GINI

Return to Education and
Income Inequality in Europe and the US

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GROWING INEQUALITIES' IMPACTS

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Abstract

In this paper we study the relationship between wage inequality and education in 13 OECD countries over the period 1985-2005 using the Luxembourgh Income Study (LIS) data. Our results show a great deal of heterogeneity in the patterns of the rate-of-return estimates across countries. On the other hand, our results confirm the finding of a general increase in wage inequality. As for the correlation between wage premia and wage inequality, the results show a positive but weak correlation between the estimates of the education return and the Gini index and between the convexity of wage premia and wage inequality. The results show that the increase in wage inequality in the countries considered can only partially be accounted for by observable characteristics such as education and educational premia; i.e., it is largely residual in its nature.

1.   Introduction

In the last decades there has been a general increase in income inequality in most OECD countries (see OECD, 2010). At the same time, there has been a general increase in the average educational level and a consequent decrease in educational inequality (see Meschi and Scervini, 2010). How to reconcile these two different and apparently contradictory trends? In other words, what is the relationship between income inequality and educational inequality?

This question motivates the present paper.

In general terms, the evolution of income distribution depends on some underlying basic phenomena which can be grouped into three categories:

a.   changes in the distribution of assets and individual characteristics, which include education levels, but also unobservable abilities: this is an endowment effect;

b.   changes in the returns to those assets: the price effect;

c.   changes in how individuals use those assets, mainly in the labour market: the occupational effect.

Thus, focusing on the education level, the extent to which inequality in educational attainments translates into wage inequality depends on the magnitude of the returns to education, determined by the interplay between demand and supply of education in the labour market.

In general, in addition to the evidence on the inequality in educational attainments, the evidence on the return to education can contribute to understanding the dynamics of income distribution by adding the "price effect". Now, suppose that factors a) and c) are kept constant: that is, suppose we observe the same demographic composition for educational levels and the same labour supply. How a change in the returns to education would affect the income distribution? Suppose the wage earnings (and income in general) are convex function of years of schooling: this — keeping constant the education distribution - would imply that an increase in average education would lead to a increase in income inequality. Hence a further issue is that of checking for the convexity of the income premia of education.

We are aware that the three factors above are not independent of one another and that a structural model linking endowment, price and occupational effect would be necessary in order to study this complex issue. However, this paper, more modestly, aims at offering some empirical evidence on the returns to education that can help to construct some tentative answer to the question of the relationship between education and income inequality. More

precisely, in this paper we use Luxembourg Income Study (LIS) data for 13 countries over the period 1985-2005 and perform the following exercises:

- first, for each country we estimate the private return to education and we study the evolution of such return in the last two decades;

- second, for each country we study the correlation between the return education end income inequality;

- third, for each country we test the hypoteses of convexity of the income premia and we study the correlation between the degree of convexity and income inequality.

To evaluate returns to education we estimate a wage equation in which individuals' (net) wages depend on years of schooling and other individuals' characteristics like age and gender. This procedure typically presents two major problems, the first due to self-selection into the labour market and the second caused by endogeneity of school levels, which could determine a bias both in the estimation of the wage and employment equation. Because of data limitation in what follows we only deal with the selection problem and estimate a two-stage Heckman model, i.e. determining the probability of employment at the first stage and the wage for those employed at the second stage.

Our results show a general increase in wage inequality, particularly evident is countries such as US, UK, Germany, Nehederland, Luxemburg. On the other hand, the data show a great deal of heterogeneity in the pattern of the rate-ofreturn estimates across countries.

As for the correlation between wage premia and wage inequality, the results show that the increase in inequality is only partially accounted for by the return to education.

As for the second order effect that we study, the data show that in most countries the wage premia shows a convex pattern.

However, the evidence on the relationship between convexity of the wage premia and wage inequality confirms that the increase in wage inequality in the countries and in the period considered is largely residual.

These results are in line with respect to the (few) previous works that have analyzed the relationship between education and income inequality on a comparative basis (see in particular Krueger et al. 2010).

Let us stress once again that we are perfectly aware that these are only suggested correlations, given the limited number of cases in this cross-country analysis. Nevertheless these results are useful to confront our theoretical expectations with the data. These results may be a key input for a more structural model trying to explain in a unified framework the interplay between endowment, price and occupational effect in the education-income inequality relationship.

The rest of the paper is organized as follows. The next two sections present the dataset we use and the estimation model. Section 4 presents and discusses the results. Section 5 concludes.

2.   Data analysis

We use data from the Luxembourgh Income Study (LIS) and follow 13 countries over 5 years (about 1985 - 1990 - 1995 - 2000 - 2005). The countries under analysis are Austria (AT), Belgium (BE), France (FR), Italy (IT), Luxembourg (LU), Spain (ES), Germany (DE), Denmark (DK), Finland (FI), the Netherlands (NL), Norway (NO), Sweden (SE) and the United States (US).

The survey contains information on a large number of individual and household characteristics and provides a common data source with comparable individual and household level micro-data allowing for significant improvements in the comparability of country-specific measures. The wage variable is defined as post-tax individual wage for Austria (AT), Belgium (BE), France (FR), Italy (IT), Luxembourg (LU), Spain (ES) whereas for the remaining countries individual wages are measured pre-tax. We also consider some additional individual characteristics such as gender, age, marital status and education and restrict the sample to individuals aged between 25 and 65.

3. Estimates of the private rate of return of tertiary education

In this section we estimate the private rate of return to tertiary education in terms of wage and employment opportunities.

The two methods commonly used in the literature to evaluate returns to education are the computation of the internal rate of return (see Psacharopoulos, 1981 among others) and the estimation of the Mincerian wage equation (see Heckman, Lochner and Todd, 2003). The first assesses the profitability related to an additional year of education given the costs and benefits related to it, while the second estimates empirically an earning function in which individuals' wages essentially depend on years of schooling and other individuals' characteristics like expertise, age and gender. Only under very restrictive assumptions the two methods might give the same results. In this paper we follow the second approach and estimate a wage equation where log of individual wage depends on education, gender, age and marital status.

As acknowledged in the literature a couple of methodological issues might rise: (i) the sample of wage earners may be a nonrandom selection of the overall working age sample due to sample-selection bias (see Heckman, 1979 and 1980) and (ii) the education variable could be endogenous (see Card 1999) mostly due to ability bias, i.e. the most capable individuals normally earn high income and reach high level of education. The first issue may bias the marginal effect of education on the wage regression whereas the second problem may influence the effect of educational attainment on both the wage regression and the probability of employment. Because of data limitation in what follows we only deal with the selection problem and estimate a two-stage Heckman model, i.e. determining the probability of employment at the first stage and the wage for those employed at the second stage. Hence the model we estimate is

$$e_i = \eta_0 + \sum_{j=1}^{k} \eta_j x_{ij} + \eta_p pri\_edu_i + \eta_t ter\_edu_i + \eta_m marital_i + u_i \quad (1)$$

$$y_i = \beta_0 + \sum_{j=1}^{k} \beta_j x_{ij} + \beta_p pri\_edu_i + \beta_t ter\_edu_i + \gamma \lambda_i + \varepsilon_i \quad (2)$$

where *e* is a binary variable equal to one when an individual is employed and zero otherwise; *y* is the logarithm of individual wage; x_j are standard demographic (gender dummy, age and age squared), whereas *pri_edu* and *ter_edu* are dummy equal to one when individuals have attained respectively the first and the third step of education of the LIS standardized levels of education and u and ε are white noises. The wage premium is estimated by using the Heckman two step approach and in equation (2) λ is the inverted Mill's ratio that estimates the individual's propensity to participate in the labour market. According to the literature we consider marital status as an excluding restriction to identify self-selection into the labour market, see Boarini and Strauss (2011), Ciccone et al. (2006) among others.[1] We repeat this exercise for each country and year available and for two cohorts - individuals aged between 25 and 45 and those aged between 46 and 65.

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1   The choice of such an excluding restriction is dictated by data availability.

4. Empirical Results

4.1. The returns to education

In this section we briefly discuss cross-country differences in the dynamics of the return to education and in the relationship between average return to education and the income inequality. Results are showed in Figures 1-14 and and in Table 1.

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

Fig 7

Fig 8

Fig 9

NETHERLANDS

Fig 10

NORWAY

Fig 11

SPAIN

Fig 12

SWEDEN

Fig 13

UK

Fig 14

US
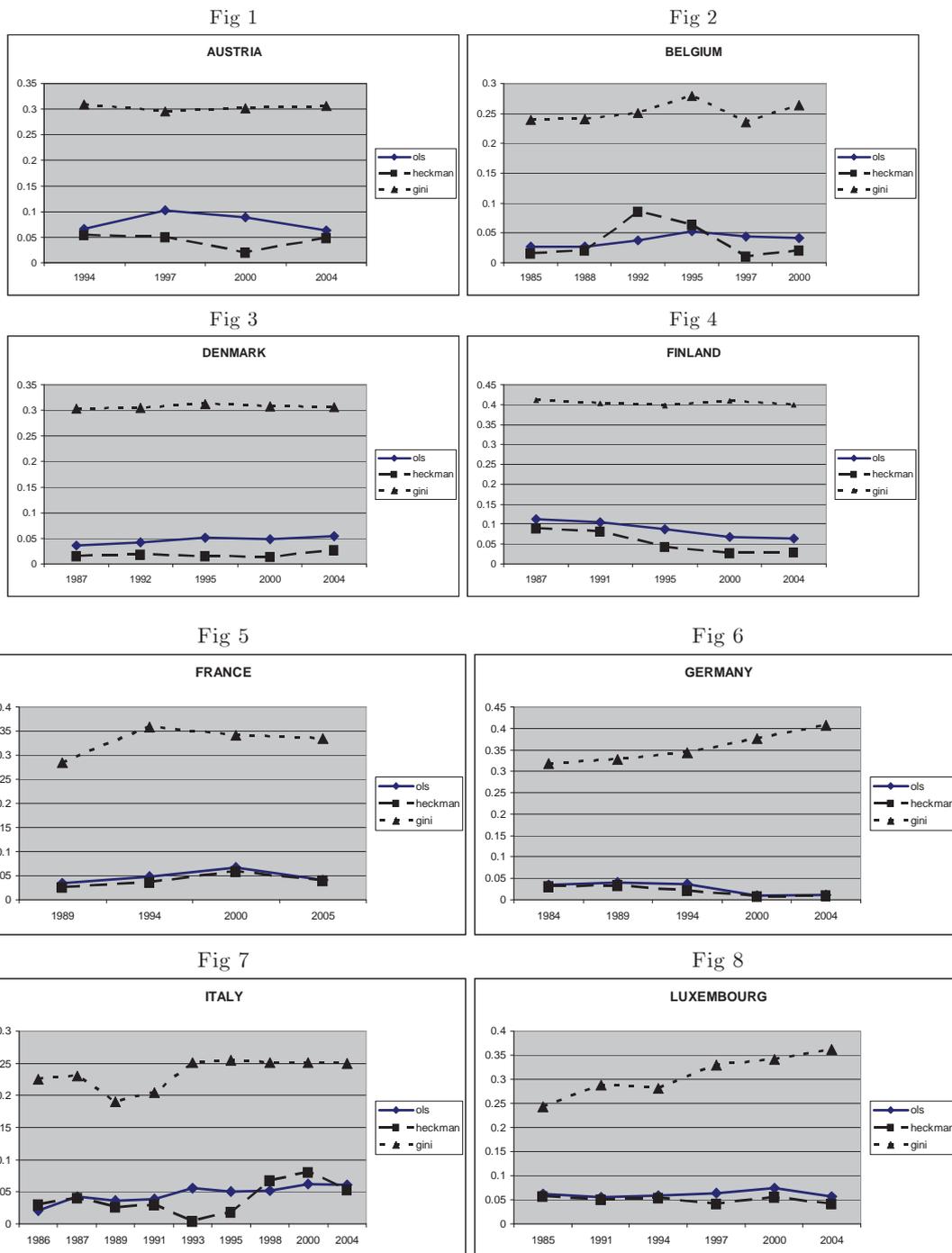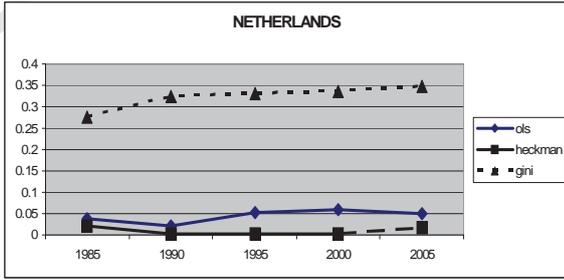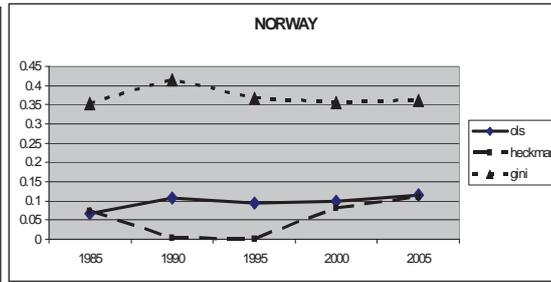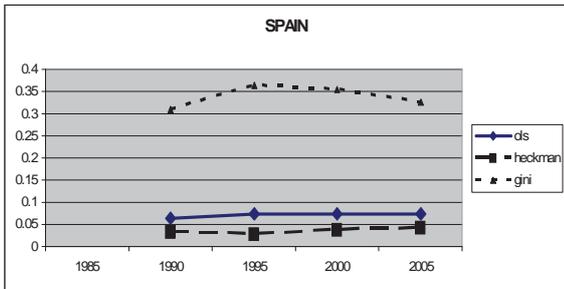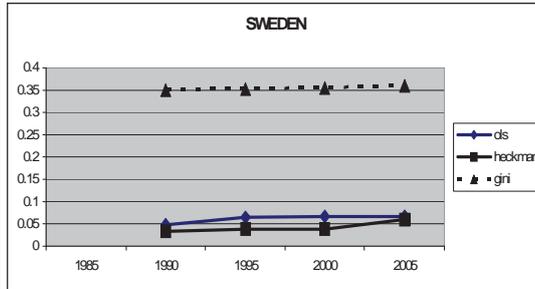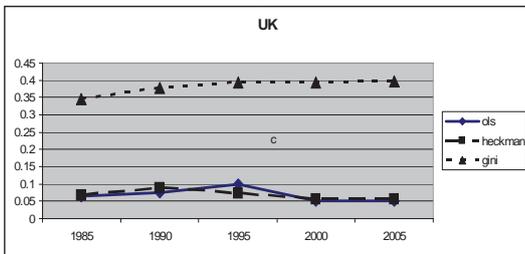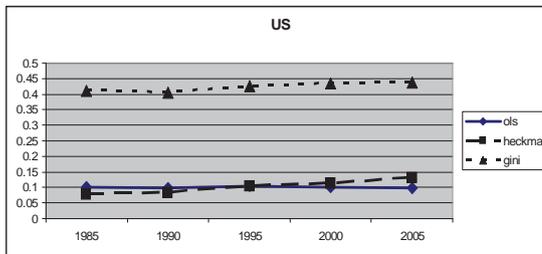
Table 1: Correlation coefficients between average returns and Gini

country	Heckman	ols
AT	0.26	-0.26
BE	0.3	0.73
DK	-0.18	0.77
FI	0.46	0.39
FR	0.56	0.63
DE	-0.91	-0.9
IT	0.28	0.69
LU	-0.69	0.29
NL	-0.53	0.37
NO	-0.64	0.42
ES	-0.5	0.75
SE	0.91	0.83
UK	-0.32	0.06
US	-0.62	0.03

Notes: Average return is calculated using years of education

The figures plot the return to education, estimated both by the OLS and Heckman models, and the Gini inequality index for each of the 13 countries considered and for 5 years: 1985, 1990, 1995, 2000, 2005.

The figures confirm the finding of a general increase in wage inequality, particularly evident is countries such

as US, UK, Germany, Nehederland, Luxemburg and, with a less continuous pattern, Belgium and Italy. As for the return to education, the figures (both the OLS and Heckman estimates) show a much more mixed pattern. In countries such as Sweden, Norway, Italy, Denmark there is a increasing trend; while in countries such as Finland, UK and Germany there is a decreasing path. Mixed patterns emerge for the other countries.

As for the correlation between wage premia and wage inequality, the results show in general a positive correlation between the OLS estimates of the education return and the Gini index, which is however sufficiently significative only for 5 countries: Denmark, France, Italy, Spain and Sweden. A mixed picture emerges when using the Heckman estimates. This differencemight be due to the importance of the selection process, i.e. the relevance of education in accessing the labor market.

Table 2: Correlation coefficients between returns convexity and Gini

country	Heckman
AT	0.41
BE	-0.094
DK	0.18
FI	0.44
FR	0.48
DE	0.67
IT	-0.47
LU	0.63
NL	0.21
NO	0.56
ES	0.12
SE	-0.44
UK	
US	-0.82

Notes: Average return is calculated using years of education

4.2.   The convexity of the return to education

In addition to the results above presented, we investigate a second order effect of education on wage inequality. More specifically we consider a measure of inequality of returns calculated as the ratio between the educational premium of the primary level of education with respect to the second (η_p) and the educational premium of the tertiary level of education with respect to the second (η_t), i.e. $\frac{\eta_p}{\eta_t}$ Clearly ηp is always negative whereas η_t is positive, hence the ratio is negative. Such a ratio might be considered as an indicator of convexity of returns to education: in absolute terms numbers smaller than one indicate a higher degree of convexity and vice-versa.

We conjecture that the convexity of the return to education might be correlated with an increase in inequality, i.e. the smaller the absolute value of the ratio, the higher the Gini index. Results are summarized in Table 2.

Most countries show a convex pattern in the wage premia. However, the evidence on the relationship between convexity of the wage premia and wage inequality shows a very weak correlation. Only Germany Luxembourgh and Norway show significative positive values.

In summary, the results show that the increase in wage inequality in the countries and in the period considered can only partially be accounted for by observable characteristics such as education and educational premia; i.e., it is largely residual in its nature.

5.   Concluding remarks

In this paper we have estimated the private returns to education in 13 OECD countries over 5 years (about 1985 - 1990 - 1995 - 2000 - 2005) using the Luxembourgh Income Study (LIS) data.

Our results show a great deal of heterogeneity in the patterns of the rate-ofreturn estimates across countries. On the other hand, our results confirm the finding of a general increase in wage inequality. As for the correlation between wage premia and wage inequality, the results show a positive but weak correlation between the OLS estimates of the education return and the Gini index and between the convexity of wage premia and wage inequality.

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Aims

The core objective of GINI is to deliver important new answers to questions of great interest to European societies: What are the social, cultural and political impacts that increasing inequalities in income, wealth and education may have? For the answers, GINI combines an interdisciplinary analysis that draws on economics, sociology, political science and health studies, with improved methodologies, uniform measurement, wide country coverage, a clear policy dimension and broad dissemination.

Methodologically, GINI aims to:

- exploit differences between and within 29 countries in inequality levels and trends for understanding the impacts and teasing out implications for policy and institutions,
- elaborate on the effects of both individual distributional positions and aggregate inequalities, and
- allow for feedback from impacts to inequality in a two-way causality approach.

The project operates in a framework of policy-oriented debate and international comparisons across all EU countries (except Cyprus and Malta), the USA, Japan, Canada and Australia.

Inequality Impacts and Analysis

Social impacts of inequality include educational access and achievement, individual employment opportunities and labour market behaviour, household joblessness, living standards and deprivation, family and household formation/breakdown, housing and intergenerational social mobility, individual health and life expectancy, and social cohesion versus polarisation. Underlying long-term trends, the economic cycle and the current financial and economic crisis will be incorporated. Politico-cultural impacts investigated are: Do increasing income/educational inequalities widen cultural and political 'distances', alienating people from politics, globalisation and European integration? Do they affect individuals' participation and general social trust? Is acceptance of inequality and policies of redistribution affected by inequality itself? What effects do political systems (coalitions/winner-takes-all) have? Finally, it focuses on costs and benefits of policies limiting income inequality and its efficiency for mitigating other inequalities (health, housing, education and opportunity), and addresses the question what contributions policy making itself may have made to the growth of inequalities.

Support and Activities

The project receives EU research support to the amount of Euro 2.7 million. The work will result in four main reports and a final report, some 70 discussion papers and 29 country reports. The start of the project is 1 February 2010 for a three-year period. Detailed information can be found on the website.

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