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Exploring International Differences in Rates of Return to Education: Evidence from EU SILC

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Abstract: This paper uses EU-SILC data from 2005 and 2006 to explore the hypothesis that international differences in rates of return to education reflect variations in the level of risk associated with educational investments. While there was some evidence to support this hypothesis with regards to returns to ISCED level 5 qualifications among males, the majority of the variation in international returns was related to distributional impacts. The results suggest that higher rates of return to more advanced qualifications relate to more dispersed distributions among poorly qualified workers which, in turn, raise the returns to credentials further up the educational spectrum.

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1.0 Background & Introduction

This paper explores the idea that cross-country differences in the rates of return to education can be explained by variations in relative risk. Pereira & Martins (2002) demonstrate, using micro 1995 data for 16 countries, a positive relationship between rates of return and risk. Pereira & Martins (2002) estimate a set of quantile Mincer regressions for each country and measure risk as the difference in the years of schooling coefficient in the first and ninth quantile. While the measurement approach adopted by Periera & Martins (2002) is novel, it is also not without its drawbacks. Specifically, the quantile regressions were estimated over the total population, thus the technique compares the investments of individuals at the bottom end of the distribution, who have typically low levels of schooling, with those in the top decile, who are typically graduates. The approach is acceptable provided that the returns to schooling are linear and that both returns and risk do not vary with the level of education. However, Heckman, Lockner & Todd (2003) demonstrate that the assumption of linearity does not, in fact, hold. This suggests that the risk measure adopted in the earlier study is more indicative of the difference in the returns to different levels of schooling and may not, therefore, adequately reflect the risk of investing in a particular level of education. The results from Heckman, Lochner & Todd (2003) also suggest that uncertainty will vary across educational groupings, leaving open the possibility that the risk of specific investments may have a higher weight in explaining any observed relationship with rates of return.

The notion of differing rates of return is consistent with the Skill Biased technological Change framework (SBTC) (see Katz & Autor (1999) for an overview of the literature) which emphasises the idea that as the economy grows, technology will disproportionately increase the relative demand for more skilled labour. Thus, given the evidence is support of SBTC, we should expect to observe larger returns to higher levels of educational attainment. Potentially these higher returns will also be associated with a higher risk of investment. However, it has also been argued that SBTC can result in accelerated returns to having few or no qualifications at all. Autor, Levy and Murnane (2003) argue that technology can replace human labour in more routine tasks but cannot replace labour in non-routine tasks, a point also made by Keep (2005). So, while computers can replace precise tasks in manufacturing, and even routine clerical operations, tasks such as cleaning and waiting tables cannot be replaced. And in fact, a growth in high-skilled employment may cause an increased demand for low-skilled service jobs. The result of such a scenario would be a rising relative demand in both high-skilled and low-skilled jobs, but a falling-off in relative demand for jobs in the 'middle', where technical skills can replace human labour. These demand changes will result in rising returns for the high skilled, but wages of the low skilled will be maintained**.** Thus SBTC may also result in falling returns to lower levels of schooling associated with mid-skilled occupations.

Recognition that rates of return can vary at different levels of education also opens up the possibility that earnings dispersion may also differ by level. Such variation in wage dispersion could take place if different sectors of the labour market are differential influenced by labour market institutions. Therefore, there are strong grounds to believe that both rates of return and relative risk will vary by level of educational attainment suggesting that a more disaggregated approach to the study of cross-country risk-return relationships is warranted.

2.0 Data and Methods

The data for this study comes from the EU Survey on Income and Living Conditions (EU-SILC) which is a voluntary survey of private households carried out by national statistical units under EU legislation (Council Regulation No 1177/2003) and coordinated by Eurostat. The first survey was carried out in 15 countries in 2004 and expanded in 2005 to 26 European countries (plus Turkey). The present piece of work relies on data from waves 2 and 3 (corresponding to 2005 and 2006, respectively). The primary focus of the survey is the collection of information on the income and living conditions of different types of households to compute indicators on poverty, deprivation and social exclusion. It is not, therefore, designed to provide information on the structure of wages, job or employer characteristics making it more limited than it was in its predecessor, the European Community Household Panel (ECHP).

Nevertheless, it provides us with an opportunity for estimating differences in cross-country returns using relatively recent data.

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The EU-SILC data set presents a number of challenges in the context of any international study on rates of return. Firstly, we use information on gross monthly wages and average hours worked per week to derive gross hourly wages. Information on gross monthly wages was only available in the period 2005/2006 in nine countries (namely, Austria, Spain, Greece, Italy, Portugal, Ireland, Iceland, Poland and the UK). This is the most restrictive feature of the data set since it hinders the extent of our international comparisons. Nevertheless, the countries for which information was available represent the main European welfare regimes or institutional setups, with Mediterranean countries fully represented, Nordic (Iceland), Central or Continental (Austria), Liberal (Ireland and UK) and new Easter European EU member states (Poland).

The second challenge in the data-set is the accuracy of the measure of educational attainment, which is also absolutely crucial if returns to education are to be correctly identified. According to Schneider and Müller (2009) the education attainment variables (following ISCED97 classification) in EU-SILC present problems in a number of countries. The principal problems relate to an overrepresentation of ISCED 3 and other dissimilarities between the distribution of populations in the home countries Labour Force Survey and that of EU-SILC. While such dissimilarities did not appear to radically affect estimated rates of return, the exception to this was the UK where the estimates appeared much lower than in previous literature, making it necessary for us to exclude the UK from our analysis. However, a clear advantage of the EU_SILC dataset is its regional geographical component, which allows for us to examine both inter and intra-country differences in rates of return. The country sample sizes vary from 6,698 observations in Iceland, to 28,928 in Italy. The country level data has been disaggregated into NUTS1[1] regions (see Annex for concrete labels of the regions).

[1] NUTS stands for Nomenclature of Territorial Units for Statistics. The NUTS territorial units were established to provide standard regional statistics for the EU and are used for policymaking and analysis. The NUTS nomenclature is a three-level hierarchical categorization that divides each of the 25 EU member states into a whole number of NUTS-1 regions. Population in NUTS1 rank between three and seven million people.

With respect to the methodology employed, our primary objective was to generate reliable estimates of both educational returns and dispersion for each NUTS region. As stated, the returns to schooling are generally estimated using a standard Mincer regression such as in equation 1 where S_{ij} represents the years of schooling undertaken, ex relates to labour market experience and X_i is a vector of earnings related personal or job characteristics. The alternative specification which allows for possible non-linear rates of return is outlined by equation 2 whereby the years of schooling variable S_i in equation 1 is replaced by Q_i ,which denotes the highest qualification obtained by the respondent. Given the concerns outlined in this paper, equation 2 is obviously preferred.

$$LnW_i = \sum_{i=1}^{i} S_i\alpha + X_i\beta + ex_i\delta + ex_i^2\gamma + \varepsilon_i \qquad (1)$$

$$LnW_{ij} = \sum_{j=1}^{J} Q_i\alpha + X_i\beta + \delta ex_i + \gamma ex_i^2 + \varepsilon_i \qquad (2)$$

We estimate equation 2[2] to generate returns to ISCED levels 3&4[3] and ISCED 5 with both estimates related to the base category which contains individuals educated to ISCED level 2 and below. The equations are estimated separately by gender with the female models accounting for selection bias.

With respect the riskiness of the human capital investment, we follow the approach adopted in the industrial economics literature by Winter-Ebmer & Zweimuiller (1999) who include the regression standard error of a firm level wage regression as a dependant variable representing conditional intra-firm dispersion in a firm level productivity regression. In a similar vein we estimate equation 3 for each educational level within each region taking the regression standard error σ_{ij} as a measure of wage dispersion

[2] In terms of our X variables, these are restricted to 1 digit NACE dummies.
[3] Due to the small number of cases in ISCED 4 category and the fact that it refers to different types of post/secondary studies across countries we have merged categories 3 and 4 in a post-compulsory but non tertiary education category.

controlling for observable differences in the experience profile and sectoral composition of the regions educational cohort.

$$LnW_{ij} = \sum_{j=1}^{J} X_i\beta + \delta x_i + \gamma x_i^2 + \varepsilon_i \qquad (3)$$

3.0 Results

Table 1 displays the distribution of employees in NUTS1 by gender according to the three education levels defined in this paper. While we have estimated returns for each region for both 2005 and 2006, for convenience we report the 2 year averages for each of our 28 regions. Table 1 shows wide dispersion in education attainment across Europe and even within European countries. The proportion of employees with ISCED 0 to 2 (up to compulsory education) is particularly high in Portugal (with around 70 percent of males and 58 percent of females) followed by southern regions in Spain and Italy. In the opposite extreme we find Polish and Austrian regions, where ISCED 3 and 4 count for more than half of the employee population. Finally, very high education attainment (measured by the proportion of higher education graduates, ISCED 5 or above) is found in Spain for both men and women and in Greece and Ireland.

[Table 1 about here]

As for differences within countries, considerable variation may be found between North-East and Central versus Southern Spain as regards both extremes in the distribution. In Greece, Attiki (GR3) registers far more higher education graduates then the other regions, whereas Poland, Central (PL1) has a much higher share of graduates relative to the rest of the country, with the difference particularly pronounced among males.

Table 2 shows returns to education (namely, the coefficients from simple region-gender-specific Mincer equations outlined in equation 2). Since returns to education with dummy variables need a category to be used as a base-case (in our case, ISCED 0, 1 and 2) we only display and use the coefficient for ISCED 3 / 4 and ISCED 5. Due to the semilogarithmic shape of the wage equations, coefficients may be interpreted as rates of return to the specific ISCED levels compared to the base case.

[Table 2 about here]

Returns to secondary and non-tertiary education (ISCED 3&4) are high in Austria (and are particularly high in the Southern region of Austria) and Portugal, followed closely by Poland. The highest nation-wide rates are of return to ISCED 3 / 4 attainment range between 30 and 40 per cent for both men and women (depending on the country). The lowest rates of return to this level of education are registered in Spain, Italy and Greece, with rates averaging around 16 percent for men in these countries. Women tend to enjoy higher returns to this level of education, with the noteworthy exceptions of Iceland and Austria. Amongst higher education graduates, returns range for males from between 42 percent in Spain to 92 percent in Portugal, whereas for females the lowest return is registered in Iceland (44 per cent) and the highest, again, in Portugal (approximately 100 per cent). There is again notable variation between regions within countries, such as in Spain (between North-East and the Centre) and Italy (it varies across genders, but South and Islands appear to reward higher education more than North East and Centre).

To get a preliminary feel for the extent of any relationship between rates of return and conditional earnings dispersion, we plot the estimated coefficients for each region from equations 2 against the corresponding standard errors generated by equation 3. The linear trend line would suggest a strong positive relationship between rates of return and conditional dispersion for ISCED levels 5 for both men and women (but particularly for men). With respect to ISCED levels 3 / 4 the positive relationship appears somewhat weaker for male's returns while, if anything, the trend line for females has a slightly negative slope. The preliminary graphical evidence would suggest that the relationship between returns and conditional dispersion strengthens as the level of educational attainment rises.

[Panel 1 about here]

We now move onto the regression analysis. In order to assess the extent to which the dispersion measurement approach adopted here is comparable with that of Pereira &

Martins (2002) we estimate equation 1 for quantiles 1 and 9 at regional level and take the absolute difference in the years schooling coefficients as a measure of dispersion. This will be compared to a measure based on the regression standard errors of regional equations estimated using equation 2. Thus we initially estimate an overall measure of conditional dispersion in a sample including all levels of educational attainment within each region. Table 3 presents the results from OLS models that regress the standard error dispersion measures on the regional rates of return to each ISCED level in each year. Consistent with the descriptive analysis we find that conditional general dispersion, as measured by the regression standard error, is positively related to rates of return for all education levels with the exception of ISCED 3 /4 among females where the coefficient is negative but non-significant. Interestingly, the R^2 statistic suggests that this measure of dispersion is particularly effective in explaining spatial variations in the rates of return to ISED level 5 among males. We then include country level dummies to assess the relationship within countries but across regions. By including such controls we are able to assess the extent to which the relationships we observe in the more basic model relate to inter, as opposed to intra, country relationships. We find that the controls remain significant for ISCED level 5, however, the marginal effects are somewhat lower suggesting that the observed result was important both within and across countries. Conversely, the ISCED 3/4 result is no longer significant when country effects are included suggesting that dispersion is only important within a cross-country context. Table 4 replicates the model with the quantile regression based estimate and while, at first glance, the results look similar to those in table 3, substantial differences do exist. For instance, no relationship between dispersion and rates of return was found within the male ISCED 5 equation, despite the fact that this was a particularly strong effect in the previous model. Furthermore, the relationship between the male returns to ISCED 3 /4 and dispersion is much stronger in table 4, accounting for over 40 per cent of the variation. Generally, the finding, implied by table 4, that variations in dispersion become less important in explaining spatial differences in rates of return to higher levels of schooling seems somewhat implausible. This suggests that the quantile regression based estimate is, perhaps, a somewhat less reliable measure of dispersion. Finally, it is worth noting that, in table 4, when county level controls are included in the model the results suggest that regional variations in returns to ISCED level 3/4 and 5 attainment for males is positively related to dispersion.

[Table 3 about here]

[Table 4 about here]

While the analysis of the impact of overall labour market conditional dispersion on rates of return is interesting it is not highly informative as, given the high correlation between overall labour market dispersion and that in the various components of the wage distribution, we cannot distinguish the extent to which the relationship is driven by risk as opposed to purely distributional impacts. If, as hypothesised by Pereira & Martins (2002) the relationship centres on the risk of the educational investment, then only dispersion at ones own highest education level will prove important. However, it may be that the observed relationships relate more heavily to dispersion in other parts of the distribution, specifically in the areas associated with lower levels of educational attainment. Arguably, high levels of dispersion among workers with lower qualification could generate a higher floor to the rates of return enjoyed by more highly qualified workers. To test these competing hypotheses, we regress the conditional dispersion measures of each education level on the various rates of return. However, given that within country levels of dispersion are likely to be highly correlated, concerns regarding colinearity dictate that we cannot simply estimate a model that includes multiple conditional dispersion measures without some degree of consistency checks. The issue is illustrated by table 5 which reports the correlation coefficients for the various regression standard errors, note, we also include conditional dispersions from the regression estimated using the ISCED 2 and below educational category. Generally speaking, the correlation coefficients are larger for males with the rate of correlation highest between the ISCED 3 / 4, 5 and overall conditional dispersion measures while that based on ISCED 2 was relatively poorly correlated with the other education specific measures. With respect to females, the correlation was highest between the measure of conditional dispersion estimated using the ISCED 3/4 population and that based on the overall and ISCED level 2 distributions. However, as was the case with males, the female ISCED level 2 conditional dispersion measure was poorly correlated with that based on ISCED 5 and the overall distributions.

[Table 5 about here]

Given our concerns with colinearity we estimate our models to include each measure of dispersion as a singular right hand side variable, before estimating a model that includes all measures. The results are reported in table 6. Dealing firstly with the cross-country / cross-region regressions, based on the relative magnitude of the R^2 statistics, the results for males suggest that the returns to ISCED level 3&4 and ISCED level 5 are more effectively explained by conditional dispersion levels in the ISCED 2 and below distribution. Similarly for females, the variation in returns to ISCED level 5 appears to be most effectively explained by conditional dispersion levels in the ISCED 3 & 4 distributions. These results suggest that distributional effects whereby the labour markets in lower educational categories, by virtue of their more dispersed nature, set a more elevated floor for returns to more advanced educational attainments are the principal driver of the dispersion / returns relationship. The absence of a dominant relationship with own dispersion levels would tend not to support the hypothesis that variations in cross-country returns solely reflect a higher return to riskier educational investments. The results hold when the model is re-estimated to include all conditional dispersion measures although there is some suggestion that the risk return relationship may, in fact, also be a factor with respect to spatial differences in the returns to ISCED 5 qualifications among males[4]. Finally, when country level controls are included the models suggest that, within countries and across regions, higher returns to ISCED 5 among males do predominately reflect an increased investment risk whereas the ISCED 2 effects appear more important in explaining differences in returns the national level.

4.0 Summary and Conclusions

This paper uses SILC data to explore the relationship between wage dispersion and rates of return. The analysis seeks to shed further light on the hypothesis that variations in cross-country returns are positively related to the risk level of the human capital investment, as measured by dispersion in the expected rate or return. The results find that while risk is a contributing factor, particularly for explaining varying rates of return

[4] The within country region generated an unusual result whereby male returns to ISCED level 3 & 4 investment are dependant on dispersion at ISCED 5. However, given that this coefficient was negative and non-significant when included as a solitary control we believe the result here is spurious and a product of colinearity bias.

to level 5 qualifications both within and across countries, distributional factors appear to represent a much more important component in explaining spatial variations in rates of return. The findings of this study suggest that higher rates of return to both level 3/4 and level 5 qualifications relate primarily to higher dispersion levels in the earnings of those with lower levels of educaiton, which, we contend, create a higher floor for rates of returns to more advanced qualifications.

The results for males appear consistent with a scenario whereby changes in the relative demand have resulted in an increased rate of dispersion for individuals at both extremes of the distribution which is consistent with the notion that SBTC will result in increased demand for both high and low skilled labour. These findings are also consistent with an interpretation based on the impact of labour market institutions. We would expect that strong labour market institutions should lead to wage compression, an effect that could be particularly marked at lower levels of education. Such wage compression can lower returns both among the poorly qualified as well as the highly skilled, at ISCED 5 and above. However, it is not within the scope of the current study for formally test this hypothesis.

With respect to females the results are less clear cut and, in general, conditional dispersion was found to be less important in explaining variations in rates of return. The finding that female returns to level 5 qualifications relate to conditional dispersion in the level 3/4 distribution may be related in some way country level differences in the structure of the public sector, which is a common source of employment for many intermediately qualified females,

REFERENCES:

Autor, D., Levy, F. and Murnane, R. (2003) 'The skill content of recent technological change: an empirical exploration'. *Quarterly Journal of Economics*, CXVIII, pp. 1279-1333.

Heckman, J., Lochner, J. & Todd, P, (2003). "Fifty Years of Mincer Earnings Regressions," NBER Working Papers 9732

Katz, L. and Autor, D. (1999) 'Changes in the Wage Structure and Earnings Inequality', in Ashenfelter, O, and Card, D. (Eds) *Handbook of Labor Economics*, Vol. 3A. Amsterdam: North Holland.

Keep, E. (2005), "The 'Bottom Half' and the Dangers of Labour Market Polarisation – Challenges for Policy", ERINI Seminar April 2005.

Pereira, T. & Martins, P, (2002). "Is there a return-risk link in education?," *Economics Letters*, vol. 75(1), pp 31-37

Schneider, S. and W. Müller (2009), Measurement of Education in EU-SILC / Preliminary Evaluation of Measurement Quality, paper presented in EQUALSOC EDUC/INCDIS Meeting on the potential of the EU-SILC International Module, in Dublin, 26th -27th March 2009.

Winter-Ebmer, R. & Zweimuller, J. (1999). "Intra-firm Wage Dispersion and firm performance", *Kyklos*, 1999 52(4); pp. 555-72

Table 1: Education attainment in regions, ordered by country and welfare regime.

		men			women		
		isced 0-2	isced 3&4	isced 5	isced 0-2	isced 3&4	isced 5
country/regime	regions						
Central Europan							
Austria	AT1	0.147	0.650	0.203	0.185	0.612	0.203
	AT2	0.100	0.723	0.177	0.166	0.651	0.183
	AT3	0.159	0.658	0.183	0.203	0.632	0.165
average	*AT*	*0.141*	*0.668*	*0.190*	*0.188*	*0.627*	*0.185*
Mediterranean							
Spain	ES1	0.430	0.259	0.311	0.343	0.264	0.393
	ES2	0.333	0.255	0.412	0.247	0.239	0.513
	ES3	0.313	0.277	0.410	0.209	0.276	0.515
	ES4	0.484	0.228	0.288	0.336	0.229	0.435
	ES5	0.463	0.259	0.279	0.354	0.262	0.384
	ES6	0.522	0.230	0.248	0.360	0.260	0.379
	ES7	0.539	0.249	0.212	0.402	0.255	0.343
average	*ES*	*0.440*	*0.252*	*0.308*	*0.318*	*0.258*	*0.424*
Greece	GR1	0.340	0.417	0.243	0.206	0.398	0.396
	GR2	0.383	0.457	0.161	0.284	0.463	0.253
	GR3	0.235	0.448	0.317	0.148	0.449	0.402
	GR4	0.406	0.404	0.190	0.256	0.507	0.237
average	*GR*	*0.307*	*0.437*	*0.256*	*0.193*	*0.443*	*0.364*
Italy	ITC	0.440	0.428	0.132	0.338	0.504	0.157
	ITD	0.429	0.442	0.129	0.298	0.515	0.187
	ITE	0.386	0.456	0.158	0.279	0.489	0.233
	ITF	0.488	0.374	0.138	0.225	0.503	0.272
	ITG	0.526	0.359	0.115	0.230	0.537	0.233
average	*IT*	*0.445*	*0.419*	*0.136*	*0.292*	*0.506*	*0.202*
Portugal	PT	0.712	0.167	0.121	0.584	0.194	0.222
Liberal							
Ireland	IE0	0.312	0.384	0.304	0.223	0.391	0.386
Nordic							
Iceland	IS	0.308	0.461	0.231	0.344	0.356	0.300
Eastern European							
Poland	PL1	0.080	0.656	0.264	0.041	0.566	0.393
	PL2	0.045	0.776	0.179	0.040	0.634	0.326
	PL3	0.072	0.731	0.197	0.030	0.622	0.349
	PL4	0.085	0.750	0.165	0.072	0.631	0.297
	PL5	0.061	0.776	0.164	0.042	0.683	0.275
	PL6	0.084	0.756	0.160	0.074	0.666	0.259
average	*PL*	*0.070*	*0.737*	*0.193*	*0.049*	*0.627*	*0.324*

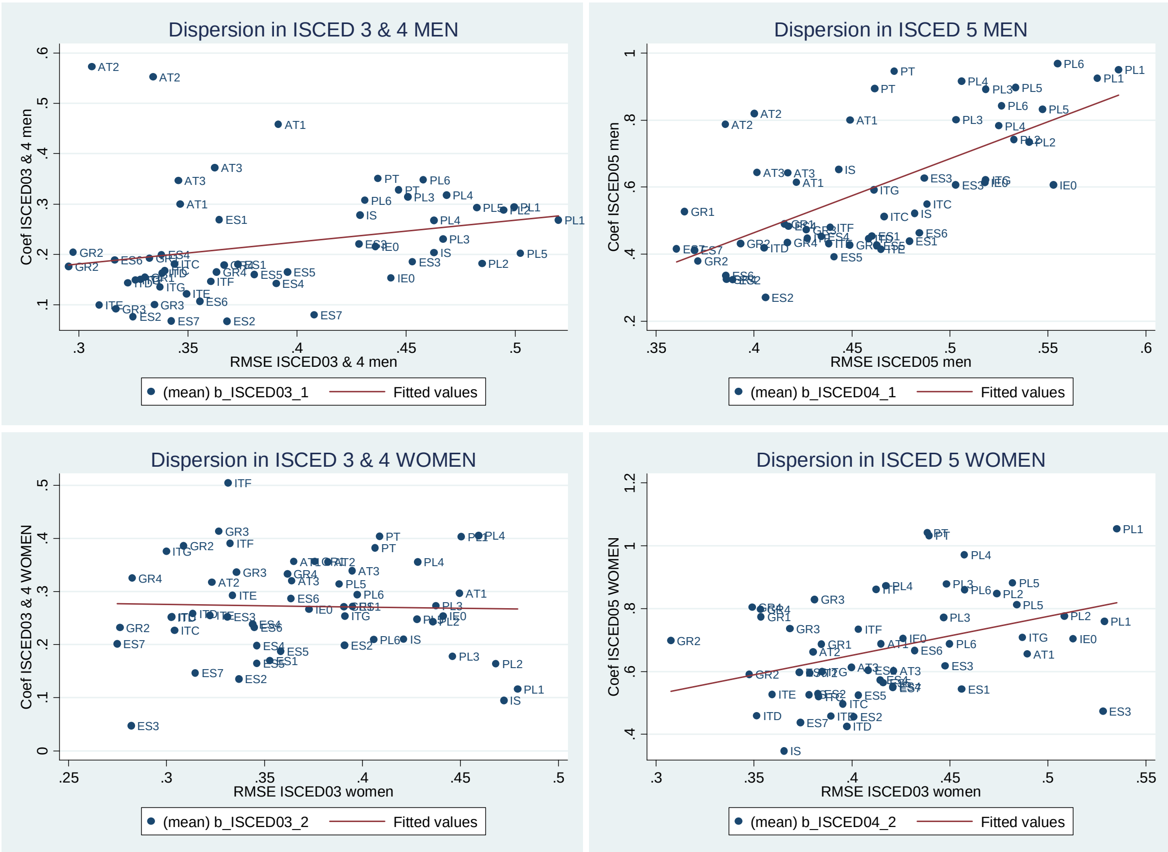
Source: EU-SILC 3005, 2006. Eurostat.

Table 2: Returns to education in regions, ordered by country and welfare regime

		men		women	
		isced 3&4	isced 5	isced 3&4	isced 5
country/regime	regions				
Central European					
Austria	AT1	0.384	0.713	0.324	0.673
	AT2	0.563	0.803	0.336	0.628
	AT3	0.360	0.643	0.330	0.608
average	*AT*	*0.398*	*0.691*	*0.329*	*0.642*
Mediterranean					
Spain	ES1	0.224	0.446	0.219	0.575
	ES2	0.072	0.298	0.168	0.493
	ES3	0.206	0.615	0.160	0.553
	ES4	0.169	0.467	0.219	0.563
	ES5	0.163	0.409	0.176	0.543
	ES6	0.149	0.402	0.259	0.633
	ES7	0.074	0.413	0.175	0.491
average	*ES*	*0.159*	*0.427*	*0.209*	*0.572*
Greece	GR1	0.173	0.509	0.313	0.729
	GR2	0.190	0.405	0.309	0.644
	GR3	0.096	0.450	0.374	0.781
	GR4	0.172	0.379	0.329	0.801
average	*GR*	*0.158*	*0.488*	*0.351*	*0.755*
Italy	ITC	0.174	0.531	0.239	0.508
	ITD	0.153	0.433	0.255	0.442
	ITE	0.111	0.424	0.274	0.493
	ITF	0.148	0.464	0.447	0.797
	ITG	0.142	0.607	0.315	0.654
average	*IT*	*0.158*	*0.485*	*0.283*	*0.530*
Portugal	PT	*0.340*	*0.920*	*0.393*	*1.037*
Liberal					
Ireland	IE0	*0.185*	*0.610*	*0.260*	*0.704*
Nordic					
Iceland	IS	*0.240*	*0.586*	*0.152*	*0.436*
Eastern					
Poland	PL1	0.281	0.937	0.252	0.899
	PL2	0.235	0.738	0.204	0.812
	PL3	0.273	0.847	0.226	0.826
	PL4	0.293	0.851	0.381	0.922
	PL5	0.249	0.866	0.282	0.848
	PL6	0.328	0.907	0.252	0.776
average	*PL*	*0.306*	*0.893*	*0.286*	*0.889*

Source: EU-SILC 3005, 2006. Eurostat.

Panel 1. Returns to education and ISCED-specific dispersion of wages, by gender.



Source: EU-SILC 2005, 2006, Eurostat.

Table 3 OLS robust regression: returns to education explained by overall dispersion

	NOT Controlling for country effects				Controlling for country effects			
	ISCED 3&4		ISCED 5		ISCED 3&4		ISCED 5	
	Men	Women	Men	Women	Men	Women	Men	Women
Overal RMSE	0.628***	-0.404	2.354***	1.524***	0.122	-0.120	1.568***	1.085**
	(0.155)	(0.272)	(0.238)	(0.461)	(0.359)	(0.431)	(0.530)	(0.533)
year 2006	-0.000	-0.003	0.013	-0.017	-0.003	-0.005	0.009	-0.014
	(0.028)	(0.024)	(0.036)	(0.041)	(0.016)	(0.020)	(0.021)	(0.024)
Austria					0.260***	0.064**	0.253***	-0.008
					(0.052)	(0.026)	(0.058)	(0.038)
Spain					-0.022	-0.072**	-0.028	-0.095**
					(0.042)	(0.034)	(0.058)	(0.043)
Greece					-0.012	0.062	0.019	0.125**
					(0.053)	(0.038)	(0.071)	(0.056)
Iceland					0.058	-0.109**	-0.004	-0.257**
					(0.041)	(0.043)	(0.082)	(0.107)
Italy					-0.022	0.034	0.095	-0.013
					(0.055)	(0.060)	(0.079)	(0.078)
Poland					0.089***	0.008	0.220***	0.137***
					(0.029)	(0.027)	(0.034)	(0.036)
Portugal					0.162***	0.127***	0.407***	0.389***
					(0.033)	(0.025)	(0.042)	(0.036)
Constant	-0.035	0.436***	-0.366***	0.072	0.127	0.316	-0.146	0.221
	(0.073)	(0.107)	(0.098)	(0.176)	(0.176)	(0.194)	(0.258)	(0.240)
Observations	56	56	56	56	56	56	56	56
Rmse	0.104	0.0902	0.135	0.152	0.0595	0.0735	0.0762	0.0893
r2	0.124	0.0448	0.545	0.188	0.754	0.449	0.874	0.756
F	8.749	1.123	49.04	5.530	48.68	28.71	68.05	142.8
df_r	53	53	53	53	46	46	46	46
Robust standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								
Source: EU-SILC, waves 2005, 2006, Eurostat								

Table 4. Consistency check: OLS robust regression: returns to education explained by overall dispersion (measured through differences in returns to 9th and 1st decile)

	NOT Controlling for country effects				Controlling for country effects			
	isced 3&4		isced 5		isced 3&4		isced 5	
	men	women	men	women	men	women	men	women
absdif91	0.638***	0.062	-0.021	0.240**	0.253***	0.026	0.207**	-0.026
	(0.099)	(0.078)	(0.185)	(0.103)	(0.091)	(0.069)	(0.092)	(0.075)
Year 2006	0.009	-0.004	-0.000	-0.020	0.001	-0.005	-0.001	-0.007
	(0.022)	(0.025)	(0.053)	(0.043)	(0.015)	(0.020)	(0.021)	(0.025)
Austria					0.175***	0.070	0.128*	-0.076
					(0.052)	(0.060)	(0.066)	(0.080)
Spain					-0.048	-0.067	-0.172***	-0.157**
					(0.042)	(0.056)	(0.060)	(0.072)
Greece					-0.047	0.069	-0.188***	0.032
					(0.044)	(0.058)	(0.063)	(0.075)
Iceland					0.045	-0.107	0.016	-0.273***
					(0.055)	(0.074)	(0.081)	(0.096)
Italy					-0.053	0.044	-0.151**	-0.128*
					(0.043)	(0.057)	(0.063)	(0.074)
Poland					0.071	0.002	0.245***	0.146**
					(0.043)	(0.058)	(0.061)	(0.072)
Portugal					0.094	0.127*	0.284***	0.338***
					(0.059)	(0.075)	(0.080)	(0.095)
Constant	0.134***	0.264***	0.601***	0.617***	0.176***	0.261***	0.556***	0.717***
	(0.021)	(0.022)	(0.065)	(0.040)	(0.040)	(0.053)	(0.062)	(0.072)
Observations	56	56	56	56	56	56	56	56
Rmse	0.0836	0.0917	0.200	0.160	0.0550	0.0735	0.0796	0.0944
r2	0.438	0.0128	0.000247	0.0925	0.789	0.450	0.862	0.727
F	20.68	0.343	0.00655	2.702	19.11	4.182	32.00	13.63
Df_r	53	53	53	53	46	46	46	46

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
EU_SILC, waves 2-3

Table 5. Correlation between measures of conditional dispersion

Males	Stand Error 1 & 2	Stand Error 3&4	Stand Error 5	Overall SE
Stand Error 1 & 2	1.0000			
Stand Error 3&4	0.6034	1.0000		
Stand Error 5	0.4738	0.7627	1.0000	
Overall SE	0.7485	0.9451	0.8014	1.0000
Females				
Stand Error 1 & 2	1.0000			
Stand Error 3&4	0.7416	1.0000		
Stand Error 5	0.2575	0.4713	1.0000	
Overall SE	0.5451	0.8430	0.7321	1.0000

TABLE 6: OLS robust regressions: returns to education explained by all overall dispersion, ISCED-specific dispersion and spillover effects across ISCED levels

	Non controlling for country fixed - effects				Controlling for country fixed effects			
	ISCED 3 & 4		ISCED 5		ISCED 3 & 4		ISCED 5	
	males	Females	Males	Females	Males	Females	Males	Females
own ISCED RMSE	**0.433****	-0.046	**2.220*****	**1.261*****	-0.179	0.112	**1.196*****	0.661
	(0.215)	(0.269)	**(0.313)**	**(0.445)**	(0.320)	(0.326)	**(0.322)**	(0.425)
Rmse	0.108	0.0922	0.150	0.155	0.0593	0.0735	0.0733	0.0914
R2	0.0622	0.00164	0.433	0.154	0.755	0.450	0.883	0.744
RMSE ISCED 2	**0.593*****	0.023	**1.293*****	**0.588****	0.228	0.153	**0.235***	0.327
	(0.187)	(0.164)	**(0.257)**	**(0.281)**	(0.168)	(0.194)	**(0.136)**	(0.230)
Rmse	0.0902	0.0922	0.139	0.162	0.0575	0.0728	0.0824	0.0918
R2	0.347	0.00121	0.516	0.0705	0.769	0.460	0.852	0.742
RMSE ISCED 3&4	**0.433****	-0.046	**2.162*****	**1.380*****	-0.179	0.112	0.672	**0.566***
	(0.215)	(0.269)	**(0.271)**	**(0.436)**	(0.320)	(0.326)	(0.500)	**(0.324)**
rmse	0.108	0.0922	0.144	0.149	0.0593	0.0735	0.0816	0.0925
R2	0.0622	0.00164	0.481	0.214	0.755	0.450	0.855	0.738
RMSE ISCED 5	0.334	-0.245	**2.220*****	**1.261*****	0.351	-0.105	**1.196*****	0.661
	(0.255)	(0.277)	**(0.313)**	**(0.445)**	(0.217)	(0.405)	**(0.322)**	(0.425)
rmse	0.110	0.0914	0.150	0.155	0.0583	0.0735	0.0733	0.0914
R2	0.0316	0.0202	0.433	0.154	0.763	0.450	0.883	0.744
RMSE ISCED 2	**0.696****	0.058	**0.838*****	0.113	0.225	0.149	**0.264***	0.284
	(0.274)	(0.206)	**(0.253)**	(0.293)	(0.161)	(0.207)	**(0.139)**	(0.223)
RMSE ISCED 3&4	-0.222	0.044	0.590	**0.996***	-0.361	0.072	0.192	0.433
	(0.339)	(0.381)	(0.430)	**(0.539)**	(0.256)	(0.332)	(0.387)	(0.334)
RMSE ISCED 5	-0.102	-0.289	**0.989****	0.712	**0.485****	-0.116	**1.154*****	0.620
	(0.292)	(0.385)	**(0.390)**	(0.554)	**(0.237)**	(0.398)	**(0.321)**	(0.388)
rmse	0.0906	0.0930	0.119	0.148	0.0566	0.0743	0.0726	0.0895
R2	0.366	0.0238	0.658	0.255	0.787	0.462	0.890	0.766
Observations	56	56	56	56	56	56	56	56

Source: EU-SILC 3005, 2006. Eurostat.

Annex: labels of the NUTS1 regions identified in the data-set

AUSTRIA		ITALY	
AT1	OSTÖSTERREICH	ITC	NORD-OVEST
AT2	SÜDÖSTERREICH	ITD	NORD-DEST
AT3	WESTÖSTERREICH	ITE	CENTRO (I)
SPAIN		ITF	SUD
ES1	NOROESTE	ITG	ISOLE
ES2	NORESTE	POLAND	
ES3	COMUNIDAD DE MADRID	PL1	REGION CENTRALNY
ES4	CENTRO (E)	PL2	REGION POLUDNIOWY
ES5	ESTE	PL3	REGION WSCHODNI
ES6	SUR	PL4	REGION POLNOCNO-ZACHODNI
ES7	CANARIAS	PL5	REGION POLUDNIOWO-ZACHODNI
GREECE		PL6	REGION POLNOCNY
GR1	VOREIA ELLADA		
GR2	KENTRIKI ELLADA	PT	PORTUGAL
GR3	ATTIKI	IE0	IRELAND
GR4	NISIA AIGAIOU, KRITI	IS0	ÍSLAND

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