Overeducation and Wages in Europe: Evidence from Quantile Regression

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Abstract

In this paper we use quantile regression and data from 12 European countries to explore the wage effects of overeducation at different points of the conditional wage distribution. We detect significant differences across segments of the distribution. By differentiating between quantiles, we discriminate between groups of workers with different (unobservable) skills. We find that the detrimental effects of overeducation among the high-skilled are indeed higher than among the low-skilled. This finding lends support to the view that overeducation is an event that reduces the worker's potential productivity, regardless of his skills.

Keywords: Returns to education, overeducation, quantile regression, skills heterogeneity.

JEL-Codes: C29, D31, I21

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0. Introduction

Investing in human capital is a key tool for economic progress and, as such, a major policy issue 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 overeducated[1]. This phenomenon raises serious efficiency concerns. Presumably, overeducated workers do not make full use of their skills, some of them acquired through costly education, resulting into a waste of resources for the economy, the firm and the individual. From a temporal perspective, furthermore, the overeducation phenomenon warns that the real economic benefits of the rapid educational expansion that has characterized developed economies in recent decades might be lower than previously thought.

In this paper, we use data from the European Community Household Panel to explore the extent and wage effects of overeducation in Europe. Even though this topic has been addressed for a variety of countries and years, up to date there is little comparable evidence for Europe. Major differences between the studies arise not only from crucial differences in the model specifications but also from the use of different definitions of overeducation, diverging datasets and differently defined sample of individuals. This paper contributes to fill this gap by using a common wage equation, the same definition of overeducation, and comparable data from a set of European countries. An advantage of our study over previous research is, therefore, comparability. To our eyes, this is a key ingredient when attempting to establish stylized facts regarding the overeducation phenomenon.

As a second contribution, we use an econometric approach that is quite new in the overeducation literature: quantile regression (QR)[2]. This approach presents two appealing features. First, the literature to date has typically assumed that the impact of overeducation on wages is uniform over the conditional wage distribution. Within this context, the switch from matched to mismatched work can be trivially represented by a shift of the conditional wage distribution. This shift, which represents the percentage wage differential between an

[1] Using data from 25 countries, Groot and Van den Brink (2000) find that an average of one fourth of the working population is overeducated. This proportion ranges from about 10% to 40% in the set of estimates reported in two recent surveys by Hartog (2000) and McGuinness (2006).

[2] The quantile regression model was first introduced by Koenker and Basset (1978). For a survey of these models and some applications, see Buchinsky (1998), Fitzenberger *et al.* (2001), and Koenker and Hallock (2001).

overeducated worker and his well-matched counterpart, is assumed to be constant across conditional quantiles. With QR, in turn, we can measure the impact of overeducation on wages at different points of the distribution, thus describing changes not only in the location but also in the shape of the distribution. In this paper, we ask whether wage dispersion among the overeducated is larger than among the adequately educated. The results have potential implications for the inequality effects of an increase in the incidence of overeducation in Europe.

Second, the QR approach allows for a non-trivial interaction between the explanatory variables and unobserved factors related to productivity. Conditional on observable characteristics, workers located at higher quantiles of the wage distribution are precisely those who have more productive skills (due to ability, motivation, better academic credentials and other unmeasured characteristics affecting individual-specific productivity). Thus, if the conditional distribution of wages emerges from the underlying distribution of unobserved skills, then differences in the overeducation wage effect between workers at high-pay and low-pay jobs can be interpreted as differences between workers with high and low unobservable skills. While in most other papers the effect of overeducation on wages is estimated for a representative individual with average skills, in this paper we provide snapshots of the wage effects of overeducation within narrowly defined skill groups[3].

Most of the overeducation debate has gravitated around the question of to what extent the incidence of overeducation entails a productivity loss. It may be the case that the overeducated are in some way less able and lack some of the abilities and skills required to do a job commensurate with their level of education. In this case, their lower wages would be due to the lack of adequate skills, rather than the result of a true mismatch. This paper

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[3] Some authors have explored the interplay between educational mismatches and unobserved skills using panel data (Bauer, 2002), instrumental variables (Dolton and Silles, 2001) and proxies of skills (Chevalier, 2003, McGuiness, 2003a). These approaches present, however, their own limitations. First, the use of panel data implicitly assumes that the transitions of workers from the status "overeducated" to "non-overeducated" are exogenous. To the extent that these transitions are affected by those unobservable characteristics affecting productivity (for instance, if individuals with more ability are more prone to abandon mismatched work), panel data estimates may be subject to selection bias. Second, the instrumental variables approach requires finding instruments that are related to wages and, at the same time, unrelated to overeducation. Despite appealing, this is not a straightforward task. At the international level, furthermore, differences in the quality and validity of the instruments (if any) preclude conducting any comparative work. A similar argument applies to the use of skill measures. Our econometric approach is, therefore, a working compromise to provide international evidence and, at the same time, explore the interplay between overeducation and unobserved characteristics.

contributes to the debate by exploring the effects of over-education for different skills groups. If overeducation was a consequence of less capacity, as some authors argue, then its effects should be concentrated in the lower segments of the conditional wage distribution, i.e., amongst the less skilled. In turn, we find that workers located at the upper quantiles of the distribution, i.e., workers whose unobserved skills make them highly productive, are also penalized due to overeducation. Our interpretation is that the incidence of overeducation is not a mere statistical outcome arising from the lack of unobservable skills. Rather, it appears to be the result of allocative inefficiency, i.e., an imperfect matching between the worker's productivity potential and the job's productivity ceiling.

The plan of the paper is as follows. In Section 1 we review the literature on overeducation and highlight the most relevant theoretical approaches that have been put forward to explain the phenomenon. In Section 2 we present the dataset and variables, including the indicators of overeducation used in the paper, and provide summary statistics of relevant variables. In Section 3 we present the quantile regression model. The results and their implications are presented in Section 4. Finally, Section 5 contains the concluding remarks. The paper includes an Appendix with a description of the variables used in the regressions.

1. Economic framework

Overeducation describes the extent to which an individual possesses a level of education in excess of that which is required for his job. Even though the incidence of overeducation is found to differ across countries, datasets and measurement methods, it is well established that a significant proportion of the labour force has more education than is required in their jobs.

There is consisting evidence that overeducated workers earn less than their well-matched counterparts. The estimated differential amounts to 12% in Dolton and Vignoles (2000), 18% in Dolton and Silles (2003), and 27% in Chevalier (2003) for the UK, 11% in Cohn and Kahn (1995) and 13% in Verdugo and Verdugo (1989) for the US, 26% in Groot (1993) for Holland and 8% in Kiker et al. (1997) for Portugal. Other studies differentiate between those years required to match the educational requirement of the job and those years that exceed the education level needed at the job. The general finding is that excess education gives a return that is 50% lower than the return to required education (Duncan and Hoffman, 1981, Hartog and Oosterbeek, 1988, Sicherman, 1991, Alba-Ramírez, 1993).

Overall, this evidence represents a challenge to Becker's (1964) Human Capital Theory. The prediction of HCT that individuals are paid by their marginal product, which in turn will be determined by their level of human capital, is questioned when researchers find that workers who apparently have the same level of human capital earn different wages, depending on whether or not they are overeducated. This evidence could be rationalized within the HCT framework if educational mismatches were found to be a short run phenomenon, that is, the consequence of transitory disequilibria that take place while firms adjust their production processes in order to utilize their workers human capital fully or, alternatively, while workers find a more appropriate job through job search. Despite some earlier works support this view (Sicherman, 1991, Alba-Ramirez, 1993), recent empirical research indicates that this explanation is not an open road, as a substantial fraction of workers remain in jobs for which they are overqualified during long periods (Robst, 1995, Rubb, 2003a, Dolton and Vignoles, 2000, McGuinness, 2003a).

One alternative road is to admit that the earnings equation framework lacks adequate controls for a variety of characteristics that may affect both the probability of taking up mismatched work and earnings. In this case, the wage effects of overeducation would be the result of an omitted variables problem, rather than a real economic problem. Thus, for example, less formal measures of human capital, such as tenure and on-the-job training, may act as substitutes of formal schooling (substitution hypothesis). Similarly, the overeducated may be in some way less able and lack some of the abilities and skills required to do a job commensurate with their level of education (ability-skills hypothesis). In this case, the overeducation pay penalty would be a reflection of the lower human capital implied by these shortages, and overeducation itself, a mere statistical trick.

The evidence supporting these arguments is however limited. Consistent with the substitution hypothesis, Duncan and Hoffman (1981), Sicherman (1991), and Sloane et al. (1999) find that overeducated workers tend to have lower levels of tenure and training. However, Groot (1996) argues that there exist a cohort effect rather than a substitution effect: younger workers, who are more educated, find it difficult to enter in high-qualified jobs since older, less educated workers, have already taken these jobs. In the same vein, Groot (1993) and Alba-Ramirez (1993) find nothing to support that on-the-job training is treated by employers as substitutes of formal education. Moreover, Dolton and Vignoles (2000) find that the extent and wage effects of overeducation are significant among workers with similar levels of tenure and experience.

In support to the ability-skills hypothesis, Groot (1996) finds that the pay penalty of overeducation increases with tenure. The interpretation is that as employers find out the real capabilities of their workers, they tend to discriminate the overeducated due to their lower ability. Sloane et al. (1999) report that, probably due to fewer competencies, overeducated workers have lower chances of being promoted. This evidence, however, is less convincing when confronted with studies that explicitly control for skill and ability heterogeneity. McGuiness (2003b) and Chevalier (2003) extend the earnings equation to control for skill differences, and find that in the resulting model the pay penalty of overeducation is still large and significant. Bauer (2002) uses panel data to control for unobserved heterogeneity. His results show that about 30% of the estimated penalty cannot be accounted for by unobserved individual effects. McGuiness (2003a) and Green et al. (1999) stress the importance of differentiating between skill mismatches and educational mismatches. McGuiness (2003a) finds that a large proportion of the wage penalty associated with being overeducated is independent of the level of skill utilization within firms. Similarly, Green et al. (1999) find that the correlation between actual and required skills is far from being perfect even among non-overeducated workers. Moreover, the effects of overeducation are found to be roughly as large as the effects of overskilling. Finally, Mcguiness and Bennet (2006) use quantile regression to differentiate between high-skill and low-skill workers and find that female overeducation decreases wages also among the high-skilled.

On the basis of this evidence, there is scope to conclude that the central predictions of HCT are unlikely to be fully explained by gaps in the earnings equation, even though including job characteristics and some form of skill and ability heterogeneity control can importantly affect the estimated relationship between overeducation and wages. This scenario has lead researchers to interpret the overeducation phenomenon within the context of alternative theories of the labour market. From the supply-side perspective, Carrier Mobility theory (CMT, Galor and Sicherman, 1990) suggests that workers with high levels of formal education accept positions for which they are apparently overeducated whilst they gain experience and occupation-specific human capital through training. The acquired skills are then used to move towards higher occupation levels where they make full use of their qualifications. Job Competition Theory (JCT, Thurow, 1975) assumes that unemployed individuals are located in a particular job queue. Once they get the job, they are paid a wage that is already given for that particular job cell. This view emphasizes the importance of a person's relative position in the job queue. Specifically, over-investment in education would be the individual's optimal response to protect or improve his position in the queue. In the same spirit, Signalling Theory (ST, Spence, 1973) highlights the role of education (and excess education) as a screening device used by employers. Finally, the Educational Credential Hypothesis (ECH, van der Meer and Wielers, 1996) states that large organisations and/or firms in the financial and professional services sector rely heavily on educational credentials due to the difficulties to measure workers productivity.

Another group of theories concentrate on the inefficient matching between supply and demand forces. Assignment Theory (AT, Sattinger, 1993) stresses that marginal product and thereby wages are determined by the human capital supplied by the worker and, at the same time, by the requirements and productivity ceilings of the job. As a result of the assignment process, some workers are misallocated to jobs for which they do not have comparative advantage and, consequently, end up earning lower wages. Within this context, overeducation is nothing but a form of allocative inefficiency. Matching Theory (MT, Jovanovic, 1979) stresses this view by focusing on search costs and imperfect information as the reasons for imperfect matches.

2. Data and Variables

We use data from the last wave (2001) of the European Community Household Panel (ECHP, henceforth). This survey contains personal and labour market characteristics, including wage, hours worked, tenure, experience, sector, firm size, marital status and immigrant condition, among other variables. Individuals are asked to report the maximum level of education that they have completed according to three categories based on the ISCED-97 classification (OECD, 2003): less than upper secondary, upper secondary and tertiary education.

We use the same estimation procedure and population group for all countries. Our estimating sub-sample consists on private sector men who are between 18 and 60 years old, working normally between 15 and 80 hours a week, and not employed in the agricultural sector. 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 also been excluded.

Several methods to measure overeducation have been proposed in the literature, with each method having its own advantages and limitations. Here, we use the worker's self-assessment regarding the match between the worker's skills and the firm's job requirements[4]. Following Alba-Ramirez and Blazquez (2002) and Budría and Moro-Egido (2006), we use two questions included in the ECHP,

- **(Q1)** *Do you feel that you have skills or qualifications to do a more demanding job than the one you have now?*

This information allows us to identify the group of 'overqualified' workers. However, over-qualification represents, when taken alone, a weak definition of mismatch: many workers identified as overqualified have an adequate job match when their skills acquired through training and education are evaluated to determine the match's quality. Thus, in order to strengthen our criterion, we consider an additional question included in the ECHP,

(Q2) *Have you had formal training or education that has given you skills needed for your present type of work?*

This information allows us to identify those workers that are 'incorrectly qualified'. Throughout the paper, we will use a strong definition of mismatch by restricting the sample of mismatched workers to those individuals that answer 'yes' to Q1 and 'no' to Q2, that is,

[4] The education level needed in a job can be assessed i) subjectively, ii) by professional job analysts, or iii) described by the mean education level in that type of jobs (see Dolton and Vignoles, 2000). Our choice of the first method (given by data availability) is not expected to be crucial in determining the results of the paper. McGoldrick and Robst (1996), Battu *et al.* (2000), Groot and Van den Brink (2000b) and Rubb (2004) explore the extent to which the various methods yield different estimates of the incidence and wage effects of overeducation. Despite concerns relating to poor correlation between the various measures, the authors report that the alternative approaches generate broadly consistent evidence in terms of the estimated effect of overeducation on earnings.

individuals who are overqualified and, at the same time, incorrectly qualified[5]. We will abuse language somewhat and will call these workers, simply, the 'overeducated'[6].

In Table 1 we report summary statistics of the distribution of education groups and the extent of educational mismatches. To provide a more illuminating view, we report the incidence of overqualification, incorrect qualification, and the combination of the two, overeducation. The first column reports the averages for the pooled sample. The incidence of overqualification ranges from 41.6% in Portugal to 68.5% in Belgium, at an average of 59.5%. The incidence of incorrect qualification is somewhat lower, ranging from 20.5% in Germany to 68.1% in Portugal at an average of 42.5%. It is interesting to note that while over-qualification is more frequent in those countries with higher education levels (Belgium, Denmark, Finland and Germany), incorrect qualification appears to be related to low educational attainments (France, Greece, Ireland, Italy, Portugal and Spain)[7]. As a result of these two opposing effects, the proportion of overeducated individuals is only weakly related to the country's education level. This proportion ranges from 14.3% in Germany to 30.4% in Italy and is on average 21.9%.

3. The model

The quantile regression model can be written as

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

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

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

[5] As Sloane (2002) puts it, in most measures of overeducation "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). Our definition is consistent with the view that educational mismatches are due to excess qualifications as well as to incorrect qualifications.

[6] We are aware that workers who are incorrectly qualified can be hardly regarded as 'over-educated', as their formal education and training did not provide them with the skills needed at their jobs. However, we maintain the nomenclature in order to be consistent with previous works, which typically treat the group of overqualified workers as a homogeneous group.

7 These two patterns are clearly illustrated by the country with the lowest education level, Portugal, in which the incidence of over-qualification is lowest and the incidence of incorrect qualification is highest among European countries.

where the check function $\rho_\theta(z)=\theta z$ if $z\geq 0$ or $\rho_\theta(z)=(\theta-1)z$ if $z < 0$. This problem is solved using linear programming methods, where standard errors for the vector of coefficients are obtained using the bootstrap method described in Buchinsky (1998). It must be noted that if the underlying model were a location model, that is, changes in the explanatory variables producing changes only in the location, not in the shape, of the conditional wage distribution, then all the slope coefficients would be the same for all θ. We use the following earnings equation

$$ln\ w_i = \alpha_\theta + \delta_\theta X_i + \gamma_{\theta 1} uppersec_i + \gamma_{\theta 2} tertiary_i + \beta_\theta over_i + e_{\theta i} \quad (4)$$

where $ln\ w_i$ is the logarithm of the gross monthly wage and X_i is a vector of explanatory variables, including age, job tenure, unemployment experience, marital status, health problems affecting daily life, highest education level, fixed term or casual employment, establishment size, and one-digit industry. The construction of these variables is described in Appendix A. 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. Finally, we introduce a dummy variable, *over,* to capture the wage effect of overeducation[8].

4. Empirical results

In this section we calculate the average effect of overeducation on wages as well as the effects at eleven selected quantiles. We proceed in two steps. First, we pool all the countries together and run a joint regression allowing for country effects[9]. Then, we run the wage regression separately for each country. The results for the overeducation coefficient are reported in Table 2.

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[8] The use of a categorical variable is inspired by previous work by Verdugo and Verdugo (1989), Dolton and Vignoles (2000) and Chevalier (2003). 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 (for a detailed description of these models, see Hartog, 2000). We do not investigate this specification, as our data does not contain sufficient information to asses the schooling level required in a job.

[9] In the pooled sample the sampling weights have been rescaled so that each country's relative size in the sample is equal to its relative size in census data. Specifically, the sampling weight of country's *i* observation *j* in the pooled sample is $\omega_{j,i}= (\gamma_i/\alpha_i) \cdot \rho_{j,i}$, where γ_i is the ratio between country's *i* population and the population of all countries included in the ECHP according to census data, α_i is country's *i* sample size relative to the ECHP sample size, and $\rho_{j,i}$ is the original sample weight of country's *i* observation *j*.

A glance to the OLS estimates shows that in Europe overeducated workers earn less, ceteris paribus, than similarly educated workers whose skills are fully utilized. The estimated differential amounts to 7.7% in the pooled sample. Differentiating across countries, we find that the overeducation pay penalty varies from the highest, about 10.9% in Denmark, to the lowest, 2.6% in Portugal. Two groups of countries can be observed. In the first group, the largest, we include Austria, Denmark, Finland, France, Germany, Greece, Italy and Spain. In these countries, the pay penalty of overeducation exceeds 5% and is statistically significant. In the second group, Belgium, Ireland, Portugal and the UK, the estimated effect is below 5% and fails to be statistically significant.

An important feature of our analysis is comparability. A review of the literature reveals that the estimates of the overeducation wage effect differ largely across studies, ranging from almost zero up to 30% (Hartog, 2000, and McGuiness, 2006). Implicitly, such variation puts forward the question of to what extent differences across studies reflect true differences rather than differences in the model specification, the use of different definitions of educational mismatch, diverging datasets and differently defined sample of individuals. Our estimates, which are fully comparable and comprised in the 3%-11% interval, suggest that variation across countries is lower than previously thought. They also provide consisting evidence that, as far as our definition of overeducation is concerned, overeducated workers tend to earn less relative to their well matched counterparts.

Next, we turn to the quantile estimates. We find that the wage effects of overeducation are not homogeneous across the conditional wage distribution. In the pooled sample, the estimated effect ranges from 3.1% in the θ=0.10 quantile (Q10) to 10.8% in the θ=0.90 quantile (Q90). Similarly, the country-specific estimates uncover important differences across quantiles regarding the size and statistical significance of the overeducation coefficient.

In Figures 1 and 2 we have depicted the quantile estimates together with their 5% confidence interval and the OLS estimates. As is apparent from the profiles, in the European labour market the wage effects of overeducation differ across segments of the distribution. In Table 3 we have tested whether such variations are significant at conventional confidence levels. The results for the pooled sample are clear-cut: according to the pair-wise tests, the differential between any two of the selected quantiles is statistically significant. Similarly, the F-test reported in the last column indicates that differences across all quantiles are jointly significant. This evidence confirms that in the European labour market the wage effects of overeducation can not be well described in an average sense.

Turning to the country-by-country estimates, we find that in Denmark, Finland, France, Italy and Spain the F-statistics as well as the pair-wise tests fail to reject the null hypothesis of equality of coefficients. In these countries, therefore, the overeducation effect can be described reasonably well by its average. In most countries, however, the OLS estimates do not capture all the action taking place at different parts of the wage distribution. In Austria, Belgium, Germany, Greece, Ireland, Portugal and the UK differences between the selected quantiles tend to be statistically significant.

Among those countries where the overeducation effect is found to differ significantly across quantiles we detect two different profiles. In Europe as a whole as well as in Austria, Germany, Ireland, Portugal and the UK the overeducation pay penalty is found to be increasing when moving up along the wage distribution. In the pooled sample, the penalty is 7.7 percentage points higher at the top quantile than at the bottom quantile. Similarly, the estimate goes from 7.9% at the first quantile to 18.8% at the top quantile in Austria, from 2.1% to 10.0% in Germany, from 2.5% to 8.6% in Portugal, and from 0.1% to 8.4% in the UK. On the other side, we have Belgium and Greece. In these two countries the overeducation pay penalty tends to decrease as we move up along the wage distribution. In Belgium, the estimated effect goes from 11.2% in the first quantile to 3.4%, while in Greece it increases from the first to the third decile and then decreases from the third to the top decile.

4.1. Implications for the wage distribution

QR estimates can be used to describe the conditional wage distribution of different population groups (Buchinsky, 1994). In this sub-section, we use our regression results to compare the conditional wage distribution of adequately educated and overeducated workers.

We start by analyzing Europe as a whole. As shown above, the average impact of overeducation on wages is negative and significant in the pooled sample. This can be represented by a shift (to the left) of the conditional distribution of wages. Moreover, the overeducation effect shows significant variation across quantiles, indicating that overeducation affects not only the location of the distribution (through its average effect) but also the shape of the distribution (through differences across quantiles). In Table 4 we report the differential in the overeducation coefficient between individuals that are located at different quantiles of the distribution. We find that overeducation contributes to reduce wage differences between individuals at high-pay and low-pay jobs, as it carries a larger penalty for those that precisely earn more (those located at the upper quantiles). To put it different, in Europe the conditional wage distribution of overeducated workers is, ceteris paribus, less dispersed than the distribution of adequately educated workers.

Differentiating among countries, we detect three different groups. In the largest group, Austria, Belgium, Germany, Greece, Ireland, Portugal and the UK, the overeducated exhibit less wage dispersion than their well matched counterparts, as it was found in the pooled sample. In the second group, Denmark, Finland, France, Italy and Spain, conditional wage dispersion is similar between the overeducated and the adequately educated, as in these countries the impact of overeducation is uniform over the conditional wage distribution. Finally, in the third group, Greece and Belgium, overeducated workers exhibit more dispersion than their well-matched counterparts. Still, this result should be interpreted cautiously in the case of Greece, as in this country wage dispersion among the overeducated tends to be, relative to the adequately educated, lower at the bottom tail and greater in the middle and upper quantiles of the distribution.

4.2 Overeducation and unobserved skills

As we have shown, the wage impact of overeducation shows important variation across individuals that have the same observable characteristics but are located at different quantiles of the earnings distribution. There are several factors that can potentially account for this variation. Arguably, differences in the degree of overeducation, field of education, and the interaction between mismatched work and specific job characteristics may importantly affect individual's earnings. Consistent with this view, Green et al (1999) and McGuiness (2003b) find that the mismatch between actual skills and skills required for the job is lower among graduates from technical and scientific areas and higher among graduates from humanities and arts. In the present study, however, we do not explore these factors due to data limitations.

There is, however, one important avenue that we can explore: unobserved skills. In the quantile regression framework, the estimates at different quantiles represent the effects of a given covariate for individuals that have the same observable characteristics but, due to unobservable characteristics, are located at different quantiles of the conditional distribution. Therefore, those workers that end up in high-pay jobs (located at the upper part of the wage distribution) are those who have more productive skills, where by productive skills we indicate the ability, better academic credentials, motivation, etc., to earn a higher wage given a vector of observable characteristics. Having the labour market segmented by skill deciles, with individual skills indexed by the individual's position in the conditional wage distribution, then differences in the wage effects of overeducation across conditional quantiles can be interpreted as differences between skill groups.

Interestingly, we find that overeducation is an event that reduces wages amongst all skills groups. If overeducation was simply a consequence of low skills, then its influences should be restricted to the lower segments of the earnings distribution. In turn, we find that with the exception of Belgium and Greece, in all countries the pay penalty of overeducation among the high-skilled is, if not higher, as large as among the low-skilled (see Table 2). In most countries, indeed, individuals with high (unobservable) skills are exposed to a *larger* wage decrease if they end up in mismatched work.

Green et al. (1999) and McGuiness (2003a) report evidence that the overeducation effect persist even after controlling for skill differences. Our results are consistent with this view. In turn, Chevalier (2003) finds that part of the estimated wage differential between overeducated and adequately educated workers can be explained by controlling for skill differences. Specifically, his results show that to some extent the overeducated earn less because they are less skilled. Here, we provide an alternative view: overeducated individuals are a distinct subset of any skill group, earnings less than similarly educated peers. There are at least two factors that may explain the divergence between our study and Chevalier's results. First, we do not examine the earnings differential between overeducated workers who have different skills, but the differential between overeducated and adequately educated workers with similar (unobserved) skills. Second, we use a broad definition of skills, including all those unmeasured characteristics that actually affect the worker's position in the wage distribution. Chevalier (2003), in turn, bases his results on test scores and degree classifications, which may be very specific and may not capture a lot of the job requirements that matter for an individual's earnings.

5. Conclusions

In this paper we used international comparable data to assess the extent and wage effects of overeducation in Europe. We found that more than one fifth of the working population in Europe lacks qualifications commensurate with their jobs.

In line with previous work, we found that overeducated workers earn less than their well matched counterparts. This differential is on average 7.7%, ranging from a non-significant 3% in Portugal to a significant 11% in Denmark. The range of estimates is relatively small, suggesting that most part of the variation across studies found in the literature is due to differences in the earnings equation, alternative definitions of educational mismatch, and diverging estimating samples.

Using QR we explored the wage effects of overeducation across the conditional wage distribution. We found significant differences across quantiles regarding the overeducation wage effect. This finding warns researchers in the field that restricting the analysis of the wage impact of overeducation to averages may miss important information.

By differentiating between quantiles, we discriminated between groups of workers with different (unobservable) skills. We found that the detrimental effects of overeducation among the high-skilled are, if not higher, as large as amongst the low skilled. This was interpreted as evidence that overeducation is an event that reduces the worker's potential productivity, *regardless of his skills.* Our results, therefore, lend further support to the view that the overeducation pay penalty emerges, at least in part, from an imperfect matching between the worker's productivity potential and the job's productivity ceiling.

We used our QR estimates to describe how overeducation affects the location and the shape of the conditional wage distribution. We found that wage levels as well as wage dispersion tend to be lower within the overeducated.

Appendix. Description of data source and estimating samples

The European Community Household Panel (ECHP) is available from 1994 to 2001 for fifteen European countries. For each of them, it has a sample of households and 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 an small proportion of the total sample. The wave chosen is 2001 for all countries except for Germany, Finland and UK, in which we choose 1996, since questions about overeducation are not available. We describe the variables used in the analysis.

Gross monthly 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 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.

Unemployment experience. Individuals are asked to report the existence of any unemployment period before current job.

Health. Individuals are asked about their health in general.

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TABLE 1: DESCRIPTIVE STATISTICS

	EUROPE	AUSTRIA	BELGIUM	DENMARK	FINLAND	FRANCE	GERMANY	GREECE	IRELAND	ITALY	PORTUGAL	SPAIN	UK
Educational mismatches													
Overqualification	59.46	51.72	68.48	62.95	62.82	55.25	67.82	49.11	46.75	48.46	41.63	59.44	68.26
Incorrect qualification	42.49	27.96	28.26	27.51	29.06	48.23	20.46	64.94	36.04	67.91	68.07	47.45	31.74
Overeducation	**21.92**	**15.61**	**19.13**	**19.33**	**20.09**	**23.68**	**14.29**	**29.81**	**16.26**	**30.35**	**25.47**	**25.01**	**19.42**
Education													
Less than upper secondary	25.83	8.40	23.70	12.02	14.74	63.08	18.79	34.33	32.11	42.58	76.59	47.41	31.82
Upper secondary	35.46	83.36	33.70	53.41	52.99	8.95	50.64	41.11	43.22	44.93	14.54	21.90	35.54
Tertiary	25.83	8.23	42.61	34.57	32.26	27.97	30.56	24.56	24.66	12.49	8.86	30.69	32.64
Average education[(a)]	1.87	1.99	2.19	2.23	2.17	1.65	2.12	1.90	1.92	1.70	1.32	1.83	2.00

(a) Average of a variable that takes value ‘3’ if the highest level of education attained by the individual is tertiary education, ‘2’ if upper secondary education, and ‘1’ if less than upper secondary education.

TABLE 2: OLS AND QUANTILE ESTIMATES OF THE OVEREDUCATION PAY PENALTY

	EUROPE	AUST.	BELG.	DENM.	FINL.	FRANCE	GERM.	GREECE	IREL.	ITALY	PORT.	SPAIN	UK
OLS	**-0.077*** **	**-0.073*** **	**-0.030**	**-0.109*** **	**-0.103*** **	**-0.071*** **	**-0.088*** **	**-0.074*** **	**-0.035**	**-0.056*** **	**-0.026**	**-0.090*** **	**-0.046**
	(0.002)	(0.028)	(0.029)	(0.039)	(0.037)	(0.025)	(0.030)	(0.026)	(0.043)	(0.019)	(0.021)	(0.021)	(0.038)
Q10	-0.031***	-0.079**	-0.112***	-0.097	-0.011	-0.050	0.021	-0.048	0.047	-0.027	-0.025	-0.075**	-0.001
	(0.005)	(0.043)	(0.055)	(0.084)	(0.099)	(0.044)	(0.046)	(0.045)	(0.071)	(0.032)	(0.034)	(0.037)	(0.068)
Q20	-0.053***	-0.061	-0.060*	-0.070	-0.022	-0.069***	-0.035	-0.127***	-0.057	-0.025	-0.008	-0.105***	-0.007
	(0.003)	(0.043)	(0.038)	(0.049)	(0.048)	(0.029)	(0.037)	(0.032)	(0.053)	(0.023)	(0.026)	(0.031)	(0.041)
Q25	-0.040***	-0.069*	-0.078***	-0.083*	-0.042	-0.079***	-0.050*	-0.139***	-0.030	-0.035*	0.004	-0.094***	-0.010
	(0.002)	(0.039)	(0.032)	(0.046)	(0.039)	(0.029)	(0.032)	(0.035)	(0.051)	(0.019)	(0.021)	(0.026)	(0.046)
Q30	-0.042***	-0.059*	-0.082***	-0.035	-0.071	-0.061***	-0.076***	-0.125***	-0.041	-0.040**	0.004	-0.087***	-0.026
	(0.002)	(0.035)	(0.029)	(0.039)	(0.035)	(0.025)	(0.032)	(0.040)	(0.044)	(0.017)	(0.019)	(0.025)	(0.042)
Q40	-0.061***	-0.054*	-0.047	-0.040	-0.072**	-0.060***	-0.118***	-0.091***	-0.059	-0.035**	-0.002	-0.079***	-0.025
	(0.003)	(0.032)	(0.032)	(0.031)	(0.037)	(0.023)	(0.033)	(0.032)	(0.047)	(0.016)	(0.021)	(0.025)	(0.035)
Q50	-0.069***	-0.084***	-0.036	-0.079***	-0.089***	-0.054***	-0.114***	-0.065***	-0.021	-0.049***	-0.009	-0.081***	-0.036
	(0.002)	(0.026)	(0.034)	(0.029)	(0.031)	(0.020)	(0.037)	(0.023)	(0.058)	(0.016)	(0.022)	(0.025)	(0.027)
Q60	-0.071***	-0.091***	0.008	-0.062**	0.105***	-0.085***	-0.123***	-0.070***	-0.062	-0.028*	-0.012	-0.050**	-0.048*
	(0.002)	(0.031)	(0.035)	(0.032)	(0.039)	(0.023)	(0.029)	(0.021)	(0.045)	(0.017)	(0.022)	(0.024)	(0.030)
Q70	-0.083***	-0.086***	-0.003	-0.070***	-0.120***	-0.072***	-0.117***	-0.088***	-0.065*	-0.032**	-0.006	-0.063***	-0.082***
	(0.003)	(0.031)	(0.034)	(0.033)	(0.041)	(0.028)	(0.025)	(0.025)	(0.040)	(0.017)	(0.026)	(0.022)	(0.033)
Q75	-0.082***	-0.081***	0.004	-0.089***	-0.113***	-0.091***	-0.127***	-0.078***	-0.101**	-0.028*	-0.009	-0.076***	-0.102***
	(0.003)	(0.030)	(0.032)	(0.034)	(0.042)	(0.036)	(0.028)	(0.029)	(0.047)	(0.017)	(0.025)	(0.025)	(0.038)
Q80	-0.081***	-0.110***	-0.003	-0.061	-0.096**	-0.063*	-0.134***	-0.064***	-0.088*	-0.039*	-0.016	-0.073***	-0.098***
	(0.004)	(0.032)	(0.031)	(0.040)	(0.045)	(0.038)	(0.032)	(0.032)	(0.051)	(0.021)	(0.022)	(0.027)	(0.044)
Q90	-0.108***	-0.188***	-0.034	-0.115**	-0.095*	-0.067*	-0.100*	-0.032	-0.031	-0.035	-0.086***	-0.073***	-0.084*
	(0.003)	(0.049)	(0.045)	(0.063)	(0.050)	(0.040)	(0.056)	(0.040)	(0.086)	(0.024)	(0.030)	(0.027)	(0.053)
No. of obs.	17212	1162	916	696	834	1609	1563	1231	733	1947	2031	2210	926

Notes to Table 2: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level; ii) OLS estimation is heteroskedastic-robust; iii) standard errors, in parenthesis, have been calculated using a bootstrap method of 500 replications; iv) Controls: age, job tenure, unemployment experience, marital status, health problems affecting daily life, highest education level, fixed term or casual employment, establishment size, and one-digit industry.

TABLE 3: TESTS FOR THE EQUALITY OF COEFFICIENTS AT DIFFERENT QUANTILES (P-VALUE)

EUROPE	Q25	Q50	Q75	Q90	Joint equality
Q10	0.07	0.00	0.00	0.00	0.00
Q25		0.00	0.00	0.00	
Q50			0.00	0.00	
Q75				0.00	

AUSTRIA	Q25	Q50	Q75	Q90	Joint equality
Q10	0.81	0.92	0.96	0.06	0.06
Q25		0.63	0.76	0.02	
Q50			0.93	0.02	
Q75				0.00	

BELGIUM	Q25	Q50	Q75	Q90	Joint equality
Q10	0.45	0.17	0.06	0.25	0.20
Q25		0.20	0.04	0.37	
Q50			0.20	0.96	
Q75				0.24	

DENMARK	Q25	Q50	Q75	Q90	Joint equality
Q10	0.85	0.83	0.93	0.85	0.98
Q25		0.91	0.91	0.67	
Q50			0.75	0.56	
Q75				0.61	

FINLAND	Q25	Q50	Q75	Q90	Joint equality
Q10	0.72	0.43	0.33	0.44	0.68
Q25		0.20	0.15	0.37	
Q50			0.50	0.91	
Q75				0.70	

FRANCE	Q25	Q50	Q75	Q90	Joint equality
Q10	0.43	0.91	0.38	0.75	0.59
Q25		0.39	0.75	0.78	
Q50			0.19	0.73	
Q75				0.45	

GERMANY	Q25	Q50	Q75	Q90	Joint equality
Q10	0.10	0.01	0.01	0.08	0.07
Q25		0.09	0.05	0.40	
Q50			0.69	0.80	
Q75				0.52	

GREECE	Q25	Q50	Q75	Q90	Joint equality
Q10	0.02	0.71	0.58	0.80	0.03
Q25		0.02	0.12	0.04	
Q50			0.64	0.44	
Q75				0.25	

IRELAND	Q25	Q50	Q75	Q90	Joint equality
Q10	0.32	0.40	0.05	0.42	0.19
Q25		0.84	0.18	0.99	
Q50			0.13	0.90	
Q75				0.26	

ITALY	Q25	Q50	Q75	Q90	Joint equality
Q10	0.77	0.50	0.98	0.90	0.74
Q25		0.46	0.73	0.92	
Q50			0.21	0.55	
Q75				0.85	

PORTUGAL	Q25	Q50	Q75	Q90	Joint equality
Q10	0.26	0.67	0.67	0.13	0.01
Q25		0.46	0.64	0.01	
Q50			0.96	0.02	
Q75				0.00	

SPAIN	Q25	Q50	Q75	Q90	Joint equality
Q10	0.71	0.86	0.95	0.93	0.99
Q25		0.80	0.72	0.82	
Q50			0.86	0.94	
Q75				0.94	

UK	Q25	Q50	Q75	Q90	Joint equality
Q10	0.86	0.57	0.14	0.28	0.38
Q25		0.52	0.07	0.22	
Q50			0.07	0.36	
Q75				0.70	

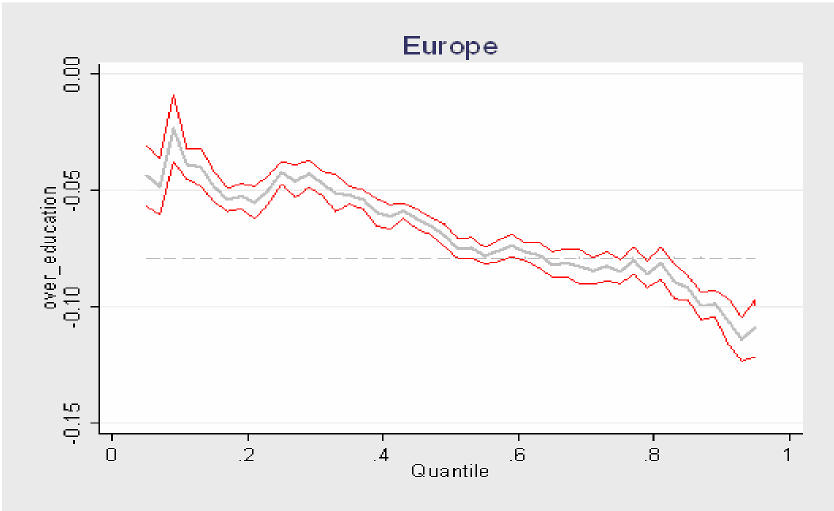
Notes to Table 3: i) The element in the Q*j* column and the Q*i* row is the p-value of a pair-wise test between the estimates at the *j* and the *i* quantiles, $H_0 : \beta_j = \beta_i$, $H_1 : \beta_j \neq \beta_i$; ii) the joint equality test reports the p-value of the F-test $H_0 : \beta_{0.10} = \beta_{0.20} = ... = \beta_{0.90}$, $H_1 : \beta_m \neq \beta_n$ for some $m \neq n$; iii) p-value < 0.10: significant at the 10% confidence level, p-value < 0.05: significant at the 5% confidence level, p-value < 0.01: significant at the 1% confidence level.

TABLE 4: INTERQUANTILE DIFFERENCES IN THE OVEREDUCATION PAY PENALTY

	EUROPE	AUSTRIA	BELGIUM	DENM.	FINLAND	FRANCE	GERMANY	GREECE	IRELAND	ITALY	PORTUGAL	SPAIN	UK
Q90-Q10	-0.077***	-0.109*	0.078	-0.018	-0.084	-0.017	-0.121*	0.016	-0.078	-0.008	-0.111	0.002	-0.083
Q90-Q25	-0.068***	-0.119***	0.044	-0.032	-0.053	0.012	-0.05	0.107**	-0.001	0.00	-0.090***	-0.119	0.044
Q90-Q50	-0.039***	-0.104***	0.002	-0.036	-0.006	-0.013	0.014	0.033	-0.010	0.014	-0.077***	0.008	-0.048
Q90-Q75	-0.026***	-0.107***	-0.038	-0.026	0.018	0.024	0.027	0.046	0.07	-0.007	-0.077***	-0.107	-0.038
Q75-Q10	-0.051***	-0.002	0.116*	0.008	-0.102	-0.041	-0.148***	-0.03	-0.148***	-0.001	0.016	-0.002	0.116
Q75-Q25	-0.042***	-0.012	0.082**	-0.006	-0.071	-0.012	-0.077**	0.061	-0.071	0.007	-0.013	-0.012	0.082*
Q75-Q50	-0.013***	0.003	0.04	-0.01	-0.024	-0.037	-0.013	-0.013	-0.08	0.021	0.00	0.003	0.040*
Q50-Q10	-0.038***	-0.005	0.076	0.018	-0.078	-0.004	-0.135***	-0.017	-0.068	-0.022	0.016	-0.006	-0.035
Q50-Q25	-0.029***	-0.015	0.042	0.004	-0.047	0.025	-0.064*	0.074***	0.009	-0.014	-0.013	-0.015	0.042
Q25-Q10	-0.009*	0.01	0.034	0.014	-0.031	-0.029	-0.071*	-0.091***	-0.077	-0.008	0.029	0.01	0.034

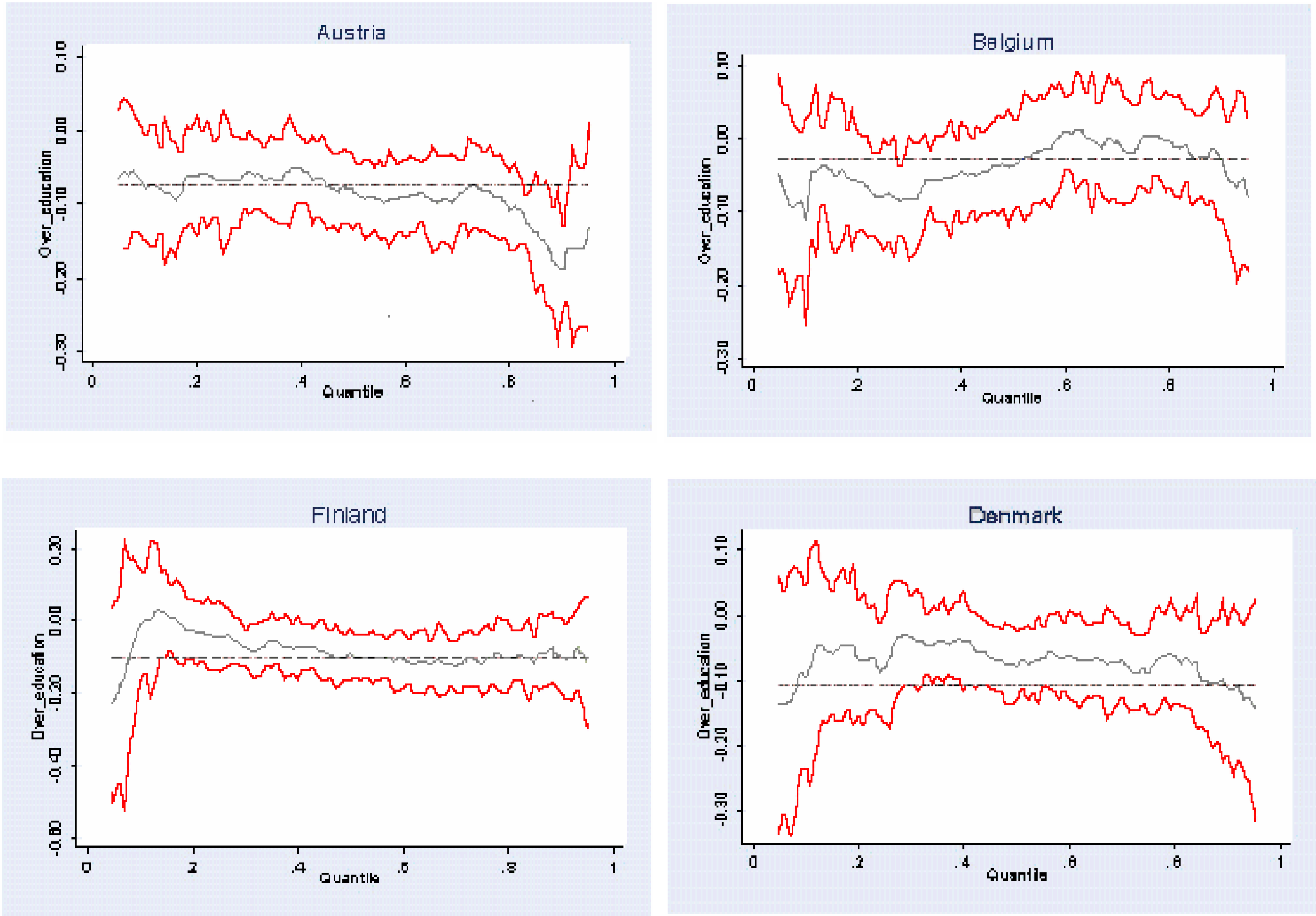
Notes to Table 4: i) * signals significant at the 10% level, ** signals significant at the 5% level, and *** signals significant at the 1% level.

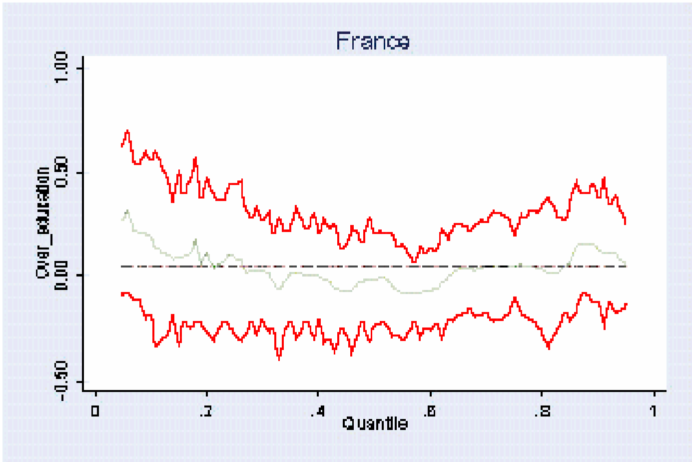
FIGURE 1. QUANTILE-RETURN PROFILE OF THE OVEREDUCATION PAY PENALTY – POOLED DATA



Notes: Grey line: quantile estimates, Red lines: 5% confidence intervals, Dotted line: OLS estimate.

FIGURE 2. QUANTILE RETURN PROFILE OF THE OVEREDUCATION PAY PENALTY – EUROPEAN COUNTRIES

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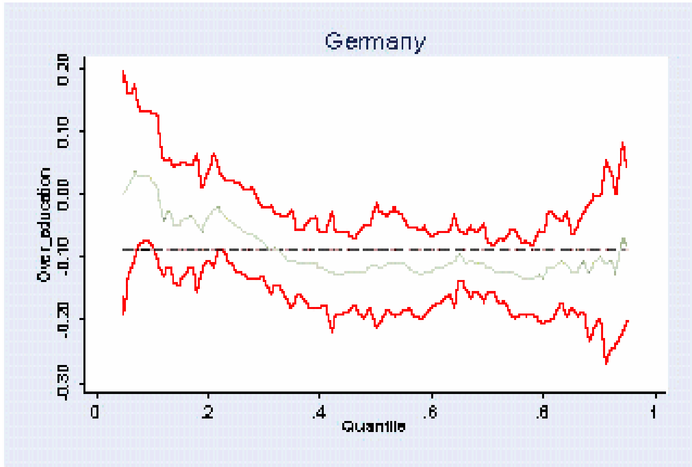
0.00
-0.50
0
.2
.4
.6
.8
1
Quantile


Germany
Over_education
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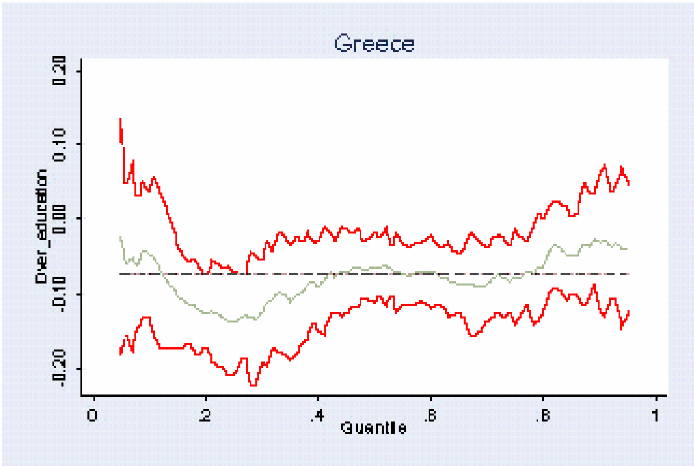
0.10
0.00
-0.10
-0.20
-0.30
0
.2
.4
.6
.8
1
Quantile


Greece
Over_education
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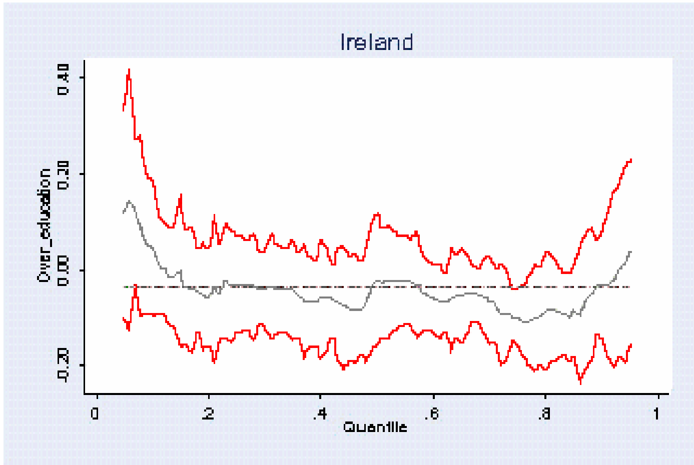
0.10
0.00
-0.10
-0.20
0
.2
.4
.6
.8
1
Quantile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0.00
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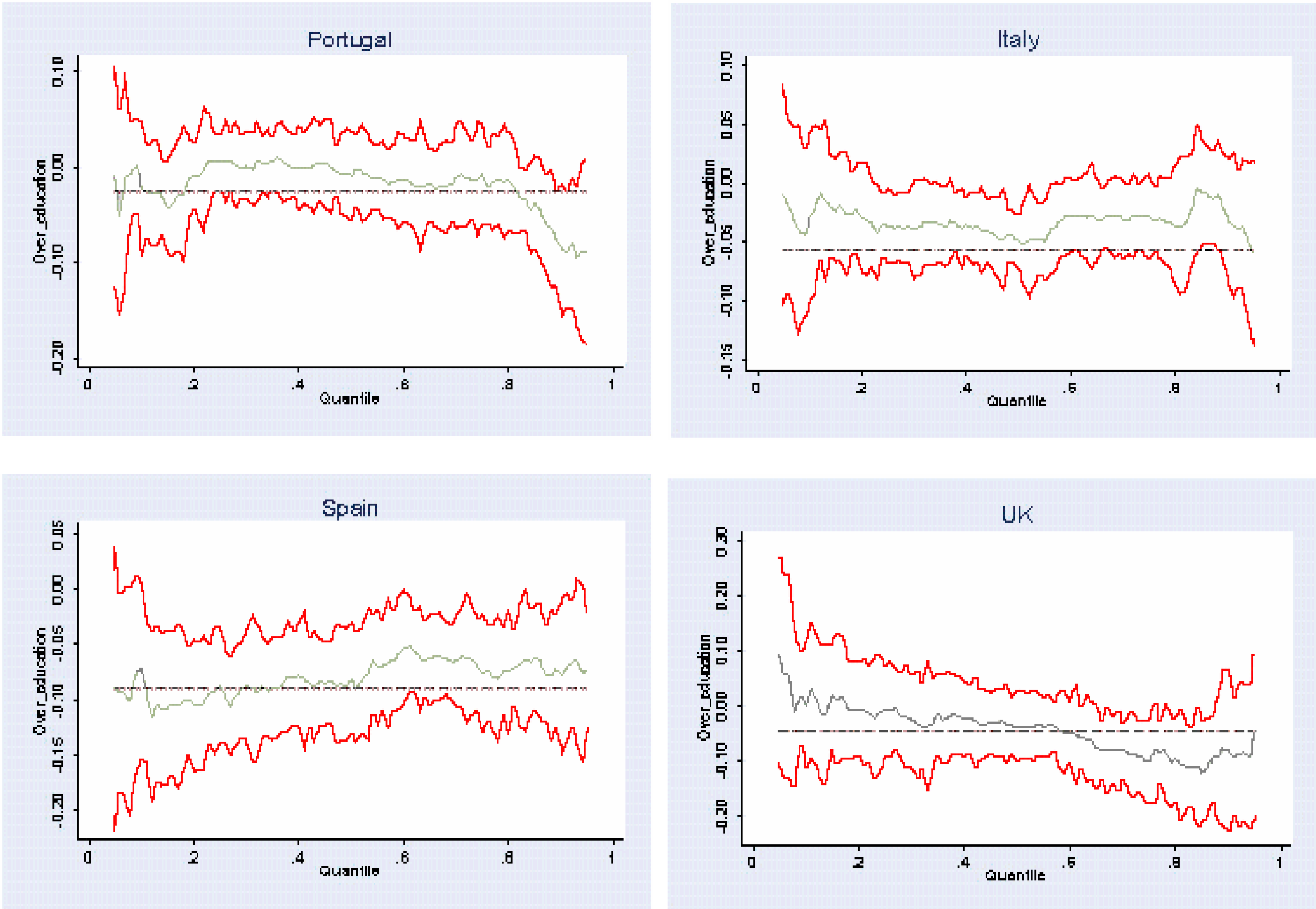
0
.2
.4
.6
.8
1
Quantile



Notes: Grey line: quantile estimates, Red lines: 5% confidence intervals, Dotted line: OLS estimate.