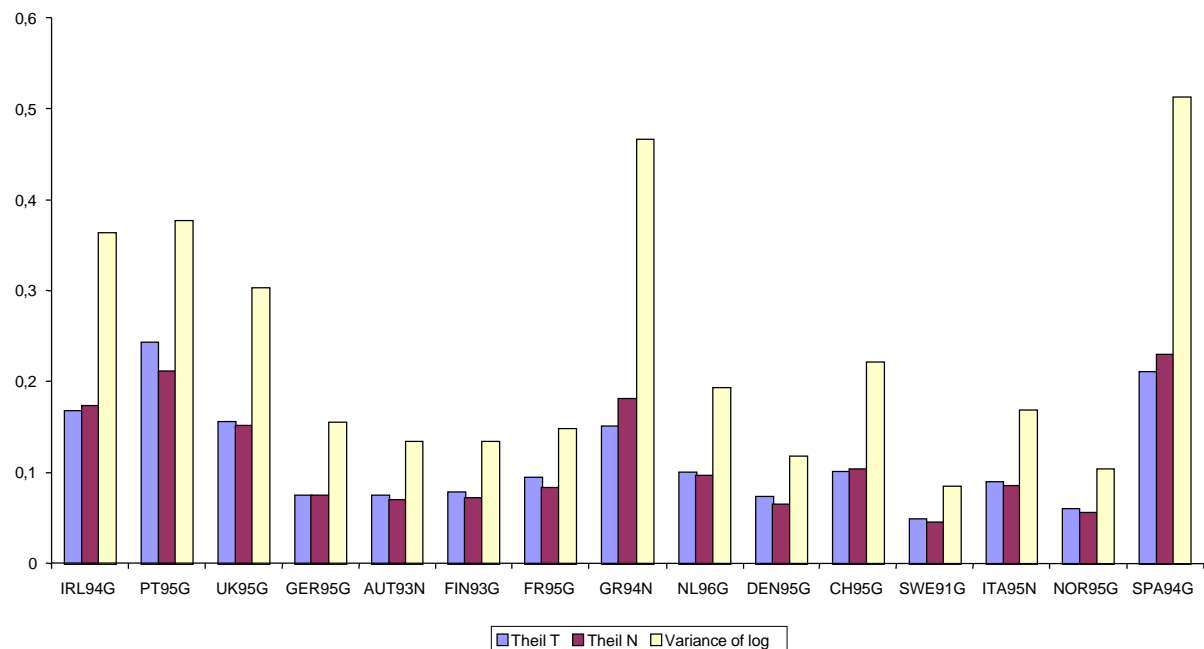
The main conclusions that can be drawn from the figure are:

q   The differences between *Theil T* (using income shares as weights) and *Theil N* (using population shares as weights) are for all countries relatively small.

q   The *variance of the log incomes* measure is about twice as large as Theil T.

q   Spain, Greece, Portugal, Ireland and the UK are by far the most unequal countries with respect to hourly wages.

q   Sweden is the most equal one.

As a consequence of the first and the second conclusion we shall concentrate on *Theil T* in the remainder of this chapter. When decomposing the index according to gender, education, age, and a composition of these three variables, a total of four different between-group inequalities can be calculated. In Figure 5.2 those four between-group inequalities are expressed as a percentage of total inequality for each of the 15 PURE countries.

Figure 5.2.   Decomposition of Theil T according to gender, education, age and a combination of the three variables for the 15 PURE countries, percentage of total inequality
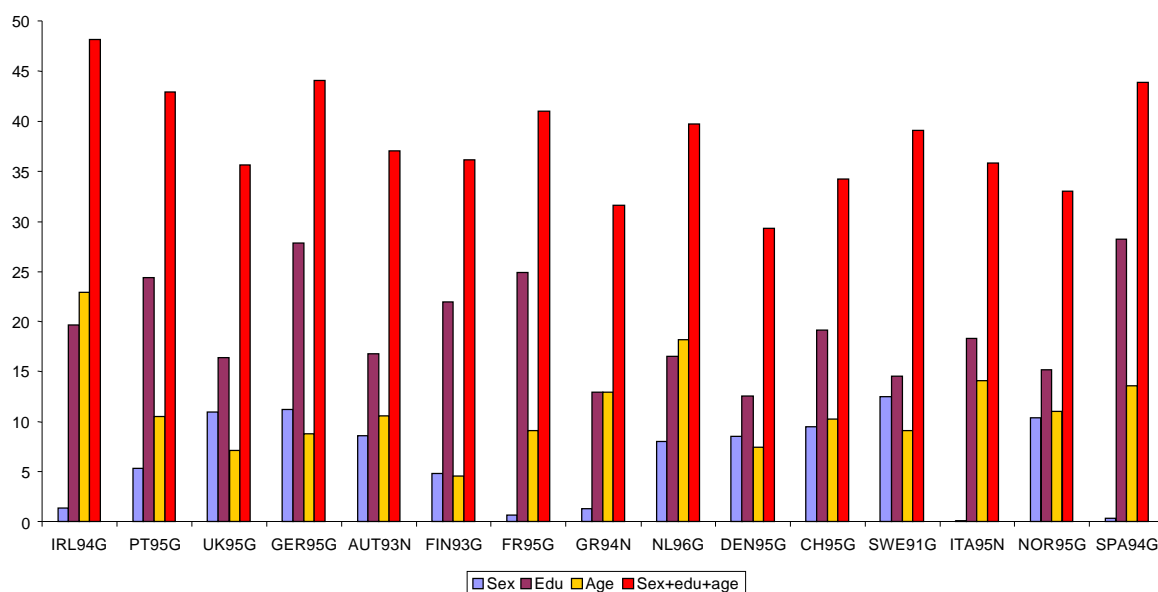
The following conclusions can be drawn from Figure 5.2:

q   The combination of sex, education and age stands for about 30% to 50% of total inequality; Ireland with 48% being the highest and Denmark the lowest (28%).

q   The sex effect varies heavily; from almost nothing (France) to over 12% (Sweden). However, this outcome might be influenced by the composition of age and gender.

q   In Ireland and the Netherlands, age is more important than education; in almost all other countries the reverse is true.

In Figure 5.3, the wage distributions of males have been further analysed by adding various variables to education and age: regions, part-time vs. full-time, occupation, private vs. public sector, and manual vs. non-manual labour.

Figure 5.3.   Decomposition of Theil T of males according to education, age, and combinations of education and age with region, private sector, manufacturing, and manual/non-manual occupation in the 15 PURE countries, percentage of total inequality
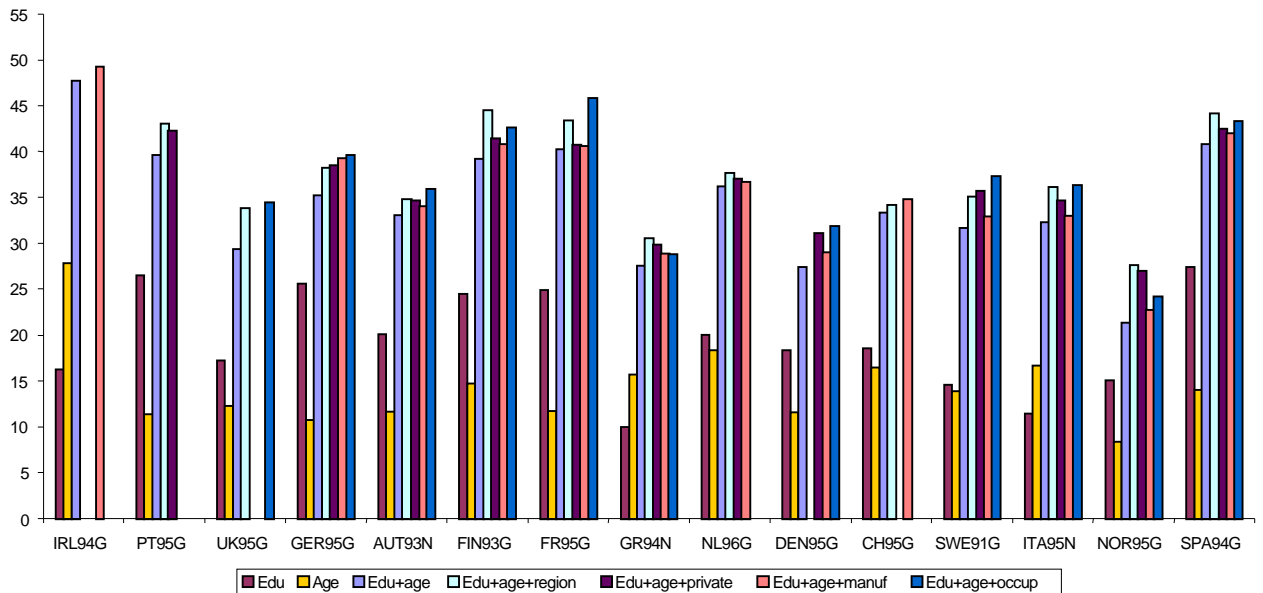
We can conclude that:

q   Adding more variables (region, part-time, occupation, sector, etc.) does not substantially increase the share of between-group inequality in total inequality.

q   Accordingly gender, education and age/experience are the top three components of income inequality between wage earners.

So far a static situation has been analysed. One of the main characteristics of the labour market in the second half of the 20th century is the increased schooling of the working population. According to the demand and supply models, one might think that wage inequality has therefore been reduced substantially. There are, however, forces that work in the opposite direction.

Figure 5.4   Trend of Theil T for males in the 15 PURE countries
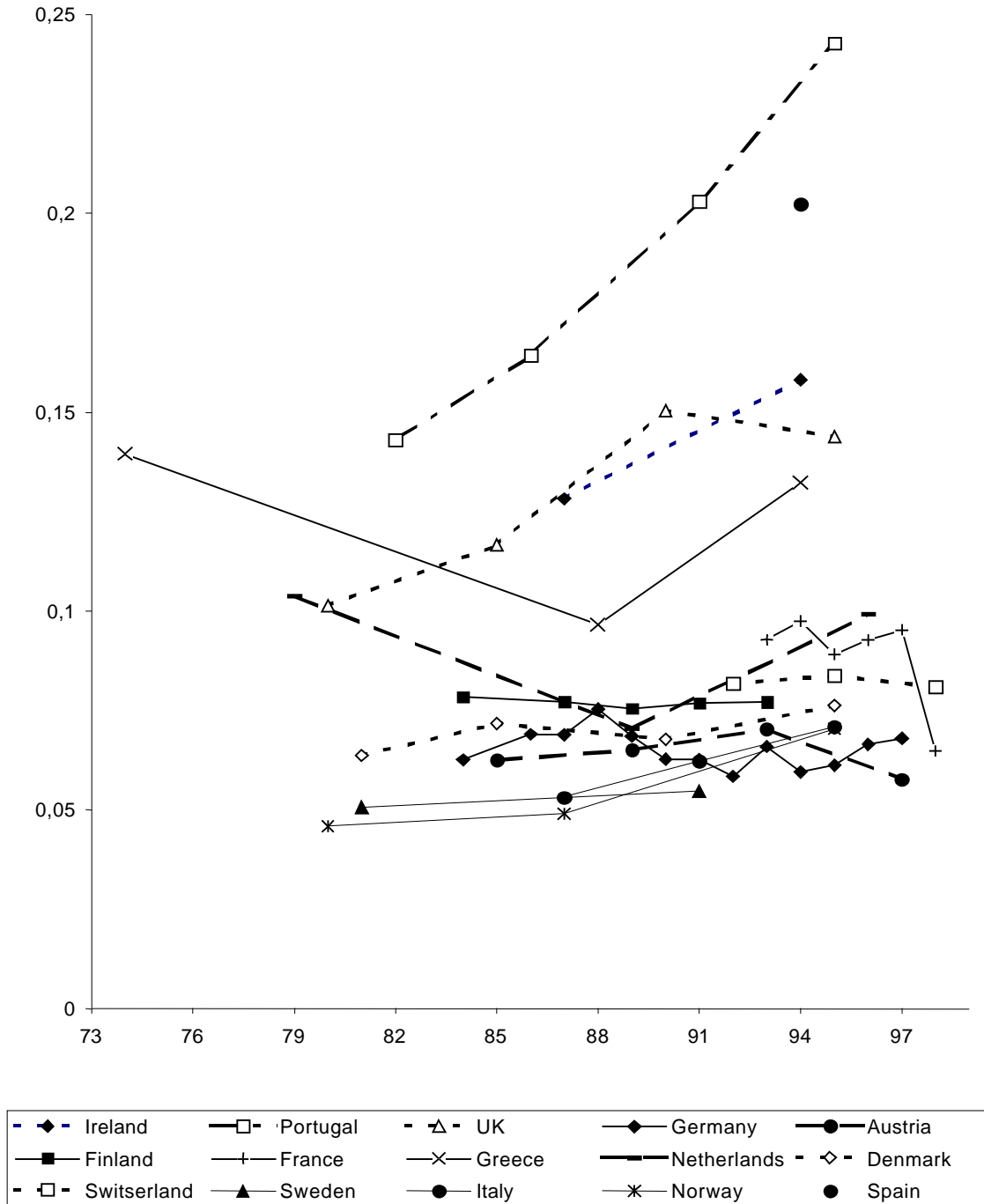
Not only has there been an increased supply of higher educated people, but also an increased demand in the labour market for such skills. Wage differences decrease only if this "race between technological development and education" (Tinbergen 1975, Ch. 6) is won by education. Since the eighties the rate of return on investment in education has been more or less constant in most PURE countries.

As long as wage ratios are constant, an increase in the population share of highly educated from a low level to a substantial level will increase between-group inequality (see above). Furthermore, within-group inequality is generally highest in the groups with the highest wages. As the shares of these groups are increasing, the weighted sum of the within-group inequalities will rise as well. Therefore we see in Figure 5.4, which shows the trend in wage inequality for 14 of the 15 PURE countries, that for most of them wage inequality has been increasing since 1980.

5.4   Some consequences for incomes policies

Three main groups of wage differences with respect to different political issues can be distinguished:
q   compensating differences
q   differences based on productivity differentials
q   differences based on imperfect market conditions.
For *socialists* there is no problem if wage differences compensate for differences in effort or in the quality of the work (dirty, unpleasant). Wage differences based on productivity differences, in contrast, might be interpreted by them as being unfair. *Liberals* are in favour of good functioning markets. They will argue that productivity differences should be reflected in wages. If not, serious inefficiencies might be the result. *Both socialists and liberals* are in favour of elimination of differences based on imperfect market conditions. Therefore, in many countries the *equity efficiency trade-off* is a major political issue.
What about wage differences related to the big three: differences in education, experience or age, and gender? If the rate of return on investment in education reflects the reference discount rate (e.g. a market interest rate corrected for (wage) inflation, uncertainty and the quality of the job), then we might argue that education-induced wage differences are compensating differences. Differences in experience reflect work done in the past, implying that those differences might be interpreted as a compensation for this past effort.
Lifetime wage incomes can be calculated by discounting wages over time. If the rate of return on investment in education happens to be the discount rate, then the differences arising from education and (calculated) experience will disappear out of the distribution of lifetime wages. The same is true for age-induced differences.
So far we have been working with age differences and not with differences in (estimated) experience. However, in groups with equal age and education the calculated experience will also be the same. We can therefore state that the education-related wage differences found in the PURE data sets largely reflect one-third to one-half of wage inequality whether measured by indexes or by wage equations. A substantial part of those differences might be interpreted as compensating wage differences.
This result, however, does not mean that there is no task for the policy makers. The race between technology and education has not ended yet. The demand for higher educated workers continues to grow. The important task of the government is to stimulate education. If the supply side lags behind demand, this may lead to increased inequality, and also to problems between supply and demand that might generate substantial unemployment.

Furthermore, the differences due to gender are substantially smaller than the differences in mean wages between genders. However, the resulting differences will probably still not be acceptable to politicians.

References:

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Kakwani (1980), *Income Inequality*. Oxford.

Theil, H. (1967), *Economics and Information Theory*. Amsterdam: North-Holland.

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6. SCHOOLING, WAGE RISK AND INEQUALITY[10]

Pedro Silva Martins and Pedro Telhado Pereira

6.1 Motivation

The scarce evidence available suggests that both income and wage inequality have been on the rise in the Western world since the 1980s. This result is particularly clear for the United States and the poorer European Union member states, but applies also to the other Western Europe countries.

The main explanation for this phenomenon lies on globalisation. Either through the increase of trade, namely with less developed countries, or through a faster spread of technology, globalisation is likely to have had impacted on the premium of skills in Western countries.

The role of the distribution of skills is in fact crucial as the less skilled are precisely those who have lost the most in wage terms since the early 1980s. Given that employers may transfer their production to countries where wages for non-skilled work is much lower, the less-skilled workers from the Western world see the demand for their labour fall. On top of that, the technological advances require skilled, rather than unskilled, individuals, which leads to a further decrease in the demand for the latter workers.

Given this background, policy-makers have argued that schooling is the best weapon to erode the rising wage inequality. For instance, the recent Lisbon EU Summit placed a great amount of emphasis on training, so that the new internet-related technologies could be spread more fairly across the people in order to eradicate the "info-exclusion" process.

On a more general note, investments in schooling are perceived to be a relatively non-distortionary way to influence the wage distribution. This contrasts with changes in the tax system, namely those meant to make it more progressive, which may entail substantial labour supply disincentive effects. It is thus understandable that policy-makers have turned to schooling provision as a better way to achieve efficiency-equity fine-tunings.

However, the scope of schooling to cut wage inequality is overall an issue poorly researched so far. Although one may assume that a more balanced distribution of schooling will result in a more balanced distribution of earnings, the truth is that the characteristics of both education systems and labour markets and their interactions may

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[10] For extended and more technical versions of this summary chapter, see the papers *Does Education Reduce Wage Inequality? Quantile Regressions Evidence From Fifteen European Countries* and *Schooling, Wage Risk and Inequality*, both available at the PURE web-site www.etla.fi/PURE and at the authors' web-sites www.fe.unl.pt/~psmart and www.fe.unl.pt/~ppereira.

prevent that from happening. In this chapter we endeavour to shed some light on this issue, by analysing specific results from PURE countries (plus the US case).

Another related issue that we address in this chapter is wage risk. We define this as the unpredictability which further schooling may entail in terms of its earnings impact. This is a matter of concern, because so far it has been assumed in the traditional methodologies (described below) that there is no risk in this relationship. Undoubtedly this assumption is a gross simplification, as the schooling investment is liable on many factors that may make what initially seems to be a sound investment into a not so profitable one. Following a similar approach to the one we use for the wage inequality case, we present some evidence also for this matter.

6.2   Methodology

The traditional tool to assess the impact of schooling on earnings has been the Mincer equation. This framework, which has been used extensively in the PURE project (see Chapter 2 of this volume), posits that the earnings of individuals depend on some of their observable characteristics, such as their schooling attainment and their degree of labour-market experience, plus some unobservable features. Moreover, the usual estimation procedure (ordinary least squares regression, OLS) considers the impact of such characteristics "on the average". It allows one to say that, "on the average", schooling is associated with, say, a 6% increase in earnings. This average concerns all individuals having attained a given level of schooling, regardless of their precise amount of earnings.

Here we adopt a different estimation approach, *quantile regressions (QR)*. This technique allows us to assess the impact of schooling at different points of the distribution of the dependent variable. In particular, this means that we assess the earnings-enhancing scope of schooling both for those individuals who receive high earnings given their schooling and for those who earn low wages, also given their schooling. When using the OLS estimation method, these differences – between those who did better and worse given their schooling level – are not taken into account as they are amalgamated into a single group. With this new methodology, we explicitly focus on these differences and assess the contribution of schooling upon the different types of individuals (that is, those who do better and worse given their schooling attainment).

We thus evaluate the contribution of schooling to inequality by comparing the returns at the bottom and the top of the wage distribution. A necessary result of the view that schooling decreases (within-levels) inequality would be that the return to schooling for individuals who do worse in the labour market, given their schooling level, is higher than for those who do better.

Wage risk, in turn, is measured by the difference in returns at the top and the bottom of the wage distribution. The rationale for this approach is that if this difference is small, then the amount of within-educational-levels wage inequality is small, implying that one's education investment is not liable to uncertainty in terms of whether it will pay off much better or much worse than on average.

6.3   Data

We draw on the PURE micro data sets and on comparable information from the USA. All results refer to the mid-90s and to the case of men. Descriptive statistics on average schooling attainment and wage inequality levels (which also include information for the early 1980s) indicate that both measures have increased during the period covered. However, they reveal significant differences between countries as well. In terms of schooling, Southern European countries have particularly lower levels (Figure 6.1). With respect to wage inequality, the Cohesion Fund EU countries (Portugal, Spain, Ireland and Greece) exhibit the higher values (Figure 6.2). This phenomenon may be related to the so-called Kuznets curve. This theoretical relationship argues that as countries experience economic development, inequality will initially rise (when the country is very poor and there is little scope for differentiation) and will then fall (when the country becomes richer and there is, once again, little scope for differentiation).

Figure 6.1.   *Schooling levels of the work force, 1980 and 1995*
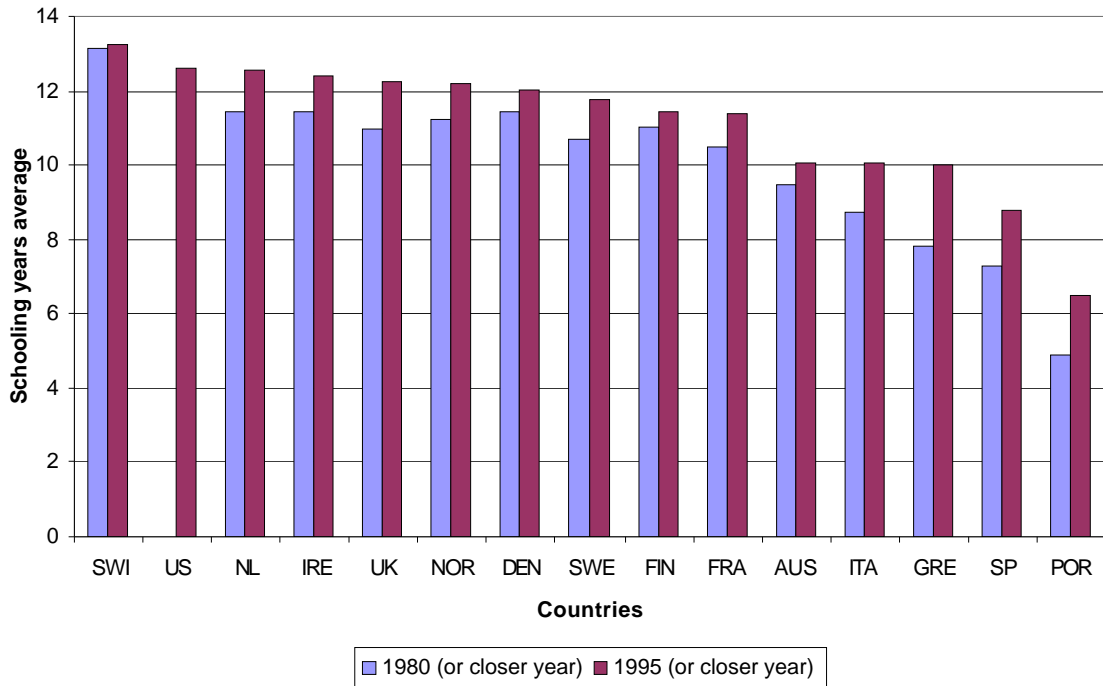
Figure 6.2.   *Wage inequality, 1980 and 1995, measured as the ratio between the 9th and the 1st decile (gross hourly wages)*

Legend: □ 1980 (or closer year) ■ 1995 (or closer year)
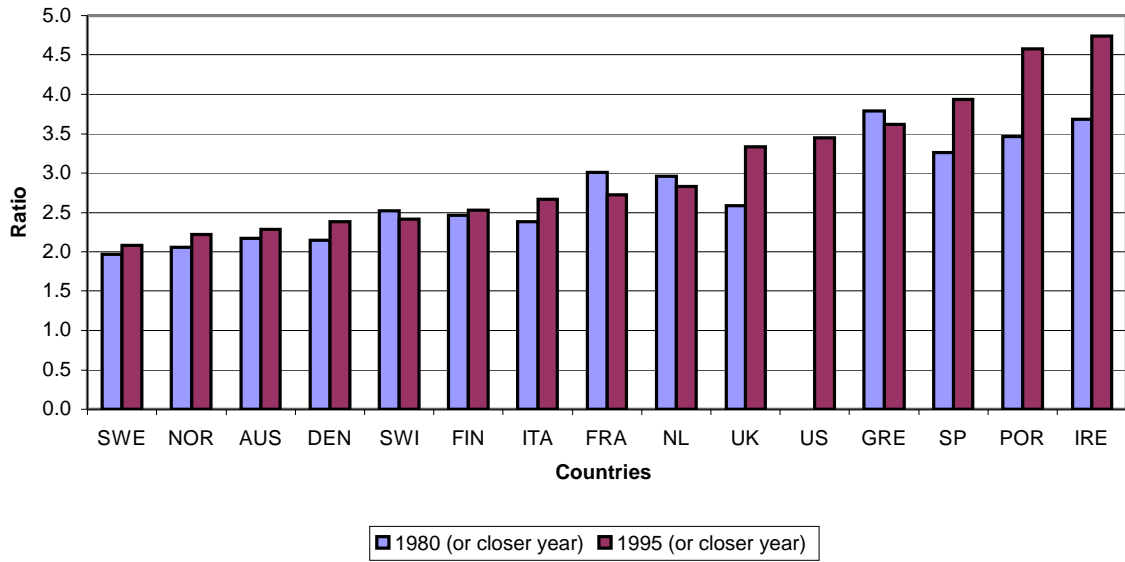
6.4   Results

One may have expected that the heterogeneity across the countries surveyed, in terms both of their schooling systems and labour-market institutions, would be translated into heterogeneous results. However, we found a very similar result across the countries, so similar that one may refer to it as a stylised fact: Returns to schooling turned out to be consistently higher for those individuals who earn more given their schooling levels. As can be seen from Figure 6.3, which depicts the return to schooling at the top against that at the bottom of the wage distribution, most countries are placed in the upper, left-hand-side triangle. This result means that within-educational-levels pay differences increase with the educational level.

Figure 6.3.   *Returns to education, quantile regression*
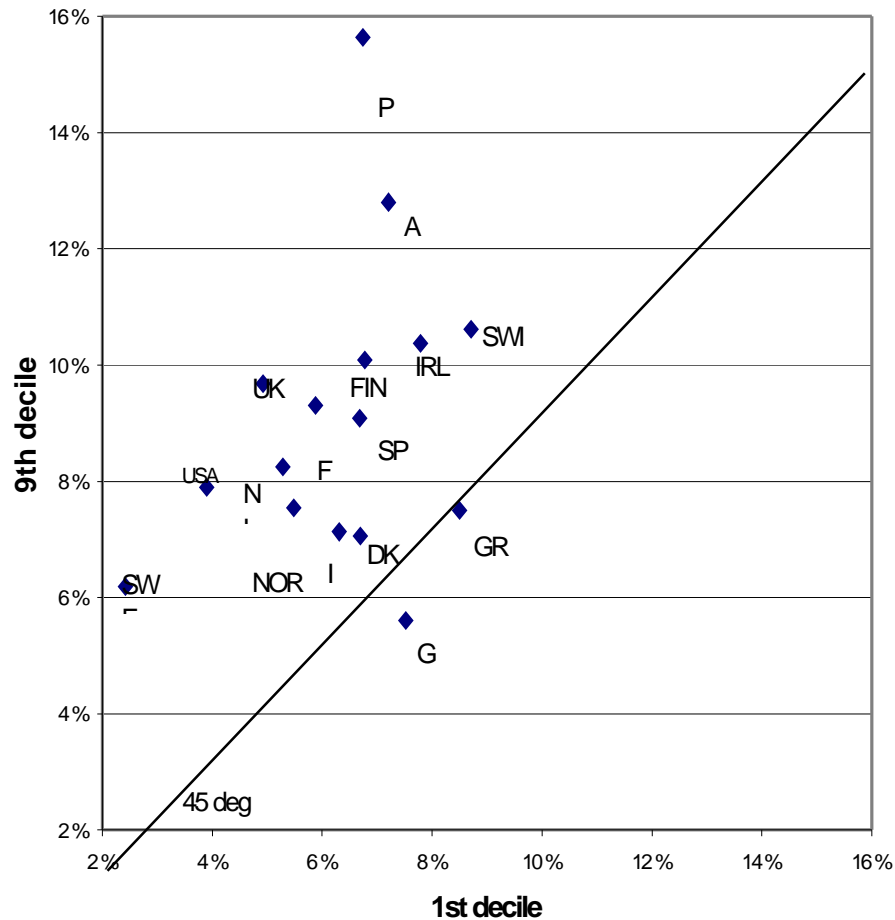
The single exception to this pattern is Germany (the results for Greece should be disregarded as they are not fully comparable with those of the remaining countries, given that this country's results are based on net wages, rather than gross wages). Unlike for the other countries, the returns obtained for Germany are approximately the same for "richer" and "poorer" individuals.

With respect to the wage risk dimension, we thus also find high degrees of uncertainty in the European labour markets. An additional finding is obtained by considering simultaneously the wage-risk measure (the difference between returns at the top and the bottom of the wage distribution) and the average return to education (the one resulting from OLS estimation) – see Figure 6.4.

This analysis reveals a strong positive correlation between the two measures (with a correlation coefficient of 0.6). This means that, in international terms, higher average returns are associated with riskier returns; countries which boast higher returns to education have generally also more dispersed returns to education and vice versa.

Figure 6.4.   Spread in QR returns and OLS returns to education
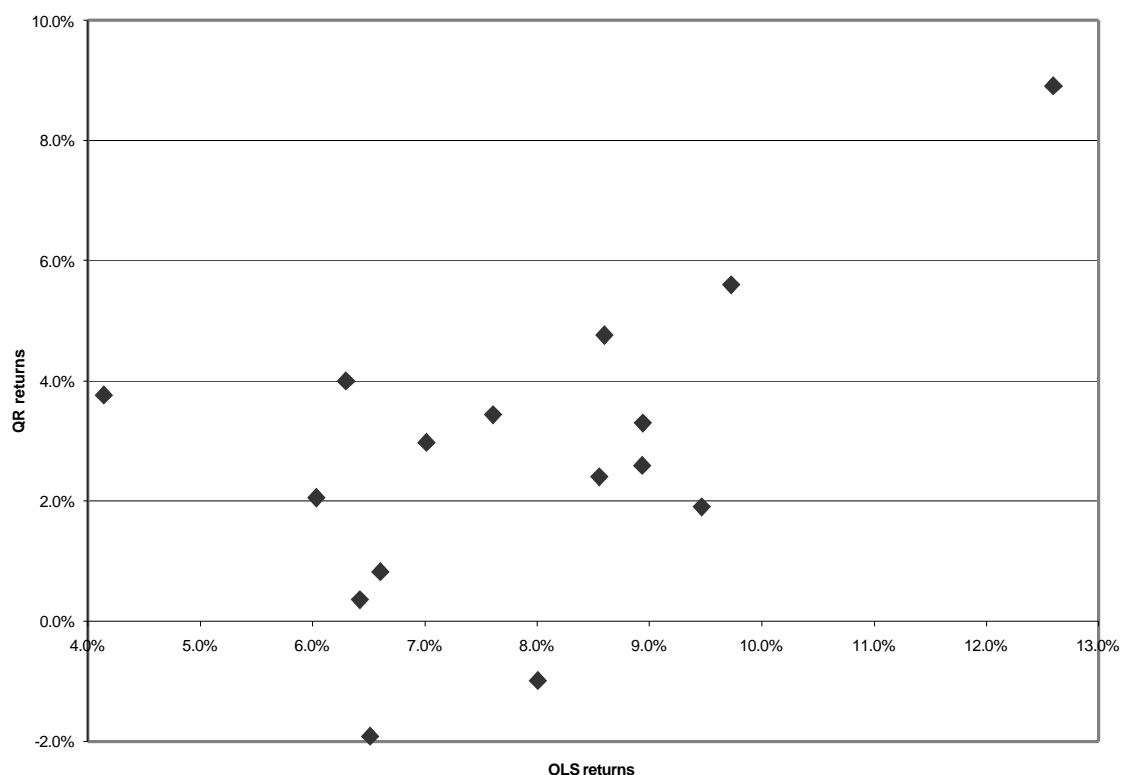
6.5   Discussion

One may outline a few explanations which are consistent with the pattern we have uncovered: higher returns to education to individuals who do better in the labour market (i.e., that given their observable characteristics, they end up with higher earnings than those other individuals apparently similar to them).

A first explanation relates to over-education, which occurs when highly educated individuals take jobs that could be performed by workers with lower qualifications. (Over-education may be an important problem if the individuals affected by it perceived their schooling as an investment (rather than consumption) and had high expectations towards the return on that investment.) If this argument holds, then one would in fact witness a lower return to schooling for those workers who do worse in the labour market, given their educational attainment – as we do in our data.

A second explanation concerns a possible interaction between ability and schooling, thus amplifying the impact of ability upon earnings. (By ability we mean the set of the individuals' characteristics which make them particularly suitable for some job and which are likely to be rewarded financially, given that their productivity is higher.) This is an argument along the lines of the nature-rather-than-nurture line of thought, which would require factors that are difficult to influence in school to have a strong impact on the individual's socio-economic performance.

A third and last explanation regards school quality differences. The approach adopted in this study implicitly assumed all schooling to be the same, as it only acknowledged school quantity variation. It may, however, be the case that individuals who do worse at the labour market (given their schooling attainment) are precisely the same who have received lower-quality schooling. If this were the case, we would indeed expect the returns to be lower for individuals who interacted with lower-quality schooling.

We find these explanations particularly convincing as they fit into the exception of Germany. In fact, this country's educational system is characterised by a good matching between labour market needs and skills supplied (e.g. apprenticeships) which, together with the relatively low number of undergraduate students, may erode the scope for over-education to rear its ugly head. Moreover, Germany has been characterised by a strong ability tracking system. This means that the ability spread within each educational level is small, thus preventing the hypothesised schooling-ability interaction from influencing the country's results. Finally, Germany has also been characterised by strong uniformity in terms of school quality.

All in all, our findings suggest that the link between schooling and inequality is definitely not a straightforward one. Broadly speaking, higher schooling levels are characterised by more dispersed distributions of earnings.

An overall and definitive analysis of the link between schooling and inequality would, of course, also have to account for issues concerning between-educational-level inequality. Educational expansion may entail higher inequality because of more individuals shifting into within-inequality-prone schooling levels. But at the same time this might be more than compensated for by having more individuals in *on the average* better paying schooling attainment levels. However, with the approach adopted here, our work inevitably casts some doubts on the inequality-reducing properties commonly attributed to schooling.

With respect to the wage risk concept and the evidence we provide on it, we believe this is an important dimension of the returns to education literature, which has been overlooked so far. It may not be enough to outline the size of returns without mentioning their spread. Our evidence furthermore suggests that countries where the average returns to education are higher, are also characterised by a riskier relationship between schooling and earnings.

7. UNEMPLOYMENT AND RETURNS TO EDUCATION IN EUROPE[11]

Fernando Barceinas–Paredes, Josep Oliver–Alonso, José Luis Raymond–Bara, José Luis Roig–Sabaté and Bernhard A. Weber

7.1 Introduction

Rates of return to education give synthetically a measure of the net benefits associated with investment in further education. Costs and benefits from that investment depend on the increased earnings obtained in the labour market when the individual attains a higher level of education. Therefore, expected wage would be a crucial part of the individual's decision. However, in situations of high unemployment, like the European case, that expected wage should be weighted by employment expectations. Casual evidence but also survey results seem to show that employment expectations play a non-trivial role in the educational investment decision. Moreover, under conditions of low wage flexibility, unemployment differentials should play a more important role in the formation of the individual expected wage.[12]

If individuals internalise unemployment in their decisions on further education, this implies that rates of return to education should be adjusted by employment expectations and unemployment benefits, if we are to explain the demand for further education. The objective of our research is to analyse the impact of including unemployment on the estimated rates of return.

A wide empirical literature exists showing a significant effect of unemployment on educational demand both in macro and micro models. Nonetheless, the work addressing the effect of unemployment on the rate of return is rather scarce. In this context, some contributions should be mentioned, though. Nickell (1979) adjusts rates of return by introducing unemployment because "we shall be underestimating the private rate of return to the extent that the individual will only be in receipt of those earnings for some proportion of the time where the proportion is directly related to schooling" (Nickell

[12] See Guiso et al. (1998).

1979, S126).[13] Groot and Oosterbeeck (1992) and Wolter and Weber also estimate the effect of unemployment on the level of rates of return to education[14], while Asplund et al. (1996) reformulate the earnings equation to allow for the introduction of unemployment.[15] In all these cases, when unemployment differentials are taken into account, returns to education increase, in general, at all levels.

In fact, it is quite surprising that, while the number of papers devoted to the calculus of rates of return to education is really impressive[16], studies of the impact of unemployment on it are so scarce.[17] Our aim is to contribute to the discussion on the relationship between unemployment and education by using an approach in line with that of Nickell, Groot and Oosterbeek, Wolter and Weber, and Asplund et al.; that is, by introducing the employment probability and unemployment benefits as determinants of the level (and relative position) of the marginal rate of return to schooling. The effect cannot be determined theoretically. Most of the empirical evidence, however, gives support to the idea that unemployment increases the return to education.

7.2   Methodology

One problem with educational returns resulting from the Mincerian equation is that their estimation does not introduce other factors, apart from schooling, in the investment decision.[18] In this common approach, the only *benefit* considered is the change in expected earnings while foregone earnings from the schooling period are the costs taken into account.[19] In addition to factors like family background and/or financial constraints, other important aspects that may influence the individual's investment decision in

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[13] Nickell found that after correcting for unemployment, the pre-tax weekly income rises by 0.6 percentage points (from 8% to 8.6%). When after-tax income and unemployment benefit are considered, the impact is lower and very small (0.1 – 0.2 percentage points).

[14] Their study limits this approach to 35–45 year-old men. It is worth noting that Weale (1993), while signalling the potential sources of a downward bias in the value of rates of return, points out primarily unemployment differentials: "Obviously, any assessment of the benefits of education which compares the remuneration of different types of employed labour, and neglects the differential probability of unemployment, will normally understate both private and social returns to education" (Weale 1993, 732).

[15] They introduce unemployment by defining *basic earnings* as the product of the wage rate and the *expected* number of hours worked.

[16] Blaug states that "Calculations of the rates of return to invest in formal schooling have proved to be the bread-and-butter of the human capital research program: literally hundreds of such studies have now been carried out around the world in both developed and developing countries..."(Blaug 1992,16).

[17] Psacharapoulus ("Mr. Rate-of-Return himself", Blaug 1992, XII) treats the unemployment effect on rates of return indirectly when he considered the differences between incidence and duration, and graduate unemployment as a result of a "job-search" process (Psacharapoulus 1981). The surveys on rates of return by Psacharapoulus and Hinchliffe (1973) and Psacharapoulus (1985) have no mentioning about this topic. Mincer (1991) states that while the wage structure by education has generated an impressive amount of research, less effort has been devoted to mobility and unemployment aspects of education.

[18] Layard and Psacharapoulus (1979) extended the traditional model to allow the shape of experience to differ across levels of schooling. They find that the rate of return to training increases by 3.9% for each additional year of schooling. Also see Brunello and Comi (2000) and Chapter 3 of this volume. Asplund et al. (1996) reformulate the Mincerian wage equation to allow unemployment to play a role. This requires longitudinal data or a proxy to them, however.

[19] The model may also incorporate direct costs (books, fees, etc.), but this aspect is not essential here.

schooling are the probability of being employed and the increasing risk of further education implied by the growing spread in wages at higher levels of education.[20] A procedure that allows the introduction of some of these aspects is the so-called "*elaborate method*" (Psacharopoulos 1981). This implies the calculus of a rate of return that equals the opportunity costs and the expected life-cycle earnings. While differences in the value of the rates of return obtained by a Mincerian wage equation and by the elaborate method should not occur, the latter approach permits some other aspects to be introduced into the decision of schooling that the Mincerian approach cannot account for. Our approach attempts to incorporate in the calculus of the rate of return one additional factor of uncertainty, namely the risk of being unemployed.

7.3   Results

To carry out the analysis, the *internal rate of return* was calculated for fourteen PURE countries (only results for men are shown). For each country a wage equation was estimated, including two educational dummies[21] and potential experience (and its square). The equations were estimated from samples for 1995 or a year close to it. From the equations, age–earnings profiles by educational level were generated. Using these earnings we were able to calculate the internal rates of return, as shown in Figure 7.1. These are the non-adjusted internal rates of return that, basically, do not differ from the rates obtained from estimating Mincerian wage equations.

Figure 7.1.   Non-adjusted internal rates of return in PURE countries, men

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[20] See the evidence in Chapter 6 of this volume on increasing wage dispersion within educational groups at higher educational levels in a majority of European countries.

[21] In order to homogenise educational levels across countries we used the ISCED classification equivalences with an aggregation into three levels: LOW, MEDIUM and HIGH which crudely approach up to low secondary, upper secondary and tertiary education.
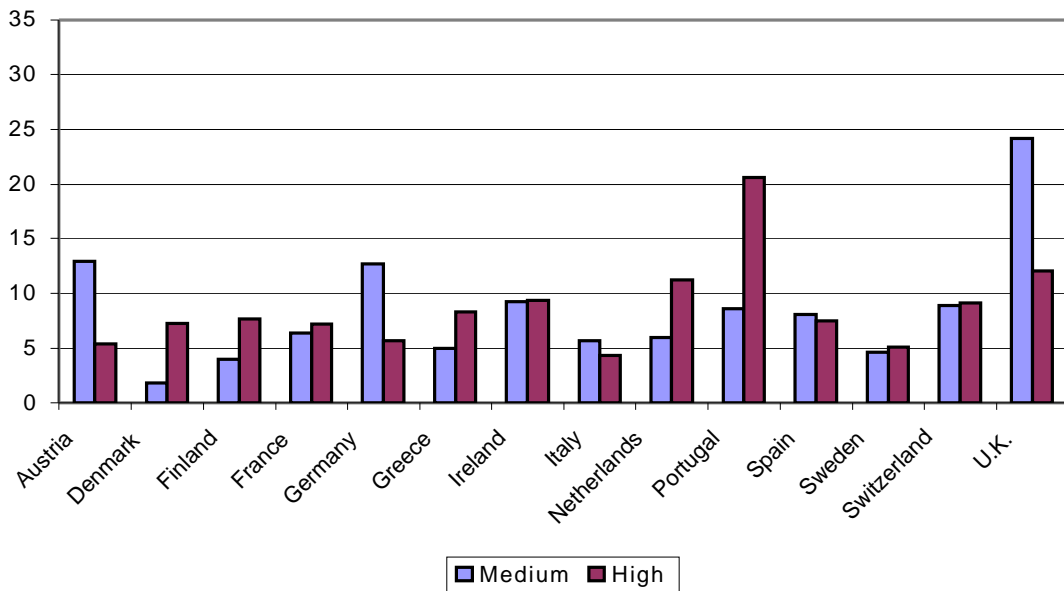
Figure 7.2 depicts average male unemployment rates by educational level for a period that covers most of the nineties. It is easy to recognise the countries with higher unemployment rates, like Ireland and Spain. These two country cases, however, illustrate quite different situations, which are of interest to mention. In the case of Ireland we can see large unemployment differentials especially between low and medium levels, for which this country in fact records the largest differential of all fourteen countries. Conversely, in the Spanish case unemployment differentials between levels are much less important. So, we should differentiate between levels and differences between levels. Our point is that what matters are differentials, not levels.[22] We will show this in what follows.

Figure 7.2.   Male unemployment rates by educational level in PURE countries

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[22] (
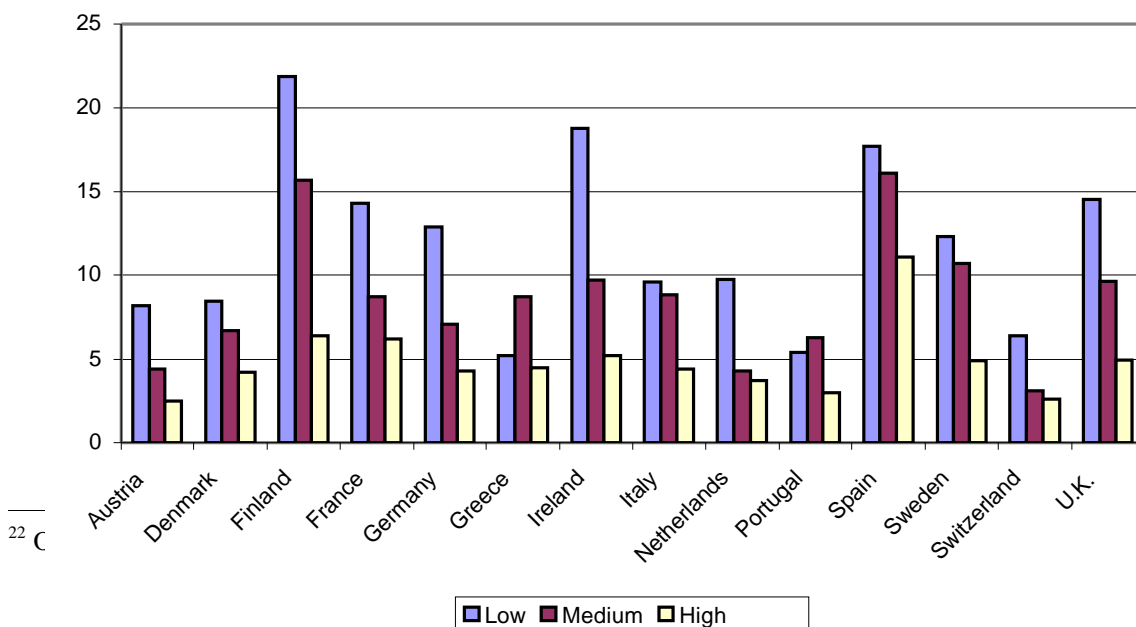
An "adjusted" internal rate of return was then calculated for each country. In this case, age–*expected* earnings profiles were generated, and the predicted earnings for each age–educational level were weighted by the employment rate of the corresponding age–educational level.[23] To this last calculation phase also "the unemployment rate times the unemployment benefit" was added. In this way, for each age–educational level the expected earnings were estimated taking the following form:

$W^e = W^p * ER + B * UR$,

where W^e is the expected earnings for each age–educational level; W^p is the predicted earnings; ER is the employment rate (defined as employed over labour force) for that age–educational level; B is the unemployment benefit; and UR is the corresponding unemployment rate (obviously, $UR = 1 – ER$).

From these, age–expected earnings profiles, flows of costs and benefits were generated in order to calculate an employment-adjusted internal rate of return. The results are shown in Figure 7.3.

Figure 7.3.   Adjusted internal rates of return for PURE countries, men
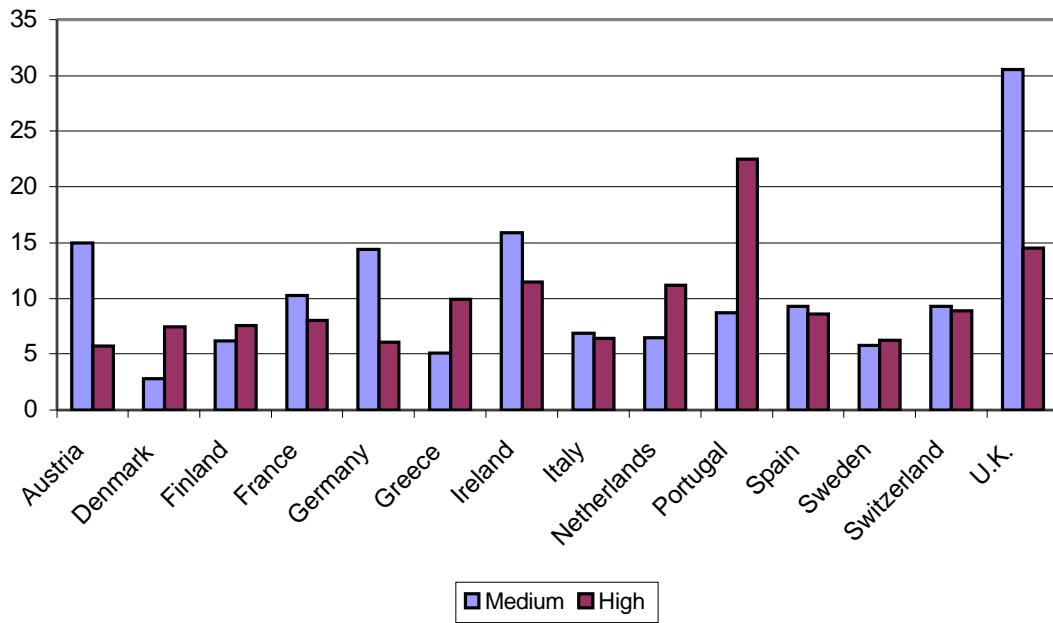
Comparison of the two internal rates of return uncovers the following results:
First, employment adjustment changes the level of returns for almost all PURE countries. Only in nine cases out of 28 is the change less than 0.5 percentage points. Additionally, only in two cases, Finland and Switzerland, there is a minor reduction in returns, for both at the high-education level (–0.1 and –0.2 percentage points, respectively). Second, the medium-level return is the one that undergoes the larger change in ten of the countries. Employment expectations thus seem to play a more important role in the step from compulsory to non-compulsory education than from medium to higher levels of education. Ireland is the country with the medium-level change being the largest in

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[23] Eurostat provided tabulations for each country of the employment status of the population by educational level and five-year age brackets.

both absolute and relative terms. At this point it is worth recalling that Ireland is also the country facing the largest unemployment differential between the low and medium levels. Spain, on the other hand, despite a high unemployment rate is among the countries experiencing a rather small change in medium-level returns.

Third, the higher the unemployment differential between educational levels, the higher is the change in rates of return. Three qualifications should be added to this. The first one is that this relation, as mentioned above, stands out more clearly in passing from low to medium level. A second one is that a notable part of the explanatory effect of unemployment on returns should be ascribed to the age distribution of unemployment. Finally, the unemployment benefit system may outweigh, at least partly, the effect of employment expectations. Obviously, the extent of this effect depends on the generosity of the system.

7.4 Final considerations

Based on these results three considerations can be made:

First, adjusted returns result from the behaviour of unemployment differentials. This aspect should be expected to influence the schooling decision of individuals. Given individuals' imperfect foresight, it seems adequate to assume that expectations about future earnings are likely to correlate with current economic conditions. From this point-of-view, our work can be taken to suggest that the rates of return that individuals or households take into account when making decisions on schooling investment are those adjusted by employment probability and unemployment benefits.

Second, from the perspective of educational policies, in a situation of relatively high unemployment and/or low wage flexibility, the non-adjusted internal rate of return estimated from Mincerian wage equations does not seem always to reflect the real price. The consequence might be misguided policy decisions if an incorrect price is taken as input for those decisions.

As a final point, it should be noted that the proposed methodology to adjust the internal rates of return could provide an input to models that try to determine the optimal length of schooling and its relation to the economic cycle. Experiences of countries like Spain, where the period of high unemployment resulted in a big push in enrolment rates, show that this is a rational response of individuals facing bad or worsening employment prospects.

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8. DO WE NEED ALL THAT HIGHER EDUCATION? EVIDENCE FROM 15 EUROPEAN COUNTRIES [24]

Erling Barth and Marianne Røed

8.1 Introduction

Over the last twenty years the labour markets of the European Union have experienced a boom in higher education. On average, the relative number of employees with a tertiary education to those educated at a lower level has doubled from 1980 to 1996 in the 15 European countries covered by the PURE project. Behind this development lies educational policies in each of the countries, boosting enrolment into higher education. As we report below, the real value of total public expenditure on higher education has increased by more than 75% over the same period.[25] The questions we try to answer in this study are the following[26]: How have national labour markets responded to these changes in the composition of the labour force? In which way has public funding of higher education affected the formation of relative wages between higher and lower educated workers? Is the labour market willing to absorb all higher educated workers, and how do such changes in demand affect the value of education?

The first two questions are related to the consequences of openness and international trade (see Johnson and Stafford 1999). According to standard trade theory, relative factor prices are affected by changes in the factor endowment in a single country, only to the extent that these changes affect the world supply of factors. This theory also states that changes in the educational policies of a country impact on industry structures and trade patterns, not on relative factor prices. Here we investigate this topic by studying the relationship between educational wage premiums and educational policies of individual countries. As we report below, we find, for all countries, a significant

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[24] This chapter reports from the work of the PURE "sub-group" that has focused on labour market implications of public funding and educational policies. The analysis is restricted to tertiary education only. The chapter draws on the work by Erling Barth, Arnauld Chevalier, Gauthier Lanot, Marianne Røed and Josef Zweimüller reported in Barth et al. (2001). We have benefited from other results produced within the PURE project, especially those on private returns to education (see Asplund and Pereira (1999), Harmon et at. (2001) and Chapter 2 of this volume). We are indebted to all PURE partners for providing us with national data on labour supply, educational systems, student support and public funding. Thanks also to Michael Wallerstein, who provided us with data on bargaining institutions. We have also benefited much from the comments received at PURE's user-oriented Lisbon seminar, particularly from Lord Richard Layard.

[25] This number is calculated on the basis of data from the thirteen countries for which information about public expenditure on higher education was available for each year over the entire period, see Figure 8.2.

[26] See Barth et al. (2001) for a thorough report of the analyses undertaken.

relationship between the level of public funding of the educational system, the supply of highly educated workers and the wage premium for education.

The finding that relative wages do react on changes in relative demand and supply has consequences for the interpretation of European unemployment as well. Jackman et al. (1997) argue, based on evidence mainly for the USA and the UK, that relative wage rigidity cannot be the cause underlying European unemployment.

The third question raised above concerns the evaluation of education in the labour market. The observation of a positive wage premium for education implies that employers value education.[27] A standard demand curve for education is downward sloping, indicating that an increase in supply has to be met with a decline in the observed wage. However, if supply and demand shift simultaneously, wages may go either up or down, depending on the size of the shifts and the slopes of the curves.[28] An extensive literature has documented that skill-biased technological change has increased in importance during the last decades (see e.g. Berman et al. 1997). If this is the case, then the value of education in the labour market is increasing over time. Below we calculate the size of the increase in relative demand for education based on estimates from all PURE countries for 1980 to1995.

To get a flavour of the subsequent analysis, consider the illustration in Figure 8.1. The vertical axis measures the wage premium of education in the labour market; that is, the wage for higher educated employees relative to the wage of employees educated at a lower level.[29] The horizontal axis measures the relative employment of highly educated; that is, the number of employees with a higher education divided by the number of employees without a higher education. The downward sloping curve illustrates relative demand for higher education.[30] When the relative wage falls, firms demand relatively more higher education. The upward sloping curve illustrates relative supply of higher education. The level of supply is determined by the number of persons in the labour force with higher and lower education as well as by the employment rate of those two groups of workers. In the figure, we have drawn the supply curves very steep, indicating small or negligible effects of relative wages on relative supply of the two groups. The equilibrium relative wage is given by the interception of the supply and demand curves.

Figure 8.1.   The race between technology and education
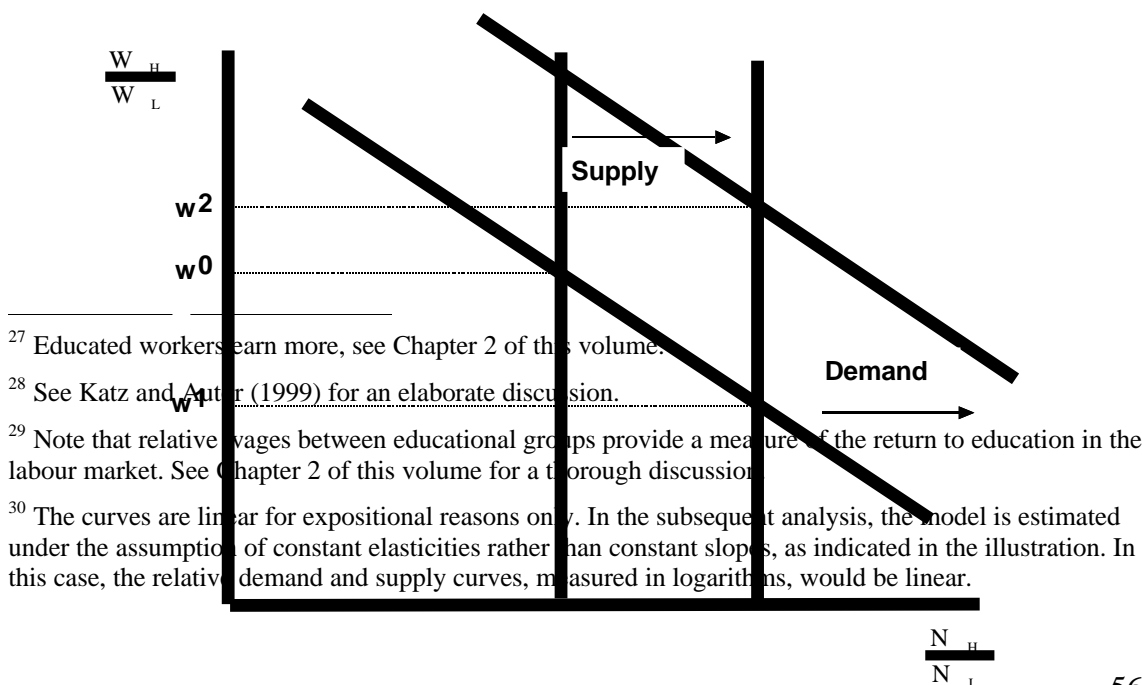
[27] Educated workers earn more, see Chapter 2 of this volume.

[28] See Katz and Autor (1999) for an elaborate discussion.

[29] Note that relative wages between educational groups provide a measure of the return to education in the labour market. See Chapter 2 of this volume for a thorough discussion.

[30] The curves are linear for expositional reasons only. In the subsequent analysis, the model is estimated under the assumption of constant elasticities rather than constant slopes, as indicated in the illustration. In this case, the relative demand and supply curves, measured in logarithms, would be linear.

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Let w^0 be the initial equilibrium level of relative wages. Consider next a positive shift in relative supply, for instance as a result of increased public expenditure on higher education. Firms are willing to employ a higher share of educated workers only if the relative wage is reduced. Consequently, a new equilibrium level of relative wages is given by w^1. Thus, higher relative supply implies lower relative wages. However, if demand – due to a change in the underlying technology – shifts as well, the drop in relative wages is counteracted, possibly even to the point where relative wages rise, as illustrated by w^2 in the figure. Hence the figure illustrates that "the race between technology and education"[31] may shape the time path of relative wages.

The analysis reported below uses two-stage regression techniques to estimate the elasticity of supply and demand as well as relative wages. The analysis uses variation in public expenditure on education, in student support and in lagged relative supply between countries and over time to identify the underlying parameters. Differences in bargaining regimes and unionism over time and across countries are also used to identify the parameters of the model. The analysis is undertaken under the assumption that the underlying shifts in technology within industries are similar in the European countries. It is also assumed that there are barriers (costs) to labour mobility across national borders; that is, capital and technology are considered to be more mobile than labour.

At the national level, the demand curve is determined both by the technology of firms within industries and by the composition of industries in the economy. A positive demand shift may come about either by a technological change favouring higher education within all firms and industries or by a change in the distribution of total production from less to more education-intensive industries. Below we calculate the implied demand shift based on estimated slopes of the demand and supply curves and observed changes in wage and supply. We estimate the average increase in relative demand for tertiary education in the European labour markets to have amounted to about 5% per year over the period 1980 to1995. Demand has increased even more in the 1990s than in the 1980s.

In the contemporary European economies, wages do not necessarily reflect the forces of demand and supply only. Unions and bargaining institutions may also influence relative wages. In the analysis, we also allow for the influence of wage-setting institutions on relative wages in addition to supply and demand forces. It turns out that co-ordinated bargaining as well as high levels of union membership and coverage of collective agreements tend to compress wages, producing a lower relative wage for workers with a higher education. Still, both demand and supply forces influence wages as well.

The next section outlines the expansion in public expenditure on higher education, the increase in enrolment rates for higher education, and trends in relative supply for the PURE countries. Section 8.3 describes the trend in relative wages. Section 8.4 reports on results from a simultaneous analysis of relative demand, supply and wages. Section 8.5 provides the calculated demand shifts, and Section 8.6 concludes.

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[31] This expression was originally coined by Tinbergen (1974).

8.2   Public expenditure on higher education and the supply of higher education 1980–1995(96)

In this section we illustrate the changing pattern of higher education in the Western European countries during the past two decades. We focus on the growth of public expenditure, enrolment rates and the development of the relative supply of workers with a higher education. Differences between countries and changes over time are at the centre of interest.

Figure 8.2 describes the growth of real current public expenditure on higher education in the period 1980 to 1996. This figure gives the total sum of expenditure in 13 Western European countries, together with one per cent of GDP for the same group of countries. The figure clearly illustrates the expansion in public financial support to higher education during this period. In the 13 countries the real value of public expenditure on higher education increased with about 80% between 1980 and 1996. The rate of growth is low in the first part of the investigated period and then increases sharply towards the end. In the first five years, the increase was only 1.7%. The next five years, from 1985 to 1990, reveal an increase by 29% and from 1990 to 1996 by 39%. In the eighties, the real growth of public expenditure on higher education follows closely, or is slightly lower than, the real growth of GDP. Thus, public investment in higher education per unit of output remained quite stable. In the early nineties this relationship changed dramatically: the growth rate of public expenditure clearly exceeded the growth rate of GDP.

Table 8.1 of the appendix gives the real value of current public expenditure on higher education as a percentage of GDP for 14 Western European countries. The numbers reveal that there are great differences between the countries with respect both to the level and the growth rate of this indicator. The development of the standard deviation indicates that the average difference in levels declined during the eighties, but grew sharply during the first part of the nineties. The Nordic countries in particular increased the public expenditure on higher education relative to GDP in this period. With regard to the growth rate, Denmark is lagging behind the other Nordic countries. However, Denmark started out at a considerably higher level in 1980. The Southern European countries that started from a relatively low level have also experienced a high rate of growth in real public expenditure on higher education. The exception in this group of countries is Italy, which saw a decline in the value of public expenditure relative to GDP during the investigated time period.

Figure 8.2.   Real total public expenditure on higher education and GDP/100.
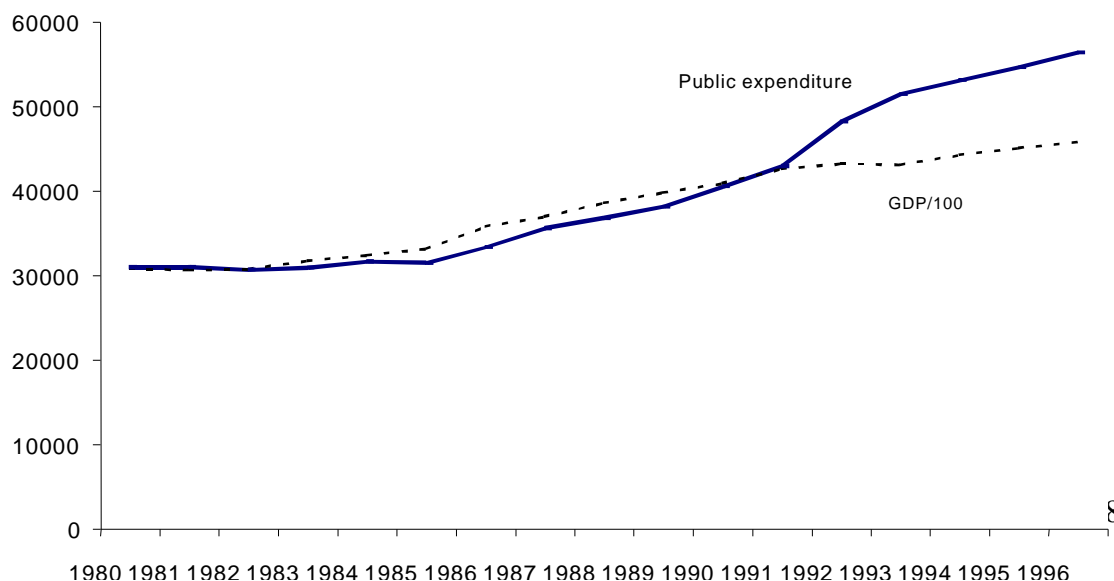
*Figure 8.3.   Public expenditure on higher education per person in the age group 18–24, mill. Euro 1985 value. The total sum for 13 Western European countries *, divided by the total number of persons in that age group.*
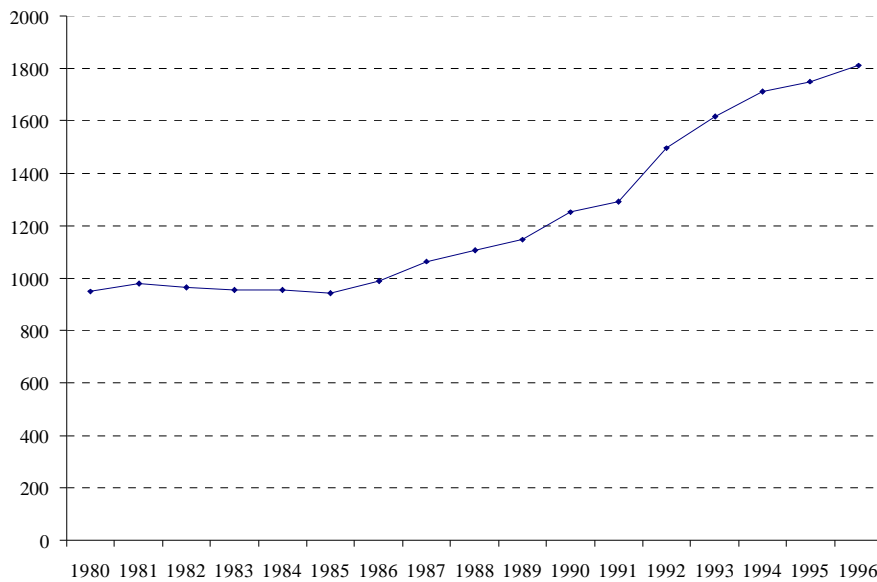
* Norway, Sweden, Finland, Denmark, Switzerland, UK, Netherlands, Germany, Portugal, France, Austria, Italy, Ireland.

Source: *UNESCO Institute for Statistics (2000)*

Sum of 13 Western European countries, measured in Euro (mill. 1985 value).*

* Norway, Sweden, Finland, Denmark, Switzerland, UK, Netherlands, Germany, Portugal, France, Austria, Italy, Ireland.

Source: *UNESCO Institute for Statistics (2000)*

The 18 to 24 year-olds may be considered as the age group with the highest disposition to enrolment in higher education. Differences in the value of public expenditure per person in this group indicate variations across countries in private investment costs related to higher education. Put differently, provided that the production costs of a certain level and type of education are given, the more the government contributes per individual in this age group, the less each person has to invest to attain a certain level and type of education.

Figure 8.3 shows the total sum of real public expenditure on higher education in the same 13 Western European countries as in Figure 8.2, divided by the total number of persons in the age group 18 to 24. Measured by the total growth rate in these countries, the real value of public expenditure per person among the 18 to 24 year-olds has

increased by almost 90%. As can be seen from the figure, however, the increase did not start until the mid-80s.

As is apparent from Table 8.2 of the appendix, there are great differences between countries with regard both to the level and the growth rate also of this indicator. Measured by the standard deviation the average differences between countries increased between 1985 and 1996. The Nordic countries, which were located more or less in the middle of the distribution in the early 1980s, had clearly moved to the top of the distribution by the mid-90s. With the exception of Italy, the growth rate has been high also in Southern Europe.

Figure 8.4.   Enrolment into higher education and public expenditure on higher education per student enrolled (in mill. Euro 1985 value). Total sum of expenditure and enrolment for 13 Western European countries*.
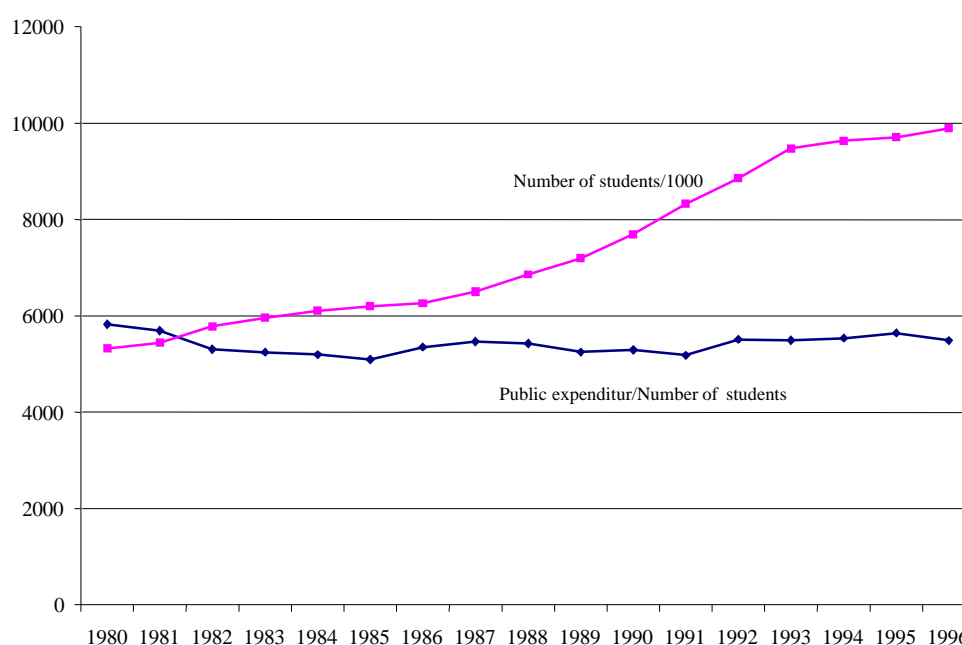
* Norway, Sweden, Finland, Denmark, Switzerland, UK, Netherlands, Germany, Portugal, France, Austria, Italy, Ireland.

Source: *UNESCO Institute for Statistics (2000)*

Figure 8.4 shows the sum of enrolment into higher education and the sum of real public expenditure on higher education in the 13 Western European countries. While the number of students has increased by about 85%, public expenditure per student has decreased slightly (about 6%) during the investigated time period. Measured by these indicators, it is clear that the increase in public funding during the last two decades has expanded the Western European system of higher education quantitatively rather than qualitatively.

Again there are large differences between countries. Table 8.3 of the appendix displays the number of students as a percentage of the number of individuals in the age group 18 to 24 for the period 1980 to 1996. In the following we refer to this indicator as the enrolment rate. The table shows that this enrolment rate has increased strongly in all

countries. The table also gives the development in real public expenditure on higher education per student enrolled. In all countries in the Northern and Southern regions of Europe expenditure per student has increased. In contrast, in some of the large countries in Central Europe it has decreased.

Figure 8.5   Index of relative supply of highly educated workers in the PURE countries. 1980=100
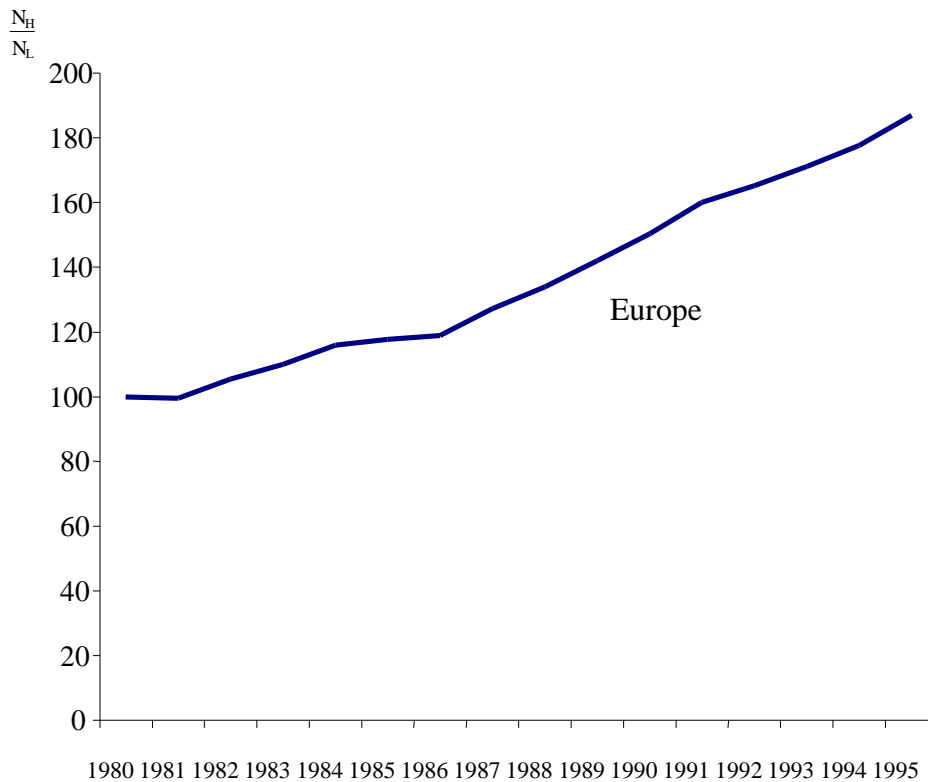
Notes: The time trend is calculated from a regression model of relative supply with only year and country dummies included. N_H is the umber of workers with a tertiary education (ISCED=5,6,7), N_L is the number of workers with a secondary or lower education (ISCED=1–4).

If the population cohorts available for the educational system have not strongly declined in number, then the increase in enrolment rates, apparent from Figure 8.4 and Table 8.3, must result in an increased supply of highly educated workers in the labour market. Based on data created within the PURE project, a time trend for the relative supply of highly educated employees was calculated (Figure 8.5). Relative supply is defined as the number of employees with a completed education above the high-school level, N_H, divided by the number with a completed education at the high-school level or below, N_L. This ratio has increased by more than 80% from 1980 to 1995.

Figure 8.6.   *Relative supply of highly educated workers in the labour force of the PURE countries, $100 \cdot \dfrac{N_H}{N_L}$, 1996*
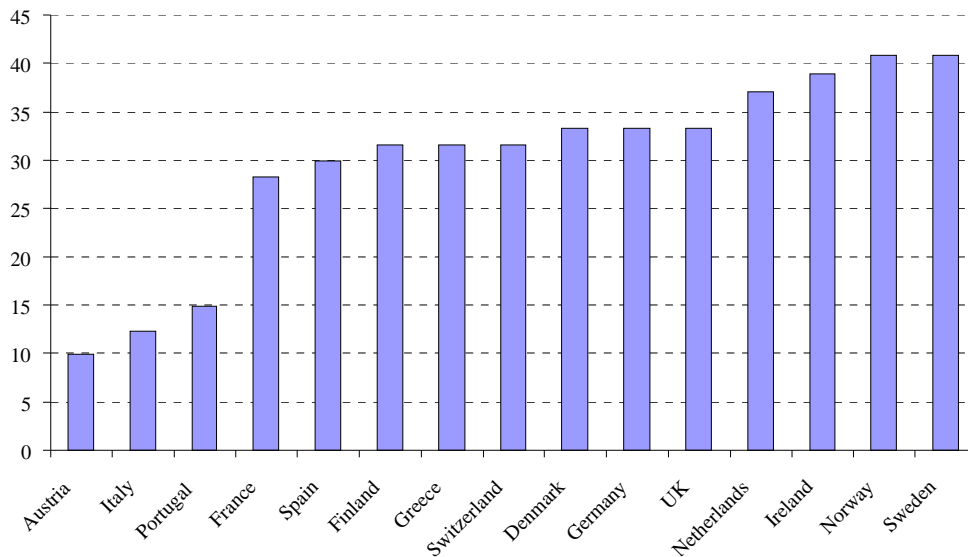
Notes: N_H is the number of workers with a tertiary education (ISCED=5,6,7); N_L is the number of workers with a secondary or lower education (ISCED=1–4).

Source: *OECD Education at a Glance (1998)*

Figure 8.6 shows the same ratio for all 15 PURE countries for 1996, calculated from OECD data. There are still large differences between European countries with regard to the composition of the labour force.

8.3   The wage premium for tertiary education

The wage premium for tertiary education is calculated as the cumulative returns to 6 years of education from Mincer-type wage equations.[32] The relative wage is calculated as the predicted wage for a person with 15 years of education divided by the predicted wage for a person with 9 years of education. In Figure 8.7 we display the overall trend in relative wages for the 15 PURE countries.

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[32] All information on relative wages is derived from the PURE reports edited by Asplund and Pereira (1999) and Harmon et al. (2001). Also see Chapter 2 of this volume.

Figure 8.7.   Relative wages for higher education, $\frac{W_H}{W_L}$ *, 1980 – 1995.   Estimated trend for PURE countries.*
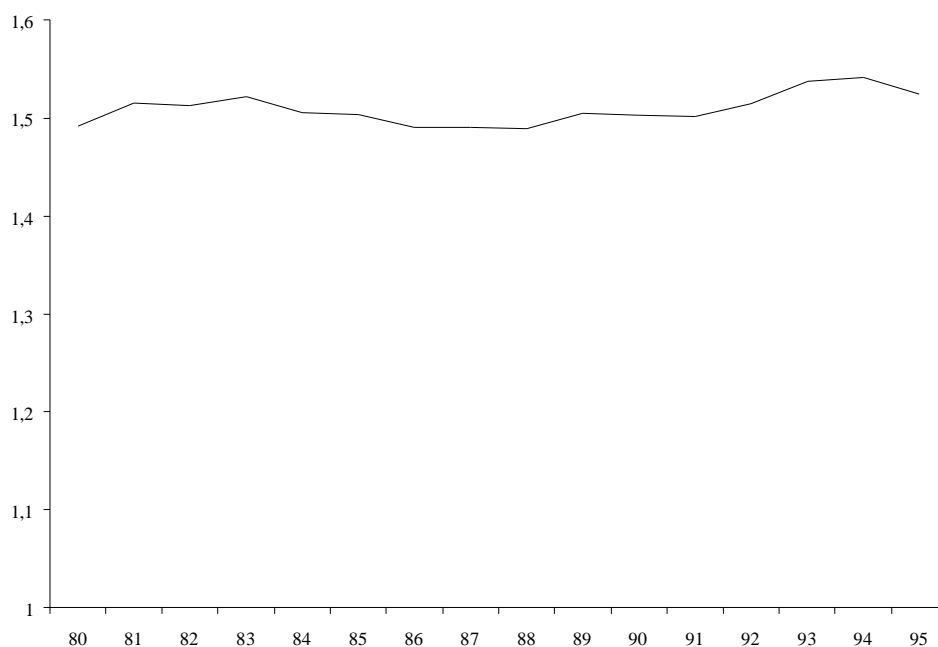
Notes: W_H is the wage of workers with a tertiary education (ISCED=5,6,7); W_L is the wage of workers with a secondary or lower education (ISCED=1–4). The trend is calculated from the year dummies of a regression model of the return to education on country and year dummies.

From 1980 to 1995 the calculated average has increased from 1.49 to 1.52. Thus, on average for the PURE countries, relative wages have risen slightly over this period. As shown in Chapter 2 of this volume, the pattern differs substantially between countries, however. Most countries have experienced a growth in relative wages or rather stable relative wages, while only a few have seen a decline in the relative wages of highly educated workers. In other words, the trend displayed in Figure 8.7 is not the result of a consistent trend across Europe, but rather a summary of different national trends. Still it remains clear that we do not observe a general decline in relative wages over this period despite a considerable boom in the supply of workers with a higher education. Thus, in accordance with our analytical framework, demand must have boomed as well. In the next section we present some results from a more elaborate analysis of supply, demand and wage setting.

8.4   Results

Some of the results of the statistical analysis are summarised in Table 8.4 of the appendix. In the following we discuss some of the main results with respect to supply, demand and wage setting for higher education.

8.4.1   Relative supply of higher education in the labour market

As has become evident above, there are large differences with regard to public expenditure on higher education both between countries and over time. The analysis of supply, as reported in Table 8.4 (column 1), is based on within-country variation only. Not surprisingly, it reveals a strong relationship between public funding of higher education and growth in the relative supply of workers with a higher education. Keeping total expenditure on education constant, an increase in public expenditure on higher education by one percentage point of GDP (the average is slightly below one per cent) increases the relative supply of highly educated workers with 7.6%. Increasing total expenditure on education, while keeping the expenditure on higher education constant, decreases the relative supply of highly educated workers with 2.3%. When controlling for the level of public expenditure on education, we found no effects of direct student support (average grants, tuition) on the relative supply of higher education.[33] Nor did we find a significant effect of relative wages on relative supply. This result may indicate that the rather steep supply curve in the relative price-quantum diagram (Figure 8.1 above) reflects reality fairly well. Moreover, this finding is consistent with the results reported in Chapter 9 of this volume, namely that overall student enrolment into higher education is rather insensitive to relative wages.
The coefficient of lagged supply is about 0.9 and significantly less than unity, indicating a tendency of convergence in the relative supply of workers across the European countries. Countries with a high level of supply experience lower growth rates than countries with a low level of supply, given relative wages, public expenditure and student support.
Basically we model the change in the stock of human capital, rather than the level. In steady-state, where relative supply is kept constant, the effect of the explanatory variables would be magnified (by a factor around 10 since the coefficient of the lagged variable is 0.9). The long-term effects of higher public expenditure and relative wages are thus considerably larger than the short-term effects. For instance, a doubling of public expenditure from a level of one per cent of GDP to two per cent of GDP would increase supply by 7.6% in the first year, but eventually relative supply would reach a level that is more than 76% higher than initially.

8.4.2   Relative wages

Table 8.4 of the appendix also presents results from a wage equation. In this model the elasticity of relative wages with respect to relative supply is estimated at –0.06. The interpretation of this coefficient is that an increase in relative supply of one per cent will decrease relative wages by 0.06%.[34] The model includes time-specific fixed effects in

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[33] We did not obtain complete information from all PURE countries on student support. Moreover, the available information is difficult to compare across countries.

[34] If wages were set at market-clearing levels and if supply were inelastic with respect to wages, we would expect to get a coefficient of $-1/E$, where E is the elasticity of demand with respect to wages. The relation between our estimate and that of a wage-setting model is discussed in detail in Barth et al. (2001).

order to capture the impact of technological change from the demand side. When time dummies are included, the link between aggregate supply (of all PURE countries) and aggregate relative wages disappears as well. This suggests that the effect arises from differences in the countries' own endowment of higher education, rather than from some aggregate of European-level higher education. This result is contradictory to the predictions from trade theory, according to which the influence from supply should come from the development of aggregate international supply, rather than from the factor endowment of single countries.

The results further reveal that increased union density and/or bargaining coverage tend to compress wages between educational groups, at least for medium or lower levels of union density and coverage. This result is in line with observations in the literature that unions generally tend to compress wages (Freeman and Medoff 1984). There is a counteracting interaction effect, however, implying that at higher levels of union density, increased coverage will no longer compress wages. Likewise, for high levels of coverage, increased union density no longer compresses wages. Our tentative interpretation of this interaction effect is that at high levels of density and coverage, unionism extends well into the higher educational strata of the labour force, in which case the compressing effect of unions is counteracted by the internal pressure from members with higher education.

Finally, we also find a significant compressing effect of co-ordination in bargaining on relative wages. Going from a completely decentralised country to a completely centralised one would decrease relative wages by about 15%.[35]

8.4.3 Demand for higher education

The elasticity of relative demand to relative wages is estimated at about –1.6. This means that the elasticity of substitution between the two groups of labour is about 1.6. The estimate is very close to the "preferred" 1.4 for the USA as reported by Katz and Autor (1999) and the one estimated for the UK (1.04) by Jackman et al. (1997). Furthermore, we are not able to reject the null hypothesis of an elasticity of unity (Cobb–Douglas).

With this elasticity of relative demand, a growth in relative employment of about 80%, as experienced in Europe over the investigated 15-year period, would imply a decline in relative wages of about 50%, given that the demand curve is stable. This has not been the case, however. Demand has shifted as well. Figure 8.8 shows an estimate of the shift in demand from 1981 to 1995.[36] Relative demand is fixed at 100 for 1981, and the curve displays the growth in demand that would have occurred for a given relative wage. We note from the figure that the shift in demand has been even stronger in the 1990s than in the 1980s and that the index ends up at about 190 for 1995.

As mentioned in the introduction, demand growth may come about as a result of within-industry growth or as a result of a change in the structural composition of industries. The dotted line in Figure 8.8 gives the calculated increase in demand from structural

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[35] We have used a combination of the centralisation index created by Wallerstein (1999) and the co-ordination measures reported in OECD (1997). See Barth et al. (2001) for details.

[36] The demand shift is estimated under the assumption of an elasticity of substitution of 1.585 and the displayed trend is calculated from a regression model of these shifts including time and country dummies only.

change between industries.[37] It may be concluded from the figure that, at least with a fairly coarse definition of industry, between-industry changes have contributed only marginally to the overall change in relative demand.

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[37] The industry demand index is constructed from average European education intensities for 1-digit industries (times gender) in 1990 and changes in employment shares for 1-digit industries (times gender) from 1980 to 1995 relative to the 1990 industry structure.

Figure 8.8.   Estimated demand shift, average for PURE countries. 1981=100
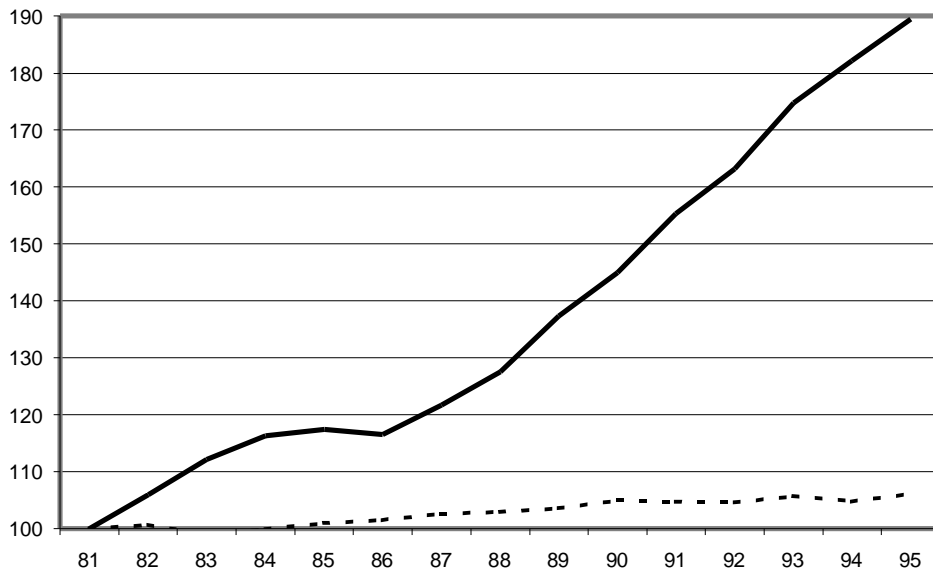
Notes: Calculated from a demand model, based on an estimated elasticity of substitution of 1.585. The trend is calculated from a model including time and country dummies only.

In Table 8.5 of the appendix, we have calculated average growth rates of relative supply, relative demand and relative wages. The first three columns report average annual growth rates (log points) of relative supply, employment and wages for the 15 PURE countries, estimated from the period 1985 to 1995. The highest growth in employment rates has occurred in Ireland, Sweden and Portugal, while Italy and Germany show the lowest growth rates in relative employment of higher education. We note that employment has risen at least as much as supply in 11 of the 15 countries. The unweighted average growth rate in relative employment is 5.0% while the average growth rate in relative supply is 4.9%. Italy and Greece have experienced the highest growth in relative wages, while Austria and Sweden show a decline. We note, once more, that the unweighted average growth rate of relative wages is positive even in a situation with a very high growth rate of relative employment.

The next two columns of the table report calculated growth rates for relative demand and supply indexes. The demand (supply) index is calculated as the annual growth rate minus (plus) the elasticity of relative demand (supply) times the annual growth rate of relative wages. These indexes are interpreted as giving the size of the shift of the demand (supply) curves in Figure 8.1; that is, the growth in demand (supply) that has taken place at given relative wages.

We find that the underlying shifts in supply have been particularly strong in Ireland and Sweden. In Italy, in contrast, the annual growth in supply has been only 0.4%, which is extremely low for a country having experienced a growth in relative wages of 2.2% per year. The reported supply shifts should be interpreted as increased relative supply, *given relative wages*. Behind these shifts are to a large extent the expansion of the school system and increased public funding of higher education.

Large shifts in the underlying relative demand curves are found for Ireland, almost 11% per year, and for Greece, Portugal and Switzerland, all of which have experienced shifts in relative demand of more than 7% per year. Germany turns out to be the country with the lowest calculated shift in demand among the PURE countries over this period. Behind these shifts are for the most part, as we observed in Figure 8.8, technological changes within industries (at least for the industry classification used in this study). It should, however, be stressed that the specific numbers for the single countries are uncertain and calculated on the assumption of constant elasticities of demand and supply across countries and over time. Averaging across countries gives a demand shift of 5.6% per year, which has been met by a shift in supply of 4.7%.

8.5   Conclusions

The expansion of the educational system may be considered as a nation's attempt to influence its own endowment of human capital. Public expenditure on higher education works to increase the human capital content of the labour force. We have found that such an expansion would, ceteris paribus, be accompanied by a reduction in the relative wages of the country. On the whole, however, the increasing supply of highly educated labour has not led to a reduction in relative wages in Europe. The reason is that demand has shifted as well. At the aggregate European level, the relative demand curve has shifted more than the relative supply curve. The demand for education has increased by about 5% per year and, moreover, with a higher growth rate in the1990s than in the 1980s.

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Appendix tables

Table 8.1.   Real total public expenditure on higher education, % of GDP in 14 Western European countries (Euro 1985 value)

	1980	**1985**	**1990**	**1995**	**% change 80–95**
Sweden	0.72	0.88	0.90	2.16	200
Norway	0.79	0.75	0.93	1.90	141
Denmark	1.04	1.38	2.05	2.02	94
Finland	0.94	0.98	1.36	1.96	108
Spain		0.43[1]	0.59	0.75	74
Portugal	0.38	0.49	0.64	0.87	128
Italy	0.75	0.55	0.64	0.69	−8
France	0.60	0.71	0.70	0.99	65
Ireland	1.24	1.09	1.06	1.23	0.8
Austria	0.69	0.87	0.95	1.05	52
Switzerland	0.87	0.84	0.90	0.99	14
Germany	1.2	1.17	1.25	1.37	8.3
UK	1.18	0.95	0.90	1.30	10
Netherlands	1.89	1.58	1.80	1.44	−45
STD	0.38	0.30	0.33	0.49	

Note: [1] 1987

Source: *UNESCO Institute for Statistics (2000)*

Table 8.2. *Real total public expenditure on higher education, per person in the age group 18–24, in 14 Western European countries, 1980–1996 (Euro 1985 value)*

	1980	**1985**	**1990**	**1996**	**% change 80–96**
Sweden	916	1122	1303	3309	261
Norway	968	1027	1280	3590	271
Denmark	1464	2020	2341[1]	4163	184
Finland	850	1050	1939	3018	255
Spain		181[2]	287	397	119
Portugal	63	73	163	248	294
Italy	347	304	511	658	90
France	671	825	981	1576	135
Ireland		660[3]	807	1235	87
Austria	752	929	1268	1975	163
Switzerland	1695[4]	1705	2343	2898	71
Germany	1671	1485	2085	2945	76
UK	1023	793	922	1796	76
Netherlands	2098	1680	2329	2487	19
STD	590	571	739	1233	

Notes: [1] 1991; [2] 1987; [3] 1986; [4] 1981.

Source: *UNESCO Institute for Statistics (2000)*

Table 8.3.   Enrolment rates and public expenditure per student, 1980–1996

		1980	1985	1990	1996	% change 80–96
Sweden	ENROLMENT RATE		22	23	35	56[1]
	Expenditure per student		5184	5684	9442	88[1]
Norway	ENROLMENT RATE	18	21	30	44	138
	Expenditure per student	5291	4838	4220	8216	55
Denmark	ENROLMENT RATE	20	21	26	36	75
	Expenditure per student	7270	9796		11669	62
Finland	ENROLMENT RATE	23	24	34	51	126
	Expenditure per student	3724	4326	5586	5838	56
Spain	ENROLMENT RATE	17	20	26	36	119
	Expenditure per student		787	1068	1088	
Portugal	ENROLMENT RATE	9	9	17	30	246
	Expenditure per student	735	830	968	839	14
Italy	ENROLMENT RATE	19	19	23	33	67
	Expenditure per student	1784	1639	2254	2021	13
France	ENROLMENT RATE	18	21	28	36	99
	Expenditure per student	3694	3904	3489	4343	17
Ireland	ENROLMENT RATE		18	23	28	
	Expenditure per student		3709	3493	3850	4[2]
Austria	ENROLMENT RATE	16	19	23	33	101
	Expenditure per student	4604	4942	5451	5988	30
Switzerland	ENROLMENT RATE	12	15	20	25	100
	Expenditure per student	13686	11192	11692	11591	–15
UK	ENROLMENT RATE	14	16	20	36	157
	Expenditure per student	7202	5064	4663	4962	–31
Germany	ENROLMENT RATE	16	18	23	28	78
	Expenditure per student	10522	8182	9148	10402	–1
Netherlands	ENROLMENT RATE	21	22	25	32	51
	Expenditure per student	9817	7596	9397	7687	–21
STD	ENROLMENT RATE	4	4	5	7	
	Expenditure per student	3938	3074	3247	3683	

Notes: [1] 1984–96. [2] 1985–96. Enrolment rate = 100* (number of students)/(number of individuals aged 18–24). Expenditure per student = (Real total public expenditure, Euro 1985 value) / Number of students enrolled.

Source: *UNESCO Institute for Statistics (2000)*

Table 8.4. *The market for highly educated workers in Europe. Relative supply, relative demand and the log of relative wages. Regression results, 2SLS.*

	Relative supply	**Relative demand**	**Relative wages**	**Mean values**
Relative wage	0.55 (0.350)	–1.58* (0.595)		0.42
Relative supply			–0.06* (0.014)	–1.92
Relative supply, lagged	0.91 (.031)			–1.97
Public expenditure, % of GDP:				
On higher education	0.076* (0.028)			0.94
On all education	–2.25* (1.068)			5.33
Student support	–0.01 (0.017)			390.58
Bargaining institutions:				
Co-ordination			–0.04 (0.016)	1.53
Coverage			–0.36* (0.118)	0.68
Union density			–0.93* (0.209)	0.39
Density times Coverage			1.11* (0.254)	
Country dummies	Yes	Yes	No	
Year dummies	No	Yes	Yes	
R-square	0.99	0.98	0.45	
N			240	

Table 8.5. *Average annual growth rates in relative employment, relative wages and relative demand, 1985–1995. Log-points per country times 100.*

	Growth in Relative			**Calculated growth in index**	
	Supply	**Empl.**	**Wages**	**Demand**	**Supply**
Austria	5.5	5.5	–1.1	3.7	6.1
Denmark	3.0	3.1	1.0	4.7	2.4
Finland	4.1	5.1	0.1	5.3	4.0
France	3.8	3.8	0.9	5.2	3.3
Germany	1.9	2.3	–0.4	1.8	2.1
Greece	5.1	5.2	1.7	7.8	4.2
Ireland	10.7	10.4	–0.0	10.4	10.7
Italy	1.6	1.6	2.2	5.2	0.4
Netherlands	5.4	5.2	–0.1	5.0	5.5
Norway	5.2	5.5	–0.1	5.3	5.3
Portugal	6.1	6.0	0.7	7.1	5.7
Spain	5.0	5.1	–0.1	4.9	5.1
Switzerland	5.4	5.6	1.0	7.1	4.8
Sweden	6.7	7.2	–0.7	6.2	7.1
United Kingdom	3.3	3.1	0.0	3.2	3.3
Average	4.9	5.0	0.3	5.6	4.7

Notes: Average annual growth rates for relative supply, employment and wages are (100 times) the coefficients of a linear trend in semi-logaritmic regressions for each country including a constant term and the time trend only. Average yearly growth rates of the demand and supply indexes are calculated for each country on the assumption that the elasticity of substitution is 1.585 and that the elasticity of relative supply equals 0.55.

9. PUBLIC FUNDING AND ENROLMENT INTO HIGHER EDUCATION[38]

Gauthier Lanot, Rudolf Winter–Ebmer and Aniela Wirz

In most European countries higher education is highly subsidised by the public sector. What impact does this public funding have on the educational choices of students? The theory underlying this relationship is the classical human capital model, where an individual maximises his/her discounted stream of lifetime earnings net of the costs of education. The net costs or price of education refer to out-of-pocket costs like tuition fees and education material net of public subsidies. An individual will invest in schooling up to the point where the marginal cost of an additional year of schooling (foregone earnings plus net costs) is equal to the marginal benefit (the discounted stream of earnings attributable to another year in school, being a function of the individual's ability and time preference or discount rate).

Why is there any reason for public intervention concerning the private choice of education? In principle, three arguments can be made. The first is a public-good story: a better educated population fosters civic participation, a stable democracy and a richer cultural life. As these benefits accrue to all members of society, they can be considered a public good. The second argument relies on liquidity constraints. The optimal schooling choice is dependent on a capital market being accessible for all individuals. But since ability cannot be used as collateral, students from poorer backgrounds may not be able to borrow to invest in their own education. Public funding can then provide the necessary temporary liquidity by giving loans that the credit market cannot provide. This argument is certainly more relevant for higher education. Finally, a more educated population can generate social externalities through complementarities in production or consumption. These externalities – which are prominent in the new growth increasing returns literature – could arise, because people are more productive if they are around other clever people.

This chapter assesses the importance of the effect of public funding on private enrolment behaviour into higher education. Previous research has concentrated, on the one hand, on time-series evidence for some European countries, and on the other hand, on more detailed evaluations of grant programmes for the USA. If only time-series variation is available for funding and enrolment, no firm conclusions can be drawn, because there is a suspicion of trends in many of these variables. The US evidence seems to indicate that grants have a positive effect on enrolment (or, vice versa, a negative effect of tuition rates), with a higher effect on lower income groups. While

enrolment into higher education appears to be quite sensitive to factors affecting either the marginal benefit or the marginal cost of additional schooling in cross-sections, explaining the evolution of enrolment rates over time proves to be even more complicated. Overall the evidence is that neither public funding of education, nor tuition fees policies can explain alone the evolution of aggregate enrolment rates (post-secondary education) over time.

A different strand of literature goes back one step and attempts to describe the relationship between teenager enrolment into higher education and parental income. After carefully disentangling permanent from transitory (current) income changes, many authors conclude that liquidity constraints are not important in explaining enrolment rates. However, this conclusion does not really strengthen the case against public funding of education. On the one hand, in-kind transfers like grants, subsidies or tuition costs might have very different impacts on spending behaviour as compared to money itself. On the other hand, there is still an argument for public funding of enrolment if external effects of education or public-good aspects are present.

Taking a European perspective, we focus our efforts on the effect of public funding on enrolment into higher education. We use data for the 15 PURE countries over the last two decades. This allows us to exploit different regimes in funding and higher education institutions between countries as well as over time. Moreover, the panel character of the data allows us to account for country-specific phenomena as well as for generally rising trends in higher education.

Not surprisingly we have to deal with the simultaneity of public funding and enrolment. On the one hand, higher public funding may be causing higher enrolment into higher education while, on the other hand, an increase in student numbers mechanically increases public expenditure on education. We use political economy information on the type of government, election times and ideology of the government to explain public funding – along with general public-sector deficit ratios.

Unfortunately it was not possible to get consistent information on the generosity of student grants and subsidised loans over time. Insofar as these public subsidies are part of the educational budget, their effect is already included in the public funding variables themselves. Moreover, systems of numerus clauses (direct enrolment rationing at the tertiary level) in the different countries did not change over time, so they will be picked up by the country fixed effect.

Our econometric specification is in general in logs. It relates enrolment rates into universities to public funding at large as well as to public funding for higher education. This specification tests whether public funding for higher education has a larger impact on enrolment than funding for secondary schooling. Other explanatory variables are the extent of entry exams in the high-school system, where we can observe if entry exams are important in no schools, some schools or most schools. Likewise, we have an indicator for the existence of tuition fees in the different countries. As rational students will react to discounted lifetime income differentials, higher returns to education should influence enrolment positively. We use PURE estimates for returns to years of education based on uniform specifications across countries, separately for males and females. Finally, opportunity costs of potential students are influenced by current unemployment rates for young workers.

We find that a 1% increase in public funding of education at large increases male enrolment by almost 1%, whereas no additional impact of funding for higher education is detected. Of course, this effect can be due to different enrolment patterns in different countries. When we include country fixed effects – to control for country-specific

enrolment patterns – our elasticity reduces to 0.63%; it declines somewhat further, to 0.54%, when we also introduce time dummies to control for a uniform cross-European rise in enrolment. Once we control for endogeneity of the expenditure variables, interestingly the elasticity gets higher again.

Instruments prove, in fact, to be relevant in explaining public expenditure. Especially government ideology is highly significant both for total spending for education as well as for spending for higher education. Interestingly, centre governments spend less on education as both left- and right-wing governments. The form of the government is less important for total education, but in the case of higher education, single party governments spend significantly more as compared to coalition or minority governments. Moreover, entry exams in the high-school system are confirmed to have a negative impact on enrolment and the lack of tuition fees influences enrolment positively, as expected. But current returns to education and opportunity costs of potential students, as measured by current unemployment rates for young workers, play no role in explaining current enrolment into higher education.

In summary, our results indicate that a one per cent increase in public funding more or less increases enrolment by one per cent. For economic policy, most relevant is that this relates to general public funding of education, while the actual partitioning of these funds into expenses for secondary or tertiary education does not seem to matter.

10. STUDENT LOANS IN EUROPE: AN OVERVIEW [39]

Marianne Guille

Education is expensive. In 1995 the average global effort in favour of education represented 6.7% of GDP in OECD countries, and this effort is still largely due to the public sector.

The conjunction of three reasons might explain the recent developments in the efficiency of this financing. First, education is not a pure public good. Second, as a consequence of the spectacular rise in the number of graduates and students since the end of the 1960s, especially in Europe, public budgets on education experienced a rapid growth and are nowadays one of the most important public budgets in many countries. Third, at the same time government budget constraints became harder, leading to an extended period of financial stringency.

In developed countries, the debate focuses on the financing of higher education for several reasons: the rapid growth of this budget; the persistence of social inequalities despite extensive public financing, especially in Europe; and primary and secondary education being almost entirely free and publicly funded, which is generally admitted. Because education is not a pure public good, one response to this funding crisis is to increase, at a significant scale, private funding of higher education. This strategy is supported particularly by the World Bank, whose recommendations, based on efficiency and equity considerations, are relayed by numerous studies. In most cases, they recommend first of all an increase in tuition fees and second, a reform of student aid schemes. This reform is often oriented towards the creation of a public credit market of education in order to finance the costs of higher education by specific loans to students. According to this system, the State has to advance this financing only during the first years of its creation, since students re-pay their loans once they have completed their studies. The State has also to finance the difference between interest cost and interest income, if any, and the cost of the default rate.

This strategy provides funding for higher education, while the number of students may increase sharply without endangering public finance. It has a price, however: rising students' participation in the funding. Of course, this refusal to increase public-sector funding is justified by both efficiency and equity considerations.

Introducing fees and converting aid schemes into loan systems increase the students' financial burden, but as they receive the greatest benefit from education, it may be considered as an investment. Economic efficiency is also better served when individuals pay directly for services they receive compared to raising taxation. Moreover, there is little evidence on low fees and maintenance grants having encouraged the participation of children from poor families. Equity is then better served by an increase in students'

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financial participation, if those who benefit the most from public subsidies are from middle or upper social classes.

However, even though students are the main recipients of the benefits of education, they are not the only ones. Social returns exist as well. The efficient solution then is a mix of private and public funding. As a consequence, social returns must be evaluated not only to set priorities for future educational investments but also to allow comparison with private returns in order to choose an efficient mix of private and social funding that avoids over-education, if higher education is too heavily subsidised, as well as under-investment in the opposite case.

Why not private loans? First, because public loans are intended to replace or complete grants. Second, because banks would ration students to cope with information problems, especially those who do not have sufficient collateral. Banks have no interest in enhancing education, opposite to governments, as has been shown in endogenous growth models *à la* Romer.

On this basis, several countries have raised their tuition fees, especially in Europe where they were very low until the 1980s, and/or have expanded their systems of student loans, which are mostly funded by public sources. Australia and New Zealand, for instance, have created public contingent loan systems: the re-payment of these loans depends on the borrower's income, includes no real rate of interest, and is organised by taxation authorities.

What about Europe? To the extent that countries have defined needs-based national support schemes, they vary substantially according to rules for eligibility, social conditions for support and student needs, and the way the support is given. About half of the European countries provide this kind of support at least partly on a loan basis. The rest of this chapter presents an overview of these different systems of public loans to students.

All countries having developed public systems of student loans belong to the North or Mid-Western Europe: the Nordic countries, Netherlands, Germany and the United Kingdom. Although national support schemes are difficult to compare and to interpret, these countries are also clearly the ones that provide the highest support to students. This is especially true for the Nordic countries, while Southern European countries provide the lowest support.

This fact reflects differences in students' behaviour and social role: the more students live independently the more help they are given, and the more they are considered to be young citizens investing in their future the more important is the loan component of this aid. This holds especially for the Nordic countries, which were the first to design student loan systems during the fifties and, to a lesser extent, for the UK.

In Southern European countries, in contrast, where more students live with their parents, they are considered as children in a family system. Hardly any support is then provided to cover their direct expenditure on education. Mid-West European countries are in-between as they add a welfare component to this system: they provide financial aid to a large number of students but this aid depends on parental resources.

The public loan systems that have been adopted in Europe remain dependent on these differences in students' behaviour and social role, but also on the observed private returns to education. For instance, the most recent Swedish reform of the student loan system adopted in 1989 was motivated by such considerations. As private returns to education are low in Sweden[40], the government decided to restore the attractiveness of

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[40] According to PURE estimates they are the lowest in Europe, see Chapter 2 of this volume.

student loans by reducing the part re-paid by students to 70%. Ten years later, the British government decided exactly the opposite: to abolish grants and to provide students with an income-contingent loan-based aid. This choice was motivated by the considerable increase in the number of students and the fact that they receive excellent returns to their investment in education.[41] Hence, an increase in the cost of their investment was not expected to reduce their enrolment in higher education.

The major difference between European student loan systems resides in the importance of the loan and the way it is re-paid. The importance of student loans varies between 31% and 100% of the financial aid, while its amount may or may not depend on parental resources and on the student's way of living. The proportion of beneficiaries varies from 10% to 70% of the students.

The re-payment may or may not be related to the borrower's income. The period of grace varies between zero and five years after the completion of studies. The interest rate varies between 0 and 8.5%. Interest begins to be charged during the period of study (DS) or only after (AS) and may or may not be tax deductible.

Table 10.1.   Differences in student loan systems for selected PURE countries

1997	Grant	Loan	Income-contingent	Interest Rate
Denmark	66%	34%	No	4% (DS) 4.5% (AS)
Germany	50%	50%	No	0
Netherlands	69%	31%	No	5.7% (DS, AS)
Norway (1995)	26%	74%	No	7.5 or 8.5% (AS)
Sweden	28%	72%	Yes	6% (DS, AS)
UK	58%	42%	No	No real rate (2.7%)
UK (1999)	0	100%	Yes	No real rate

Accordingly, private costs and benefits of student loan systems are very different from one European country to another. Hence, these systems have not reduced the differences in schooling costs borne by European students or their families.

As a consequence, taking the private cost side into account in the estimation of returns to education and not only the benefit side, namely the increase in earnings from an extra year or cycle of education, might change the results obtained when comparing European returns. Moreover, a harmonisation of the funding policies of higher education seems to be necessary. Otherwise, students may vote with their feet, i.e. to choose to study in countries where their financial participation is most limited and to work afterwards where returns are highest.

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[41] According to PURE estimates, only Irish students receive higher returns, see Chapter 2 of this volume.

PART II

SELECTED COUNTRY-SPECIFIC STUDIES

11. THE SCREENING VERSUS HUMAN CAPITAL HYPOTHESES: EVIDENCE FROM FRANCE AND SPAIN[42]

Fernando Barceinas–Paredes, Josep Oliver–Alonso, José Luis Raymond–Bara, José Luis Roig–Sabaté and Ali Skalli

The relationship between education and productivity has long intrigued economists. According to the human capital theory, the role of education is to augment individuals' productivity. In contrast, the so-called screening hypothesis argues that education merely signals to potential employers about individuals' innate ability.

Since education enhances individuals' lifetime earnings regardless of whether it signals their inherent productivity or augments it, it is certainly a good investment for the individual. What is less clear is whether it is a good investment for the society as a whole as well. Indeed, if the only role of education is to serve as a signalling device, then the absence of social benefits from education would imply that public funding policies of education are no longer justified. If education plays both a signalling and a productivity-augmenting role, then public resources should be devoted mainly to those qualifications that improve individuals' productivity most. In contrast, if the effect of education on individuals' earnings exclusively measures an effect on productivity, then social benefits might be substantial enough to justify that education is accordingly publicly funded.

A proper test to discriminate between the screening hypothesis and the human capital theory would require data on individuals' productivity to be available. Obviously, such data do not exist so an alternative test must rely on earnings functions, where wages are assumed to proxy productivity. The problem, however, is that both the screening hypothesis and the human capital theory predict a positive effect of education on wages and, hence, are observationally equivalent. To overcome this problem, most empirical tests consist in using a particular sub-sample of the population as an unscreened control group to compare the rates of return to education for this group with those of screened sub-samples. Advocates of the so-called *P*-test compare returns across relatively competitive and non-competitive sectors. The idea here is that wages are closer to the marginal product of labour in competitive sectors than in non-competitive ones where wages are bureaucratically set and, hence, where screening is more likely. An alternative approach consists in assuming that self-employed constitute the unscreened group since they have no need to signal innate ability. Therefore, the returns to education for the self-employed are nothing but true returns to human capital. If the screening hypothesis holds, then the signalling value is the difference between the returns to education of the employed and the self-employed.

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[42] This chapter summarises work in progress.

Unfortunately there are many potential problems with this approach. First, it is not clear to what extent the two comparison groups are differently screened. At least, such a difference, if any, is not independent of institutional considerations. This is perhaps why evidence of screening has been found in some countries and not in other. Second, when comparing employees and self-employed individuals, one is comparing two types of income that are different in nature. In particular, not only are the earnings of the self-employed more variable, but clearly, business owners have more earnings opportunities not directly dependent on their educational qualifications. Third, the literature on self-employment shows that the self-employed are, in general, for tax considerations reluctant to declare their actual earnings. Last, but not least, an implicit assumption underlying this approach is that education is acquired solely with a view to future employment opportunities. Yet, not only is education not necessarily acquired for investment considerations, but employment expectations are not necessarily fulfilled, either. In addition, if screening models are right in assuming that individuals determine their employment plans on the basis of offered wage schedules set by potential employers, then one would expect individuals observed in unscreened groups to invest less in education. This is because they are supposed to decide to work in unscreened sectors prior to certification.

For these reasons, one of the tests performed in this study is that of comparing the returns to schooling for public- and private-sector employees. We model wages and sectoral choice simultaneously in order to overcome the problem of self-selection. Of course, the advantage of our cross-country comparative analysis is to shed light on the extent to which institutional considerations might condition the outcome. Our results indicate that, both in France and Spain, the returns to education are higher in the private sector, hence suggesting rejection of the screening hypothesis.

An alternative testing approach adopted in the study relies on the following idea. If the only role of education is to serve as a signalling device, then the essence of the signal should be distilled into the individual's position in the educational distribution, according to the cohort (s)he belongs to. For instance, an individual with a given qualification might be negatively signalled today, although (s)he could have been positively signalled had (s)he entered the labour market a few years ago. In the screening framework, the individual's rank in the cohort-specific educational distribution should have a greater impact on earnings than mere years of schooling. Although such a test has not yet been made for France, the Spanish results show that the ranking effect is almost zero.

One might argue that such testing strategies do not do justice to the screening hypothesis. Once an individual is hired, the employer might learn more about his/her actual capabilities and adjust his/her wage accordingly. This is the so-called weak version of the screening hypothesis. It would imply that the signalling value of education decreases over time and, hence, might be underestimated in cross-section analyses. Nevertheless, it is worth recalling that Michael Spence, one of the leading advocates of the screening hypothesis, shows that as employers hire employees with different qualifications, they also learn about the relationship between education and productivity, so that their own expectations about individuals' ability become self-fulfilling. This is the so-called strong version of the screening hypothesis. It implies that in a signalling equilibrium, a decreasing pattern of the signalling value of education is not justified.

In our attempt to do justice to both the weak and the strong version of the screening hypothesis, we have re-produced the experience–earnings profiles of university

graduates. It turned out that, in Spain, only in the beginning of working life wages are higher in the public sector. However, wages in the private sector grow faster and become higher at the end of the working career. Such a result is compatible with the weak version of the screening hypothesis, but it might also simply reflect specific wage-setting mechanisms. Indeed, in the French case, private- and public-sector experience–earnings profiles do not intersect.

An alternative test that we perform in our study relies on the comparison of returns to schooling of individuals with different job tenure durations. In contrast to what the weak version of the screening hypothesis predicts, the returns to education seem to be increasing with job tenure. In Spain, only after 20 years of seniority do returns start to decrease. In France, they start to decrease after 5 years of job tenure, but newly hired individuals get the lowest returns to schooling.

As a complementary test, we also distinguish between individuals according to their highest qualification. The idea here is that if, indeed, employers perceive higher education as a signal of higher ability, then the weak version of the screening hypothesis would predict that the seniority–earnings profiles of differently qualified individuals should converge. Neither the French nor the Spanish evidence confirms such converging patterns.

Another test that we perform consists in comparing the mid-to-early career earnings ratio for different industries as the number of years of schooling increases. Not only should we expect these ratios to decrease with the industry-specific degree of competitiveness but also with the number of years of schooling, if the weak version of the screening hypothesis holds. Once again, neither in France nor in Spain do the data uncover such decreasing patterns.

Although none of the results discussed above can be considered as strong evidence for the screening hypothesis, French as well as Spanish data do support one of its predictions; that is, faster completion of a degree should be perceived as a signal of higher ability and, hence, should yield higher returns. Indeed, estimation of the returns to qualifications according to the number of years it has taken individuals to attain them clearly shows that the longer it takes an individual to attain the qualification, the lower return (s)he gets. This also suggests that, at a given time, among individuals having spent the same number of years in school, those who fail to complete a degree get lower returns. This means that significant sheepskin effects are at work, that is, bonus returns to finishing a degree, thus reflecting the idea that drop-outs signal a lower ability to jump hurdles and to finish tasks.

12. DOES EDUCATION REDUCE GENDER SEGREGATION?[43]

Aniela Wirz and Josef Zweimüller

The difference in educational attainments between men and women accounted for around 25–30% of the gender wage gap[44] in Switzerland in 1996, calculated using the Swiss Wage Structure Survey[45] and applying a Oaxaca–Blinder (1973) wage differential decomposition. Differences in other human capital components, like working experience and tenure, explain an additional part (attributes' component of the decomposition) of the gender wage gap. But the major share remains unexplained. This unexplained component contains unobserved gender differences as well as pay differences due to discrimination.

The standard decomposition method based on wage regressions has shortcomings. First, we do not know how the unexplained component of the average gender wage differential interacts with education. If unobserved gender differences and/or sexual discrimination decrease with increasing education, then the decrease of 25–30% of the wage gap due to a catch up in women's education would underestimate the total impact of education on wage inequality. Second, it does not take into account possible differences in the distribution of men and women across establishments. We do not know if an unexplained wage differential arises because of unequal pay within a firm for given observed human capital or because men and women end up working with employers paying different wage premia. As wages are shown to differ across employers (Gibbons and Katz 1992) for given human capital endowments, sexual segregation across employers affects the gender wage gap (Barth and Mastekaasa 1996). In order to answer these questions we adapted the Oaxaca–Blinder wage differential decomposition method to account for segregation across employers using a fixed-effect wage estimation framework. Our results (see Table 12.1) show that this segregation accounts for a substantial part (13%) of the gender wage gap. But the component unexplained by human capital endowment differences within establishments still makes up the largest share of the gender wage gap. The attributes' component, which mainly reflects the impact of different educational attainments and working experience between men and women, amounts to 22–35% of the wage gap.

Table 12.1.   Oaxaca–Blinder decomposition for the standard case and for fixed-effect estimation results

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[44] Which amounts to about 30% of the average male wage.

[45] The survey of the Swiss Federal Statistical Office consists of data from 8,266 firms and 564,907 employees (Schweizerische Lohnstrukturerhebung 1996, BFS).

Estimation method:	Components:						Gender wage differential*
	Unexplained		Attributes		Segregation		
	U		A		S		WD
Men's wage structure is the reference:							
Standard	0.171	+	0.150			=	0.322
Fixed-effect	0.164	+	0.115	+	0.042	=	0.322
Women's wage structure is the reference:							
Standard	0.210	+	0.112			=	0.322
Fixed-effect	0.208	+	0.072	+	0.042	=	0.322

Note: * Difference in mean log hourly wage rates, men – women's sample average.

In a second step we estimate the wage regressions separately for each gender and education level in order to get a wage differential decomposition and segregation measure by educational level. Our results (see Table 12.2) show that individuals with a high education are segregated into establishments paying high wages. Most interestingly, the difference between the average establishment pay premium between sample men and women, which measures the segregation component, decreases clearly with increasing education.

The unexplained component of the wage gap, measuring the influence of unobserved gender differences and sexual wage discrimination within establishments, which is the only discrimination targeted by constitutional laws, is still the major part of the gender wage differential (see Table 12.3 and Table 12.4).

Table 12.2.   Average fixed-effects by educational level and gender

Educational level	Men	Women	Difference: Segregation – Component (S)
University[1]	0.099	0.100	–0.001
Upper secondary[2]	0.037	0.063	–0.027
Vocational educ.[3]	0.012	–0.010	0.022
Mandatory school[4]	–0.026	–0.065	0.039
Foreign, MEI[5]	0.022	–0.035	0.057

Notes: [1] University level includes also tertiary education of the vocational education system. [2] Includes upper secondary graduates of vocational and non-vocational education and teachers. [3] Professional education certificate officially recognised. [4] Mandatory schooling level includes also training on the job, not recognised as federal degree. [5] Foreign: non-Swiss educational degree. MEI: missing education information.

Table 12.3.   Oaxaca –Blinder decomposition for standard estimation

Educational level	Men's wage structure as reference:					Women's wage structure as reference:				
	U		A		WD	U		A		WD
University[1]	0.135	+	0.100	=	0.235	0.165	+	0.070	=	0.235
Upper secondary[2]	0.161	+	0.090	=	0.251	0.203	+	0.048	=	0.251
Vocational educ.[3]	0.172	+	0.071	=	0.243	0.217	+	0.026	=	0.243
Mandatory school[4]	0.180	+	0.036	=	0.217	0.221	+	-0.005	=	0.217
Foreign, MEI[5]	0.239	+	0.110	=	0.350	0.306	+	0.044	=	0.350

Notes: [1] University level includes also tertiary education of the vocational education system. [2] Includes upper secondary graduates of vocational and non-vocational education and teachers. [3] Professional education certificate officially recognised. [4] Mandatory schooling level includes also training on the job, not recognised as federal degree. [5] Foreign: non-Swiss educational degree. MEI: missing education information.

Table 12.4.   Oaxaca–Blinder decomposition for fixed-effect estimation

Education level	Men's wage structure as reference:							Women's wage structure as reference:						
	U		A		S		WD	U		A		S		WD
University[1]	0.139	+	0.096	+	-0.001	=	0.235	0.180	+	0.055	+	-0.001	=	0.235
Upper secondary[2]	0.184	+	0.093	+	-0.027	=	0.251	0.235	+	0.042	+	-0.027	=	0.251
Vocational educ.[3]	0.174	+	0.048	+	0.022	=	0.243	0.208	+	0.013	+	0.022	=	0.243
Mandatory s.[4]	0.155	+	0.023	+	0.039	=	0.217	0.198	+	-0.020	+	0.039	=	0.217
Foreign, MEI[5]	0.209	+	0.084	+	0.057	=	0.350	0.271	+	0.023	+	0.057	=	0.350

Notes: [1] University level includes also tertiary education of the vocational education system. [2] Includes upper secondary graduates of vocational and non-vocational education and teachers. [3] Professional education certificate officially recognised. [4] Mandatory schooling level includes also training on the job, not recognised as federal degree. [5] Foreign: non-Swiss educational degree. MEI: missing education information.

Sexual segregation across employers seems to be closely related to quantitative differences in education and other personal human capital endowments. Qualitative differences[46], in contrast, seem to be of no importance, as the employer segregation component between men and women is highest at the lowest educational levels and mandatory education is of quite comparable quality and content within Switzerland. Gender segregation in the educational choices within a given educational level[47] does not seem to have an impact on segregation between employers paying high and low wages, either. This then leaves some scope for other factors like gender differences in job-search behaviour, personal preferences (working time, regional mobility) and/or discrimination in the hiring process to explain gender segregation across employers for individuals with low and average education levels in Switzerland. These factors are beyond the influence of educational policy but contingent on the general institutional and cultural framework determining the labour market behaviour of women.

In summary, these results show that increasing education of women reduces segregation. Increasing women's education allows them to get employed at establishments paying higher wages. The higher their education is, the smaller the gender difference in segregation across employers. Education thus has a more differentiated impact on the reduction of wage inequality between men and women than the standard wage differential decomposition has led us to believe so far. The remaining unexplained gender wage differential within establishments is not correlated with education. Even if this measure reflects unobserved human capital endowment differences as well as sexual discrimination, the large size of this component (50–65%) points to some scope for equal pay legislation to reduce wage inequality within establishments in Switzerland.

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[46] Qualitative differences in education may concern the quality in teaching but also the education subject chosen by students within a level.

[47] For instance, in upper secondary and tertiary education boys in Switzerland tend to choose more often than girls a specialisation in mathematical and technical fields to the opposite of language-related teaching subjects.

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13. CHILD OUTCOMES AND CHILD POVERTY: PROVISIONAL RESULTS ON EARLY SCHOOL LEAVING

Colm Harmon and Ian Walker

The available evidence of child poverty is based on a definition that a child is in poverty if (s)he is living in a household below half median (equivalised) net income. The available evidence suggests that child poverty rates vary considerably across countries: France 11% (1998); Denmark 4% in 1979 and 6% in 1999; and UK 14% of children in 1979, 19% in 1999.

Major factors behind the high UK child poverty rates are: High and growing proportion of lone mothers; high and growing number of teenage pregnancies; low levels of child support compliance; and unemployment benefit is independent of number of children. There is a strong correlation between being brought up in a low-income household and a variety of (bad) child outcomes. For the UK see, for example, Machin et al. (1999) who show that low parental incomes are associated with outcomes such as crime, substance abuse, poor long-term health, and low levels of educational achievement. For the USA, see e.g. Currie (1998).

This correlation between low incomes and bad outcomes motivates child poverty policy and the UK government committed to "eliminating child poverty within a generation and halving it within 10 years" and is addressing the issue with higher *Child Benefit, Working Families' Tax Credit, SureStart* (a variety of direct interventions, such as high quality childcare and the (re)introduction (in 2001) of child tax allowances).

While there is enormous evidence that bad child outcomes are associated with growing-up in a poor household, there is almost no evidence that giving poor parents more money makes for better children. Recent research by Duflo (2000) looks at a recent South African "natural experiment" and finds that supporting grandmothers makes for better granddaughters. Research on US panel data by Shea (1995) looks at PSID and instruments parental incomes and finds that "exogenous" variation in incomes has only small effects on outcomes. The implication is that poor parents may simply be more likely to be poor at parenting; or they may not be skilled at spending money well on behalf of their children (or may spend it on themselves). This, then, motivates direct interventions like SureStart.

Our research concentrates on one (bad) outcome: early school leaving. The UK has a particularly high incidence of early school leaving and this may be an important factor behind the intergenerational transmission of inequality. The policy relevance of the issue is that the UK government is currently piloting the introduction of payments to children to stay at school beyond the minimum age for leaving – "educational maintenance allowances".

There is considerable evidence, from the PURE project and elsewhere, that the financial returns of education are high (see e.g. Harmon and Walker (1995) who found the returns for men to be 14%, and Chapter 2 of this volume). There is anecdotal evidence that low

education levels are related to other outcomes such as crime, health, and marital stability. However, there have been no attempts to extract the "causal" effect of education on such outcomes.

Earlier research by Micklewright (1996) and Chevalier and Lanot (1999) using NCDS data found large parental class/education effects but rather small income effects. US evidence on NLSY data reported by Cameron and Heckman (1998) suggests weak current income effects but strong wealth effects.

We use Family Resources Survey data pooled over 1994, 1995, 1996 and 1997. The over 18's were dropped because of censoring by leaving home – only post 18 children in HE/FE are recorded as external children. Thus our attention is confined to staying on at 16 (the minimum). The data contains 4,416 households containing 16–18 year old children

The raw data for boys suggests strong social class effects (non-manual sons about 30% points higher than manual sons); strong regional effects (North and Midlands about 10% lower than South); strong effects of father's education at low levels (leaving at 18 rather than 15 adds about 30% to staying-on-rate); strong effect of current income (staying-on rises at about 3% per decile); strong area (peer group) effects; and weak wealth effects.

The raw data for girls suggests weak social class effects (non-manual daughters about 15% points higher than manual daughters); strong regional effects (North and Midlands about 10% lower than South); some effect of father's education at low levels (leaving at 18 rather than 15 adds about 20% to staying-on-rate); some effect of current income (staying-on rises at about 2% per decile); weak area (peer group) effects; and weak wealth effects.

However, parental income and education (and other variables) are correlated so we cannot make inferences about the effect of either without controlling for both, and hence we need to model both (all) effects simultaneously. Unobservable effects are also likely to be correlated with income, so we cannot make inferences about the effects of income without controlling for unobservable factors that affect school leaving.

A second issue is that we are interested not just in parental income but also in schooling-contingent income. EMAs are not yet available but child benefit and child support are school-contingent income which we use here to capture the potential effect of EMAs.

We adopt a multivariate modelling strategy and estimate the *probability* of early school leaving in the FRS micro data. Our explanatory variables are: parental incomes, parental education, siblings, gender, race, region, year; wealth (proxied by council tax band times owner occupier interaction), area effects (proxied by council tax band), child support and child benefit, and other characteristics (employment status, working mother). We deal with the endogeneity of income by replacing incomes by predicted incomes which depend on education, work experience, etc. and on *instrumental variables* (the "raising of the school leaving age" and union membership). The idea is that the predicted income picks up the effect of exogenous changes in income, that is, potential policy effects.

We use a number of alternative specifications: no controls (includes only parental incomes (predicted), siblings, gender, race, region, year, and child support and child benefit); basic controls (adds parental education, other characteristics (employment status, working mother)); and, finally, a model with a full set of controls (adding wealth (proxied by council tax band times owner occupier interaction), area affects (proxied by council tax band), paternal income effects, and schooling contingent income effects).

The major policy conclusions were that:
q Parental education is very important.
Ø Each additional year increases probability by 5%.

Ø Major neglected externality of education.

Ø Motivates case for intervention.

q But EMA-type effects are small and lack precision.
Ø Best estimate is that £25 per week would raise the probability of "low achiever" from about 50 to 55% – but very imprecise estimates.

q Parental income effects are small and also not statistically robust.
Ø Not strong support for loans.

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PART III

COUNTRY-SPECIFIC CONTRIBUTIONS

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The Returns to Human Capital: A Review of the French Empirical Literature

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Economists agree upon the idea that the more individuals invest in human capital, the more they acquire skills and the higher are their earnings. This quantitative aspect is not sufficient to understand the relationship between human capital and earnings, however. Human capital includes components that differ in nature. Not only should one distinguish the skills that are of value for any employer from those that are of value for a single employer, but also those acquired before entering the labour market from those that are naturally enhanced through experience. Individuals who decide to attend extra years at school beyond compulsory schooling must find it preferable to delay their entry to the labour market and to acquire general human capital by raising their education level. Theoretically, an individual who seeks to maximise lifetime net income, will undertake the investment if it leads to a positive net present value and/or if the internal rate of return is greater than the market real interest rate. From an empirical point-of-view, it is also reasonable to argue that for the criteria of net present value or internal rate of return to be satisfied, it is necessary that age–earnings profiles are higher for workers with more education throughout their working lives.

A very popular way to compare age–earnings profiles for individuals with different education consists in estimating Mincer-type equations using ordinary least squares techniques (OLS). The popularity of such an approach resides in its simplicity and in the existence of compatible data. Moreover, it is very flexible as it enables one to directly estimate the average wage differentials

between individuals with different educational levels or simply the returns to an extra year of schooling.

The many analyses reviewed in this article highlight significant discrepancies in the estimated returns to schooling for France, varying from 4.2 to 19.2% with an approximate average of 8%. Of course, there are several explanations of these differences. The existence of important variations across worker groups is one of them. Analyses distinguishing between individuals according to their occupations unanimously highlight increasing and concave but differently shaped age–earnings profiles: they are steeper for white-collar than for blue-collar workers. Gender is also an important dimension. For instance, one question of interest is whether part of the gender wage gap might be explained by differences in returns to human capital. The French empirical literature suggests that although there is a persistent gender differential in the returns to education, most of the gender gap in wages results from other factors, such as segregation or different returns to mobility among others. Finally, employer characteristics might also yield important differences. For example, there seem to be significant inter-industry differentials in returns to education.

Another reason why there are such large differences in the estimated returns is that, depending on the data set used, they concern different time periods. This is an imprtant dimension since the returns to education are not necessarily constant over time. In the French case, evidence based on pseudo-panel analyses, shows that returns are declining over time. Moreover, this declining pattern is due to business-cycle effects as well as cohort effects. This suggests that, by making no difference between people born before World War II and those who entered the labour market in the nineties, cross-section based analyses might be misleading. This makes the use of panel data preferable as it allows a longitudinal approach to the relationship between human capital and earnings. Panel data also offer a means of measuring the importance of individual fixed effects. Although analyses based on French panel data are relatively scarce, they all conclude to the existence of significant individual fixed effects and to the rejection of the independence hypothesis between these and observable individual endowments. This, of course, underlines the importance of individual heterogeneity even though its potential sources are not identified since unobservables may include intrinsic ability as well as social origin or any unmeasured characteristic.

Yet, longitudinal analyses represent a way to overcome a serious source of bias related to individual innate ability. Ability biases have, indeed, given rise to a number of studies addressing the question of whether individuals that are characterised by factors that make them more likely to reach high education levels, would yield higher earnings even if they had stopped their education at earlier stages. If such a hypothesis holds, then the estimates of the returns to education would be biased upward as long as they ignore the reason why some individuals reach high education levels while others do not. Intrinsic individual ability is, however, not the only determinant of their education level. Social status and family background are also possible and perhaps more easily measured candidates. This means that education can no longer be treated as a simple exogenous variable if endogeneity biases are to be avoided. Cross-section as well as panel data for the French labour market show that neglecting the endogeneity of schooling systematically results in a significant downward bias in the returns to education.

One of the reasons why it is important to precisely measure the private returns to education is that they can be compared to the social returns, which include both private and public costs and benefits of education. Indeed, the more higher earnings of more educated people result from education increasing their productivity, the more society or the government representing it will be induced to devote more resources on education, ceteris paribus. If, on the contrary, the estimated private returns do not reflect an increase in productivity, then it is likely that the social returns are smaller than the private ones. Thus, once private returns have been estimated, there remains the problem of the accuracy of their interpretation in terms of productivity. Indeed, the screening hypothesis argues that, if the decision to invest in education is affected by employers'

willingness to offer higher wages to highly educated individuals, then education functions as a signal to employers of the applicants' ability. Unfortunately, there are only two studies attempting to estimate the signalling value of education using French labour market data. In addition, their approach is unsatisfactory since it simply consists in comparing the returns to individuals' actual number of years of schooling to the returns to the number of years of schooling typically required to reach their attained level. Both studies find that education has a positive signalling value.

If the returns to education reflect productivity, then there must be no significant bonus return to being successful in obtaining a qualification, as it is difficult to argue that such a bonus reflects higher accumulation of human capital. The French evidence reports, however, that such bonuses do exist. Called sheepskin effects, they probably reflect personal attributes valued by employers, such as the determination needed to finish tasks, rather than the greater human capital of graduates compared with that of dropouts.

Summing up, our review of the French empirical literature shows that most of the important questions addressed in the literature analysing the causal effects of human capital on wages have been examined empirically using French data. In the studies reviewed, topics like endogeneity bias, sheepskin effects and individuals' heterogeneity have been investigated. However, there remain topics where the evidence is not strongly convincing. Examples are the screening hypothesis and the ability bias. Still other topics have not been examined at all. For example, to what extent can one consider measurement errors in human capital variables as negligible? Does the legal length of compulsory schooling influence individuals' decision to invest in education or returns to education?

Unfortunately, researchers might find it difficult to explore new dimensions, simply because the available data are not necessarily appropriate. Thus, the question that remains is, how high would the returns to investment be when using detailed data sets and sophisticated methods. David Card concludes his survey of the literature, including recent studies of the earnings and schooling of twins and siblings, by arguing that the average return to education is not much different from the estimate that emerges from a standard human capital earnings function fit by OLS. This means that under the assumption that the various sources of bias have comparable effects from one country to another, international comparisons could reasonably be based on similar specifications of the earnings functions estimated using OLS.

France

> *Marianne Guille and Ali Skalli*
> *in Colm Harmon, Ian Walker and Niels Westergaard-Nielsen (eds), Education and Earnings in Europe: A Cross Country Analysis of the Returns to Education. Edward Elgar, March 2001.*

In this article, our main motivation is to obtain as precise as possible estimates of private returns to education. These can indeed be compared with social returns and, hence, serve as a basis to the determination of the public resources to be devoted to education. This is, however, true only if private returns measure the productivity individuals acquire through the human capital that education endows them with. By contrast, if education serves only as a screen for potential employers to judge individuals' innate ability, then student-centered funding policies might be justified.

For this purpose, we present a series of estimates of private returns to education using French labour market data. We distinguish between the public and private sectors, men and women and between part-time and full-time female employees. We also analyse changes in the returns to education between the early 1970s and the late 1990s. We have three main goals. First, we analyse the stability of the estimated returns to education and evaluate their sensitivity to

different specifications of key variables, in particular earnings and measures of educational attainment. In the process, we update results of previous studies on returns to education in France. Second, we investigate two important sources of bias by providing new evidence for the endogeneity of schooling and by taking account of women's participation in the labour market. Third, we propose tests of predictions of the screening hypothesis.

The basic ingredient of our analysis is the estimation of Mincer-type equations. However, the recent literature highlights a variety of empirical problems that this approach leads to, such as those related to ability biases and the endogeneity of schooling. Fortunately, the extent of data availability allowed attempts to overcome these sources of bias to be made. Nevertheless, even in the absence of such biases, there remains the question of how to interpret the estimated returns to education. Indeed, since Arrow and Spence, the screening hypothesis argues that these returns reflect no productivity augmenting role of education, but only its role as a device of signalling to employers the innate capabilities of individuals. Empirical analyses have shown, however, that although signalling may play a role, the evidence is still in favour of the human capital theory. Therefore, the question is to evaluate that part of the returns that is due to signalling effects, if any.

Not all aspects of the earnings–schooling relationship have been thoroughly investigated in the French literature, mainly because of data limitations. For instance, no attempt has been made to evaluate the importance of ability biases, simply because no ability measures are available in French data sets. This article is no exception. Yet, it aims at giving the reader an overview of the French labour market outcome of education by exploiting the richness of the data sets available and by using several testing techniques for each hypothesis investigated. Two examples will make our approach clearer.

First, not only do we test the endogeneity hypothesis on the basis of different as well as more recent data sets, but we also use different instruments, the accuracy of which is validated by a severe testing procedure. Second, we propose a variety of tests of the existence of bonus returns for completing a degree (sheepskin effects) and, using detailed information on individuals' educational records, we examine several predictions of the screening hypothesis.

It is worth noting that the estimates of returns to education and, hence, the importance of any source of bias depend on a variety of parameters: earnings measure, human capital measures, specification, workers' groups, period of investigation, etc. A further new aspect of the article is its focus on the sensitivity of the estimated returns to these parameters before any attempt to purge them from bias. This approach allows us to show how the returns to education are sensitive to wage determinants other than education and experience and how they vary over time for different worker groups. In particular, our results suggest that there are important differences between men and women. They highlight a major break in the evolution of the gender gap in returns: while returns were higher for men prior to the 1990s, they became favourable to women. For instance, in 1993 the rate of return was 6.29% (5.66%) for women (men). Note, however, that during the whole period, they were systematically higher for men in the private sector. Evidence is also given on a declining trend for men as well as for women. Furthermore, though there is a remarkable change in women's attitude in the French labour market in terms of participation and part-time work, the returns to education change very little when their choice of labour supply is taken into account

While part-time and non-participation related selectivity biases for women seem to be very small, endogeneity of schooling turns out to be a much more serious source of bias. Indeed, the hypothesis of exogenous schooling is strongly rejected by various robust tests. When education is treated as a choice variable and its determinants are accounted for, the resulting returns increase by 2 percentage points. Furthermore, while the exogeneity hypothesis suggests that the gender gap in returns is in favour of women, this is no longer the case when endogeneity is taken into account.

We also confirm the idea that the number of years of schooling is a rather crude measure of education in a country like France, where multiple education streams co-exist. Indeed, the returns to qualifications that require the same number of years of schooling differ according to whether the diploma is general or vocational, but also from one educational field to another.

Finally, a thorough examination is performed of the screening hypothesis, based on information on individuals' educational records and a variety of tests. The results indicate that although there are non-negligible bonus returns from completing a degree (sheepskin effects), the evidence for the screening hypothesis remains mixed. On the one hand, the returns to qualifications seem to decrease with the number of years it takes individuals to pass them. On the other hand, only for men do repeated (skipped) years have a negative (slightly positive) effect on earnings.

Working papers:

The Returns to Education in France: A Sensitivity Analysis

Marianne Guille and Ali Skalli
ERMES Working Paper n° 00-05 (Extended version of the publication "Chapter 5: France" presented above.)

The Role of Schooling: Screening versus Human Capital

Ali Skalli
ERMES, 1999. Mimeo.(A summary is included in Chapter 4 of this volume.)

Student Loans in Europe: An Overview

Marianne Guille
ERMES, 2000. Mimeo.(A summary is included in Chapter 10 of this volume. The full paper is available at the PURE web-site www.etla.fi/PURE)

A Note on the French Educational System

Marianne Guille
ERMES, 1999. Mimeo.

The French educational system is largely dominated by a public service that is laic and receives 80% of the pupils. We shall focus first, on the demographic and curricula aspects of secondary and higher education (HE) and second, on financial problems.

As schooling is compulsory since 1959 for all children living in France and aged between 6 and 16, they all attend primary and lower secondary schools. In addition, enrolment rates and schooling expectancy have soared since the mid-eighties. Hence, by 1991 France had joined the leading group of countries (together with Germany, Switzerland and Japan) with respect to the schooling enrolment rates of 17–18 year-olds, and more than three-quarters of the children now reach the upper secondary level. This level is composed of three main branches: general, technological and vocational education. The first two include three years in traditional *lycées* (high schools), where successful students are then given the general or technological *Baccalauréat*. Vocational upper secondary education offers different qualifications, which require two or three years of schooling in apprenticeship training centres or in vocational high schools, where various specialisations are proposed and especially a vocational *baccalauréat,* since 1987.

In 1996, 85% of the pupils in age to pass these upper secondary degrees were successful. Some 70% of these had been given the *Baccalauréat*. These figures are the result of a spectacular rise in the number of *bacheliers*, since only 35% of a generation passed the *baccalauréat* fifteen years ago while 60% of a generation now reach tertiary education. Such a transition from *élite* to mass higher education (HE) has led to considerable diversification of the French HE system. One of its distinguishing features was the co-existence of an open and a closed sector. The former comprises universities where vocational and selective programmes have been progressively introduced in addition to the traditional long streams of general content. The latter comprises the old and prestigious *Grandes Ecoles,* but also more recent schools offering short vocational programmes.

While the *Baccalauréat* is sufficient to enter universities, the best *bacheliers* are selected for two further years in preparatory classes before application to enter a *Grande Ecole*. Students are then selected among those applicants who have had the highest scores in national competitive exams. If the access to *Grandes Ecoles* is selective, students meet no further selection process during their schooling career. Opposite to this, there is free entry to universities but access to either doctoral programmes or vocational ones depends on the scores students have had during their previous years in HE.

Apart from health training, where there is selection through a competitive exam at the end of the first year, all traditional long streams offered by universities (law, economics, science, humanities) have similar structures. Successful students are given a first qualification (*DEUG*) after two years, a second one (*Licence*) a year later and, finally, the college degree (*Maîtrise*), yet another year later. The only requirement to access any of these is graduation from the previous level. Opposite to this, admission is selective for the *third cycle* (post-graduate level), the first year of which provides an initiation to research intended for students who aim to attend doctoral programmes or, since 1973, a vocational degree which involves courses and within-firm placements. Other new vocational short programmes have been created within universities in recent years which last two to three years beyond the *Baccalauréat*. Though offered by universities, all vocational programmes are selective since they are open to limited numbers of students.

Grandes Ecoles are traditionally specialised in three major fields: administration, business and engineering. Schooling lasts between three and four years beyond preparatory classes. In addition there are specialised schools (arts, paramedical training, etc. and short programmes leading to vocational degrees, which require two or three years of schooling beyond the *Baccalauréat*. Though less selective than *Grandes Ecoles*, access to these short vocational streams requires success in an exam, a test or an interview. This seemingly high segmentation of the French system of HE is, however, only partial. Indeed, university graduates may choose to enter *Grandes Ecoles* though they still need to pass the admission process. Alternatively there are admission rules defining the level at which a *Grande Ecole* student may enter a university. Students having attended short vocational programmes, however, have to pass a special exam to enter a university beyond the first degree (*DEUG*).

It is worth noting that any pattern remains virtually permissible, except that entry to a given level requires graduation from the preceding level. Hence, the actual number of years of schooling of an individual holding a given qualification may be either lower or higher than the number of years which is typically required to attain that qualification. Individuals may skip one or more primary school classes or they may have to repeat a year at any step of their schooling career, if their scores are too low. They may also attend classes of a given level and drop out before graduation at that level or choose an unusual pattern. Indeed, not all patterns that end up at the same level of certification are equally efficient. For instance, the "short secondary vocational–secondary general–university" pattern requires more years of schooling than the "secondary general–university" pattern but is rather frequently observed. Students try to avoid

providing a signal of personal failure to achieve the higher academic levels, which are typically attended after completion of general secondary degrees.

Finally, as in many European countries, education is expensive and its financing is mainly due to the public sector. Not only did private and public funding of educational establishments represent 6.3% of GDP (OECD country average of 5.6%) in 1995, but the public source alone represented 5.8% of GDP (OECD country average of 4.9%). As a consequence of the spectacular rise in the number of graduates and students, education is now the first budget of the French public sector. And even though this financing is still more centralised than is the case in most other OECD countries, it is nowadays more decentralised towards regional and local authorities. Although the share of primary and secondary education is always dominant, the one allocated to HE has grown. Indeed, not only has the number of students increased sharply, but the growing number of vocational courses yielded new and higher costs.

The French expenditures per pupil are close to the OECD average, except that they are much higher for secondary education and clearly inferior for HE. Moreover, like in many European countries, qualitative efforts for students have decreased, especially since the seventies. Finally, expenditures vary largely from one student to another. The cost of a *Grande Ecole* student is much higher than the one of a university student, and within universities the student costs are higher in vocational and technical programmes (medicine, science) than in general courses, particularly in law, economics, management and humanities. This means that private financing of education is rather limited. Schooling is absolutely free of charge in public schools until the lower secondary level: no fees, no travelling costs, even books are provided for free. Assistance is also given to families for accessory expenses, such as school lunches, according to social criteria and by various means (prices rebates, education grants). For upper secondary education, the only difference concerns the books, which must be paid by the parents. In addition, HE requires student fees. However, if one considers that there is a clear trend towards higher fees in Europe, France is the only country between a minority, which still raises no fees (like Denmark and Germany), and a majority, which raises substantial fees (between €300 and €3000). The basic French fee was around €112 in 1995. Hence, contrary to several European countries, the State has not engaged in a reform to increase the financial participation of students by raising fees and developing loans, according to the World Bank's recommendations.

Finally, the public financial aid directly provided to students in France is limited to a programme of grants attributed according to social criteria to some 19% of the under-graduates. These grants dispense them from paying fees and serve to cover a part of their living costs. The amounts depend on different criteria, such as parents' income, number of siblings, distance between the university and the parents' home, etc. There are also other grants attributed according to merit criteria to *third cycle* students. However, the State also provides a subsidy to students' social security, tax deductions for the students' parents, and meals (canteens), price rebates for students' travelling costs and social housing. In general, these indirect subsidies are omitted in international comparisons.

Work in progress:

The Screening versus Human Capital Hypotheses: Evidence from France and Spain

Fernando Barceinas–Paredes, Josep Oliver–Alonso, José Luis Raymond–Bara, José Luis Roig–Sabaté and Ali Skalli (A summary is included in Chapter 11 of this volume.)

Comparing the Pay of French Civil Servants and Private Sector Employees

Ali Skalli

Comparison of the wage structures in the public and the private sector has been the subject of numerous empirical studies. Efficiency as well as employment conditions in the public sector are indeed important policy issues. Moreover, many analyses aiming at estimating the possibly positive signalling value of education are based on the idea that, compared to private-sector employees, those working in the public sector constitute a screened group.

A common feature of these empirical studies is the identification of determinants of the differences in the pay structure of the two sectors. However, the literature highlights large inter-country as well as intra-country variations in the conclusions. While cross-country variation might simply reflect institutional differences, divergent conclusions for the same country are more problematic. They certainly indicate how sensitive the results are to model specifications as well as to estimation methods. Besides variations in the effort researchers exert to overcome the various potential sources of bias, the modelling of the sector choice made by individuals seems to be a major issue. Indeed, this requires the availability of choice determinants influencing individual wages via the sectoral choice only. This means that the robustness of results depends on whether the data are rich enough to provide appropriate indicators.

This study aims at comparing the wage structures of the French private and public sectors. The data sets used allow robust estimation of sector-specific wage equations. Indeed, not only does the study propose various sectoral-choice specifications based on alternative choice determinants, but it also takes into account several potential sources of bias. The analysis focuses mainly on the role of unemployment. Indeed, French civil servants face no unemployment risk while private-sector employees do. Hence, the study tries to identify the importance of the unemployment risk as a determinant of self-selection into the private or the public sector. The structural model that the study is based on shows that wages in the private sector depend on the probabilities of unemployment durations, suggesting that there must be compensating wage differentials for the unemployment risk. It also aims at proposing an explanation of the rather well-known result according to which education has a strong positive effect on the probability of working in the public sector. Indeed, since the probability of unemployment is decreasing with the educational level, compensating differentials for the unemployment risk should be zero or at least significantly lower for highly educated people.

Private and Social Returns to Education: Evidence from France

Sandoss Benabid, Marianne Guille and Ali Skalli

The most popular means of measuring returns to education is to estimate so-called Mincer equations, where such returns are evaluated as the effect on an individual's earnings of an extra year of schooling. The resulting estimates are the internal rates of return given that the only costs of education are opportunity costs and that individuals earn nothing at school and, as such,

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give a measure of the incentives for an individual to invest a further year in education. Moreover, to the extent that the extra earnings due to an extra year of education reflect the effect of the latter on productivity, the estimated returns might also serve as an indicator of whether society must devote more or less resources to education.

Obviously, these estimates should take into account not only the benefit side, namely the increase in earnings from an extra year or cycle of education, but also the cost side, that is, the earnings individuals forego while in school as well as the schooling costs incurred by individuals or their families. Two reasons might explain why such costs are so often ignored. First, the available data do not necessarily allow calculations of private costs of schooling. Second, it has long been admitted that the average global effort in favour of education is mainly due to the public sector.

However, because of the spectacular rise in the number of students since the late 1960s in Europe, the public budget on education has experienced a rapid growth at the same time as most governments have faced an extended period of financial stringency. Given that education is not a pure public good, a possible response to this funding crisis is to increase, on a significant scale, private funding of higher education, a strategy particularly supported by the World Bank, whose recommendations are relayed by numerous analyses. Indeed, several countries have raised their tuition fees, especially in Europe where such fees were very low until the 1980s, and/or have expanded their systems of student loans, although these are mostly publicly funded.

This strategy allows higher education to be funded while reducing the financial constraints that the transition from an élite to mass higher education leads to. It has a price, however: rising private costs of education. Yet, students are not the only recipients of the benefits from education; there are positive social returns as well. This implies that an efficient solution should consist of a mix of private and public funding. As a consequence, social returns must be evaluated not only to set priorities for future educational investments but also to allow comparison with private ones in order to choose an efficient mix of private and social funding.

Social rates of returns have been less widely analysed than their private counterparts. The literature proposes two major estimation methods. On the one hand, macroeconomic analyses try to link education to its cost as well as to countries' economic growth performance and, as such, are meant to shed light on the external benefits from education. These analyses seem to conclude to social profitability of investing in education. On the other hand, in microeconomic analyses, social returns are estimated in the same way as private ones, net of public costs. However, since the provision of education is often largely subsidised, this will tend to raise private returns above social ones. Obviously, at least part of the resulting private/social differential in returns should be offset if one accounts for fiscal benefits of education, i.e. taxation of private returns.

This study aims at estimating social returns to education in France using a microeconomic approach. Indeed, by exploiting individual data as well as detailed description of the cost structure of individuals' education according to the year they left school, their qualification and their educational records, we are able to analyse the impact of these costs on the returns to education. Moreover, the French case is interesting as it is one of the few European countries that seem to be reluctant to engaging in a policy reform of the funding of education. Indeed, like many other European countries, France has faced a spectacular rise in the number of *bacheliers* and students since the late sixties, accompanied, however, by a decreasing trend in private returns to education. Yet, although there is a clear trend towards higher fees in Europe, these have remained rather low in France. Moreover, public financial aid provided directly to students in France still comprises no loans and is limited to a programme of grants, which are attributed to some 19% of undergraduate students according to social criteria. The State also provides a subsidy to students' social security, social housing and canteen meals, tax deductions for students' parents as well as price rebates for travelling costs.

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Ioannis Cholezas

The structure of hourly earnings inequality in the European Union
Panos Tsakloglou

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Peter Archer, Kevin Denny, Damien Hannon and Colm Harmon
Department for Education and Employment (London), March 2000

Functional literacy, educational attainment and earnings: evidence from the international adult literacy survey

Kevin Denny, Colm Harmon and Sandra Redmond
IFS Working Paper No. 00/09, March 2000

The impact of education and training on the labour market experiences of young adults

Kevin Denny and Colm Harmon
IFS Working Paper No. 00/08, March 2000

Returns to the Quantity and Quality of Education: Evidence for Men in England and Wales

Colm Harmon and Ian Walker

Economica 67(265), February 2000

Education Policy Reform and the Return to Schooling from Instrumental Variables

Kevin Denny and Colm Harmon
IFS Working Paper No. 00/06, January 2000, and CEPR Discussion Paper 2518

A Review of Estimates of the Schooling/Earnings Relationship, with Tests for Publication Bias

O. Ashenfelter, Colm Harmon and H. Oosterbeek
Labour Economics 6(4), November 1999, 453–470

The Economic Return to Schooling in Ireland

T. Callan and Colm Harmon
Labour Economics 6(4), November 1999, 543–550

Literacy and Education in the Ireland

Kevin Denny, Colm Harmon, Dorren McMahon and Sandra Redmond
Economic and Social Review 30(3), July 1999, 215–224

Speeches:

Cognitive Skills, Educational Attainment and Earnings – Evidence from the International Adult Literacy Survey

Economic and Social Research Institute, Dublin, 4th February 1999
Department of Economics, MIT, Massachusetts, USA, 30th March 1999
Industrial Relations Group, Princeton University, Princeton, USA, 23rd March 1999

Functional Literacy and the Labour Market

Department of Education, Dublin, 16th September 1999

Family background in Instrumental Variable estimates of schooling returns

NUI Maynooth, 7th December 1999
Summer School in Labour Economics, University of Warwick, 21st July 2000
IFS, London, 31st March 2000
European Society of Population Economics Congress, Bonn, 17th June 2000
World Econometric Society Congress, Seattle, 11th August 2000

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Publications:

Returns to Education in Italy: A Review of the Applied Literature

Giorgio Brunello, Simona Comi and Claudio Lucifora
in Rita Asplund and Pedro Pereira (eds), Returns to Human Capital in Europe:
A Literature Review. ETLA, B 156, Helsinki, 1999.

The Return to Education in Italy

Giorgio Brunello, Simona Comi and Claudio Lucifora
in Colm Harmon, Ian Walker and Niels Westergaard-Nielsen (eds), Education
and Earnings in Europe: A Cross Country Analysis of the Returns to Education.
Edward Elgar, March 2001.

Working papers:

The Return to Education in Italy: A New Look at the Evidence

Working Paper, Fondazione ENI Enrico Mattei, December 1999. The paper was in late 2000 listed on SSRN's Top Ten download list for the topic "Labor: Human Capital".

Selective Schools

Giorgio Brunello and M. Giannini
Working Paper, Fondazione ENI Enrico Mattei, 75/99

Education and Earnings Growth. Evidence from 11 European Countries

Giorgio Brunello and Simona Comi
Working Paper, Fondazione ENI Enrico Mattei, 29/2000. (Also available at the PURE web-site www.etla.fi/PURE. A summary of the study is included in Chapter 3 of this volume.) The paper was in late 2000 listed on SSRN's Top Ten download list for the topic "European Economics".

Absolute Risk Aversion and Returns to Education

Giorgio Brunello
IZA Discussion Paper n°192, August 2000

The College Wage Gap in 10 European Countries: Evidence from Two Cohorts

Giorgio Brunello, Simona Comi and Claudio Lucifora
Working Paper, Fondazione ENI Enrico Mattei, 85/2000. (Also available at the PURE web-site www.etla.fi/PURE. A summary of the study is included in Chapter 3 of this volume.)

Speeches:

Selective Schools

Giorgio Brunello
PURE project meeting in Barcelona, January 2000

The Returns to Education in Italy

Claudio Lucifora
56th Congress of IIPF on Human Capital, Sevilla, Spain, August 2000

The college wage gap in 10 European countries: evidence from two cohorts

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Publications:

Private Returns to Education in the Netherlands: A Review of the Applied Literature

Joop Hartog, Joop Odink and Jeroen Smits
in Rita Asplund and Pedro Pereira (eds), Returns to Human Capital in Europe: A Literature Review. ETLA, B 156, Helsinki, 1999.

Rendement op scholing stabiliseert

Joop Hartog, Joop Odink and Jeroen Smits
Economisch Statistische Berichten 4215, 1999, 582–583

New results on returns to education in the Netherlands

Jeroen Smits, Joop Odink and Joop Hartog
in Colm Harmon, Ian Walker and Niels Westergaard-Nielsen (eds), Education and Earnings in Europe: A Cross Country Analysis of the Returns to Education. Edward Elgar, March 2001.

Schooling, Family Background, and Adoption: Is It Nature or is it Nurture?

Erik Plug and Wim Vijverberg
Available at the PURE web-site www.etla.fi/PURE

Work in progress:

Differences among Countries, Trends, and Decompositions of Earnings Inequality in 15 European Countries

Joop Odink and Jeroen Smits

The Explanation of Trends in Earnings Inequality in 14 European Countries

Jeroen Smits, Joop Hartog and Joop Odink

Speeches:

PURE project meeting in Barcelona, January 2000 (Joop Odink)
PURE project meeting in Warwick, July 2000 (Joop Odink)
Second PURE user-oriented seminar in Lisbon, October 2000 (Joop Odink)

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Publications:

Education and Earnings in Norway

Erling Barth and Marianne Røed
*in Colm Harmon, Ian Walker and Niels Westergaard-Nielsen (eds), Education
and Earnings in Europe: A Cross Country Analysis of the Returns to Education.
Edward Elgar, March 2001.*

The Return to Human Capital in Norway. A Review of the Literature

Erling Barth and Marianne Røed
*in Rita Asplund and Pedro Pereira (eds), Returns to Human Capital in Europe:
A Literature Review. ETLA, B 156, Helsinki, 1999.*

Return to education – variations between countries and over time

Erling Barth and Marianne Røed
Søkelys på arbeidsmarkedet 1/00, ISF, Oslo, 2000 (in Norwegian)

Return to education in Norway 1980–1995

Erling Barth and Marianne Røed
Søkelys på arbeidsmarkedet 1/99, ISF, Oslo, 1999 (in Norwegian)

Work in progress:

External Effects of Education? Evidence from the Wage Structure

Erling Barth – manuscript available at the PURE web-site www.etla.fi/PURE
This paper explores the idea that there are spillovers from education within establishments.
Establishments with a higher share of educated workers are more productive. The theoretical
analysis explores the consequences of this for the wage structure. Two sources of matched

employer–employee data are used to investigate this idea empirically. The empirical evidence shows that there is an independent effect of the average educational level of the employees, in addition to the individual's return to education. This result is valid even after controlling for individual heterogeneity.

The Market for Higher Education in Europe

Erling Barth, Arnaud Chevalier, Gauthier Lanot, Marianne Røed and Josef Zweimüller
ISF, manuscript.(A summary of the study can be found in Chapter 8 of this volume.)

Returns to education for Europeans in the US labour market

Erling Barth and Bernt Bratsberg

Speeches:

Return to education in Norway and in other European countries

Marianne Røed
User-oriented seminar in the Norwegian Ministry of Labour and Administration, October 5th, 1999.

External Effects of Education? Evidence from the wage structure

Erling Barth
Research seminar, Statistics Norway, December 1999.
EALE/SOLE conference, Milano, Italy, June 2000.
AEA conference, Helsinki, Finland, September 2000.

Returns to education for Europeans in the US labour market

Erling Barth and Bernt Bratsberg
Institute for social research, Oslo, 2000.

The wage premium to education in the Nordic countries – a European perspective

Marianne Røed
Nordic conference on labor market statistics, Loka Brunn, Sweden, October 25–27, 2000.

The market for higher education in Europe

Erling Barth
Second PURE user-oriented seminar, Universidade Nova de Lisboa, October 27th, 2000.

The market for highly educated workers in Europe

Marianne Røed
User-oriented seminar in the Norwegian Ministry of Labour and Administration, November 14th, 2000. User-oriented seminar for all government departments, Oslo, December 1st, 2000.

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Publications:

Wages and Human Capital: Evidence from the Portuguese Data

> *Pedro Telhado Pereira and Francisco Lima*
> *in Rita Asplund and Pedro Pereira (eds), Returns to Human Capital in Europe:*
> *A Literature Review. ETLA, B 156, Helsinki, 1999.*

Objective and method: To analyse applied research on wage formation in the Portuguese labour market, in particular the robustness of the results, by surveying previous published and unpublished research.

Results and policy implications: The estimated coefficients associated to education, total work experience and tenure are positive and rather robust. Individuals with over-education earn less, if they are assigned correctly, but earn more than their co-workers with less education. Wages in the Lisbon region are higher than in other regions. As the results seem to be robust it is correct to assume that returns to education in Portugal are high, therefore more investment (either private or public) in education is justified.

Returns to Education in Portugal, 1982–1995: High and Rising

> *Pedro Telhado Pereira and Pedro Silva Martins*
> *in Colm Harmon, Ian Walker and Niels Westergaard-Nielsen (eds), Education*
> *and Earnings in Europe: A Cross Country Analysis of the Returns to Education.*
> *Edward Elgar, March 2001.*

Objective and method: To present a thorough and robust analysis of Mincer returns to education for Portugal. We covered a long time period (1982–1995), different data sets ('Quadros de Pessoal' and 'European Community Household Panel'), different econometric methodologies (Ordinary Least Squares, Instrumental Variables, Heckman Selectivity Correction), and different equation specifications (linear and non-linear schooling, simple or extended, gender separated or pooled, etc). Another objective was to describe the evolution of the education system as well as of the labour market in Portugal.

Results and policy implications: We have uncovered high and increasing rates of return to education in Portugal. These are consistently above 9% and reach up to 13% by the end of the

period considered. No substantial gender differences were found. Strong differences were detected in terms of the payoff to different educational levels: the higher ones (secondary and tertiary education) are associated with much higher (and increasing) returns, whereas the lower ones are characterised not only by lower but also by falling returns. Results from non-linear specifications also suggest that the decision of the mid-70s to drop the intermediate technical branches led to a subsequent increasing payoff to those workers who had previously benefited from that school training. Finally, these estimates proved robust to a number of sensitivity tests performed. The evidence on high returns to education may have ambiguous policy implications. More specifically, they may suggest that governments should spend more on schooling given the high returns that individuals receive. Alternatively, governments should spend less on schooling given that the perception of high returns should *per se* make individuals engage in further schooling and provided that liquidity constraints are dealt with by means of credit markets. However, given the large evidence on market failure in these respects (e.g. the impossibility of taking schooling attainment as collateral, or the supposedly large externalities of education) we subscribe to the first type of policy implications. In a different dimension, our historical analysis of returns to education suggests that the above-mentioned mid-70s decision to abolish the technical streams in secondary education was misguided given that it probably led to a shortage of such type of human capital. In prospective terms, this result recommends education policy decisions to be grounded also on labour market concerns. Moreover, a strong outlook as regards future skill needs be put into practice.

Does Education Reduce Wage Inequality? Quantile Regression Evidence from Fifteen European Countries

Pedro Telhado Pereira and Pedro Silva Martins
Faculdade de Economia da Universidade Nova de Lisboa Working Paper 379; Institute for the Study of Labour (IZA, Bonn) Discussion Paper 120; ETLA (Helsinki) Discussion Paper 709. (The paper is also available at the PURE website www.etla.fi/PURE. A summary of the study appears as Chapter 6 of this volume.)

Objective and method: This works aims at shedding light on a little researched topic, that is, the link between schooling and wage inequality. Whereas the common view is that further schooling gives rise to a more balanced distribution of earnings, a more thorough approach would conclude that this is not necessarily the case. We address this topic empirically using comparable individual data from all fifteen PURE countries, and for two to four points in time during the 1980–1995 period. More precisely, we use Quantile Regressions, a more sophisticated and insightful method than the more common Ordinary Least Squares (OLS) technique. Unlike OLS, QR does not force researchers to assume the same contribution of explanatory variables across the distribution of the dependent variable. We applied this technique to Mincer equations, where earnings are seen as a function of schooling and experience, and where the coefficient on schooling can be interpreted as a rate of return. In this way, we examine whether the contribution of schooling to earnings is different across the wage distribution. This amounts to assessing the role of schooling for individuals whose unobserved characteristics place them in a given relative section of the wage distribution. The empirical part of the study uses

Results and policy implications: We find that the most representative pattern across PURE countries is that of a more important role of schooling for those individuals whose unobservables award them higher wages. In a looser sense, the "better paid" are the ones who benefit the most from schooling. Imposing the same return to education to the entire wage distribution thus seems to miss some important information concerning the features of each country's wage-setting systems. The few exceptions to this pattern were found for Denmark,

Germany, Greece and Italy, where the return to education is either stable or falling across the wage distribution. The study also presents comparable, panel-data-type information on each country's schooling attainment levels, wage inequality, experience levels, average returns to education, and the data sets used. The obtained results suggest that the link between schooling and inequality might be positive rather than negative: education might lead to further inequality if within-educational-level wage inequality is not compensated for by a reduction in between-educational-level wage inequality. A possible explanation for this is that some individuals might draw more insight from their schooling, which then translates into higher earnings and a more unbalanced wage distribution. Policies aiming at less wage inequality, which have so far depended quite considerably on schooling, should henceforth regard education in a more suspicious manner. Policy-makers, together with researchers, should also attempt to pinpoint the reasons that contribute to the different results across countries.

Educação, Salários, e Desigualdade: A Situação Europeia e o Caso Português (Education, Wages, and Inequality: The European Situation and the Portuguese Case)

Pedro Telhado Pereira and Pedro Silva Martins
Economia Pura, April 2000 (also available at the PURE web-site
www.etla.fi/PURE)

Schooling, Wage Risk and Inequality

Pedro Telhado Pereira and Pedro Silva Martins
submitted to an economics journal (The paper is also available at the PURE web-site www.etla.fi/PURE. A summary of the study appears as Chapter 6 of this volume.)

Objective and method: To shed further light on the link between schooling and wage inequality and to introduce the concept of wage risk (i.e., the wage uncertainty of further schooling). The method is based on Quantile regressions applied to Mincer equations.

Results and policy implications: We find a stylised fact across the 15 PURE countries, implying that returns to education are higher at the top of wage distribution. Individuals who, conditional on their characteristics, do better at the labour market receive higher returns to their schooling. This suggests that higher educational levels are associated with an increasing spread in wages, which means that within-levels inequality increases with the educational level. This result holds for all countries except for Germany, an outlier as its returns to schooling are similar both at the bottom and the top of the wage distribution. Moreover, we uncover a strong positive correlation between average (OLS) returns to education and our measure of educated-related wage risk (the difference between returns to schooling at the top and the bottom of the wage distribution). This indicates that there may be country-specific mechanisms that equate the average return and its spread. The specific characteristics of the German education system and the fact that this country breaks the pattern uncovered for all other PURE countries may imply that German-specific features attenuate the forces that drive an increasing spread in wages for the higher educated. Among these features are little variation in school quality, a strong vocational component and a relatively low number of university graduates. More generally, the results suggest that increasing schooling attainment may have the drawback of trading between-levels inequality by within-levels inequality, which would lead to an ambiguous final outcome in terms of overall wage inequality. On a different note, the wage risk result (and its very concept) suggests that the link between schooling and earnings should not be interpreted in a

straightforward manner, as the process involves what in some countries is a substantial amount of uncertainty.

Educação e Desigualdade (Schooling and Inequality)

Pedro Telhado Pereira and Pedro Silva Martins
forthcoming in Nova Economia, January 2001

Avaliação e Reforma do Sistema Educativo Português
(Evaluation and Reform of the Portuguese Education System)

Pedro Silva Martins
Newspaper "Diário Económico", November 28, 2000 (available at the PURE web-site www.etla.fi/PURE)

Objective and method: To put in perspective the resources spent in the Portuguese education system and some of its implications. To apply some simple tools of economic analysis to a matter of great public importance in Portugal, which involves the allocation of a sizeable share of the government's budget. To suggest some lines of reform, towards a more cost-effective education system, thus contributing to the current on-going debate in Portugal. This is done by reviewing international results on students' outcomes and education system characteristics, mainly drawn from international institutions such as the European Commission (e.g. the 'European Report on Quality of School Education'), the Organisation for Economic Cooperation and Development (e.g. 'Education at a Glance') and the International Monetary Fund (e.g. 'The Efficiency of Education Expenditure in Portugal'). Data collection from national sources, including the Ministry of Education and the Ministry of Finances.

Results and policy implications: Evidence is found to suggest a reasonable amount of inefficiency in the Portuguese education system. The relationship between the amount of resources spent (e.g. the share of GDP) and the proficiency displayed by Portuguese students in international exams is rather unfavourable for the country. The system may be liable to bottlenecks at several levels, including the incentive mechanism designed for teachers. Moreover, a serious degree of lack of transparency is uncovered as regards the financial allocation within the different sub-levels of the system. International results also suggest that the human capital endowment of the Portuguese working population is substantially lower than that of both current and prospective European Union countries. A set of reforms is suggested in order that future generations could draw on better (higher quality and/or less costly) publicly-provided schooling. Among these are: updated incentive systems for teachers (including rewards for student performance), defining clear performance goals for public schools, setting minimum students-teachers ratios, and raising university fees (while increasing scholarships for students from poorer backgrounds).

Rendibilidade da Educação na Europa (Returns to Education in Europe)

Pedro Telhado Pereira and Pedro Silva Martins
Economia Pura, December 2000

Work in progress:

A Meta-Analysis of Returns to Education in Portugal
Pedro Telhado Pereira and Pedro Silva Martins

Quantile Regression Evidence on Non-Linear Returns to Education in Europe
Pedro Telhado Pereira and Pedro Silva Martins

Explaining Quantile Regression Returns to Education: Portuguese and Swedish Evidence
Mahmood Arai, Christian Kjellström, Pedro Martins and Pedro Pereira

Financial Expectations of Portuguese Undergraduate Students
Pedro Telhado Pereira and Pedro Silva Martins

Returns to Education and Educational Policy in Portugal
Pedro Silva Martins and Pedro Telhado Pereira

Speeches:

Does Education Reduce Wage Inequality? Quantile Regression Evidence from Fifteen European Countries

Pedro Telhado Pereira and/or Pedro Silva Martins
Seminars at PURE Barcelona project meeting (January 2000), Banco de Portugal (March 2000), Faculdade de Economia da Universidade Nova de Lisboa (March 2000), Ministério das Finanças (March 2000), University of Oxford Young Economists' Meeting (March 2000), Portuguese Ministry of Finance (March 2000); IZA Summer School (June 2000), European Society for Population Economics (June 2000), Instituto Superior de Economia e Gestão (June 2000).

Schooling, Wage Risk and Inequality

Pedro Telhado Pereira and/or Pedro Silva Martins
Seminars at the European Science Foundation Euresco Conference 'European Society or European Societies' (September 2000), European Education Research Association Meeting (September 2000), Faculdade de Economia da Universidade Nova de Lisboa (September 2000), second PURE users-oriented seminar in Lisbon (October 2000), Warwick University Economics PhD seminar (November 2000)

Avaliação e Reforma do Sistema Educativo Português (Evaluation and Reform of the Portuguese Education System)

Pedro Silva Martins
Seminars at Instituto Francisco Sá Carneiro/Hotel Tivoli Lisboa (June 2000) and Confederação da Indústria Portuguesa/Feira Internacional de Lisboa (October 2000)

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Publications:

Los rendimientos de la educación en España (Returns to education in Spain)

Fernando Barceinas, Josep Oliver, José Luis Raymond and José Luis Roig forthcoming in Papeles de Economía Española (available at the PURE web-site www.etla.fi/PURE)

The article analyses from the beginning of the eighties up to mid nineties the temporal evolution of returns to education in Spain. Here after, the returns to education by educational levels as well as by university degrees are studied, considering also the effects that education has on the unemployment probability. It is concluded that educational investments are profitable and that this profitability has experimented a certain increase from 1990, in spite of the strong increase that in the Spanish human capital stock. This is indicative of a more intensive rhythm of growth of demand than supply of human capital, which can be a by-product of technological change in a wide sense.

Hipótesis de señalización frente a capital humano. Evidencia para el caso español (Signalling hypothesis vs. human capital. Evidence for the Spanish case)

Fernando Barceinas, Josep Oliver, José Luis Raymond and José Luis Roig forthcoming in Revista de Economía Aplicada (available at the PURE web-site www.etla.fi/PURE)

In this paper a set of procedures is employed to test the signalling hypothesis versus the human capital hypothesis, as the more adequate explanation of wages in Spain. We use information from different sources (Household Budget Survey 1990/91, Continuous Household Budget Survey 1985–1996, European Household Panel 1994 and Wage Structure Survey 1995). The

general conclusion is that, despite that a weak impact of signalling should be considered, the human capital theory explains the lion part of wage differentials in Spain.

Rendimiento público de la inversión educativa y restricción presupuestaria
(Public returns to educational investment and budget constrain)

Fernando Barceinas, Josep Oliver, José Luis Raymond and José Luis Roig
forthcoming in Papeles de Economía Española (available at the PURE web-site
www.etla.fi/PURE)

The work analyses the role of public expenditure in education as a human capital investment. It is proved that the human capital investment is not only profitable from an individual point of view, but also the public sector obtains a high return from such expenditure. This return for the public sector comes from the increase of the tax revenues that the increase in the individual educational level implies. So, in the long term, for these kinds of expenditure, the budget constrain disappears.

Work in progress:

Rendimientos de la educación y efecto tratamiento. El caso de España
(Returns to education and treatment effect. The Spanish case)

Fernando Barceinas, Josep Oliver, José Luis Raymond and José Luis Roig
(available at the PURE web-site www.etla.fi/PURE)

OLS estimations of returns to education may be inconsistent due to the endogeneity of the "schooling" variable. Estimating returns by instrumental variables techniques has turned out to be a popular way to solve the problem. However, it has been demonstrated that these assessments may be reflecting the returns of a specific group of the community, which is known as the "treatment" effect. Considering this, returns to education related to the "treatment" effect caused by the 1970 Educational Reform in Spain have been estimated. The main result is that the group that might supposedly have benefited from the Reform (talented individuals with financial restrictions) obtained a very much higher average return on their investment in education than the rest of the population, mainly because of the impact over worked hours.

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Publications:

Returns to human capital in Sweden

Mahmood Arai and Christian Kjellström
in Rita Asplund and Pedro Pereira (eds), Returns to Human Capital in Europe: A Literature Review. ETLA, B 156, Helsinki, 1999.

Sweden

Mahmood Arai and Christian Kjellström
in Colm Harmon, Ian Walker and Niels Westergaard-Nielsen (eds), Education and Earnings in Europe: A Cross Country Analysis of the Returns to Education. Edward Elgar, March 2001.

Work in progress:

Variations in returns to education across the income scale. Evidence from data for 1968, 1974, 1981 and 1991

Mahmood Arai and Christian Kjellström

Explaining Quantile Regression Returns to Education: Portuguese and Swedish Evidence

Mahmood Arai, Christian Kjellström, Pedro Martins and Pedro Pereira

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Publications:

Wages and Human Capital: Evidence from Switzerland

Bernhard A. Weber and Stefan C. Wolter
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