Are there asymmetries in the Pay Penalty of Over-education?: Evidence Across Europe

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Abstract

Investing in human capital is a key tool for economic development and, as such, a major policy concern for most governments. The phenomenon of over-education exists in a large number of countries and raises serious efficiency concerns. It is well established that over-educated workers are penalized in term of wages relative to their matched peers. Among possible explanations, the ability-skills hypothesis is the one that has attracted most the attention of researchers. We focus our analysis on that hypothesis: whether the effects of over-education display asymmetries across the conditional distribution of wages. We use QR methodology and European Community Household Panel (ECHP) to analyze the interactions between unobservable individual characteristics and over-education across conditional distribution. Across the conditional distribution of wages the observed patterns do not lead to a clear conclusion. Homogeneity in pay penalty of over-education arises for some countries, while increasing and decreasing asymmetries appear for some others.

Keywords: Returns to education, over-education, quantile regression, unobserved heterogeneity.

JEL-Codes: C29, D31, I21

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0. Introduction

Investing in human capital is a key tool for economic development and, as such, a major policy concern for most governments. However, a significant proportion of the labour force in developed countries has more education than is actually required for their jobs, i.e., is over-educated (Sloane, 1999, Groot and Van den Brink, 2000, Hartog, 2000). This phenomenon raises serious efficiency concerns, as it suggests that a fraction of the workforce is not fully using their skills at their current job, resulting into a waste of resources.

The mean returns to different forms of human capital have been extensively investigated in labor economics literature, especially the returns to formal education. Relatively recently, attention has moved to study the degree to which education might be associated with some other changes in conditional distribution, movements in wage inequality and differing returns to education. However, to our knowledge, less few studies have analyzed how over-education affects the conditional wage distribution.

It is well established that over-educated workers are penalized in term of wages relative to their matched peers (Alba, 1993, Sloane et al., 1999, Dolton and Vignoles, 2000). This finding has clear implications for the relation between education and wages, alerting prospective students and policy makers that attaining a certain qualification is not a sufficient condition to get a high-pay job. Our main goal will be to determine whether the pay-penalty associated with over-education is constant or not across conditional wage distribution, that is the existence of asymmetries in the pay penalty of over-education on conditional wage distribution.

The determinants of over-education are not clear cut. Among possible explanations we pointed out some of plausible explanations. First, some studies show that there are significant complementarities between unobserved ability (unobservable individual characteristics) and education, and then higher ability individuals, further to the right in the conditional wage distribution, might have higher returns to education, see Arias, Hallock and Sosa-Escudero (2001). In terms of over-education, those who end up

accepting mismatched work are the less able[1]. Also it is possible to show that over-education might display a negative effect on wages, that is, conditional on observable characteristics, over-educated workers earn less, relative to workers with similar skills but who are not over-educated. An upward or downward sloping profile when we graph the over-education effect across quintiles of the conditional wage distribution will be due to ability, that is, an unobservable individual-specific effect that may interact with over-education differentially across the conditional wage distribution. If non-observable individual characteristics and education are complementaries, then those individiual characteristics might offset the negative effect of being over-educated. Then, being over-educated but in the upper part of the skills distribution reduces the loss of earnings associated to over-education. An alternative interpretation could be that if over-education arises due to the lack of skills, we should observe a diminishing pay penalty to over-education when moving from the lower quantiles to the upper quantiles of the conditional wage distribution, i.e., from low-skill to high-skill groups. If, in turn, the pay penalty to over-education in the upper segment persists, then over-education affects workers with high skills as well.

Secondly, the variations in the pay-penalty of over-education across the conditional wage distribution might reflect the willingness of worker to take up mismatched work in exchange of other forms of human capital such as training and experience, and the willingness of employers to compensate with excess education other forms of human capital. The existing evidence is, however, rather mixed. Sicherman (1991) and Sloane et al. (1999) suggest that over-educated workers have lower labour market experience and training. As opposite, Duncan and Hoffman (1981) and Alba-Ramirez (1993) find that evidence that training and labor market experience are not treated by employers as a

[1] Chevalier (2003) and McGuiness (2002) find evidence that low-ability workers are more prone to take mismatched work. Similarly, Robst (1995) finds a negative relationship between college quality and the probability of being over-educated. Controlling for skill heterogeneity, Chevalier (2003) finds that about 40% of the pay penalty of over-education is due to unobserved ability. Using panel data Bauer (2002) finds that wage differentials between matched and mismatched workers vanish once unobserved heterogeneity is controlled for. Opposite to these findings, McGuiness (2003b) shows, using data from the UK that the penalty to over-education persists even after controlling for workers heterogeneity. In the same vein, Dolton and Silles (2000) use individual characteristics to endogenize the probability of being over-educated and find that, once this probability is taken into account in the wage regression, the wage effects of over-education are large and substantial.

substitute for formal qualifications. Also workers may accept mismatched work if this raises their probability of being promoted within the firm or to another firm. **Ref:**

Thirdly, from an aggregate perspective, the increase in average schooling levels observed in developed countries over the last years may have outpaced the demand for educated workers, thus resulting in a fraction of the work force entering jobs for which they are over-qualified. According to this view, the over-education phenomenon has a transient nature, as it simply reflects a temporal disequilibrium. However, there is consistent evidence that the determinants of over-education are far more complex. Dolton and Vignoles (2000) and Mcguiness (2003) find that for some workers over-education is a long-run phenomenon.

Among these three alternative explanations, the ability-skills hypothesis is the one that has attracted most the attention of researchers. We also focus our analysis on that hypothesis: whether the effects of over-education display asymmetries across the conditional distribution of wages. The two contributions of this paper are the following. First, we use recent and comparable data from European countries included in the European Community Household Panel (ECHP). Up to date there is little comparable evidence for Europe regarding the wage effects of over-education. Major differences between the studies arise not only from crucial differences in the model specifications but also from the use of different definitions of variables, diverging datasets and differently defined sample of individuals. The results reported in this paper contribute to the literature by reporting updated and internationally comparable estimates of the wage effects of over-education for a set of European countries.

Secondly, in contrast to Ordinary Least Square techniques (OLS), Quintile Regression (QR) methods allow for interactions between unobservable factors and observable wage determinants. If over-education (observable determinant of wages) interact with the unobservable variable (e.g. ability) in a non-trivial way, then an exogenous shift, e.g. changes in policy of education, may affect the scale, shape and location of conditional distribution. We can assess how over-education affects low-skill and high-skill workers and whether or not there exists asymmetries on the pay penalty of over-education. Conditional on observable characteristics, those individuals that are located at higher quintiles of the earnings distribution have, presumably, more skills, where skills include

ability, motivation, better academic credentials and other unobservable characteristics affecting productivity. Theoretically, in a perfect competitive labour market, one would expect that returns to investment in human capital might be the same across conditional distribution. There are some arguments that suggest it might not be the case.

Previous results controlling for unobserved heterogeneity were based on panel data and instrumental variables (Chevalier, 2003, Dolton and Silles, 2000). These approaches have their own limitations. On the one hand, the estimates using panel data are based on the transitions of workers from the status "over-educated" to "non-over-educated". To the extent that these transitions are not exogenous, the results arising from panel data may be biased. On the other hand, the instrumental variables approach requires finding instruments that are related to wages and, at the same time, unrelated to over-education. This imposes a strong condition, as those variables related to unobserved individuals characteristics presumably have an impact on wages as well. Due to the difficulty of finding similar and valid instruments for different countries, the instrumental variables approach almost precludes conducting any comparative work.

Our estimates allow us to analyze whether being over-educated but in the upper part of the skills distribution reduces the loss of earnings associated to over-education. If over-education arises due to the lack of skills, we should observe a diminishing pay penalty to over-education when moving from the lower quantiles to the upper quantiles of the conditional wage distribution, i.e., from low-skill to high-skill groups. If, in turn, the pay penalty to over-education in the upper segment persists, then over-education affects workers with high skills as well.

According to our results, there exists a pay penalty associated to over-education for all skills groups and countries. This result indicates that conditional on observable characteristics, over-educated workers earn less, relative to workers with similar skills but who are not over-educated. This finding cast serious doubts on the interpretation that over-educated workers earn less because they are less able. The differential ranges on average varies from the highest, about 11% in Denmark, to the lowest statistically significant, 5% in Italy. The variation is larger, when considering the lowest statistically insignificant of about 2,6% in Portugal.

Across the conditional distribution of wages the observed patterns do not lead to a clear conclusion. Homogeneity in pay penalty of over-education would imply that the figures are flat so that it is possible to draw a horizontal line within the confidence interval band. That homogeneity appears when considering France, Denmark, Spain and Italy display a constant pay penalty across quantiles. The pay penalty displays heterogenous effects across distribution in the rest of countries. However, while Belgium or Finland present a downward trend, meaning that quantiles at the bottom of the distribution suffer a less pay penalty than the ones at the top, Germany, Austria, UK, Portugal and Ireland present an upward trend.

The rest of the paper is organized as follows. Section 1 presents dataset, variables, and estimating sample used in the paper. Section 2 presents the quintile regression model. Section 3 explores how pay-penalty affects across conditional distribution of wages. Section 4 presents the concluding remarks. The paper includes an Appendix describing the data source and variables used in the analysis. At the end, a section with talbes and figures is preesnted.

1. Data and Variables

We use the 2001 wave for the European countries included in the European Community Household Panel (ECHP, henceforth). This survey contains personal and labour market characteristics, including monthly wage, education level, hours worked, tenure, experience, sector, firm size, marital status and immigrant condition. Individuals are asked to report the maximum level of education that they have completed according to three categories: less than upper secondary, upper secondary and tertiary education. Appendix A describes such datasets, including the years for which the information applies, the number of observations used, and additional details concerning country-specific definitions of variables.

We use the same estimation procedure and the same population group for all countries. We focus on male wage earners in the private sector, aged between 18 and 60, who work normally between 35 and 85 hours a week, and are not employed in the

agricultural sector[2]. Thus, self-employed individuals, as well as those whose main activity status is paid apprenticeship, training and unpaid family worker have been excluded from the sample. The case of women is disregarded on account of the extra complication of potential selectivity bias. Workers with a monthly wage rate that is less than 10% or over 10 times the average wage have been also excluded.

Our dependent variable is monthly earnings rather than hourly wages. This choice is aimed to avoid the measurement error that is typically associated to hours worked. Ideally, we prefer to use gross wages rather than net wages. However, for Portugal, Greece, Italy, and Sweden only net wages were available. Even though differences in the dependent variable may trouble some comparisons between countries, this is not a fundamental problem for the question under study. We use the last available year for each country when reporting cross-sectional evidence[3].

Most researchers have defined an individual as being over-educated if he has education in excess of that required to do his job. However, there are several approaches to measure the degree of over-education, each of one having its own limitations[4]. Following most other authors, we use the worker's self-assessment regarding the match between the worker's skills and the firm's job requirements. In particular, we use two questions included in the ECHP,

- *Do you feel that you have skills or qualifications to do a more demanding job than the one you have now?*
- *Have you had formal training or education that has given you skills needed for your present type of work?*

We consider as over-educated workers those who answer "yes" to the first question and "no" to the second question[5]. According to this definition, in 2001 the proportion of

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[3] The reference year for all countries is 2001 except for Germany, UK and Luxemburg that is 1996

[4] These approaches are basically three: job analysis, the statistical approach, and the worker's self-assessment. For a description of these methods, see Hartog (2000) and Sloane (2002).

[5] Sloane (2002) warns that in some measures of over-education "reference is made to the level of education rather than the type of education. Thus a worker may still be mismatched if the level of education is appropriate, but its type inappropriate, such as an English graduate being hired as a statistician" (p. 7). By considering simultaneously the above questions, we take into account both the

over-educated workers varies form 14% in Germany to 30% in Greece or Italy. The proportions are broadly in line with those reported in Eurostat (2003). Educational attainment also varies from an average level of education of 1.77 in Denmark to 2.68 in Portugal. Note that countries with a large proportion of people with tertiary level of education correspond to larger percentages of over-educated workers.

2. The model

The quantile regression model can be written as

$$\ln w_i = X_i\beta_\theta + e_{\theta i} \qquad \text{with } Quant_\theta(\ln w_i|X_i) = X_i\beta_\theta \tag{1}$$

where X_i is the vector of exogenous variables and β_θ is the vector of parameters. $Quant_\theta(ln\ w_i|\ X_i)$ denotes the θth conditional quantile of $ln\ w$ given X. The θth regression quantile, $0<\theta<1$, is defined as a solution to the problem

$$\min_{\beta\in R^k}\left\{\sum_{i:y_i\geq x_i\beta}\theta|ln\ w_i - X_i\beta_\theta| + \sum_{i:y_i<x_i\beta}(1-\theta)|ln\ w_i - X_i\beta_\theta|\right\} \tag{2}$$

which, after defining the check function $\rho_\theta(z)=\theta z$ if $z\geq 0$ or $\rho_\theta(z)=(\theta-1)z$ if $z<0$, can be written as

$$\min_{\beta\in R^k}\left\{\sum_i \rho_\theta(ln\ w_i - X_i\beta_\theta)\right\} \tag{3}$$

This problem is solved using linear programming methods. Standard errors for the vector of coefficients are obtainable by using the bootstrap method described in Buchinsky (1998).

We define the pay penalty of over-education as the differential in the return to education earned by these two groups. By calculating this penalty at different quantiles we can asses the impact of over-education on within-groups dispersion at different points of the wage distribution.

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level and type of education. These questions have been also used by Alba and Blázquez (2002), who exploit the panel structure of the ECHP to investigate the relation between job promotions and over-education.

To explore the impact of over-education on wages, many researchers introduce an over-education dummy in the wage regression (Verdugo and Verdugo, 1989, Dolton and Vignoles, 2000, Chevalier, 2003). However, the effects of over-education may differ importantly across education levels. To take this into account, we use the following specification

$$\ln w_i = \alpha_\theta + \delta_{\theta 1} X_i + \beta_{\theta 1} upper\,\mathrm{sec}_i + \beta_{\theta 2} tertiary_i + \beta_{\theta 3} over_i + e_{\theta i} \qquad (5)$$

where $ln\ w_i$ is the logarithm of the gross hourly wage and X_i is a vector of explanatory variables, including experience (and squared), tenure, marital status, immigrant condition, sector (industry or service), and firm size[6]. The construction of these variables is described in the Appendix. The dummies *uppersec* and *tertiary* are activated only when the individual's maximum level of education is, respectively, upper secondary or tertiary education. Thus, *less than upper secondary* is the excluded education category. The use of dummies, rather than years of schooling, is motivated by two reasons. First, the use of education groups highlights the non-linearities of the response of wages to additional education. As we show, dispersion across quantiles increases non-monotonically as we move towards higher levels of education. Second, we believe that the labour market reward to formal qualifications is better captured by levels rather than by years of schooling. Finally *over* is activated if the worker is over-educated[7].

4. Empirical results

In this section we calculate OLS returns, to facilitate comparisons with the usual procedures, and conditional returns to education at all deciles plus percentiles 25th and 75th. For simplicity in exposition, we report OLS and QR estimated parameter

[6] We do not include controls for occupation. As the acquisition of education allows individuals to access certain occupations that are better rewarded, we prefer to interpret these wage gains as a return to education rather than a return to occupation.

[7] An alternative specification is the ORU model, in which years of schooling are decomposed into required, surplus and deficit years of schooling in relation to those necessary to do the job. Relative to our specification, the ORU model has one advantage: it controls for the amount of over-education. However, it presents two shortcomings. First, it assumes that the impact of over-education on wages is constant across education levels. Second, and more important, in the quantile regression framework the use of years of schooling rather than levels of education would assume that the marginal impact of education (and over-education) on within-groups dispersion is the same for all education levels. Clearly this is not the case, since, as we show, tertiary education has a much larger impact on within-groups dispersion than secondary and primary education.

corresponding to over-education variables, in Table 2. The full sets of estimates are available upon request from authors. Also the tests of equality of (pay-penalty of over-education) coefficients at the 0.10, 0.25, 0.50, 0.75 and 0.90 quantiles are presented in Table 3.

A glance to the OLS estimates, we observe that over-educated workers earn less than similarly educated workers whose skills are fully utilized, that is, the pay penalty of over-education exists, and it is statistically significant, except for Belgium, Finland, Ireland, Portugal and UK. The range of this pay penalty varies from the highest, about 11% in Denmark, to the lowest statistically significant, 5% in Italy. The variation is larger, when considering the lowest statistically insignificant of about 2,6% in Portugal.

Next, we turn to the estimates at different quantiles. To facilitate the analysis, in Figure 1 we plot the quantile-pay penalty for all countries. Homogeneity in pay penalty of over-education would imply that the figures are flat so that it is possible to draw a horizontal line within the confidence interval band. This is the case of France, Denmark, Italy and Spain. The case of Denmark or Italy shows significance of OLS estimates comes from the significance of few quantiles at the midele of distribution (50^{th} to 75^{th}). Those findings are confirmed by the test of equality, jointly of pair-wise, presented in Table 2. For those countries the F-statistic of joint equality does not imply a rejection. The remaining F statistics, pair-wise equality tests, also lead to the same conclusion. That is, quantile coefficients of over-education are statistically identical.

In some countries the asymmetries are increasing, meaning that quantiles at the bottom of the conditional distribution suffer more pay penalty than the ones at the top[8]. Germany, Austria, UK, Ireland and Portugal are countries of that type. However, while Austria and Germany display significant effects, UK and Ireland do only at the bottom of the conditional distribution, Portugal has no significant effects across distribution, with the exception of the 90 decile. Although average pay penalty is larger in Germany, the quantile pay penalty in Austria varies from 7% to 18%, while in Germany goes from about 2% to 13%. In UK that variation is only, when significant, from 4% to 8%. Those results are confirmed by the test of equality. Note that for Germany, the joint test of

[8] Note that coeffecients are considered in absolute value but reflects a negative effect since it is pay penalty.

equality and the pair-wise tests confirm that pay penalty is statistically different across conditional distribution. In the case of Austria, although the joint test implies the rejection of this equality hypothesis at the 5% level, the pair-wise equality test (10^{th} ,90^{th}) or (25^{th}, 90^{th}) show that pay penalty at those quantiles are statistically different from zero. In the case of UK the decreasing trend is only confirmed around the middle quantiles of the distribution. In the case of Portugal, the decreasing trend is based on the test for 25^{th} and 90^{th} quantile.

The case of Belgium and in a minor way Finland is the one of decreasing pay-penalty. That effects are significative in the case of Belgium, not in the case of Finland. The pay penalty goes in Belgium from 11% to 3%. The performed tests also confirm that finding. A special case, Greece deserve attention. There is a decreasing pay-penalty at the bottom of the distribution while an increasing at the top of it. The tests shows that those differences are statistically significative.

As noted in the introduction, if there are significant offsetting effect between unobservable productivity and over-education, the higher productivity individuals, further to the right in conditional wage distribution, should have lower pay penalty. Therefore, our findings show that unobservable individual characteristics reinforce the negative effect of over-education in Germnay, UK, Austria, Portugal and Ireland, with different degrees of significativeness. For France, Denmark, Spain or Italy, the effect of pay penalty is homegeneus across distribution. Offsetting effect is only found inthe case of Belgium and Finland. In summary, our results suggest that the way in which unobservable interact with over-education is not uniform across the conditional wage distribution within a country.

5. Conclusions

The mean returns to different forms of human capital have been extensively investigated in labor economics literature, especially the returns to formal education, not only on average effects but also the effects across conditional distribution of wages. It is well established that over-educated workers are penalized in term of wages relative to their matched peers. Our main goal will be to determine whether the pay-penalty associated with over-education is constant or not across conditional wage distribution, that is the

existence of asymmetries in the pay penalty of over-education on conditional wage distribution.

The determinants of over-education are not clear cut. Among possible explanations we choose the following. While it is shown that there are significant complementarities between unobserved ability and education, and then higher ability individuals, further to the right in the conditional wage distribution, might have higher returns to education. In terms of over-education, those who end up accepting mismatched work are the less able. An upward or downward sloping profile when we graph the over-education effect across quintiles of the conditional wage distribution will be due to ability, that is, an unobservable individual-specific effect that may interact with over-education differentially across the conditional wage distribution. If non-observable individual characteristics and education are complementaries, then those individiual characteristics might offset the negative effect of being over-educated. Then, being over-educated but in the upper part of the skills distribution reduces the loss of earnings associated to over-education.

We focus our analysis on that hypothesis: whether the effects of over-education display asymmetries across the conditional distribution of wages. The two contributions of this paper are the following. First, we use recent and comparable data from European countries included in the ECHP. Up to date there is little comparable evidence for Europe regarding the wage effects of over-education. Secondly, in contrast to OLS techniques, QR methods allow for interactions between unobservable factors and observable wage determinants. Previous results controlling for unobserved heterogeneity were based on panel data and instrumental variables. These approaches have their own limitations.

According to our results, there exists a pay penalty associated to over-education for all skills groups and countries. This result indicates that conditional on observable characteristics, over-educated workers earn less, relative to workers with similar skills but who are not over-educated. This finding cast serious doubts on the interpretation that over-educated workers earn less because they are less able. The differential ranges on average varies from the highest, about 11% in Denmark, to the lowest statistically

significant, 5% in Italy. The variation is larger, when considering the lowest statistically insignificant of about 2,6% in Portugal.

Across the conditional distribution of wages the observed patterns do not lead to a clear conclusion. Homogeneity in pay penalty of over-education would imply that the figures are flat so that it is possible to draw a horizontal line within the confidence interval band. That homogeneity appears when considering France, Denmark, Spain and Italy display a constant pay penalty across quantiles. The pay penalty displays heterogenous effects across distribution in the rest of countries. However, while Belgium or Finland present a downward trend, meaning that quantiles at the bottom of the distribution suffer a less pay penalty than the ones at the top, Germany, Austria, UK, Portugal and Ireland present an upward trend.

Appendix. Description of data source and estimating samples

The European Community Household Panel (ECHP) is available from 1994 to 2001 for Spain. It has a sample size of about 5,000 households and 14,000 individuals, who are interviewed over time. They report personal and family characteristics, including marital and educational status, as well as gross monthly wages and worked hours. We have dropped workers with a monthly wage rate that is less than 10% or over 10 times the average wage. This correction for outliers affects only 1.9% of the total sample. In the following. The wave chosen is 2001 for all countries except for Germany and UK, in which we choose 1994, since questions about over-education are not available. We describe the variables used in the analysis,

Gross hourly wage. Defined as monthly gross salary in the main job divided by four times the weekly hours worked in the main job.

Level of education. Individuals are asked to report the maximum level of completed schooling, according to three categories: less than upper secondary, upper secondary, and tertiary education. These education categories are constructed following the ISCED-97 classification.

Experience. Defined as age minus age of first job.

Tenure. Defined as the difference between the year of the survey and the year of the start of the current job. We have constructed three categories: from 1 to 4 years, from 5 to 14 years, and 15 years or more.

Married. It is a dummy that takes the value 1 if the individual is married, zero otherwise.

Immigrant. It is a dummy activated if the individual was born in a foreign country.

Industry. It is a dummy that takes the value 1 if the individual works in the industry sector, zero if he works in the service sector. The agricultural sector, which accounted for 6% of the working population in 2001, was dropped on the account of the particularities of this sector.

Firm size. Individuals are asked to report the number of employees that actually work in their firm. We have constructed four categories, from 1 to 19 employees, from 20 to 99 employees, from 100 to 499 employees, and 500 employees or more.

TABLE 1: DESCRIPTIVE STATISTICS

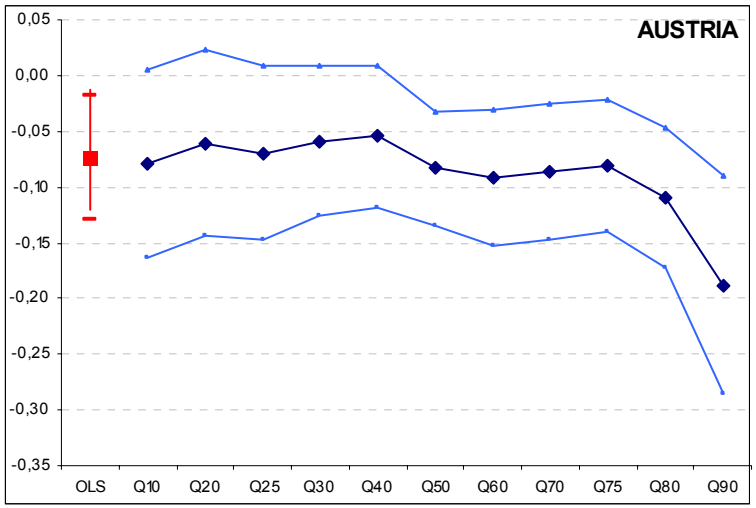
	AUSTRIA	BELGIUM	DENMARK	FINLAND	FRANCE	GERMANY	GREECE	IRELAND	ITALY	LUXEM.	PORTUGAL	SPAIN	UK
# Obs.	1166	920	807	468	1609	2107	1238	738	1954	488	2042	2219	1210
Educ	2,00	1,81	1,77	1,82	2,35	1,88	2,10	2,07	2,30	2,24	2,68	2,17	1,99
Less thansec.	0,08	0,43	0,35	0,32	0,28	0,31	0,25	0,25	0,12	0,23	0,09	0,31	0,33
Secondary	0,83	0,34	0,53	0,53	0,09	0,51	0,41	0,43	0,45	0,30	0,15	0,22	0,36
Over1	0,52	0,68	0,63	0,63	0,55	0,68	0,49	0,47	0,48	0,45	0,42	0,59	0,68
Iver 2	0,28	0,28	0,28	0,29	0,48	0,20	0,65	0,36	0,68	0,48	0,68	0,47	0,32
Over3	0,16	0,19	0,19	0,20	0,24	0,14	0,30	0,16	0,30	0,17	0,25	0,25	0,19

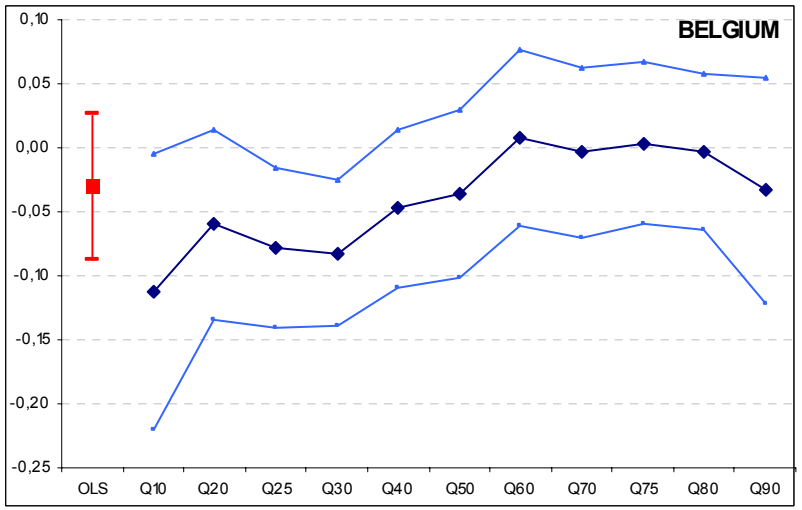
TABLE 2: QR ESTIMATIONS

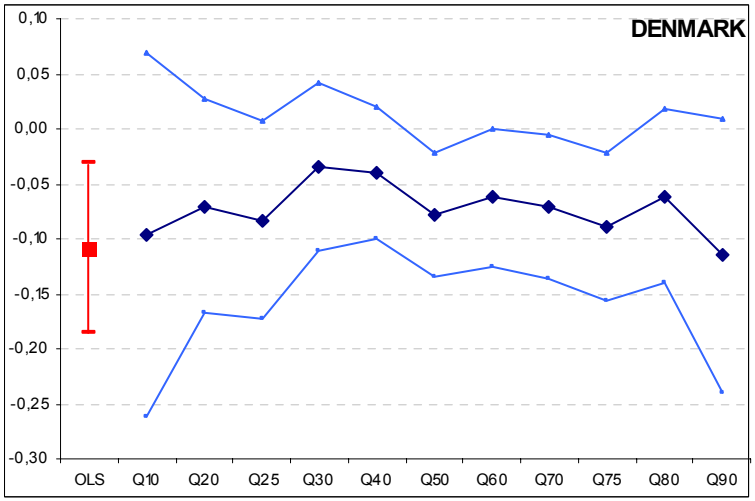
	AUSTRIA	BELGIUM	DENMARK	FINLAND	FRANCE	GERMANY	GREECE	IRELAND	ITALY	SPAIN	PORTUGAL	UK
OLS	**-0,073*** **	**-0,030**	**-0,109*** **	**-0,066**	**-0,071*** **	**-0,088*** **	**-0,074*** **	**-0,035**	**-0,056*** **	**-0,090*** **	**-0,026**	**-0,046**
	(0,028)	(0,029)	(0,039)	(0,060)	(0,025)	(0,030)	(0,026)	(0,043)	(0,019)	(0,021)	(0,021)	(0,038)
Q10	-0,079**	-0,112***	-0,097	-0,033	-0,050	0,021	-0,048	0,047	-0,027	-0,075**	-0,025	-0,001
	(0,043)	(0,055)	(0,084)	(0,172)	(0,044)	(0,046)	(0,045)	(0,071)	(0,032)	(0,037)	(0,034)	(0,068)
Q20	-0,061	-0,060*	-0,070	-0,096	-0,069***	-0,035	-0,127***	-0,057	-0,025	-0,105***	-0,008	-0,007
	(0,043)	(0,038)	(0,049)	(0,091)	(0,029)	(0,037)	(0,032)	(0,053)	(0,023)	(0,031)	(0,026)	(0,041)
Q25	-0,069*	-0,078***	-0,083*	-0,128	-0,079***	-0,050*	-0,139***	-0,030	-0,035*	-0,094***	0,004	-0,010
	(0,039)	(0,032)	(0,046)	(0,082)	(0,029)	(0,032)	(0,035)	(0,051)	(0,019)	(0,026)	(0,021)	(0,046)
Q30	-0,059*	-0,082***	-0,035	-0,065	-0,061***	-0,076***	-0,125***	-0,041	-0,040**	-0,087***	0,004	-0,026
	(0,035)	(0,029)	(0,039)	(0,084)	(0,025)	(0,032)	(0,040)	(0,044)	(0,017)	(0,025)	(0,019)	(0,042)
Q40	-0,054*	-0,047	-0,040	-0,065	-0,060***	-0,118***	-0,091***	-0,059	-0,035**	-0,079***	-0,002	-0,025
	(0,032)	(0,032)	(0,031)	(0,071)	(0,023)	(0,033)	(0,032)	(0,047)	(0,016)	(0,025)	(0,021)	(0,035)
Q50	-0,084***	-0,036	-0,079***	-0,005	-0,054***	-0,114***	-0,065***	-0,021	-0,049***	-0,081***	-0,009	-0,036
	(0,026)	(0,034)	(0,029)	(0,063)	(0,020)	(0,037)	(0,023)	(0,058)	(0,016)	(0,025)	(0,022)	(0,027)
Q60	-0,091***	0,008	-0,062**	0,001	-0,085***	-0,123***	-0,070***	-0,062	-0,028*	-0,050**	-0,012	-0,048*
	(0,031)	(0,035)	(0,032)	(0,058)	(0,023)	(0,029)	(0,021)	(0,045)	(0,017)	(0,024)	(0,022)	(0,030)
Q70	-0,086***	-0,003	-0,070***	-0,011	-0,072***	-0,117***	-0,088***	-0,065*	-0,032**	-0,063***	-0,006	-0,082***
	(0,031)	(0,034)	(0,033)	(0,058)	(0,028)	(0,025)	(0,025)	(0,040)	(0,017)	(0,022)	(0,026)	(0,033)
Q75	-0,081***	0,004	-0,089***	-0,047	-0,091***	-0,127***	-0,078***	-0,101**	-0,028*	-0,076***	-0,009	-0,102***
	(0,030)	(0,032)	(0,034)	(0,064)	(0,036)	(0,028)	(0,029)	(0,047)	(0,017)	(0,025)	(0,025)	(0,038)
Q80	-0,110***	-0,003	-0,061	-0,018	-0,063*	-0,134***	-0,064***	-0,088*	-0,039*	-0,073***	-0,016	-0,098***
	(0,032)	(0,031)	(0,040)	(0,064)	(0,038)	(0,032)	(0,032)	(0,051)	(0,021)	(0,027)	(0,022)	(0,044)
Q90	-0,188***	-0,034	-0,115**	0,020	-0,067*	-0,100*	-0,032	-0,031	-0,035	-0,073***	-0,086***	-0,084*
	(0,049)	(0,045)	(0,063)	(0,092)	(0,040)	(0,056)	(0,040)	(0,086)	(0,024)	(0,027)	(0,030)	(0,053)

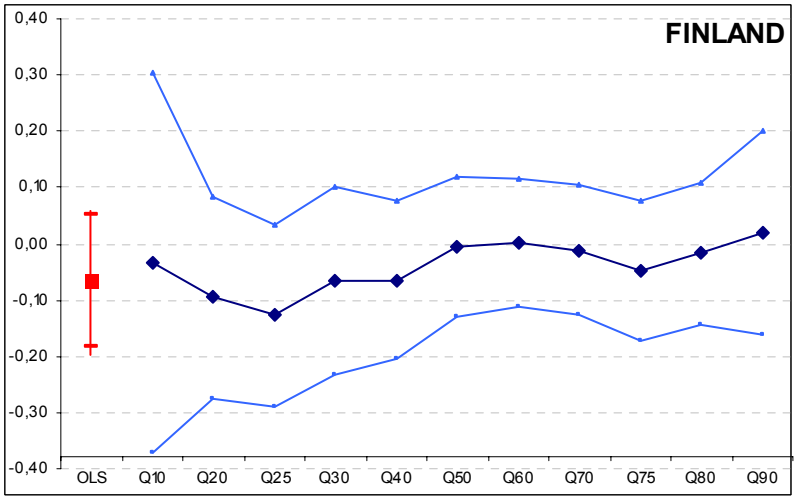
AUSTRIA	Q25	Q50	Q75	Q90	Joint equaltiy	**BELGIUM**	Q25	Q50	Q75	Q90	Joint equaltiy
Q10	0,81	0,91	0,96	0,08	0.15	Q10	0,40	0,15	0,03	0,22	0,17
Q25		0.63	0.73	0.02		Q25		0,20	0,03	0,38	
Q50			0.93	0.02		Q50			0,23	0,96	
Q75				0,		Q75				0,	
DENMARK						**FINLAND**					
Q10	0,85	0,83	0,93	0,87	0,98	Q10	0,52	0,85	0,92	0,74	0,37
Q25		0,91	0,91	0,68		Q25		0,06	0,27	0,17	
Q50			0,73	0,55		Q50			0,47	0,80	
Q75				0,		Q75				0,	
FRANCE						**GERMANY**					
Q10	0,59	0,29	0,48	0,77	0,82	Q10	0,08	0,01	0,01	0,15	0,06
Q25		0,50	0,82	0,86		Q25		0,12	0,05	0,46	
Q50			0,68	0,43		Q50			0,68	0,83	
Q75				0,		Q75				0,	
GREECE						**IRELAND**					
Q10	0.04	0.72	0.56	0.80	0.04	Q10	0.20	0.34	0.05	0.45	0.13
Q25		0.02	0.12	0.03		Q25		0.87	0.26	0.99	
Q50			0.65	0.46		Q50			0.08	0.90	
Q75				0.		Q75				0.	
ITALY						**PORTUGAL**					
Q10	0.76	0.45	0.97	0.83	0.75	Q10	0.29	0.67	0.69	0.15	0.04
Q25		0.40	0.76	0.99		Q25		0.45	0.63	0.01	
Q50			0.26	0.59		Q50			0.96	0.02	
Q75				0.		Q75				0.	
SPAIN						**UK**					
Q10	0.67	0.85	0.95	0.91	0.99	Q10	0.88	0.61	0.18	0.35	0.41
Q25		0.80	0.72	0.80		Q25		0.53	0.08	0.24	
Q50			0.85	0.93		Q50			0.08	0.34	
Q75				0.		Q75				0.	

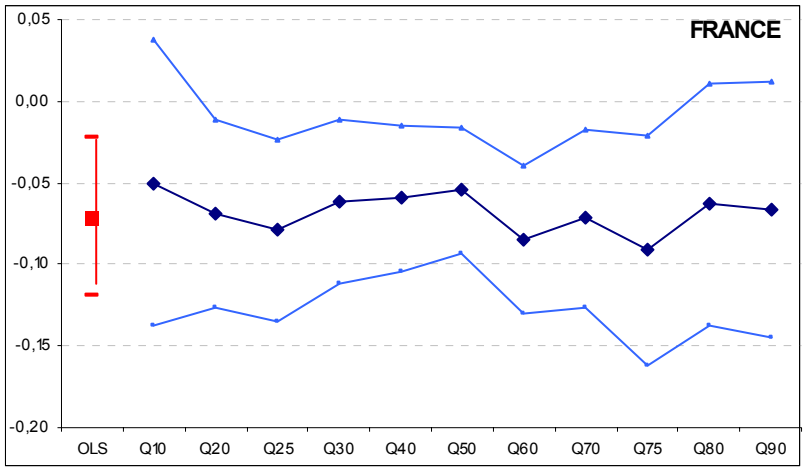
TABLE 3: F TEST OF EQUALITY OF PAY PENALTY OF OVER-EDUCATION (P-VALUE)

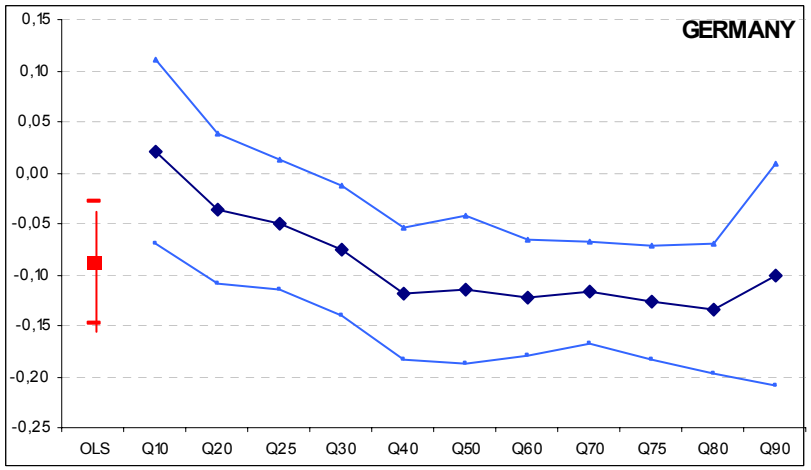

AUSTRIA
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
-0,30
-0,35
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90

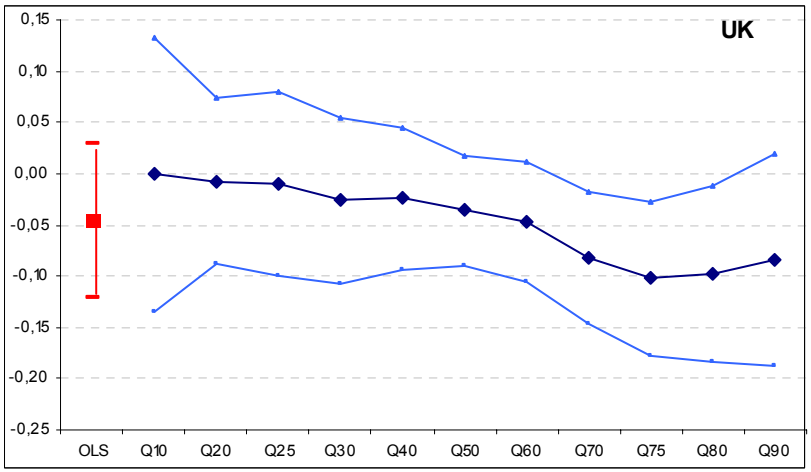

BELGIUM
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90

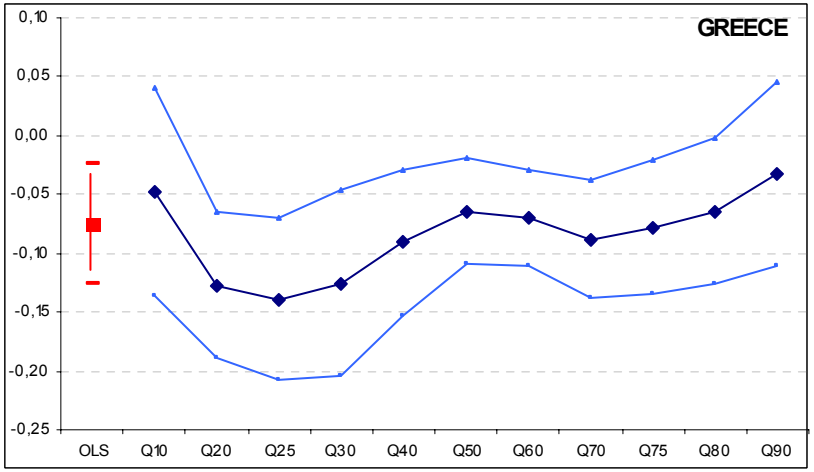

DENMARK
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
-0,30
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90

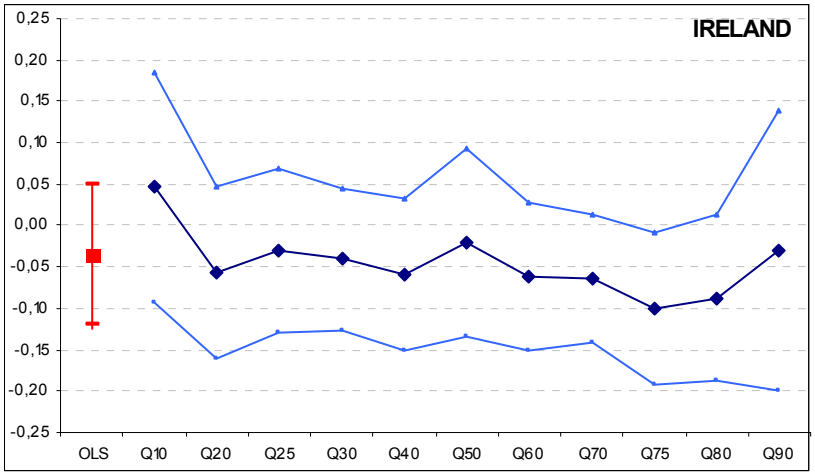

FINLAND
0,40
0,30
0,20
0,10
0,00
-0,10
-0,20
-0,30
-0,40
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90

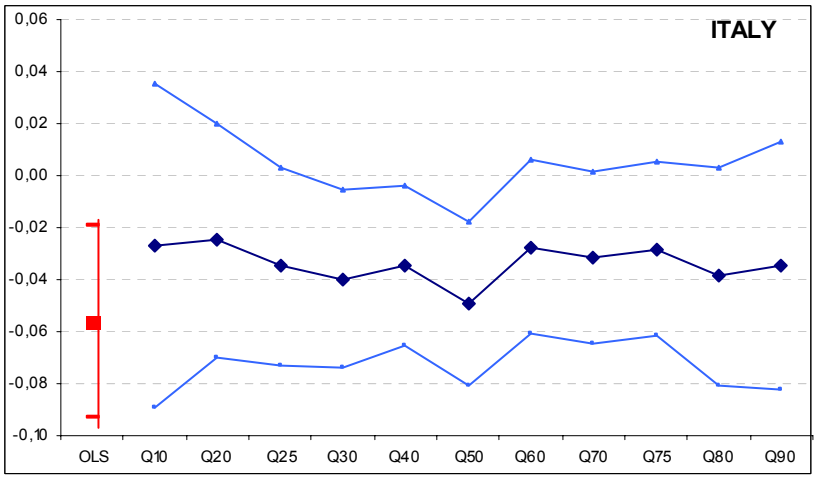

FRANCE
0,05
0,00
-0,05
-0,10
-0,15
-0,20
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90

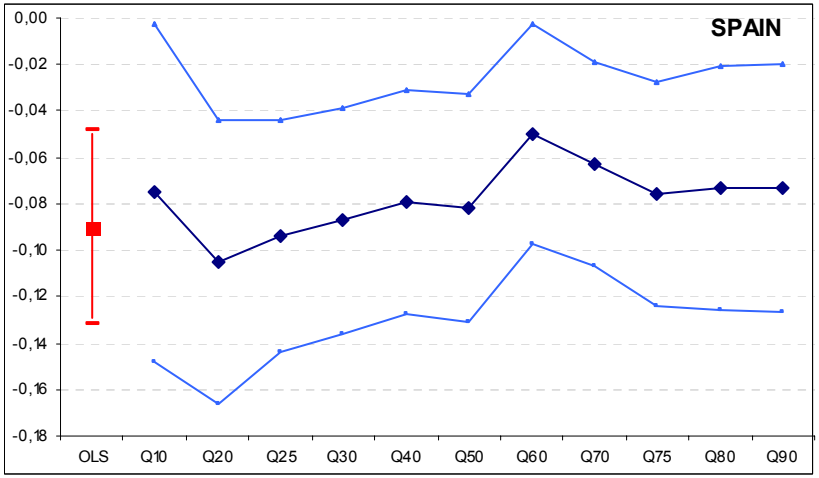

GERMANY
0,15
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90

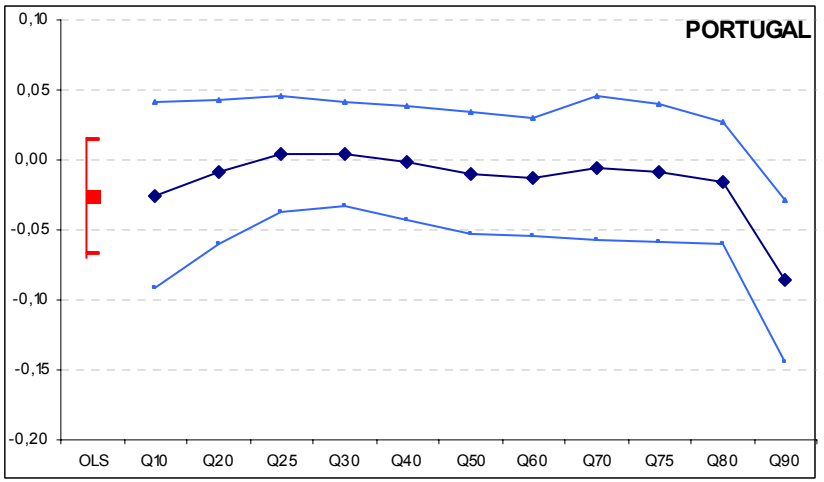

UK
0,15
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90


GREECE
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90


IRELAND
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
-0,25
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90


ITALY
0,06
0,04
0,02
0,00
-0,02
-0,04
-0,06
-0,08
-0,10
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90


SPAIN
0,00
-0,02
-0,04
-0,06
-0,08
-0,10
-0,12
-0,14
-0,16
-0,18
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90


PORTUGAL
0,10
0,05
0,00
-0,05
-0,10
-0,15
-0,20
OLS
Q10
Q20
Q25
Q30
Q40
Q50
Q60
Q70
Q75
Q80
Q90