

Income Inequality and Education Premia

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Abstract

The paper attempts to measure inequality and its changes over the period 1993-2000 for a set of 12 Countries in ECHP. Focusing on wages and incomes of workers in general, inequality is mainly analyzed with respect to educational levels as proxy of individual abilities. Estimation of education premia is performed by quantile regressions to stress differences in income distribution and questioning the true impact of education.

Keywords: Inequality, Education Premium, Quantile Regression

JEL classification: D31, J24, J31

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1 Introduction

Since '70s in the US and UK, since 80s for many European Countries wage inequality increased, both between and within groups, defined by some observables individual characteristics, with respect their 'skills'¹.

Education has been called in many analysis to explain new evidence. Facing with the increase in wage or income inequality, theories challenged to explain new findings with several models: On one extreme view, inequality pattern relates to trade growth, increasing inequality in developed countries and upward mobility in the developing ones are the two faces of same coin, no concern should be expressed when considering the whole economy². On the other extreme, inequality rises as the labor institutions (unions, employment protection laws, ...) have become weaker: hence, inequality - along with the diminishing labor share - can be related to the downfall of minimum wage or to the deunionization of labor force³. Some schumpeterian authors modeled technology resulting in skill-biased change, in order to explain the rising wage differentials between the educational groups. They also find the within groups inequality rise as an outcome of the more 'general' new technological paradigm⁴.

European Countries have some differences with respect to the US labor market, in particular in the past European labor markets were less flexible. It has been argued that the same shift in the technology produced different outcomes with respect to the US and the European Countries. In the latter labor markets the technological shock had its main effects on quantity (unemployment) rather than price (inequalities)⁵ Nevertheless, also in Europe by the late 80s something changed, labor markets have become more flexible, employment protection legislation have become weaker and inequality rose (Glyn, 2001).

In this paper the link between inequality and education is exploited with a detailed look at differences throughout income distribution. Hence, Quantile Regression (QR) are used to get a wide picture of education premia over time and for each Countries. Next section shows sample data and some figures about inequality and education. In section 3, the empirical model is presented as well the premia for education. Last section sums the results and concludes.

¹See among others Murphy and Welch (1993) and Juhn et al. (1993), for an early debate on wage inequality trends for the US.

²See for example Wood (1995).

³See DiNardo et al. (1996).

⁴Aghion, Howitt and Violante (2002) pointed out the role of luck in the labour market related to the increasing within-group inequalities, as a consequence of the major "generality" of knowledge in the new technological paradigm.

⁵See Ljunqvist and Sargent (1998) for some evidence.

2 Data

Microdata came from the European Community Household Panel (ECHP), an annual survey repeated from 1994 to 2001, based on a representative panel of households and individuals in 12 country⁶. In the following years other three Countries were added to the survey⁷, so that ECHP in the end covered 15 Countries for different periods.

A subsample of ECHP is used here: because of the availability of some key variables two Countries have been excluded, Netherlands and Sweden. Moreover, while in general the measures here refer to the period 1993-2000⁸, there are three exceptions: Austria and Luxembourg start from 1994, Finland from 1995. Workers aged 16 – 64 (employed and self-employed) are observed, incomes refer to the year prior to the survey. Incomes are measured in real terms and in PPPs based on the starting year of the period. In the ECHP data, education is classified in 3 broad levels, renamed here as low, middle and high skill levels⁹.

Sample differs by Countries in population and income shares of each educational group (see figure 1 and table 1). Over the period, mean income by group changed differently across Countries and educational groups. In general, mean income growth was slightly more effective for the high skilled group. Mean incomes figures can be summed up:

- high skilled workers mean income increased in Denmark, Belgium, Ireland, Greece, Finland and United Kingdom; it was almost stable in Germany and Luxembourg, slightly decreased in France, Italy, Spain, Portugal and Austria;
- medium skilled workers mean income increased in Denmark, Belgium, Ireland and United Kingdom, remained constant in Italy, Greece, Spain, Finland, Germany and Luxembourg, diminished in France, Portugal and Austria;
- low skilled workers mean income increased in France, Ireland, Italy, Greece, Spain, Portugal, Finland and United Kingdom, was stable in Denmark and decreased in Austria, Germany and Luxembourg.

⁶At the beginning the Countries included in ECHP were: Denmark, Netherlands, Belgium, France, Ireland, Italy, Greece, Spain, Portugal, Germany, Luxembourg and United Kingdom.

⁷Austria joined in 1995 while Finland in one year later, Sweden data were derived from the Swedish Living Conditions Survey.

⁸Incomes refer to the year prior the survey.

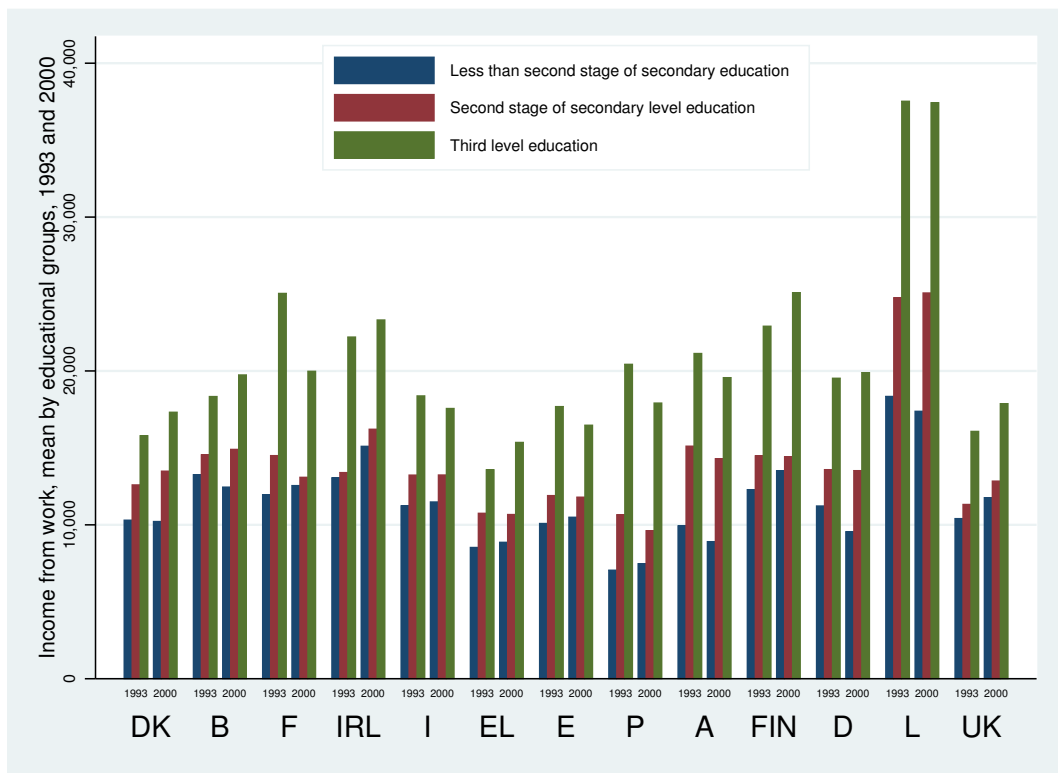
⁹In particular, the three levels are quite similar to the primary, secondary and tertiary education with few differences across Countries; low-skilled stands for 0-2 ISCED codes (pre-primary; primary or first stage of basic education; lower secondary or second stage of basic education), medium skilled for the 3 ISCED code (upper secondary education), high skilled for the 4-6 ISCED codes (post secondary non tertiary; first stage of tertiary; second stage of tertiary).

Table 1: Mean Income, Sample and Income shares by educational levels

<i>Mean Real Income, PPPs</i>						
	<i>1993</i>			<i>2000</i>		
Country	low-skill	medium-skill	high-skill	low-skill	medium-skill	high-skill
Denmark	10312.53	12606.05	15800.62	10227.93	13499.73	17328.10
Belgium	13268.84	14556.32	18349.89	12463.09	14915.81	19752.44
France	11966.43	14509.50	25051.20	12561.16	13100.09	19989.54
Ireland	13065.34	13406.81	22213.66	15113.67	16222.44	23324.79
Italy	11244.04	13242.93	18390.18	11497.96	13250.13	17571.57
Greece	8541.16	10762.47	13586.33	8876.91	10682.12	15368.24
Spain	10098.48	11912.55	17695.47	10504.25	11808.84	16484.59
Portugal	7063.89	10664.32	20442.83	7483.89	9628.30	17924.82
Austria	9942.67	15123.91	21146.21	8918.59	14308.68	19575.35
Finland	12297.14	14492.37	22917.71	13525.87	14428.73	25096.17
Germany	11235.56	13597.02	19538.43	9561.16	13532.51	19901.04
Luxembourg	18354.90	24766.83	37537.03	17390.27	25078.56	37441.18
United Kingdom	10416.11	11337.69	16083.46	11776.05	12852.60	17884.88
<i>Sample share</i>						
	<i>1993</i>			<i>2000</i>		
Country	low-skill	medium-skill	high-skill	low-skill	medium-skill	high-skill
Denmark	0.23	0.41	0.36	0.15	0.53	0.32
Belgium	0.24	0.35	0.41	0.20	0.35	0.45
France	0.30	0.45	0.25	0.55	0.13	0.32
Ireland	0.37	0.43	0.20	0.32	0.45	0.23
Italy	0.50	0.40	0.10	0.42	0.46	0.13
Greece	0.46	0.28	0.26	0.40	0.37	0.22
Spain	0.57	0.19	0.24	0.46	0.22	0.32
Portugal	0.83	0.11	0.07	0.73	0.15	0.12
Austria	0.21	0.71	0.08	0.15	0.75	0.09
Finland	0.28	0.39	0.33	0.19	0.49	0.32
Germany	0.23	0.56	0.22	0.18	0.56	0.26
Luxembourg	0.42	0.41	0.17	0.36	0.37	0.27
United Kingdom	0.49	0.16	0.35	0.28	0.24	0.48
<i>Income share, PPPs</i>						
	<i>1993</i>			<i>2000</i>		
Country	low-skill	medium-skill	high-skill	low-skill	medium-skill	high-skill
Denmark	0.18	0.39	0.43	0.11	0.50	0.39
Belgium	0.20	0.32	0.48	0.15	0.31	0.54
France	0.22	0.40	0.38	0.46	0.11	0.43
Ireland	0.33	0.38	0.29	0.27	0.42	0.31
Italy	0.44	0.41	0.15	0.37	0.46	0.17
Greece	0.38	0.29	0.33	0.33	0.36	0.31
Spain	0.47	0.18	0.35	0.38	0.20	0.41
Portugal	0.70	0.14	0.16	0.60	0.16	0.23
Austria	0.14	0.74	0.12	0.10	0.77	0.13
Finland	0.20	0.34	0.45	0.14	0.40	0.46
Germany	0.18	0.53	0.29	0.12	0.53	0.35
Luxembourg	0.32	0.42	0.26	0.24	0.37	0.39
United Kingdom	0.41	0.14	0.45	0.22	0.20	0.58

Source: ECHP

Figure 1: Mean Income by Educational Groups



Source: ECHP

Table 3: Inequality decomposition by Education, between and within components

Country	<i>Theil Index</i>					
	<i>total</i>		<i>between</i>		<i>within</i>	
	1993	2000	1993	2000	1993	2000
Denmark	0.147	0.135	0.013	0.015	0.135	0.121
Belgium	0.172	0.266	0.009	0.016	0.163	0.249
France	0.309	0.233	0.045	0.025	0.264	0.209
Ireland	0.306	0.279	0.026	0.016	0.280	0.263
Italy	0.205	0.174	0.013	0.010	0.193	0.165
Greece	0.278	0.221	0.019	0.024	0.259	0.197
Spain	0.262	0.253	0.030	0.021	0.232	0.232
Portugal	0.284	0.239	0.063	0.056	0.220	0.183
Austria	0.222	0.185	0.019	0.018	0.202	0.167
Finland	0.241	0.255	0.035	0.040	0.206	0.215
Germany	0.193	0.215	0.019	0.029	0.174	0.186
Luxembourg	0.173	0.198	0.035	0.046	0.137	0.152
United Kingdom	0.242	0.245	0.021	0.018	0.221	0.227

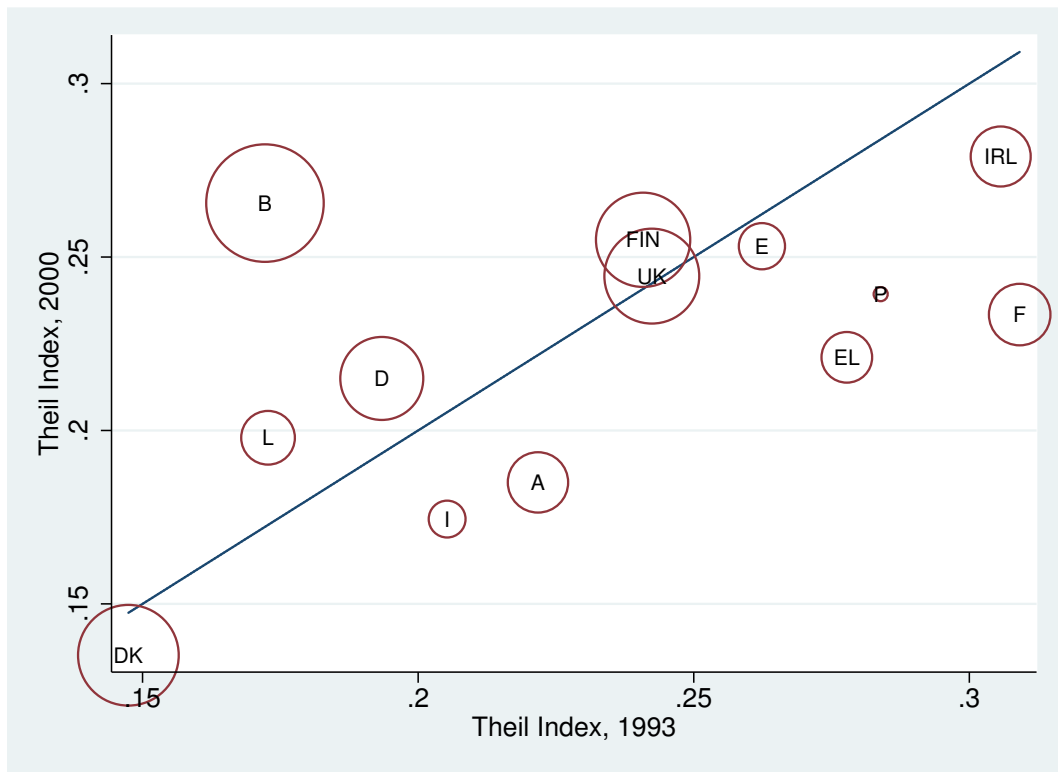
Source: ECHP

Income inequality can be decomposed into the between-group and the within-group inequality components by the three educational groups, as it's shown in table 3 with respect the Theil Index. Total inequality grew only for few Countries¹⁰: Belgium, Germany, Finland and Luxembourg. All of them were among the less unequal Countries in the sample at the starting year. The table 3 shows that education measured by the three broad levels explain only a negligible amount of total inequality, while differentials within each educational group play the major role. This is only a rough descriptive measure, where education is the only observable. Obviously, education should increase its role when accounted for other individual observables as age, sex, experience, tenure, occupation, industry and so on. Nevertheless, the link between higher inequality and education could be measured in several ways in order to get some different pictures (see figure 2, where the change in income inequality is related with the mean educational level of the Country, bigger bubbles stand for higher educational level in the period).

What we need to better understand the role played by education in inequality patterns is to get not only a measure but a detailed range of measures. In the next section, Quantile Regressions are used to consider the differences through incomes distribution in education premia between different groups of individuals.

¹⁰It should be stressed that even if referred as Countries, samples here are not representative as summary measures at Country-level.

Figure 2: Change in Inequality and Educational level



Note: Circles are proportional to the mean educational level of the workers in the samples.

Source: ECHP

3 Education Premia through Quantile Regressions

The mean effect of education on income and inequality could be misleading. The changes in the shape of incomes distribution suggest to look for the differences between some points of such distribution. Hence, the analysis is performed using quantile regression - LAD models - in some quantiles: estimation is performed at .10, .25, .50, .75 and .90 quantiles. Quantile regressions allow for a detailed look to the premia structure, distinguishing the education impact on different segments of the labor market¹¹.

The income equation is:

$$\begin{aligned}
 Y_i = & \beta_0^\theta + \beta_1^\theta Edu_i + \beta_2^\theta Edu_i^2 + \beta_3^\theta Exp_i + \beta_4^\theta Exp_i^2 + \beta_5^\theta Ten_i + \\
 & + \beta_6^\theta Ten_i^2 + \beta_7^\theta Edu_i * Exp_i + \beta_8^\theta Edu_i * Ten_i + \beta_9^\theta Edu_i * Sex_i + \\
 & + \beta_{10}^\theta Exp_i * Sex_i + \beta_{11}^\theta Ten_i * Sex_i + \delta^\theta D_i + u_i
 \end{aligned}$$

or

$$y_i = x_i' \beta^\theta + u_i^\theta,$$

$$Q_\theta(y_i | x_i) = x_i' b^\theta, \theta \in (0, 1)$$

where: θ is the quantile, Edu means years of education and is measured as age in which the worker ended higher general education course *minus* starting education age, Exp means potential experience and is measured as age *minus* age in which the worker i ended higher general education course, Ten means tenure for the current job, D is a set of few controls for sex, industry and occupation. Age does not enter in the equation because of the collinearity, since it can be thought as the sum of Edu and Exp variables.

The education premia structure has been easily measured from:

$$\frac{Q_\theta(y|x)}{Edu} = b_1^\theta + 2b_2^\theta Edu + b_7^\theta Exp + b_8^\theta Ten + b_9^\theta Sex$$

¹¹See Koenker and Bassett (1978), Buchinsky (1998).

Table 5: Education Premia, Results example

<i>Denmark 1993</i>					
Q10	Q25	Q50	Q75	Q90	OLS
.13268267	.11597426	.09515003	.0677198	.05962314	.1024382
.0117699	.00879405	.00735581	.00601565	.00799005	.00792825
.0858909	.0834702	.07524175	.06283106	.05378655	.07718212
.01011009	.00628351	.00566681	.00493439	.00582728	.00593975
.08573115	.07087203	.06250874	.05028839	.04923201	.0679873
.0101254	.00611973	.00497652	.00463083	.00793968	.00609512
.03893939	.03836797	.04260045	.04539965	.04339541	.04273123
.0084231	.00408725	.00442055	.00407729	.00717759	.00519548
.03877963	.02576979	.02986744	.03285698	.03884087	.0335364
.01249811	.00659227	.00549876	.0048543	.00979491	.0070299
.10904439	.09516202	.07757963	.05702595	.05001865	.08514503
.00945567	.00701609	.00604357	.004667	.00690212	.00638839
.06225263	.06265796	.05767134	.05213721	.04418205	.05988896
.00859445	.00540504	.00435815	.00420976	.00530719	.00496589
.06209287	.05005979	.04493833	.03959453	.03962751	.05069413
.00709606	.00408126	.00370317	.00327313	.00683387	.00432525
.01530111	.01755573	.02503004	.03470579	.03379091	.02543806
.00628892	.0037085	.00359902	.00369786	.00675218	.0044694
.01514135	.00495755	.01229703	.02216312	.02923637	.01624323
.0100491	.0054753	.005071	.00406313	.00891452	.00588047
.07949654	.06914672	.05561662	.04365863	.03801302	.06352857
.00783704	.00578632	.00522463	.00408766	.00598211	.0051694
.03270478	.03664267	.03570834	.03876989	.03217643	.0382725
.00847576	.00598104	.00391733	.00473039	.00541536	.00498523
.03254503	.02404449	.02297533	.02622721	.02762189	.02907767
.00430729	.00317126	.00355657	.00319944	.00588894	.00302038
-.01424673	-.00845957	.00306704	.02133847	.02178529	.0038216
.00580635	.0054273	.00417956	.00478787	.00682518	.00496706
-.01440649	-.02105775	-.00966597	.0087958	.01723075	-.00537323
.00808531	.00570293	.0057284	.00454171	.0082023	.00543125

Source: ECHP

and an example of the results of such estimation are shown in table 5, with reference to the male workers. Since it's really hard to get a picture from that premia tables, education premia have been plotted for each Country. The figures 3 - 15 are arranged in the way that each column refers to different educational level (from right: low, middle and high skills) while each row refers to different combinations of potential experience and job tenure, starting from the young inexperienced workers in top boxes and ending with high-tenure old workers in the bottom boxes. The red lines stand for the 2000 premia, ending year of the period, while the dashed one for the initial year, different for some Countries (see section 2). The figures show also two points for the mean OLS education premia.

Theories could suggest some general patterns in the premia figures (see section 1):

- premia should be increasing with education for the SBTC hypothesis (from the left to the right in the figures);

- premia should be increasing also with experience, given the major generality of the new technological paradigm which allows higher transferability of skills between jobs;
- premia over time reflect at least economic growth and the changes in the supply of skills: while the former should rise the overall structure, the latter effect should impact negatively on the younger workers premia.

Moreover, going back to the inequality-education link, one should note that the differences explained by education can be thought as the differences between columns in the figures (between-group inequality), while flatter lines could be seen as lower unequal returns within each educational level (within-group inequality).

Keeping in mind these suggestions, we can move to the results as they look like in the figures 3 - 15. Countries can be grouped, based on the effectiveness of the technological change on workers education premia¹². There have been increasing premia for Finland, Germany (especially for younger and low-educated workers), Ireland (younger workers) and Luxembourg (especially for younger high-skilled workers). Premia grew in some Countries for the more educated individuals: Portugal, Greece; Belgium, France and Spain (more effective for the older workers); Younger workers had increasing premia in United Kingdom and Denmark (especially for the low-skilled ones). Almost constant premia for the younger workers in Italy, United Kingdom (excepted the younger ones), Greece low-skilled and Austria high-skilled. Older workers reduced their premia in Italy and Ireland as well the high skilled in Denmark, the low-skilled in Austria and the younger low-skilled in France.

Within group - defined by education, experience and tenure - inequality was quite increasing with respect to the older workers in many Countries: Greece, Spain, Portugal, Ireland, United Kingdom, Belgium and Italy. The same is true for the younger Danish. While within inequalities among younger workers diminished for many of those Countries. Finally, there was an increase of education premia for the workers with very low or no tenure (no matter experience) in Greece, Portugal and Belgium.

4 Concluding Remarks

Education has been called to explain the behaviour of income inequality over time and across different economies. As the relative income of skilled workers grew more than the supply of skill, it was argued that a skill-biased

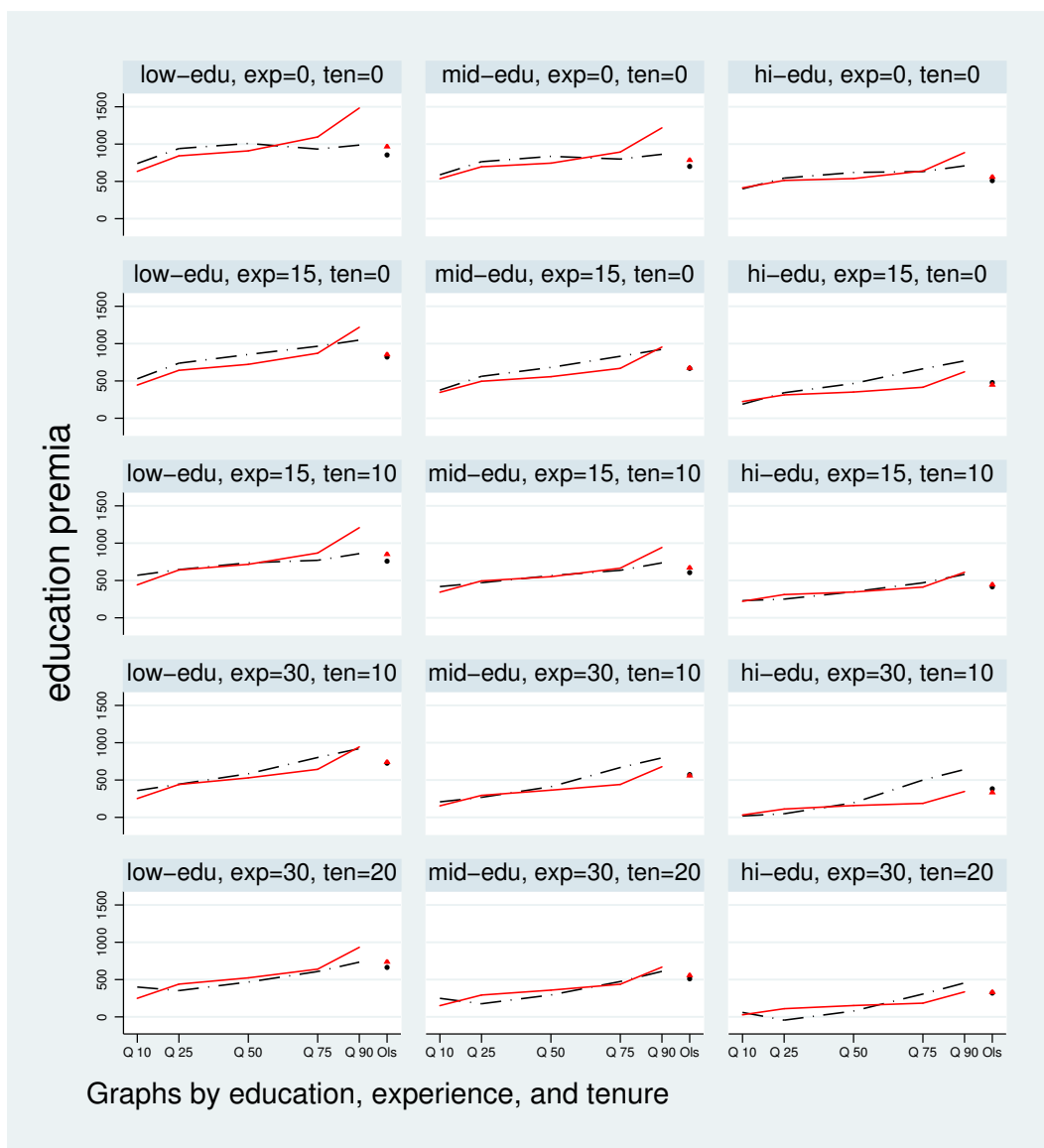
¹²For other results on some European Countries in previous years see Pereira and Martins (2004); See Buchinsky (1994) for an application to US data, Lilla (2005) for an QR analysis of Italian labor market.

technological change was occurring, demanding more and more educated workers.

Many Countries experienced the increase in education premium in its mean level, but differences arise when we look at the whole income distribution and at different groups of workers based on their sex, experience, tenure. Education had a real value especially for the younger high-skilled workers in many Countries, while the change in technology was not-so-easy for the older cohorts, with increasing within-group differences.

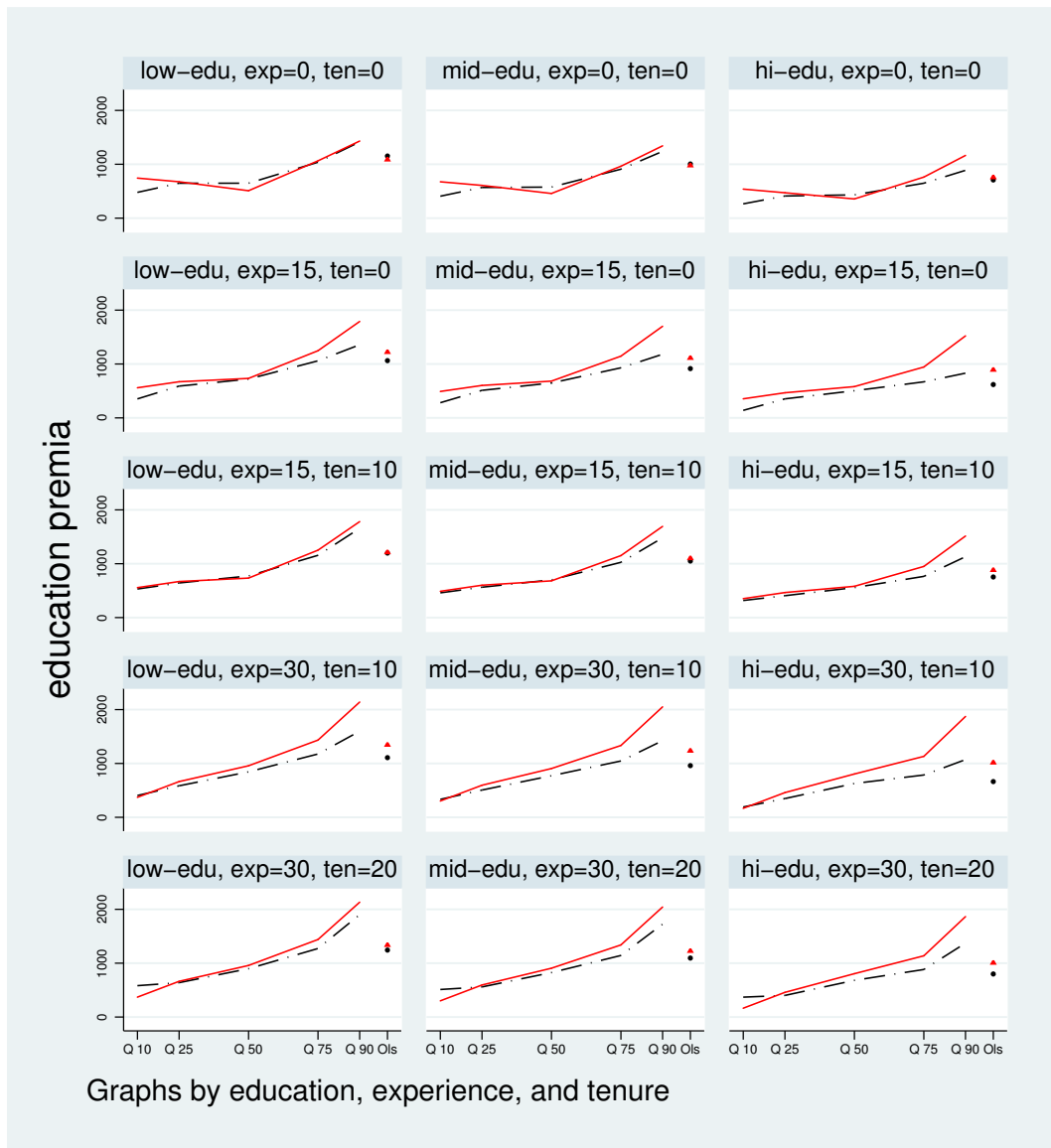
In this paper some evidence has been shown for thirteen European Countries, from the ECHP data. Analysing a period of quite declining inequality, many Countries presented a more unequal premia structure. This is true especially for some segments of the labor markets. Policies aimed at targeting these workers and facilitate their adjustment should be encouraged.

Figure 3: DENMARK



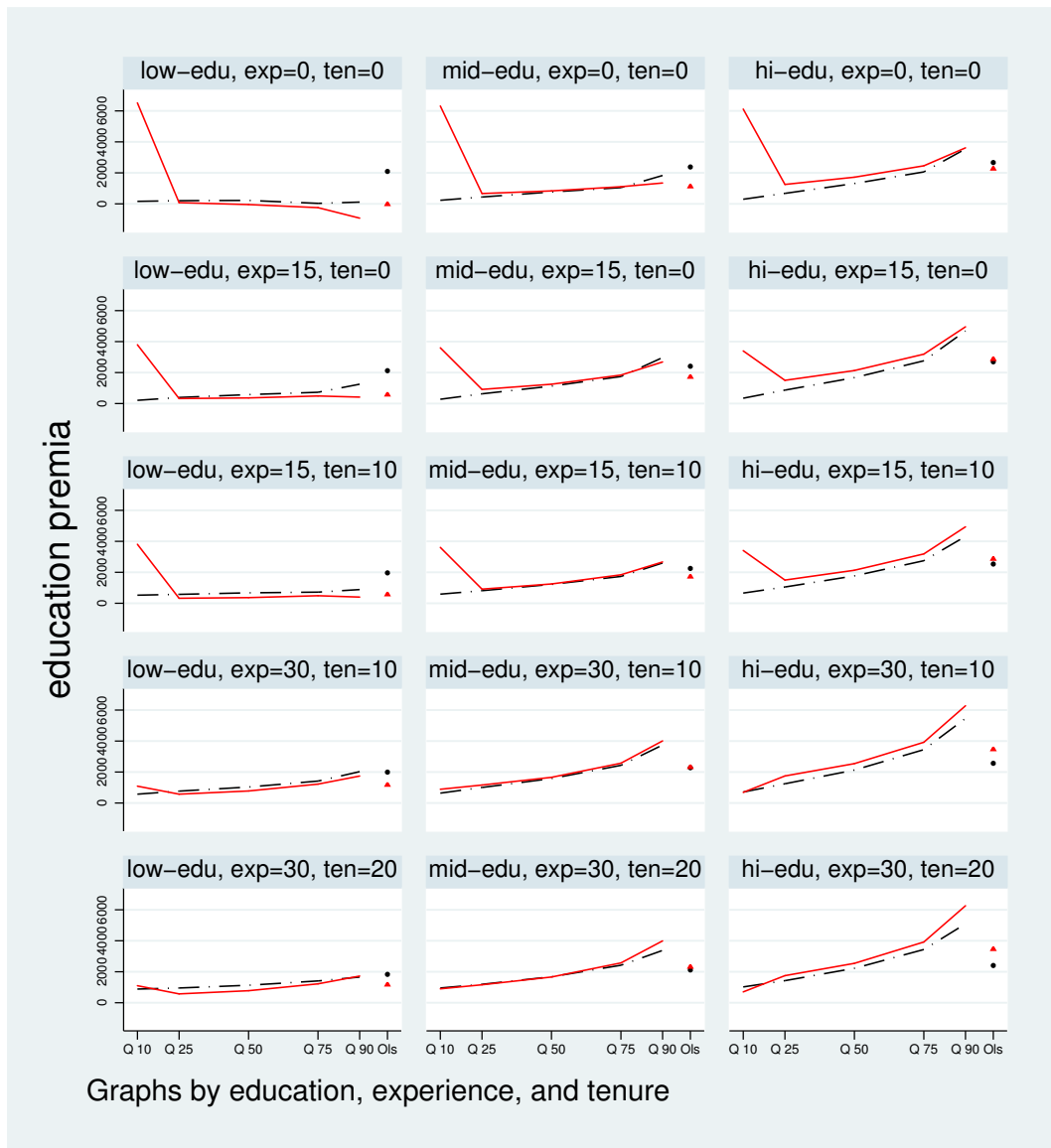
Source: ECHP

Figure 4: BELGIUM



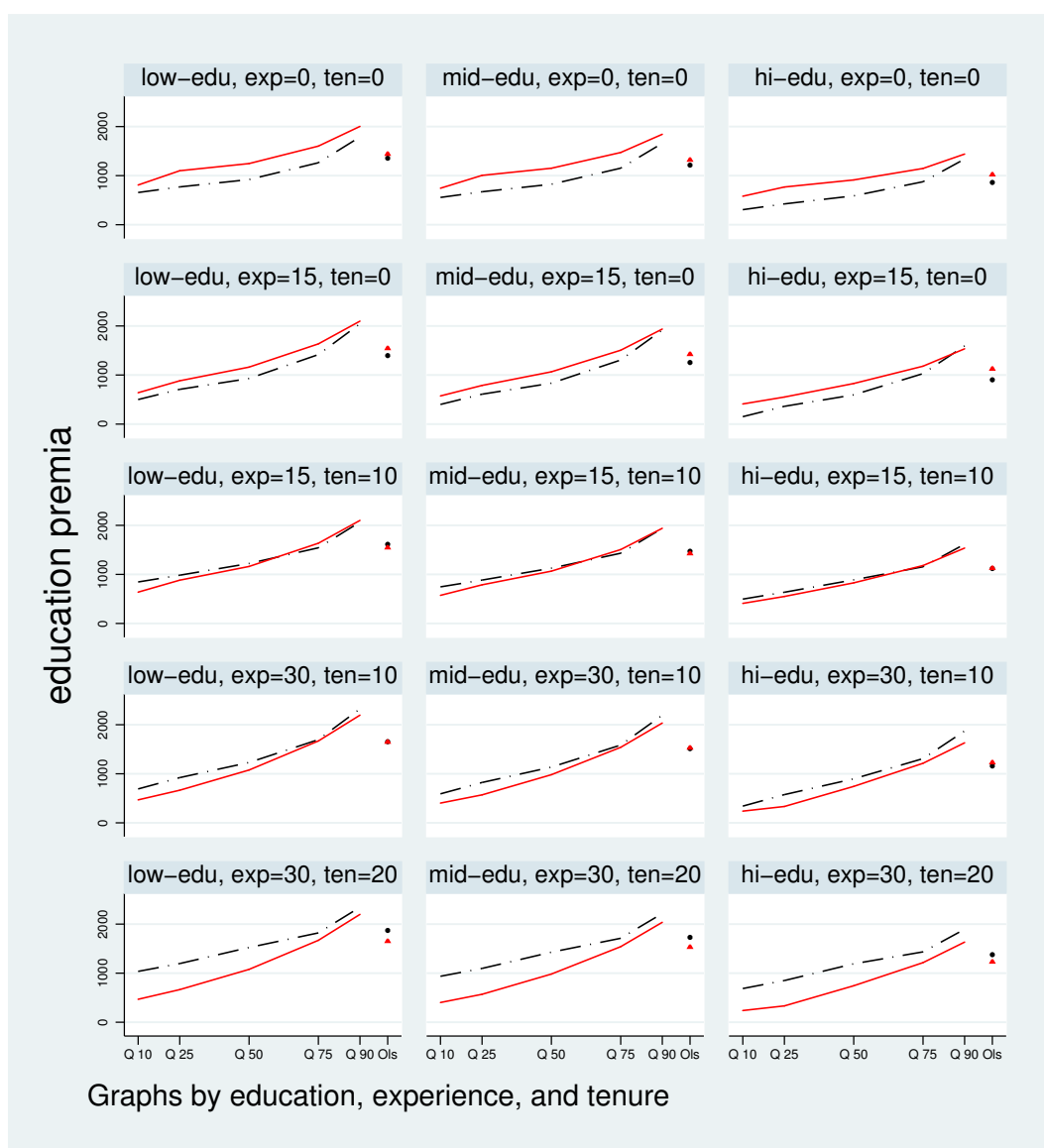
Source: ECHP

Figure 5: FRANCE



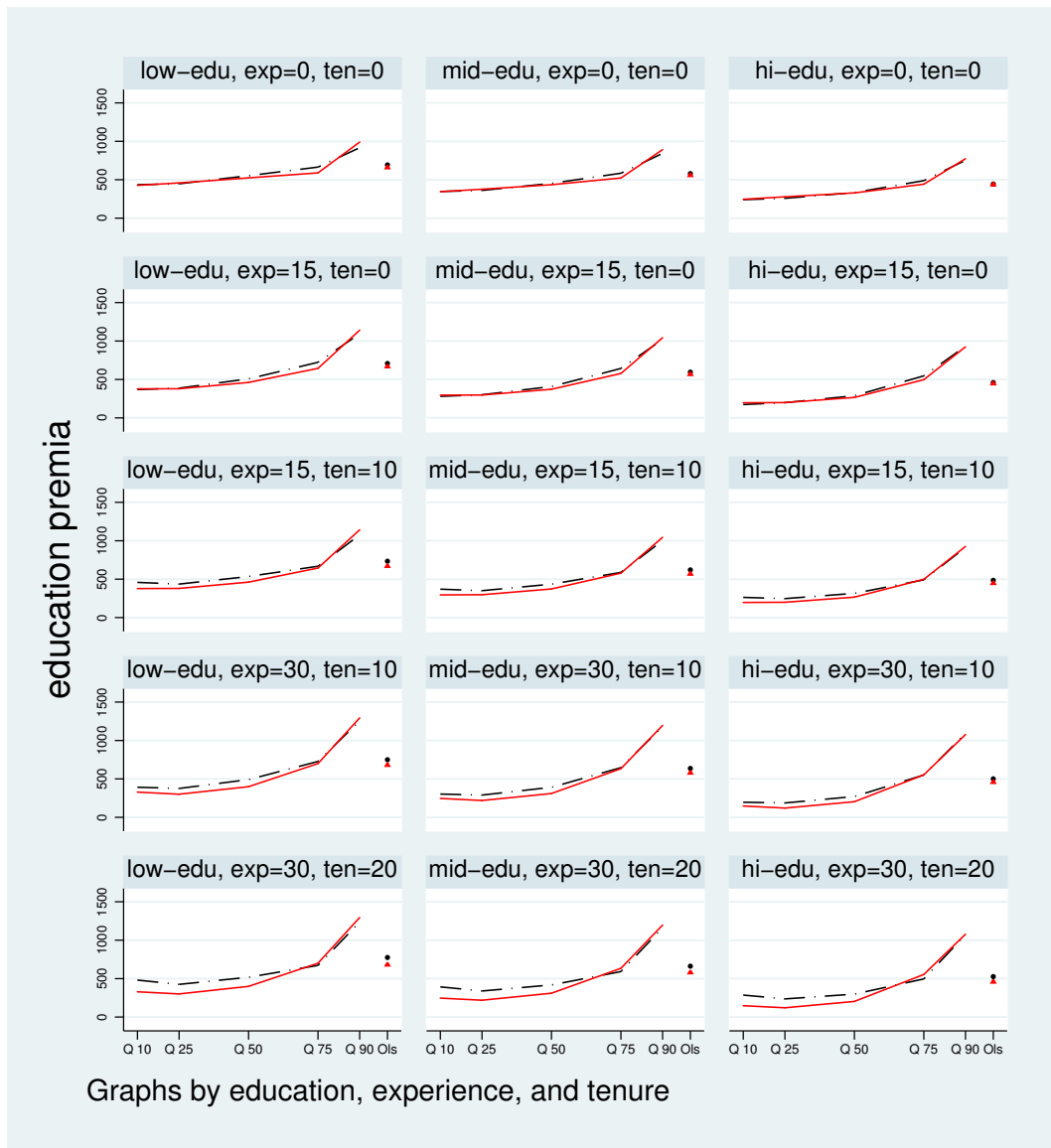
Source: ECHP

Figure 6: IRELAND



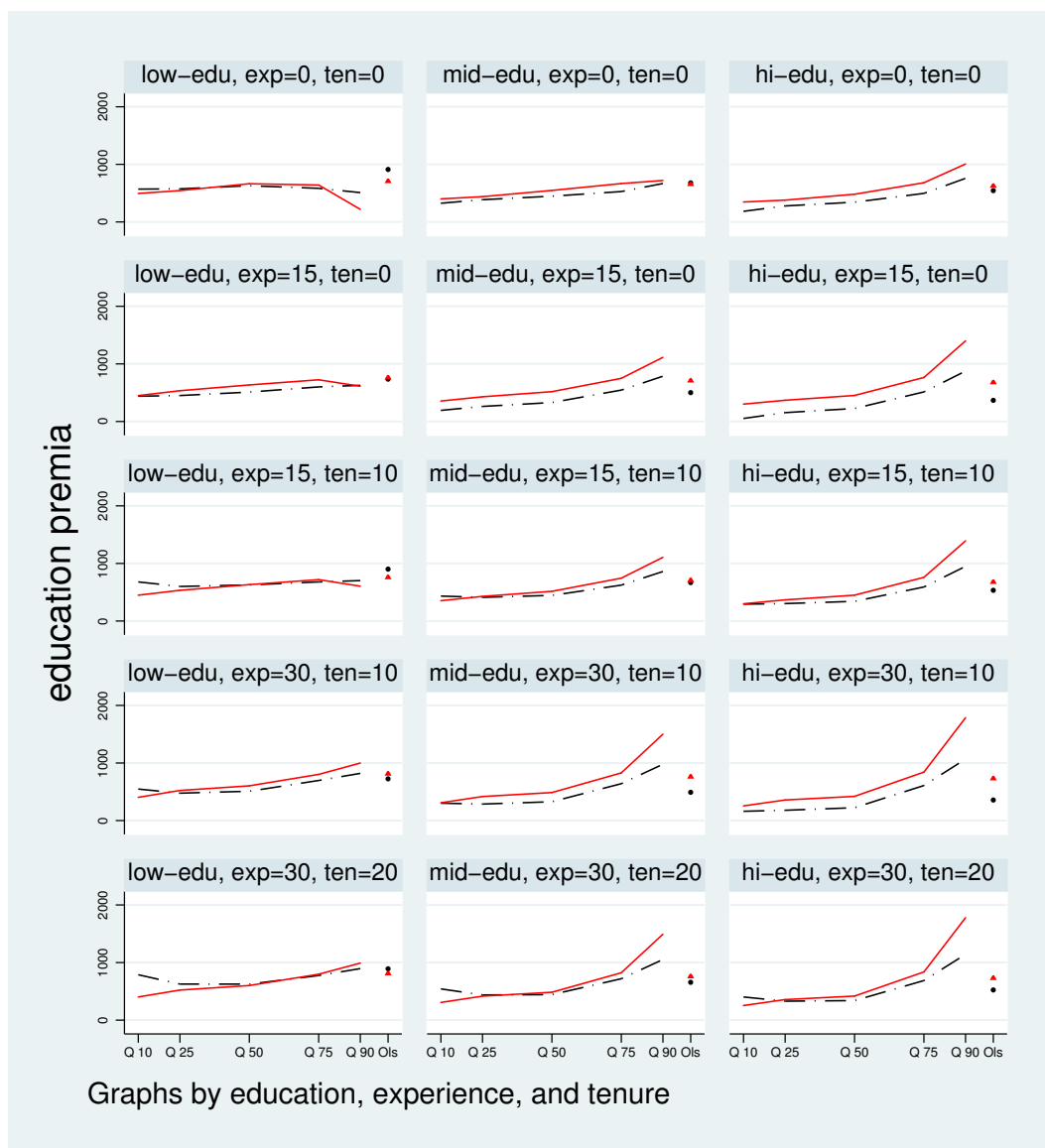
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Figure 7: ITALY



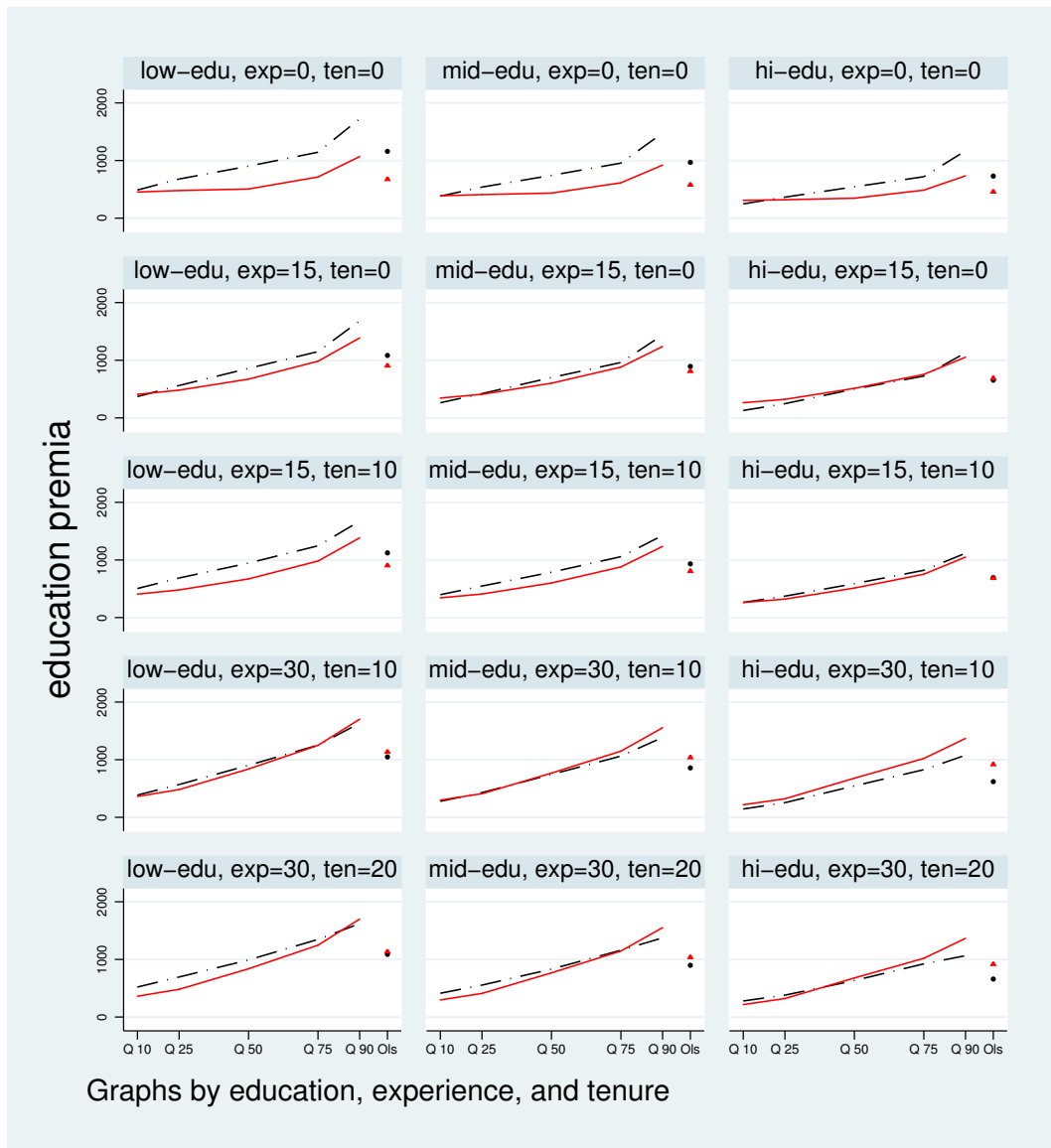
Source: ECHP

Figure 8: GREECE



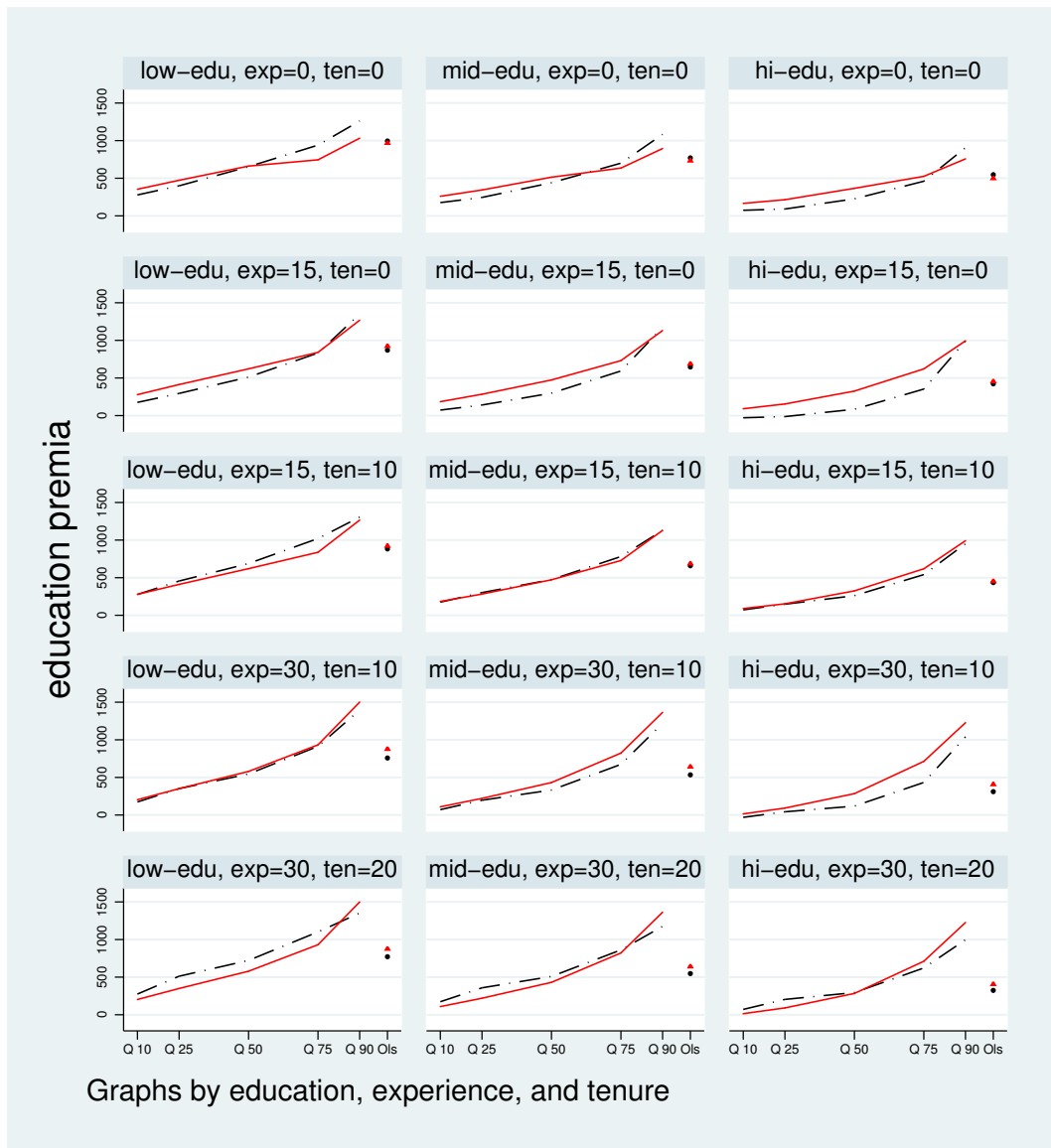
Source: ECHP

Figure 9: SPAIN



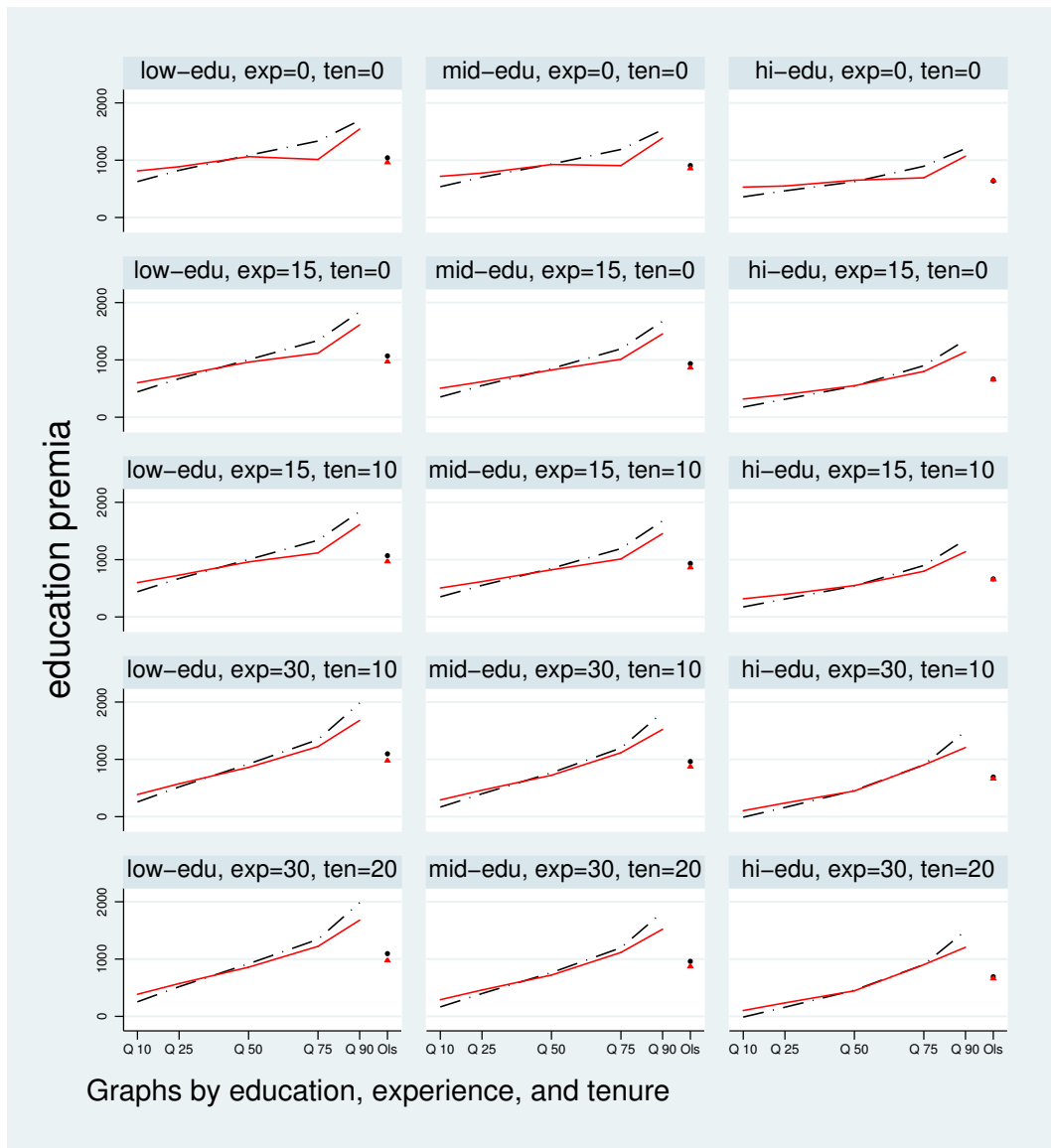
Source: ECHP

Figure 10: PORTUGAL



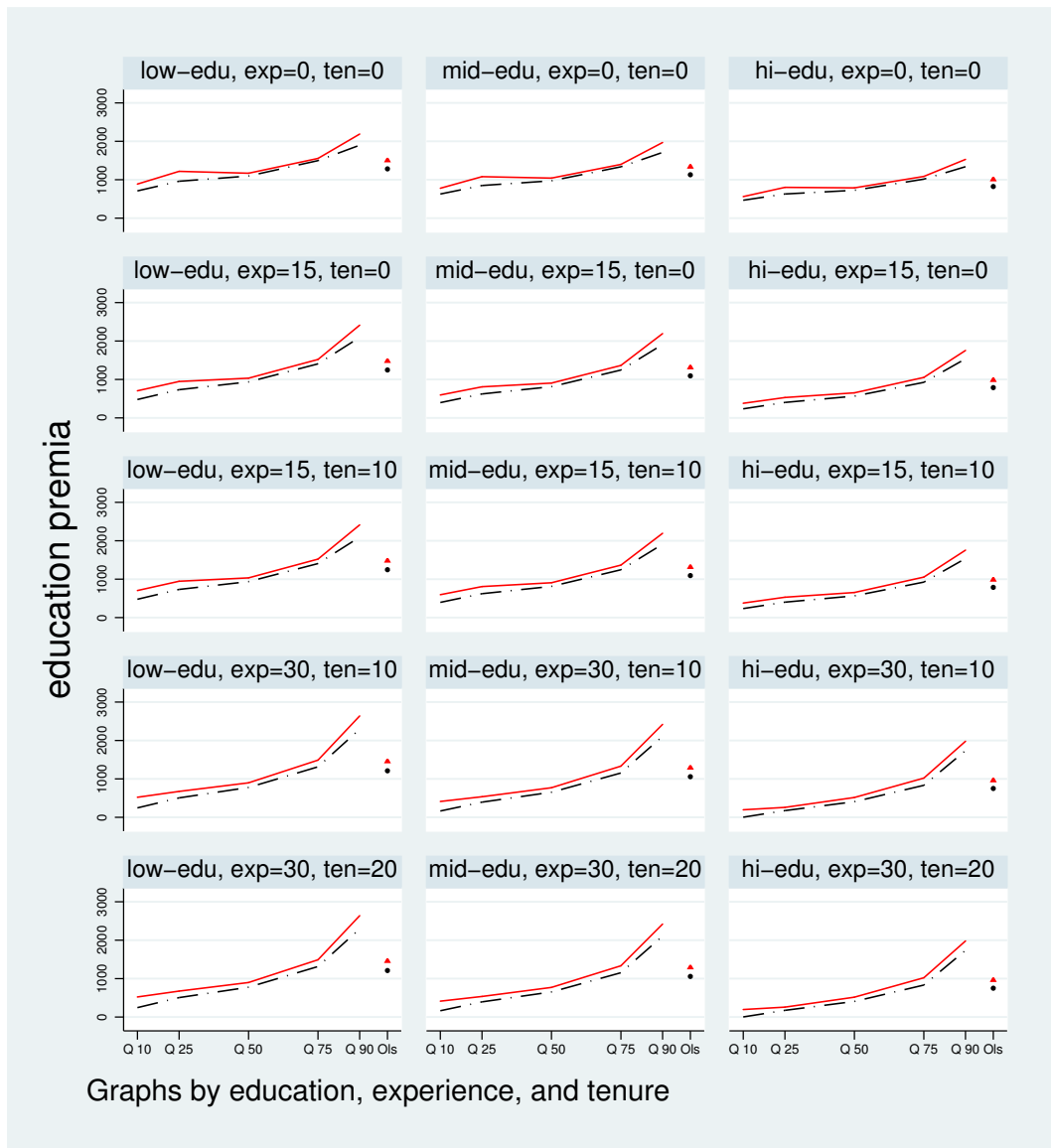
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Figure 11: AUSTRIA



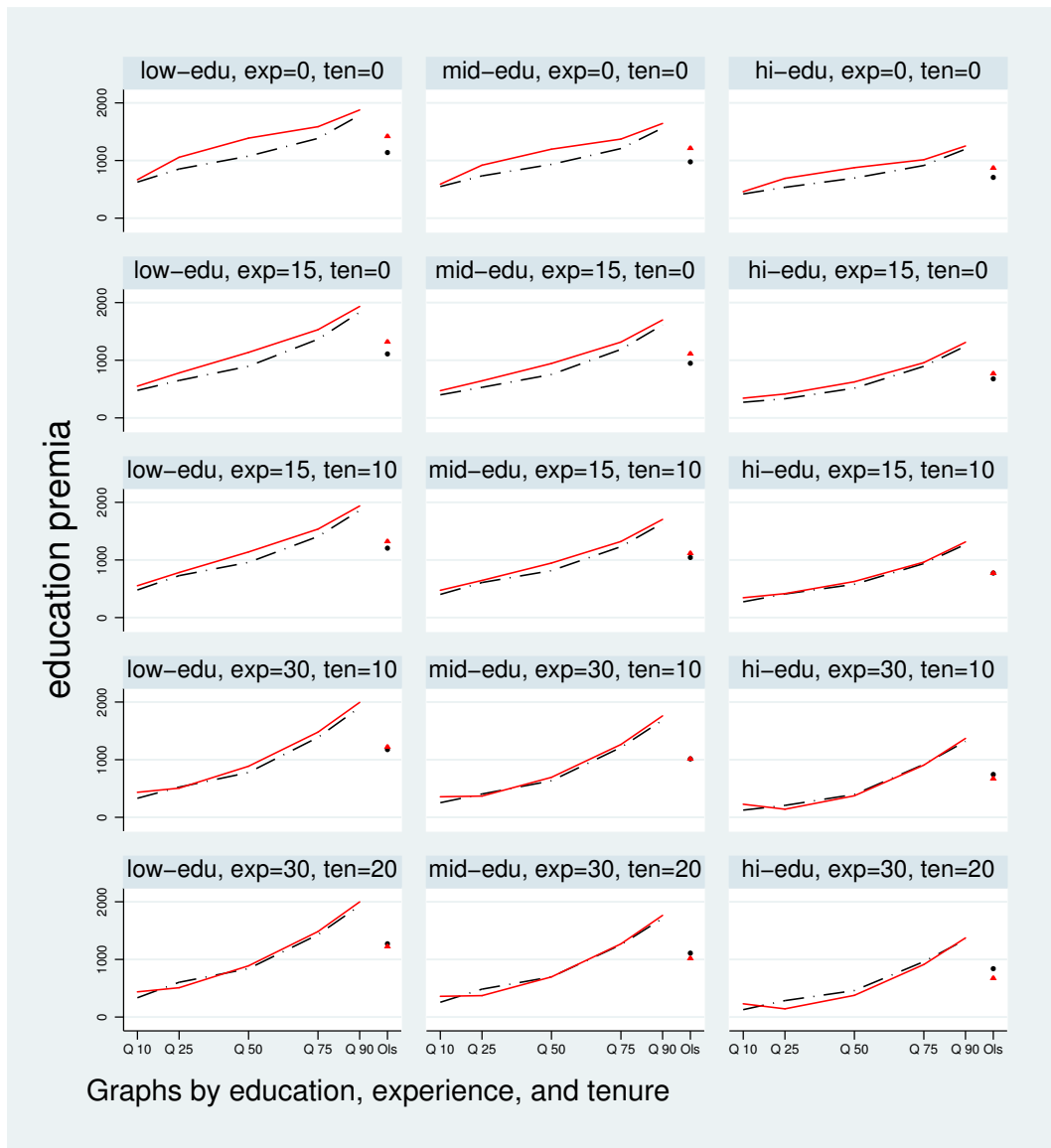
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Figure 12: FINLAND



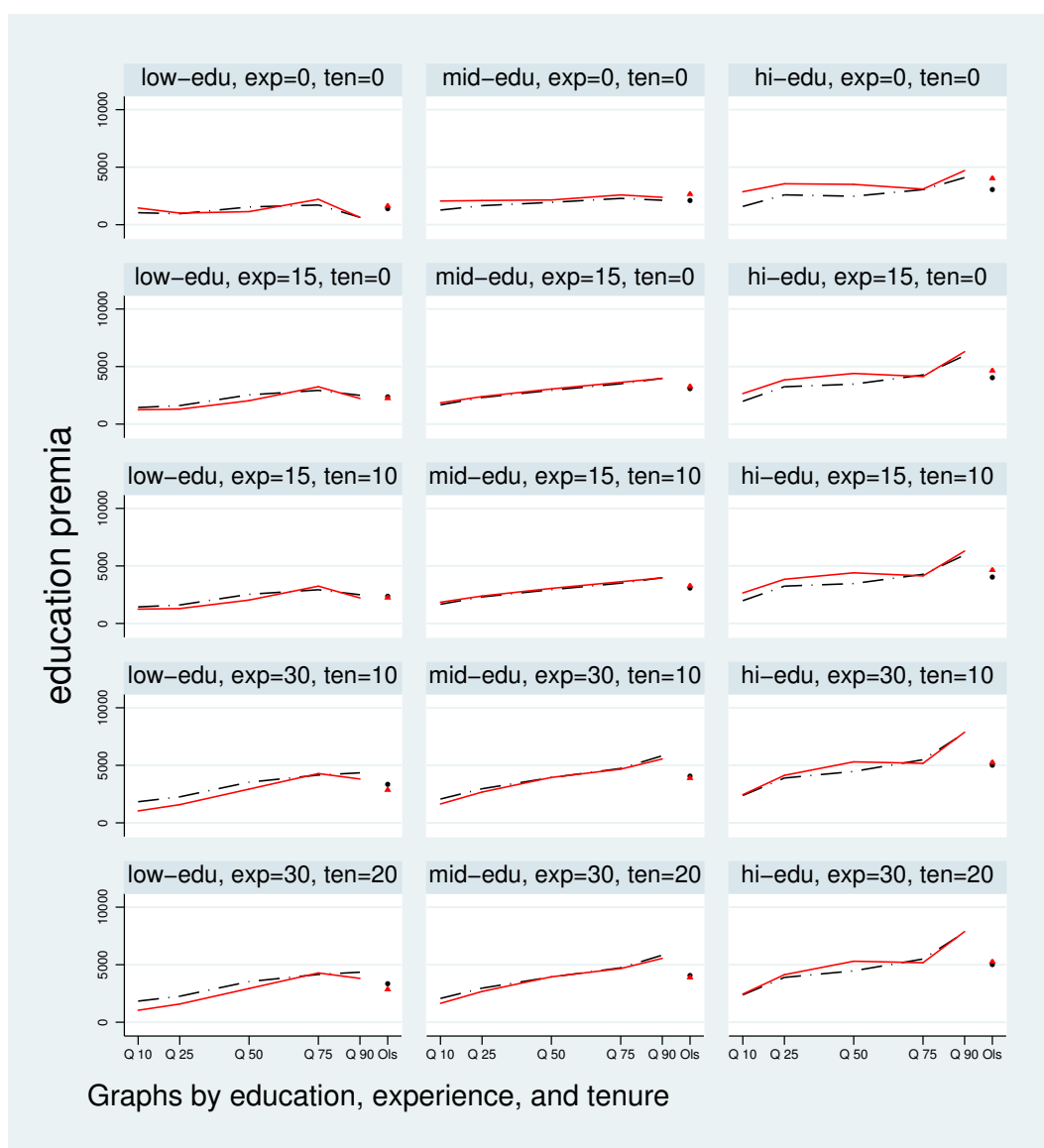
Source: ECHP

Figure 13: GERMANY



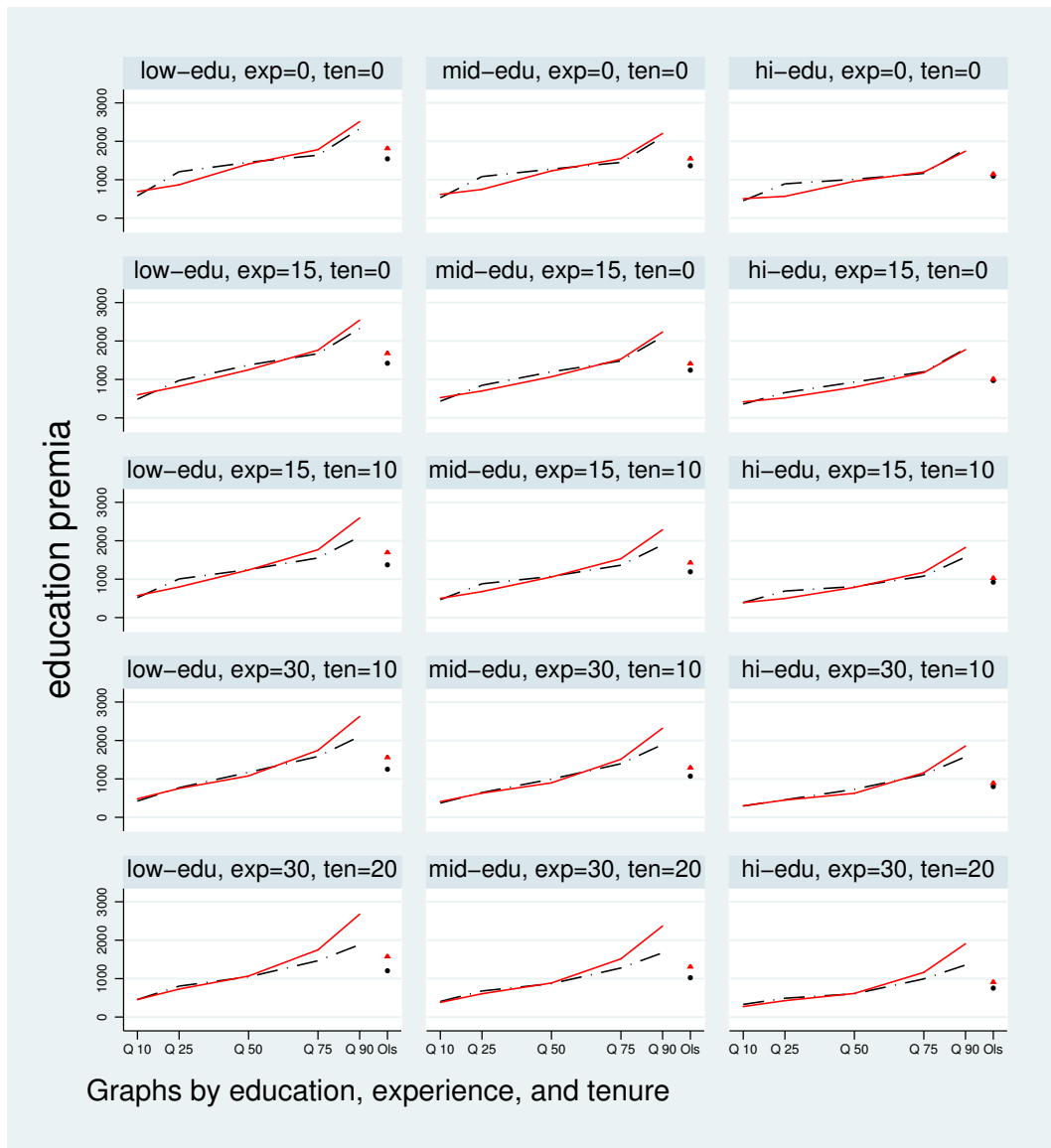
Source: ECHP

Figure 14: LUXEMBOURG



Source: ECHP

Figure 15: UNITED KINGDOM



Source: ECHP

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