The Redistributive impact of Education in the European Union[1]

Cathal O'Donoghue

National University of Ireland, Galway,
Economic and Social Research Institute, Dublin and
Université Libre de Bruxelles

February 2003

Communication préparée pour le séminaire organisé par
LE CONSEIL DE L EMPLOI, DES REVENUS ET DE LA COHÉSION SOCIALE (CERC),
LA DIRECTION DE LA PROGRAMMATION ET DU DÉVELOPPEMENT
(DPD, MINISTÈRE DE L EDUCATION NATIONALE) ET
L INSTITUT NATIONAL DES STATISTIQUES ET DES ETUDES ECONOMIQUES (INSEE)

« *Les effets redistributifs de l'éducation : les enseignements d'une approche monétaire statique* »
PARIS, 15 novembre 2002

Abstract

In this paper we considered the redistributive impact of education in Europe utilising the European Community Household Panel Survey, waves 1994-1998. We considered the redistributive effect of education across the population. We also examined the lifetime perspective, comparing the returns made to higher education levels both from the perspective of higher employment rates and from higher potential earnings. We also reported a model of the university entry decision incorporating some of the costs and benefits of education. Education expenditures in most countries are not sufficient to eliminate intergenerational inequality where students from richer backgrounds or families with a history of attending university are more likely to attend university. Lastly we considered fiscal returns to education where education expenditure by increasing the earnings and employment potential of individuals benefits the public finances through reduced transfer payments and increased taxation.

Keywords: Education, Redistribution, Europe, Microsimulation.

JEL Classification: D71, H52,

Preliminary Draft. Not for Quotation. Comments Welcome

[1] This paper is based upon empirical analyses carried out by as part of a research program to construct a Dynamic Microsimulation Model for Europe, EUROPOP. The author gratefully acknowledges financial assistance from the National University of Ireland Galway, Millennium and Commerce Faculty Research Funds, CERC (Council for Employment, Income and Social Cohesion) and the Irish Department of Agriculture Rural Stimulus Fund. This paper refers to results based on prototype and full models constructed by EUROMOD, financed by the Targeted Socio-Economic Research programme of the European Commission (Grants CT95-3009 and CT97-3060). The paper uses data from the European Community Household Panel provided by Eurostat via the Department of Applied Economics at the *Université Libre de Bruxelles*. The author is responsible for all remaining errors.

1. INTRODUCTION

In most OECD countries, education is one of the largest items of public expenditure forming between 5 - 7% of GDP (See OECD Database). It is an important investment tool, which can improve worker productivity and influence economic growth. As an important determinant of labour productivity, it also therefore has an important influence on earnings and through the tax/transfer system on public finances.

As an item of government expenditure targeted at households with members who are students and financed typically in part through general taxation, there is a degree of redistribution associated with this expenditure. Education expenditure, because it tends to increase the productivity and the employment prospects of individuals also has a lifetime redistributional role, where the recipients of more education on average will have higher lifetime income.

Public expenditures on education form only a part of the costs of education. Students and their families often bear the cost of foregone earnings, transportation, books and other costs. As a result, higher income families may be more able to afford to have their children continue in education beyond the compulsory school leaving age. Similarly those who have experienced the benefit of further education are more likely to value its benefits and encourage their children to continue in education. These effects are thus examples of the influence of intergenerational characteristics on education participation. Government expenditure on education may help to reduce intergenerational inequality, to reduce the impact of background, enabling children from poorer backgrounds to continue in education and to benefit from the lifetime returns mentioned above.

The returns to education are not only private to the individuals who participate in education. Additionally however, higher labour earnings resulting from higher levels of education can lead to higher taxes and lower transfers. Thus the state may be able to recoup some of its investments through fiscal returns to education.

This paper is divided into eight sections. The next section gives some theoretical background to the redistributional impact of education financed by taxation. Section 3 describes the data used in this paper, the European Community Household Panel Survey. In Section 4 we consider the cross-sectional redistribution impact of education expenditures on students in EU countries. Section 5 reports the life-cycle returns to education. In section 6 we examine the incentives to continue on to tertiary education, considering the influence of family background, economic conditions and returns to schooling. Section 7 investigates the fiscal return to education. Section 8 concludes.

2. BACKGROUND THEORY

In this section we consider some of what economic theory has to say about redistribution and education. State subsidies to education have an impact on redistribution as they enable families with students in education to use resources on other consumption items. However the primary redistributive impact of education is through its impact on life-cycle earnings and employment.

The human capital approach to education, developed by Mincer (1958) and Becker (1964) assumes that education improves a worker's productivity and thus earnings, that earnings rise over time, but the rate of increase falls with age and that the rate of return falls as educational attainment rises. Numerous studies have focused on this issue and confirm the positive correlation between education and earnings (See Psacharopoulos, 1993). However the positive rate of return to education may not be related to improved productivity. Griliches

(1977) argued that there is an upward bias in the return to education as individuals with higher 'ability' tend to have higher education levels than individuals with lower ability. Willis (1986) however questions why a profit maximising firm would choose to pay individuals on the basis of their education rather than their productivity. Spence (1974) postulated the "screening" theory to account for this. If employers cannot observe the true ability of potential workers, then operating under the assumption that higher ability workers will have found it easier to obtain educational qualifications, then education can be used as a proxy for potential productivity. However Kroch and Sjoblom (1993) in comparing the effect of the ranking of education ability within cohorts and the total amount of schooling found little evidence to support the signaling theory in the USA. Similarly the existence of positive returns to education by the self-employed would also negate the signaling impact.

Although higher education levels results in higher productivity, there may be diminishing returns. Historically the earnings premium fell as greater numbers of people attained higher levels of education as evidenced by Freeman (1976) who found that the earnings premium of college education in the USA was lower in the mid- 1970's than after World War 2 and in other countries by Psacharopoulos (1993). However over the last two decades in Anglo-Saxon countries, as the demand for higher skilled workers has increased, educational earnings premia have risen despite increasing numbers of those with higher levels of educational attainment. This can be potentially be explained by technological change, which tends to increase the productivity of higher skilled workers more than lower skilled workers and the growing international division of labour as developing countries compete in the output of the low skilled. In continental European countries, the wage effect has been less important as educational premia have remained quite stable over time (See OECD, 1995).

In addition to the impact of education on wage rates, there may also be an influence on employment rates. Those with higher education attainments are more likely to be employed. Dréze and Malinvaud (1994) argue that the effect of rising demand for skilled workers relative to unskilled in Europe has not had as much of an effect earnings differentials because of the stickiness of wages and that instead has manifested itself in terms of rising levels of unemployment for the lower educated.

More educated workers are likely to be able to perform a wider range of tasks than less educated workers, both because of higher specific human capital and because they are easier to train in new skills. They will thus be able to position themselves higher in the employment queue. Individuals with higher education levels are also likely to have higher potential wages in work and thus have lower replacement rates, leading to higher labour supply levels. This effect is likely to be compounded by family circumstances for women such as the presence of children, hence the particularly low labour supply rates for less educated married women. Low educated workers are also likely to be more dispensable during economic downturns and thus will tend to have lower employment tenures.

Glyn and Salverda (1998) found evidence that the employment differential may be as a result of competition from the developing world in labour intensive goods. Also an individual with low levels of education is more likely to be unemployed in an economy with high average levels of education. Orszag et al. (1998) argue that this may result from the fact that business methods may not designed for the low skilled. Economic decline appears in particular to affect the lower skilled as countries with lower levels of employment will tend to have higher employment differentials. As Glyn and Salverda note, this situation has worsened over time as in virtually all countries they examined, the employment position of the lowest quartile of achievers has worsened with respect to the highest quartile achievers. This is a trend also noted by Orszag et al. (1998), whose findings indicate that Glyn and Salverda's numbers would be worse if the rising educational attainments had also been factored in. The worsening employment prospects of the less educated has been attributed to new of technology. Rising levels of technology reduce the range of tasks which can be performed by workers and the

increased complexity has raised the cost of training. These changes are likely to affect the lower educated to a greater degree as more educated workers are likely to find it easier to adapt to new technology and have lower training costs than less educated workers.

One of the core features of recent policies targeted at the unemployed has been to increase skill levels in order to improve the chances of getting a job. Examples include FÁS training schemes in Ireland, the New Deal in the UK, and the labour market integration aspects of the RMI in France. What evidence is there that this is successful and therefore that differential employment rates affect the rate of return.? It is possible that as the best of the poorly educated individuals move to higher levels of education the unemployment levels of both high and low educated individuals increase as the average quality of workers in both groups decrease. There is however little evidence for this. For example Cohen et al. (1997) found no difference in the group specific unemployment rates in France and the USA despite very different labour force shares by education level. Also in an time series study on the impact of rising educational levels on employment in Germany and the USA, Orszag et al. (1998) found that as the labour force share of the lowest educated has fallen, the unemployment rate of this group has gradually risen relative to the unemployment rates of the higher educated levels, which have followed movements in aggregate unemployment over time. Saint-Paul (1994) argues that is as a result of the fact that a labour force shift from unskilled to skilled reduces the marginal productivity of the low skilled and because of real wage rigidity, unemployment for this group rises.

Economists often argue that higher education should not be subsidised as in the absence of capital market imperfections and externalities, the market should deliver an efficient level of human capital investment. Subsidies to education would only create distortions. Also due to ability bias in the return to education, (See Angrist and Krueger, 1991), education and innate ability are complementary and so subsidies to education therefore mainly favor higher ability people and thus leads to a widening instead of the income distribution.

Dur and Teulings (2001) however argue that an increase in the mean level of human capital reduces the return to human capital due to a substitution effect. This is because the supply of high-skilled workers goes up, reducing their relative wages, while the supply of low-skilled workers goes down, increasing their relative wages, therefore reducing wage inequality. When this indirect, general equilibrium effect of education subsidies is sufficiently large, it may offset the direct income effect due to the complementarity of education and ability. For other policy instruments such as progressive income taxation, redistribution usually results from the income effects of a policy, while the substitution effects reduce their effectiveness. Dur and Teulings argue that for education subsidies, it is the other way around; substitution effects contribute to redistribution, while income effects work in the opposite direction.

Persson and Tabellini (1994) show that pre-tax income inequality increases the political support for high marginal tax rates. As high marginal rates impair incentives and therefore growth, a dispersed pre-tax income distribution reduces growth and so policies that achieve a flatter pre-tax income distribution while promote economic growth.

As noted above if the costs of human capital acquisition such as fees, foregone earnings and other costs are not tax deductible, while the benefits from education in the form of higher earnings are taxed, human capital decisions are distorted An education subsidy may help correct for this (Trostel, 1996). Similarly, progressive income taxation will tend to introduce a distortion into human capital accumulation as education subsidies may help to remove distortions in human capital accumulation arising from progressive income taxation (Bovenberg and Jacobs, 2001).

Saint-Paul and Verdier (1993), Perotti (1993), and Benabou (1999) highlight the role of capital market imperfections. Individuals who have to borrow at rates above the market value

may underinvest in human capital. However capital market imperfections may not fully account for the extent of education subsidies. Recent empirical analyses highlight the low importance of borrowing constraints for educational choices (Cameron and Heckman, 1998 and 1999, Keane and Wolpin, 1999, Shea, 2000, and Cameron and Taber, 2000).

Capital market imperfections in themselves therefore justify the extent of educational subsidies. If only objective of subsidies to education subsidies were to improve equality of opportunity then, targeted or means tested subsidies would be sufficient. However education is subsidised more broadly than this. The general equilibrium effect of investment in human capital can provide a motivation for this.

Levhari and Weiss (1974) note that risks associated with human capital investment cannot be diversified in the same way as risks associated with investment in physical capital. If variance of income earned with education increases with the level of education, risk-averse individuals then choose less education than without uncertainty. However if the variance of income earned decreased with the level of education, risk averse individuals would invest more in education under uncertainty than without it. Therefore, uncertainty related to the returns to education does not necessarily imply that human capital investment is discouraged. Eaton and Rosen (1980) show that if returns are uncertain, welfare can be increased by having a positive wage tax rate and returning tax revenues as a lump-sum transfer. A rising marginal tax rate would provide more complete income insurance than linear taxation, but it would also mean that returns on education would be taxed more heavily than its costs. Nielsen and Sørensen (1997) argue that linear tax on labor income and a positive tax on capital income would distort investment decisions towards excessive human capital investment. Progressive taxation could negate this distortion. García-Peñalosa and Wälde (2000) argue that a graduate tax is better than other alternatives such as income-contingent loan schemes when there is uncertainty because the latter require general tax revenue to subsidize low-income workers, whereas graduate tax would avoid reverse redistribution from those not educated.

3. DATA

This paper uses the *European Community Household Panel Survey* (ECHP). The ECHP is collected by national agencies on behalf of EUROSTAT. This survey is currently available for 1994-1998. Each survey is representative at the national level across 14 countries of Europe. Sweden is excluded, while Austria and Finland joined in later years. In Germany and in the UK, the panel changes in 1997, where existing national household panel surveys became the data in the ECHP

The survey contains a variety of income, social, demographic and labour market variables at the individual and household levels. In order to consider the redistributive effect of education we need information about who attends school and how much it costs. The ECHP contains information about the current level of education participation in the following uniform categories:

- Higher University Degree
- First University Degree
- Non degree Tertiary Level
- Upper Secondary
- Lower Secondary
- Primary

We aggregate the tertiary and university categories into one heading. For children aged under 17, only some relationship and register information (the child sample) is available. Hence we have imputed age related education levels based upon table A.1 in Appendix A for this age group.[2] An assumption made is that if an individual was in education in the last year in the child sample, then the imputed education level cannot be higher than the education level attended as observed in the first year of adult sample. There were 218 cases in the ECHP where this imputation had an effect. Also we assume that all individuals below the school leaving age are attending school unless the working over 15 hours variable is equal to 1. This may tend to over-estimate the numbers attending school as in some countries there may be substantial numbers who leave before this age.

Information about the public cost of each of these levels of education has been obtained from OECD statistics as defined in Appendix A, table A.2.

In modeling the cross-sectional redistribution of education subsidies, we consider only those children who are present in a household as we cannot easily identify without reducing the sample size substantially and introducing selection bias students who are dependent on members of a household but resident elsewhere.

In modeling the transition into higher education, we consider as our base those who had been living at home in a particular year and in education who either entered university or were in upper secondary education and left education altogether.

4. CROSS-SECTIONAL REDISTRIBUTION

This section describes the redistributive effect of education considering a cross-section at a point in time. We adopt an approach similar to Callan (1992) and Antoninis and Tskaloglou (2000). We take a single wave (two) of the ECHP as the basis of our analysis.

While there are theoretical objections to the use of the cost of providing a public service as a measure of a social benefit, without measures of the output from public services, the input costs have to be used. If benefits are proportional to costs, then costs can be used as a proxy. We utilise average costs collected by the OECD as the basis of our analysis. We apply these costs to each individual according to the level of education in which they are participating.

This section is concerned with the redistribution between households of different income levels. We utilise annual equivalised household disposable income as our ranking measure.[3] Equivalised income is used to incorporate economies of scale in a household when comparing welfare between households. In considering the impact on the welfare of households, we consider the change in equivalised household income.

One issue of concern is that we do not identify individuals with their parental households. Students living alone or with other students may be regarded as living in poor families having low current income, but their standard of living may actually be high due to parental transfers.[4] In the European Community Household Panel Survey, although, we can theoretically track individuals through time and so identify these inter household relationships. In reality attrition bias is likely to be important for household dissolution and so for now we ignore this issue. We will also underestimate the student population, especially

[2] The author is grateful to members of the EUROMOD network for producing estimates of typical lengths of education levels.
[3] The equivalence scale used is 1 for the first adult, 0.5 for later adults and 0.3 for children aged under 17.
[4] The ECHP does collect information on private transfers, but such variables are notoriously unreliable.

the third level population living in university accommodation as they are not considered part of the household population.

We make the assumption that households benefit as a whole from education expenditure, so if the costs were not borne by the state they, would be borne by the household. Because we do not identify students with their parental households, we may ignore the fact that there may be international transfers due to substantial numbers of students studying overseas.

In this section, we use measures based on the Lorenz Curve to examine the degree of redistribution and progressivity.[5] The Lorenz Curve for pre-tax market income is simply a graph of the cumulative population share versus the cumulative income for the population ranked by order of their income. The Gini coefficient is a standard index of inequality, defined in equation (1):

$$G_M = 1 - 2\int_0^1 L_M(p)dp \tag{1}$$

where p is the cumulative population share and $L_M(p)$, the Lorenz Curve at point p. A population with no income inequality would have a Lorenz Curve of 45° and therefore a Gini of 0. If Lorenz Curve A lies completely inside curve B, then it is possible to say that population A has greater inequality than population B, with $G_A > G_B$. However if the Lorenz Curves cross, it is not possible to make inequality comparisons without using value judgments.

The index used here to measure redistribution is the Reynolds-Smolensky index, which is defined as the difference between the Gini coefficients for market income and post-instrument income, defined in equation (2).

$$\begin{aligned} \Pi_A^{RS}(v) &= G_M - G_{M+A} \\ &= 2\left(\int_0^1 (1-p)^{v-2}[L_M(p) - L_{M+A}(p)]dp\right) \end{aligned} \tag{2}$$

This effect is known as the redistributive effect. Palme (1996) however argues that it should be known as an equalising effect. This is because the difference of two Gini-coefficients does not imply a redistribution of income as it is not necessarily the case that both Lorenz Curves on which they are based, have the same ordering of units.

The Reynolds-Smolensky index of redistribution can be decomposed into the redistributive effect before reranking (the difference between the Lorenz curve for market income and the concentration curve for post instrument income) and the reranking effect of the instrument (the difference between the concentration curve and the Lorenz curve) as highlighted in equation (2). Equation (2) can be further transformed in equation (4) into three components, the progressivity (or departure from proportionality)(Π^K), the relative size of the instrument in question ($a/(1+a)$), (where a is the value of the instrument as a proportion of the pre-instrument income) and the horizontal or reranking effect (D) (see Kakwani, 1984).

Progressivity is a measure of the difference between the level of redistribution of an instrument relative to an instrument with the same revenue effect but where the effect is proportional to income. It is therefore a measure of the incidence of an instrument. If an

[5] The methods described here are standard methods for examining the degree of redistribution and progressivity in tax-benefit system (See for example Palme 1996).

instrument is disproportionally focused on the lower (upper) half of the distribution, then it is *regressive* (*progressive)*. If an instrument is regressive (progressive), the concentration curve for the instrument will fall outside (inside) the Lorenz curve of market income. If the instrument is proportional to income, the concentration curve will be exactly the same as the Lorenz curve for market income.

In terms of income taxes, progressivity relates to the ability-to-pay principle, whereby those with higher incomes are more able to pay higher taxes. A progressive income tax is therefore redistributive and thus inequality reducing. On the other-hand, benefits are redistributive if they are regressive, so that those with lower incomes receive higher benefits.

In this paper we use the Kakwani index of progressivity, which is the difference between the Lorenz curve for income and the concentration curve for the instrument in question.

$$\begin{aligned} \Pi_A^{RS} &= G_M - G_{M+A} \\ &= (G_M - C_{M+A}) + (C_{M+A} - G_{M+A}) \end{aligned} \tag{3}$$

$$\Pi_A^{RS} = \frac{-a}{1+a}\Pi_A^K + D \tag{4}$$

If policy instruments are based on characteristics other than income then income units may have a different order of incomes before and after the operation of the instrument. For example education subsidies are targeted at households with students and so households with students will receive subsidies while non-student households will not. This type of redistribution is known as horizontal redistribution. Changes in the order of income units in a distribution will result in the Lorenz curve of post instrument income being different to its concentration curve. The Atkinson-Plotnick reranking index, which is the difference between the Lorenz and concentration curves, is the measure of horizontal equity we use.

The redistributive effect of a policy instrument depends upon the size of the instrument and the progressivity or degree of targeting. A well targeted low value instrument may have a lower degree of redistribution than a poorly targeted high value instrument. We are restricted to considering only a subset of countries with available data on education costs. We thus ignore Austria, Denmark, Germany, Luxembourg and Portugal of the EU15.

In table 1 we report the amount of the redistribution due to each of the instruments. The numbers report the equivalised instrument as a proportion of total equivalised disposable income as this is the relevant income definition used here. Primary education and lower secondary education typically are the most important education instruments. The reason for this is mainly due to the higher proportion of the population and despite the higher costs of later education levels especially of tertiary education. Overall expenditure is bigger than most public transfer programs except for the large contributory pension plans and is similar in size to income taxation in each of the countries (See Baldini et al., forthcoming). Therefore as noted above education is a substantial expenditure program.

In table 2 we consider how targeted expenditure is utilising the Kakwani progressivity index.. The sign on the index for each education level in each country is negative indicating the expenditure tends to be targeted proportionally more on the poorest. Proportionally more of their welfare results from education expenditure than other income relative to higher income households. Comparing the targeting of education with those of other public expenditure programs (for example in Baldini et al., forthcoming), education tends to have a slightly higher degree of targeting than family benefits but is generally less well targeted than other

instruments. Universal education by it's nature is not targeted. Targeting results from the fact that students are more likely to live in poorer households. This is especially the case of countries with high child poverty levels such as Ireland and the UK. Greece with relatively low child poverty levels has less targeted education expenditure; children are more spread across the population. At this stage we have not focused on educational allowances and other forms of means testing that may exist in education systems in the different countries. University education is in general less well targeted than other levels. This is because this level of education is not compulsory and as we shall see below, children from richer households are more likely to participate and so transfers will tend to go higher up the income distribution. However the fact that we consider households of residence and not the household of dependency means that even these relatively low targeting is an over estimate as many of those poor households in receipt of tertiary education are essentially student households. If these students were allocated to their parent's households, then the absolute value of the index would be lower and in fact the sign may change direction in certain countries.

Combining the size of the instrument with the degree of targeting we consider using the Reynolds Smolensky index (with reranking) the redistributive impact of education expenditures over cross-sections of the population in table 3. In general both because of the smaller size and due to the fact that richer households are relatively more highly represented for these groups than for the compulsory school levels. Redistribution although less well-targeted than social assistance benefits, because of the higher value of benefits, often results in more redistribution. The Netherlands appears to have very little redistribution resulting from education despite a relatively high concentration of expenditure at the bottom of the income distribution. This is as a result of reranking noted above. While education expenditure is concentrated on those at the bottom of the income distribution when not considering this expenditure, once families with students move up the income distribution as a result of the transfers, the overall degree of inequality as measured by the post transfer Gini coefficient is similar to the pre-transfer Gini and so the Reynolds Smolensky Index, which is difference between the two is small. To see a decomposition of this effect in more detail, see table A.3 in the appendix to this paper.

5. LIFE-CYCLE REDISTRIBUTION

In this section we consider the redistributive effect over the lifetime of education. Table 4 produced by the OECD, describes the expected number of years of education in a lifetime. We see that there is a significant employment differential between education levels with men and women with higher education levels having higher expected years of employment. Due to greater labour supply elasticities, this differential is higher for women.

Utilising age earnings profiles for different education and gender groups, in table 5, we consider the effect of the employment differential combined with the earnings differential to see the lifetime employment income differential by education level. We sum annual earnings over the age groups to get estimates of lifetime earnings for different education groups.[6] We report the ratio of lifetime earnings for individuals with university education relative to those with lower secondary or below and upper secondary to lower secondary or below.

In every case except for the upper-secondary educated in the Netherlands, the average expected lifetime earnings are higher than for the lower educated. In general male upper secondary educated males earn about 50% more than lower educated males, due to a combination of both higher wages and better work records. University educated males earn about 50% more again. As employment differentials do not vary for males much across countries, the countries with proportionally higher lifetime incomes are countries with the higher earnings differentials. They are generally southern countries and Ireland, where the

[6] Underlying this calculation is the assumption that the discount rate is equal to the growth rate.

relatively lower numbers of higher educated in the population mean that supply is relatively lower for this group resulting in higher returns. Again largely for labour supply and employment differential reasons, higher educated females have relatively much higher

6. INTER-GENERATIONAL REDISTRIBUTION

In considering the degree of inter-generational redistribution contributed by the education systems, we consider the influence on family background on the third level entry decision. In our model of school entry, we assume that individuals will stay in education if benefits from education outweigh the costs of education. We look at those who are about to leave upped secondary education. The person has two choices, stay in education or leave education.[7] This model is described in more detail in O Ďonoghue (forthcoming).

The main cost of education is the foregone wage. We assume that for someone who enters tertiary education, their foregone earnings is the earnings an individual with upper secondary education of the same age in the same region would get if they didn t go to University. This restriction may be an underestimate due to the selection bias of those who do not continue to third level education. In most countries the coefficient is not significant. Where the coefficient is strongly significant, in 3 cases it is negative as one might expect, indicating that the higher the expected wage foregone, the lower the probability of continuing onto third level education. In the other two significant cases, foregone earnings has a positive coefficient. This is difficult to explain. It may have a geographical explanation so that those in regions with higher potential wages are also those with greater returns and so there may be some collinearity with expected lifetime benefits.

However for many the cost of not going to University is not foregone wages as youth unemployment rates are high. To incorporate this effect we include the regional youth (under 25) employment rate (as a percentage of those not in education) as a regressor. This is also a measure of labour market uncertainty. While some foregone earnings coefficients are negative almost none of the regional employment rates are. Higher employment rates mean that foregone earnings are more likely to be positive increasing the cost of education. Because of the size of the positive returns to education, a positive coefficient on the youth employment rate may indicate less uncertainty about getting a job on graduation, resulting in lower uncertainty and so an individual may be more likely to continue.

Many students also rely on parental support while attending University. We therefore include household disposable income of their parent s household from the last year of pre-University Education. We consider only those who are living at home with two parents in the last year of secondary schooling who leave upper second level education. Further work will extend this analysis to include individuals who lived with single parents or who were independent before going to University. The coefficients on this variable are generally positive indicating that students coming from families with higher education are more able to bear the cost of attending University and so are more likely to go to University. The number of adult equivalents in a household the lower the chance of going to University as resources need to be spread across more people in the household, reducing the ability to pay for University.

The benefit of education can be expressed by expected lifetime earnings, which is the sum of expected annual earnings times the expected employment rate. For identification purposes, we include region and time as explanatory variables. We assume therefore that individuals base expectations on the earnings differentials of the regions they live in. This assumption may be restrictive. We incorporate the impact of discounting by assuming that the growth rate of earnings is equal to the growth rate. Therefore the sum of predicted earnings over the work lifetime is equal to the discounted sum predicted earnings allowing for annual earnings

[7] This model may incorporate rationing due to a restriction in the number of third level places.

growth. To save on simulation time, we consider only income from 5-year intervals from 25 to 55 inclusive. The variable we use is the difference between the expected lifetime earnings with university education and upper secondary education. In most cases the coefficient is positive, even if not significantly so. It is difficult produce variability across individuals as all individuals have the same education level and similar ages. Therefore the only variability introduced in predicted lifetime earnings is that based on regional and time differences.

As an influence of family background, we include the difference between the age of parents as an explanatory variable. The wider the age difference, the more conservative the family is likely to be and so perhaps the lower the discount rate. The coefficient is generally negative indicating that these families may be less likely to send their children to university preferring them to take the less uncertain route of going into work. There is also likely to be an income effect, where the older that age gap, the older the father and so the more likely it is for the father to be in or near retirement.

We also include parental highest education level, as families without experience of tertiary education may be less likely to send their children there. The coefficients on these variables are almost entirely positive with university educated being higher. Thus more highly educated parents are more likely for their children to go to University. Parental marital status is also included as a regressor, although this in general is not significant.

We also include a range of demographic variables, of the individual at the time such as marital or cohabiting status, gender, place of origin and disability status. As expected disability to reduce the likelihood of progressing. Surprisingly however those born in other countries are more likely to continue on to university. The coefficients on the other demographic variables are usually not significant, although it seems that males are more likely to progress on the tertiary education.

7. FISCAL RETURNS AND REDISTRIBUTION

As we have seen, more educated individuals are more likely to be in employment over their lifetime and more likely to have higher earnings. Both of these effects are likely to have a positive effect on the public finances as taxes will be higher and benefits lower. In this section we report on previous work of the author examining the fiscal returns to education (See O Ďonoghue (2000)).

The measure used to consider the fiscal rate of return is the marginal benefit of an extra years education as described in O Ďonoghue (2000).[8] This effectively is a measure of the rate of return to an investment at a particular point in time rather than across the life-cycle. This method was estimated using a prototype simulation model. Because simulation allows marginal benefits to be calculated for individuals this measure has an advantage that estimates can be produced for sub-groups of the population, such as for different age groups or income levels. It thus allows one to examine the degree of targeting of government policy.[9]

[8] However that costs and benefits do not occur at the same time. For convenience we make an assumption that discount rates are equal to growth rates, and therefore it is possible to compare price adjusted quantities from different time periods in this manner.

[9] The benefits and the costs however depend on whose perspective the rate of return is being measured. From society's point of view the rate of return relevant is the social return to education. In this case we consider only monetary benefits to society from increased total earnings (gross earnings plus employer contributions), ignoring other non-monetary benefits such as reduced crime levels and other spillovers. In fact Haveman and Wolfe (1984) find that in the USA, standard rate of return estimates capture only about three-fifths of the full-value of education. Total costs to society refer to total earnings foregone plus the direct costs both public and private of education. The second concept examined is the private return to education, which measures the marginal benefit to the individual (net private income:- earnings plus transfers minus taxes and contributions) to the private cost of extra schooling (direct

$$\text{Marginal Benefit of Education} = \frac{\text{Benefit}(s + d) - \text{Benefit}(s)}{\text{Cost}(d)} \quad (2)$$

The cost of the extra year depends upon the type of return being calculated. We report the social, private and fiscal returns for comparison purposes for four European countries. We simulate the marginal benefit of a year of education using Mincerian earnings equations, combined with a mechanism to account for increasing employment levels. The tax-benefit simulation model then simulates the resulting change in taxes and benefits.

Table 7 outlines the marginal benefit of education in terms of social, private and fiscal benefits. The values in the table represent the average marginal benefit rate of a marginal increase in education. Two scenarios are considered, at one extreme where the marginal benefit of education does not include any employment response and at the other, where existing employment differentials are maintained.

Marginal benefits are relatively lower in Germany as a result of lower youth unemployment, which means that young people opting not to continue in education are more likely to find a job than in other countries. This relationship is not however maintained for fiscal benefits. Here the size of the tax system dominates, so that Italy and Germany with the highest tax rates have the highest ratio of fiscal to social returns. We also notice that although the UK has the highest private and social returns, it has the third highest fiscal returns as a result of the lower tax rate. Comparing the three measures, we find that private returns are higher than social returns which are in turn higher than fiscal returns.

We would expect countries with higher unemployment benefit rates and/or high unemployment levels to have higher fiscal returns. Also the higher the replacement rate, the lower the private returns and the lower the social returns. In general when considering employment differentials in the measurement of the marginal benefit, fiscal returns increase the most of the three returns. Thus in using education as a mechanism to promote employment, the state gains relatively more than do those moving into employment. The biggest impact on fiscal returns occurs in Germany, which in addition to having a high employment differential for men has quite high unemployment benefits. Fiscal returns increase the least in Italy as a result of a low level of unemployment benefits, which correspondingly result in the highest increase in private returns.

8. CONCLUSIONS

In this paper we considered the redistributive impact of education in Europe. Education as generally a universal public expenditure program is less concentrated than other social programs. However expenditure especially on lower education levels is concentrated relatively more on poor households as students and children in general are morel likely to be living in these households. Although less targeted the total redistributive effect exceeds that of most of the transfer programs due to the size of the expenditure on education which is comparable in most countries to the revenues raised by income taxation. Turning to the lifetime perspective, we found that as expected there are substantial returns to education and especially for women the employment differential resulting from higher labour supply elasticities are important in driving the lifetime income differential between different education levels. We also reported a model of the university entry decision. Education expenditures in most countries are not sufficient to eliminate intergenerational inequality where students from richer backgrounds or families with a history of attending university are

---

private educational costs plus net private income foregone). Thirdly we focus on the fiscal return to investment in education, where benefits are net government revenue (taxes plus contributions minus transfers) and costs are net revenue foregone plus the public direct cost of education.

more likely to attend university. While these results in themselves are not surprising, the models themselves will be used in a dynamic microsimulation model to determine not merely what types of individuals will go to universities, but in a simulated population which individuals. Lastly we considered the phenomenon that although education expenditure by increasing the earnings and employment potential of individuals benefits individuals themselves, there is also a significant gain to the public finances from reduced transfer payments and increased taxation. While the returns are lower than for the private individual, they are comparable to rates of return on other types of investment and so from the state's point of view investment in education may yield good returns.

REFERENCES

Acemoglu, Daron J., and Joshua Angrist 1999, "How Large are the Social Returns to Education? Evidence from Compulsory Schooling Laws", *NBER Working Paper* 7444.

Alsalam N. And R Conley, 1995, "The Rate of Return to Education: A Proposal for an Indicator", Education and Employment, Paris: OECD.

Angrist, Joshua D., and Alan B. Krueger 1991, Does Compulsory School Attendance Affect Schooling and Earnings?, Quarterly Journal of Economics, 106(4), pp. 979-1014.

Ansersson, Fredrik, and Kai A. Konrad 2000, "Human Capital Investment and Globalization in Extortionary States", mimeo.

Antoninis, M. and P. Tsakloglou, 2000, "Who benefits from public education in Greece? Evidence and Policy Implications." Paper presented to the International Institute for Public Finance conference Seville, August.

Baldini, M., D. Mantovani and C. O'Donoghue, forthcoming, "Modeling the progressivity of indirect taxes in Europe: An Application of EUROMOD", EUROMOD Working Paper Department of Applied Economics, University of Cambridge.

Becker, G., 1964 *Human Capital theoretical analysis with special reference to education*. New York: Columbia University Press for NBER.

Benabou, Roland 1999, Tax and Education Policy in a Heterogeneous Agent Economy: What Levels of Redistribution Maximize Growth and Efficiency?, *Econometrica*.

Bils, Mark, and Peter J. Klenow 2000, Does Schooling Cause Growth?, *American Economic Review*, 90(5), pp. 1160-1183.

Boadway, Robin, Nicolas Marceau, and Maurice Marchand 1996, "Investment in Education and the Time Inconsistency of Redistributive Tax Policy", *Economica* 63, 171-189.

Bourguignon, F., C. O'Donoghue, J. Sastre-Descals, A. Spadaro and F. Utili, 1997 "Technical Description of Eur3: a Prototype European Tax-Benefit Model", Microsimulation Research Note MU/RN/25.

Bovenberg, A. Lans, and Casper van Ewijk 1997, "Progressive Taxes, Equity, and Human Capital Accumulation in an Endogenous Growth Model with Overlapping Generations", *Journal of Public Economics* 64, 154-179.

Bovenberg, A. Lans, and Bas Jacobs 2001, Redistribution and Education Subsidies Are Siamese Twins, *CEPR Discussion Paper* No. 3309.

Callan, T., 1992. "Who Benefits from Education?" Economics and Social Research Institute Working Paper No. 32. Dublin: ESRI.

Cameron, Stephen V., and James J. Heckman 1998, Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males, *Journal of Political Economy*, 106(2), pp.262-333.

Cameron, Stephen, and Christopher Taber 2000, "Borrowing Constraints and the Returns to Schooling", *NBER Working Paper* 7761.

Card, D., 1994. "Earnings, Schooling, and Ability Revisited". *Princeton Industrial Relations Section* Working Paper: 331, pages 46.

Dur, Robert, and Coen N. Teulings 2001, "Education and Efficient Redistribution", mimeo: Ersamus University Rotterdam.

Eaton, Jonathan, and Harvey S. Rosen 1980, "Taxation, Human Capital and Uncertainty", *American Economic Review* 70 (4), 705-715.

Fernandez, R., and R. Rogerson. 1995. "On the Political Economy of Education Subsidies." *Review of Economic Studies* 62 (2), 249-262.

Fernandez, Raquel, and Richard Rogerson 1996, Income Distribution, Communities, and the Quality of Public Education, *Quarterly Journal of Economics*, 111(1), pp. 135-164.

Freeman R., 1976. The overeducated American. NY: Academic Press.

García-Peñalosa, C., and K. Wälde. 2000. "Efficiency and Equity Effects of Subsidies to Higher Education." *Oxford Economic Papers* 52, 702-722.

Glyn A. and W. Salverda, (1998). "Employment Inequalities", paper presented to the LoWER conference "Policies for Low-Wage Employment and Social Exclusion in Europe", University of Groningen, November.

Goldin, Claudia 1999, Egalitarianism and the Returns to Education during the Great Transformation of American Education, *Journal of Political Economy*, 107(6), pp. S65-94.

Goldin, Claudia, and Lawrence F. Katz 1999, The Returns to Skill in the United States across the Twentieth Century, *NBER Working Paper* No. 7126.

Haveman R.H. and B.L. Wolfe, 1984. " Schooling and Economic Well-Being: The Role of Nonmarket Effects", *Journal of Human Resources*, 19(3), pages 377-407.

Heckman, J.J. 1976. "A Life Cycle Model of Earnings, Learning and Consumption." *Journal of Political Economy* 84, S11-S44.

Johnson, G. 1984. "Subsidies for Higher Education." *Journal of Labor Economics* Vol. 2, 303-318.

Judd, K.L. 1998. "Taxes, Uncertainty, and Human Capital." American Economic Review 88 (2), 289-292.

Keane, Michael P., and Kenneth I. Wolpin (2001), The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment, *Penn Institute for Economic Research Working Paper* 01-018.

Kemnitz, A. 2000. "Social Security, Public Education, and Growth in a Representative Democracy." *Journal of Population Economics* 13, 443-462.

Kroch E.A. and K. Sjoblom, 1993. "Schooling as Human Capital or a Signal", *Journal of Human Resources*, 29(1), Winter 1994, pages 156-80.

Krueger, Alan B., and Mikael Lindahl 1999. "Education and Growth: Why and for Whom", *NBER Working Paper* 7591.

Levhari, D., and Y. Weiss. 1974. "The Effect of Risk on the Investment in Human Capital." *American Economic Review* Vol. 64 (6), 950-963.

Lorenz, W. and J Wagner, 1990. "A Note on Returns to Human Capital in the Eighties: Evidence from Twelve Countries."*Luxembourg Income Study Working Paper*, Number 54.

Mankiw N., D. Romer and D. Weil, 1992. "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics*, Vol. 107.

Milesi-Ferretti, Gian Maria, and Nouriel Roubini 1998. "On the Taxation of Human and Physical Capital in Models of Endogenous Growth", *Journal of Public Economics* 70, 237-254.

Nerlove, Marc, Assaf Razin, Efraim Sadka, Robert K. vonWeiszäcker 1993. "Comprehensive Income Taxation, Investments in Human and Physical Capital, and Productivity", *Journal of Public Economics* 50, 397-406.

OECD, 1996. *Education at a Glance-OECD Indicators*, Paris: OECD, Centre for Educational Research and Innovation.

O'Donoghue, C. 2000. "Estimating the Rate of Return to Education using Microsimulation", *Economic and Social Review*, Vol. 27, No. 5.

O'Donoghue, C. forthcoming. "Going to University, an Economic Analysis", *National University of Ireland Working Paper,*.

Orszag J.M., E.D. Phelps, G. Zoega, 1998. "Education and the Natural Rate of Unemployment", *Birkbeck College, Dept. of Economics Discussion Papers* 98/1.

Palme, M., 1996, "Income Distribution Effects of the Swedish 1991 Tax reform: An Analysis of a Microsimulation Using Generalised Kakwani decomposition", Journal of Policy Modelling, Vol. 18, No. 4, pp. 419-443.

Poutvaara, P., 2001, *Essays on the Political Economy of Education and Income Redistribution*, Unpublished PhD Thesis, University of Helsinki.

Pogue, T.F. and L.G. Sgontz. 1977. "Social Security and Investment in Human Capital." *National Tax Journal* 30 (2), 157-169.

Psacharopoulos, G., 1993. "Returns to Investment in Education: A Global Update", *Education and Employment Policy Research Working Papers of the Office of the Director, Latin America and the Caribbean The World Bank*, 1067.

Saint-Paul, G., 1994. "Unemployment and Increasing Returns to Human Capital", *CEPR Discussion Paper*, No 921.

Spence M., 1974. *Market signaling: Informational transfer in hiring and related screening processes*. Cambridge: Harvard University Press.

Shea, John 2000. "Does Parents' Money Matter?", *Journal of Public Economics* 77, 155-184.

Tilak, Jandhyala B.G. (1989), Education and its Relation to Economic Growth, Poverty and Income Distribution, World Bank, Washington.

Trostel, Philip A. 1993. "The Effect of Taxation on Human Capital", *Journal of Political Economy Vol.* 101, 327-350.

Van Ewijk, Casper, and Paul J.G. Tang 2000, "Efficient Progressive Taxes and Education Subsidies", CPB Research Memorandum 170, CPB Netherlands.

TABLES AND FIGURES

Table 1. Importance of Taxes, Benefits and Education Expenditure

Education	Belgium	France	Greece	Ireland	Italy	Netherlands	Spain	UK
University	2.3	2.3	2.3	4.8	2.7	2.8	3.5	1.5
Upper Secondary	3.5	2.1	1.1	1.6	2.7	0.5	3.5	1.8
Lower Secondary	3.6	4.7	1.9	3.7	3.1	5.1	3.8	3.8
Primary	3.6	2.9	3.6	5.8	8.0	3.6	2.9	4.3
All	13.1	12.0	8.9	15.9	16.4	12.0	13.7	11.5

Source: European Community Household Panel Survey (1995).
Note:

1. Income has been equivalised using the equivalence scale 1/0.5/0.3, where children are aged 17 or under.
2. Importance defined as equivalised value of instrument as a percentage of the equivalised of income without the instrument.

Table 2. Progressivity of Taxes, Benefits and Education Expenditure

Education	Belgium	France	Greece	Ireland	Italy	Netherlands	Spain	UK
University	-28.4	-39.2	-37.7	-11.6	-26.6	-45.4	-18.9	-7.9
Upper Secondary	-49.1	-46.5	-43.1	-57.2	-44.9	-49.9	-48.1	-42.0
Lower Secondary	-37.0	-42.3	-28.5	-63.7	-52.8	-37.2	-34.3	-47.0
Primary	-26.1	-32.3	-27.2	-44.6	-32.5	-46.9	-30.9	-47.3
All	-35.7	-40.0	-32.1	-40.4	-37.5	-42.5	-33.2	-41.2

Source: European Community Household Panel Survey (1995).
Note:

1. Income has been equivalised using the equivalence scale 1/0.5/0.3, where children are aged 17 or under.
2. Progressivity measured using Kakwani Index

Table 3. Redistributive Effect of Taxes, Benefits and Education Expenditure

Education	Belgium	France	Greece	Ireland	Italy	Netherlands	Spain	UK
University	0.42	0.58	1.07	0.71	0.39	0.52	0.28	0.76
Upper Secondary	1.34	0.78	0.87	0.80	0.88	0.18	1.36	0.61
Lower Secondary	0.97	1.45	0.43	2.05	1.29	1.45	0.96	1.82
Primary	1.59	0.74	0.71	2.12	2.68	1.40	0.69	1.96
All	3.25	3.35	2.15	4.46	3.80	0.32	3.08	3.27

Source: European Community Household Panel Survey (1995).
Notes:

1. Income has been equivalised using the equivalence scale 1/0.5/0.3, where children are aged 17 or under.
2. Progressivity measured using Reynolds-Smolensky Index, incorporating reranking. A decomposition of this index is included in the Appendix, table A.3

Table 4 Expected years in employment and out of the labour force for 25 to 64 years of age (1996)

	Below upper secondary	Upper secondary	Tertiary	Below upper secondary	Upper secondary	Tertiary
Women				*Men*		
Austria	19.6	23.6	29.5	28.3	31.5	35.3
Belgium	14	20.7	27.1	25.8	31.4	33.7
Denmark	22.5	29.2	33.5	27.7	32.4	35.3
Finland	20.9	25.8	31.1	24	27.1	32.4
France	18.9	24.8	29.1	27.2	30.7	33.6
Germany	17.4	24	29.6	26.3	30.7	34.2
Greece	15	14.4	24.4	33.3	31.7	32.9
Ireland	11.3	18.9	26.8	27.4	32.6	34.8
Italy	12.2	19.8	27.5	28.7	29.3	34.1
Luxembourg	14.2	22.5	29.7	29.8	33.1	36
Netherlands	15.6	22.4	27.9	27.8	32.1	33.2
Portugal	22.9	26.7	32.2	31.9	32	35.4
Spain	11.4	18.5	26.4	27.5	30.8	33
Sweden	25.3	30.5	34.2	29.6	31.7	34.3
UK	20	27.8	31.4	25	31.8	34.3

Source: OECD Education Database.

Table 5 Expected Lifetime Earnings from Employment

	Male		Female	
	Tertiary	Upper Secondary	Tertiary	Upper Secondary
Austria	2.17	1.46	3.38	1.80
Belgium	1.68	1.29	2.90	1.67
Denmark	1.71	1.26	1.84	1.48
Finland	2.60	1.43	3.56	1.80
France	2.43	1.35	3.04	1.73
Germany	1.42	1.12	2.03	1.30
Greece	2.45	1.62	4.44	2.08
Ireland	2.93	1.69	5.63	2.35
Italy	1.68	1.16	4.15	2.72
Luxembourg	1.86	1.31	3.02	2.06
Netherlands	1.32	0.98	1.92	0.97
Portugal	3.57	1.67	6.24	2.66
Spain	2.54	1.54	5.98	2.52
Sweden	1.62	1.21	1.78	1.30
United Kingdom	1.68	1.16	2.32	1.42

Source: ECHP 1994-1998.

Table 6 Logit Model of Participating in Higher Education

	At	Be	Dk	Fr	Ge	Gr	Ir	It	Nl	Pt	Sp	Uk
Male	-0.20	0.12	0.53	1.86***	3.20	1.14	4.70*	0.41	4.03	-0.18	-0.97	-5.07**
Foregone Earnings/100	-0.06	-0.09***	-0.02	0.08	3.42***	0.00	-11.27***	-1.45***	3.27	-0.01	0.03***	6.26
Regional Employment	-2.37	1.64	2.16	1.24	3.05	2.18**	0.00	0.12	21.84*	3.13***	0.84	3.71**
Extra Lifetime Earnings	0.000 0*	0.00	-0.33	0.10***	0.17	0.00**	0.22	0.03	0.09*	-0.001	0.000 3	-0.55**
Adult Equivalents in HH	-0.39**	-0.08	0.35	0.22	-0.12	-0.23**	-0.19***	-0.13*	-0.51*	-0.44***	-0.12*	0.00
Previous HH Disposable Income/10000	0.01***	0.00	-0.01	0.02*	0.01	0.00	0.33***	0.04	0.01	0.002***	0.003***	-0.06
Parent University Educated	0.37	1.61***	-0.14	1.85***	1.29**	1.08***	1.40***	2.47***	0.72	1.83***	1.23***	1.43***
Parent Upper Secondary Educated	0.23	1.18***	-0.31	0.83***	1.31***	0.98***	1.79***	1.31***	0.10	1.74***	0.82***	0.52
Parents Married		2.22*	1.36**	0.61	0.05			-0.22		0.46		-2.42***
Parent's Age Difference	-0.03	-0.10***	0.04	-0.04*	-0.02	0.00	0.05***	-0.01	-0.05	0.01	-0.01	-0.04
Married		-1.06	0.00***					-1.63*		-0.02		
Cohabiting	-0.93*		-1.38		1.33	-0.41		-0.11		-0.19	-1.74*	
Chronically Ill		-2.25***	-0.73	0.25	0.23	-2.32***	-0.75*	-0.40	-0.65	-0.32	-0.10	-1.43*
Foreign Born			0.79	-0.31			1.36*			0.87***	-0.32	2.27**
Wave	-0.76***	-0.45***	0.01	0.45***	0.41***	-0.98***	-0.23***	0.14***	-1.12**	-0.18***	0.01	1.23***
Constant	1.92	0.50	3.30	-6.77***	-12.21***	0.79	-0.04	0.35	-14.9*	-0.34	-2.72***	0.22
Number of obs	218	199	171	689	256	724	642	1044	155	710	1134	180
Pseudo R2	0.105	0.229	0.087	0.158	0.289	0.135	0.200	0.097	0.074	0.121	0.145	0.350

Source: European Community Household Panel 1994-1998

Notes:

1. Only for People living with parents in year before going to higher education.
2. *** indicates significant at the 95% level, ** at the 90% level and * at the 80% level. We report such wide confidence intervals because of the small sample size

Table 7 Marginal Benefit of Education (Average rate of return per equivalent disposable income quintile)

Average Rate of Return	Social	Private	Fiscal
Germany	6.7	9.6	5.0
Ireland	10.1	15.7	6.5
Italy	10.3	23.4	6.6
UK	11.7	25.7	5.6

Source: O Donoghue (2000)

APPENDIX A

Table A.1 Imputed Years of Education per Education Level

Country	Primary	Lower Secondary	Upper Secondary	University
AT	4	8	12	16
BE	6	8	12	17
DK	6	10	13	17
FI	7	10	13	17
FR	5	9	12	17
GE	4	9	12	17
GR	6	9	12	16
IR	8	11	13	17
IT	8	11	13	17
LU	4	7	11	15
NL	6	11	13	17
PT	4	8	11	16
SP	4	8	12	17
UK	5	9	12	15

Source: EUROMOD team members

Table A.2 Expenditure per student (US dollars converted using PPPs) on public and private institutions by level of education (based on full-time equivalents) (1995)

	Early childhood	Primary	Secondary	Tertiary		
				All	Non-university	University-level
Austria *	4 907	5 572	7 118	7 943	12 834	7 687
Belgium (Flemish Community) **	2 391	3 270	5 770	6 043	x	x
Denmark	4 964	5 713	6 247	8 157	x	x
Finland	5 901	4 253	4 946	7 315	6 933	7 412
France	3 242	3 379	6 182	6 569	x	x
Germany *	5 277	3 361	6 254	8 897	6 817	9 001
Greece **	x	x	1 950	2 716	1 750	3 169
Ireland	2 108	2 144	3 395	7 249	x	x
Italy *	3 316	4 673	5 348	5 013	6 705	4 932
Luxembourg	m	m	m	m	m	m
Netherlands	3 021	3 191	4 351	9 026	a	9 026
Portugal *	m	m	m	6 073	x	x
Spain	2 516	2 628	3 455	4 944	3 973	4 966
Sweden	3 287	5 189	5 643	13 168	x	x
United Kingdom **	5 049	3 328	4 246	7 225	x	x
OECD Total	2 685	3 595	4 971	10 444	7 447	12 018

Source: OECD Education Database.

Notes:

* Public institutions.

** Public and government-dependent private institutions.

[1] 1996 data.

[2] 1994 data.

Table A.3 Decomposition of Redistribution of Education

	Belgium	France	Greece	Ireland	Italy	Netherlands	Spain	UK
Average Rate								
University	2.3	2.3	2.3	4.8	2.7	2.8	3.5	1.5
Upper Secondary	3.5	2.1	1.1	1.6	2.7	0.5	3.5	1.8
Lower Secondary	3.6	4.7	1.9	3.7	3.1	5.1	3.8	3.8
Primary	3.6	2.9	3.6	5.8	8.0	3.6	2.9	4.3
All	13.1	12.0	8.9	15.9	16.4	12.0	13.7	11.5
Redistribution: Reynolds-Smolensky								
University	0.42	0.58	1.07	0.71	0.39	0.52	0.28	0.76
Upper Secondary	1.34	0.78	0.87	0.80	0.88	0.18	1.36	0.61
Lower Secondary	0.97	1.45	0.43	2.05	1.29	1.45	0.96	1.82
Primary	1.59	0.74	0.71	2.12	2.68	1.40	0.69	1.96
All	3.25	3.35	2.15	4.46	3.80	0.32	3.08	3.27
Redistribution: Progressivity								
University	0.6	0.9	0.9	0.5	0.7	1.2	0.6	0.1
Upper Secondary	1.7	1.0	0.5	0.9	1.2	0.2	1.6	0.8
Lower Secondary	1.3	1.9	0.5	2.3	1.6	1.8	1.3	1.7
Primary	0.9	0.9	0.9	2.4	2.4	1.6	0.9	2.0
All	4.1	4.3	2.6	5.5	5.3	4.6	4.0	4.3
Redistribution: Reranking								
University	0.2	0.3	-0.2	-0.2	0.3	0.7	0.4	-0.6
Upper Secondary	0.3	0.2	-0.4	0.1	0.3	0.0	0.3	0.1
Lower Secondary	0.3	0.4	0.1	0.2	0.3	0.4	0.3	-0.1
Primary	-0.7	0.2	0.2	0.3	-0.3	0.2	0.2	0.0
All	0.9	0.9	0.5	1.1	1.5	4.2	0.9	1.0
Progressivity								
University	-28.4	-39.2	-37.7	-11.6	-26.6	-45.4	-18.9	-7.9
Upper Secondary	-49.1	-46.5	-43.1	-57.2	-44.9	-49.9	-48.1	-42.0
Lower Secondary	-37.0	-42.3	-28.5	-63.7	-52.8	-37.2	-34.3	-47.0
Primary	-26.1	-32.3	-27.2	-44.6	-32.5	-46.9	-30.9	-47.3
All	-35.7	-40.0	-32.1	-40.4	-37.5	-42.5	-33.2	-41.2

Source: European Community Household Panel Survey (1995).

Notes:

1. Income has been equivalised using the equivalence scale 1/0.5/0.3, where children are aged 17 or under.
2. Progressivity measured using Reynolds-Smolensky Index, incorporating reranking. A decomposition of this index is included in the Appendix, table A.3
3. Total Redistribution is a function of the Progressivity component and reranking components. The progressivity component can be expressed as a function of the average rate and the Kakwani progressivity index.