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Exploring the inter-industry wage premia in Portugal along the wage distribution: evidence from EU-SILC data

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Abstract

In this article we investigate whether inequality in the inter-industry wage premia may be explained by unobserved differences in workers' educational skills. We use the last 2007 wave of EU-SILC data set for Portugal, a nation which can be considered a case-study, due to its traditional high inter-industry wage dispersion. Applying both OLS and Quantile Regression techniques, our results suggest that quality differences across workers still remain an irrelevant matter in the wage premia determination, even after many noteworthy educational reforms adopted in that country since the beginning of the 1990s.

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1. Introduction

There is a wide consensus that the inter-industry wage inequality across countries remains a relevant topic in the current economic literature. As a matter of fact, since the seminal article by Krueger and Summers (1988) some empirical analysis have explored possible explanations. Particularly, unobserved quality differences across workers have also been called to explain the behavior of income inequality among industries, in different countries (e.g., Gibbons and Katz, 1992).

In this context, Portugal is a chiefly suitable country, because its inter-industry wage dispersion is found to be high when compared with other European countries (Hartog et al. 2001). In such context, Martins (2004), by using a 1995 Portuguese data set, pointed out that - at the beginning of the 1990s - unobservable differences across workers were not a critical element in determining industry wage premia in that country.

Exactly since the early nineties a period of strong economic expansion began in Portugal, enhanced by several economic reforms. At the same time obvious changes in many aspects of the income distribution occurred (Budria 2010).

In particular, the improvement in the quality of education and a stronger match between achieved educational levels and occupations were the key elements for the reforms of the schooling system in that country during the 1990s (OECD 2010). Portuguese government defined new curricula and established upper-secondary education as a three-year cycle. Moreover, vocational schools were granted a new legal framework in 1993. These schools absorb a substantial number of students seeking a job-oriented training after completing the 9th form of basic schooling, representing the most important alternative training path leading to a professional qualification offered by the official educational system. Particular attention was also given to the tertiary level. The new legislation allowed public universities, on a voluntary basis, to acquire independent legal status in the form of public foundations governed by private law. The new environment should have facilitated stronger educational links to professions, regions and labor markets and more effective university-industry links for research and innovation. Overall, the reform provided a sound basis to improve the ability of Portuguese education to raise higher-level employment skills.

In this article we demonstrate that actually in Portugal, even after these relevant economic reforms, individual skills still remain an irrelevant matter in the wage determination, while non-competitive factors continue to play a more important role.

To address this issue we apply a Quantile Regression (QR) semi-parametric approach to the last 2007 wave of the European Union Statistics on Income and Living Conditions inquiry (EU-SILC), the new European homogenized panel survey, which - to the best of our knowledge - has never been used yet in exploring the unobserved quality explanation of industry wage differentials. The QR method is more interesting, as well as more suitable, for it allows us to get a particularly precise picture of the dynamics of the dependent variable at different points of the distribution, rather than at the conditional mean.

Overall, the article supports the idea that in Portugal there is not only a relevant cross-industries dispersion in returns to education, but also a high heterogeneity in wage premia at different points of the wage distribution, which OLS modeling of conditional average of a dependent variable completely fails to account for. In particular, we find evidence that, although recent governmental efforts endeavouring to improve the quality of education across workers, it cannot be called yet to spell out Portuguese inequality in the inter-industry wage premia.

This empirical article is organized as follows. The next section describes the data. Section 3 illustrates our econometric specification. Section 4 reports the results. Section 5 displays the robustness check, while in the last section we present our main conclusions.

2. Data

Data are collected from the 2007 EU-SILC survey, available since March 1st 2009. It is the new homogenized panel survey that has replaced European Community Household Panel (ECHP).

Our analysis focuses on Portuguese full-time male workers aged between 25 and 65: women have been disregarded on account of potential selectivity biases. Younger males have been also dropped because they are still in the almost exclusively educational period of their life, i.e. they are very much more likely enrolled in a secondary or tertiary course than performing a work activity whatsoever. In the 2007 EU-SILC wave 4,665 Portuguese men are interviewed: yet, our dependent variable - the hourly (logarithmic) gross wage – is available for 1,735 full-time Portuguese male-workers aged between 25 and 65 years. These constitute our reference sample. Our regressors are schooling years, which has been built up following the usual framework[1], the number of years spent in paid work and its squared: the second is regarded as being a proxy for individual experience while the third takes account of possible non linearities. Sectors surveyed are those considered in EU-SILC, i.e. the 12 macro-sectors obtained by joining several NACE 1.1 classification codes (see table 1 for further details).

Tab. 1. Summary statistics

Industries - NACE 1.1 Class.	EU-SILC class.	%
Fishing, Agriculture, hunting and forestry	a+b	7.17
Mining and quarrying, Manufacturing, Electricity, gas and water supply	c+d+e	22.96
Construction	f	19.42
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household good	g	15.83
Hotels and restaurants	h	4.49
Transport, storage and communication	i	5.67
Financial intermediation	j	2.31
Real estate, renting and business activities	k	4.81
Public administration and defence, compulsory social security	l	10.03
Education	m	3.13
Health and social work	n	1.86
Other community, social and personal service activities, Private households with employed persons, Extra-territorial organizations and bodies	o+p+q	2.31
Total		100

[1] That usual framework refers to making use of the highest ISCED level of education attained by a male worker, and for each level assigning the legal minimum number of years typically required to achieve it: more precisely, those who reached only an ISCED 1 grade have been given 5 years of schooling; 8 years of school have been assigned to those with an ISCED 2 grade; 13 years to those with an ISCED 3; 14 to men who attained an ISCED 4 grade and 18 years to those who reached an ISCED 5

3. Econometric specification: OLS versus quantile regression

We assume our OLS specification to have the following form:

$$\ln w_i = \alpha_i + \beta_i \mathrm{S} + \gamma_i X + \delta_i X^2 + \varepsilon_i \tag{1}$$

As is well known, OLS implicitly assume that the impact of the regressors along the conditional distribution of the response variable are irrelevant. But as is already equally known covariates may influence it on its whole shape. This case can be studied by performing a quantile regression (QR), which has the following functional form (Koenker & Basset, 1978):

$$Quant_\theta \begin{Bmatrix} \sum_{i:\ln w_i \geq x_i\beta} \theta \mid \ln w_i - \left(\alpha_\theta + \beta_\theta \mathrm{S}_i + \gamma_\theta X_i + \delta_\theta X_i^2\right) \mid + \\ + \sum_{i:\ln w_i \leq x_i\beta} (1-\theta) \mid \ln w_i - \left(\alpha_\theta + \beta_\theta \mathrm{S}_i + \gamma_\theta X_i + \delta_\theta X_i^2\right) \mid \end{Bmatrix} \tag{2}$$

The equation (2) is normally written as:

$$\min_{\beta \in R^k} \sum_i \rho_\theta \left(\ln w_i - \alpha_\theta - \beta_\theta \mathrm{S}_i - \gamma_\theta X_i - \delta_\theta X_i^2\right) \tag{3}$$

where $\varrho_\theta(z) = \theta z$ if $z \geq 0$ or $\varrho_\theta(z) = (\theta - 1)z$ if z<0.

This problem is solved using linear programming methods. Standard errors for the vector of coefficients are obtainable by using a bootstrap procedure. In this study 300 replications were carried out.

4. Results

In table 2 we show OLS returns to education as well as conditional returns at 5 representative quantiles in the 12 Portuguese industries. Differences between percentiles of the wage distribution computed for 4 different extremes taken by twos (θ90-θ10 and θ75-θ25) are also reported.

Following Martins (2004), we test the relevance of the unobserved worker quality hypothesis by comparing the differences in returns across high and low-wage industries and evaluating the correlation between OLS returns and both QR coefficients and inter-quantile differences. The intuition is that for the unobserved ability explanation to be relevant, high wage industries should also show a large difference in returns between the top of the wage distribution, where high ability workers are expected to be found, and its bottom, where low ability employees are likely to be.

From the results, a high dispersion across industries clearly emerges. The highest OLS sectoral coefficient (health and social work) is almost 3 times higher than the lowest (Other community, social and personal service activities, Private households with employed persons, Extra-territorial organizations and bodies).

Tab. 2. Conditional returns to schooling - OLS and QR - and significance tests

	a+b	c+d+e	f	g	H	i	j	k	l	m	n	o+p+q
OLS	0.047	0.076	0.068	0.047	0.068	0.068	0.061	0.064	0.081	0.098	0.116	0.039
	(0.080)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)	(0.032)
θ=0.10	0.044	0.032	0.034	0.023	0.021	0.032	0.015	0.027	0.052	0.096	0.081	0.026
	(0.013)	(0.003)	(0.014)	(0.073)	(0.232)	(0.186)	(0.340)	(0.170)	(0.005)	(0.000)	(0.102)	(0.470)
θ=0.25	0.039	0.051	0.045	0.040	0.033	0.068	0.032	0.052	0.085	0.102	0.104	0.060
	(0.001)	(0.002)	(0.000)	(0.023)	(0.241)	(0.089)	(0.108)	(0.009)	(0.000)	(0.000)	(0.000)	(0.066)
θ=0.50	0.031	0.079	0.053	0.041	0.086	0.061	0.071	0.072	0.093	0.098	0.112	0.045
	(0.130)	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.031)
θ=0.75	0.065	0.093	0.090	0.047	0.089	0.086	0.106	0.065	0.093	0.089	0.126	0.053
	(0.194)	(0.000)	(0.000)	0.0038	(0.000)	(0.000)	(0.001)	(0.023)	(0.000)	(0.000)	(0.000)	(0.003)
θ=0.90	0.073	0.089	0.100	0.068	0.071	0.088	0.055	0.059	0.069	0.047	0.146	-0.002
	(0.318)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.138)	(0.092)	(0.000)	(0.041)	(0.000)	(0.936)
θ90-θ10	0.029	0.057	0.066	0.045	0.050	0.056	0.040	0.032	0.017	-0.049	0.065	-0.028
	(0.614)	(0.000)	(0.031)	(0.025)	(0.205)	(0.036)	(0.372)	(0.295)	(0.154)	(0.049)	(0.161)	(0.606)
θ75-θ25	0.025	0.042	0.045	0.007	0.057	0.019	0.074	0.013	0.008	-0.013	0.023	-0.007
	(0.407)	(0.012)	(0.008)	(0.642)	(0.148)	(0.209)	(0.022)	(0.570)	(0.290)	(0.472)	(0.525)	(0.842)
All θ eq.	(0.682)	(0.000)	(0.001)	(0.146)	(0.008)	(0.016)	(0.000)	(0.453)	(0.001)	(0.386)	(0.311)	(0.288)

Note. Data are from cross sectional UDB SILC 2007 – version 1 of March 2009. P-values in brackets.
Bootstrap st. errors are obtained with 300 replications

By comparing OLS and QR coefficients, it can be noted that the industry with the highest (lowest) value in terms of OLS *is not* the industry with the highest (lowest) spread between the top and the bottom of the distribution, both for the θ90-θ10 and θ75-θ25 differences.

We find that the interquantile differences between the extremes of the distribution are not bigger for the industries with high OLS returns compared to the industries with low OLS returns. With regard to the θ90-θ10 spread, results evidence that the average difference between the 6 industries with higher OLS returns and their 6 counterparts with lower estimated OLS coefficients is tighter and *only equal* to 0.007. Using the same OLS ranking of industries, such gap is found to be *even negative* for the θ75-θ25 spread. For the unobserved heterogeneity to be a critical element for wage premia determination, we would expect a really bigger differential between the top of the distribution, where the highest ability workers are expected to be, and its bottom.

5. Robustness check

Further, we test whether gaps between quantile coefficients estimated in our QR are statistically significant. The test has been carried out with respect to the 2 spreads considered in the article (θ90-θ10=0 and θ75-θ25=0) and to all quantiles. More specifically, p-values are obtained through a bootstrapped variance-covariance matrix that includes between quantile blocks. The results indicate that in most cases the 2 linear hypothesis (θ95-θ5=0 and θ75-θ25=0) are found to be not significant. As expected, significance decreases when the interquantile spread also decreases. We also find that even the joint equality of coefficients at all quantiles is not rejected in many cases.

Moreover, while the OLS returns are well correlated with almost all the QR returns (table 3), both in terms of Pearson and Spearman's correlations, they are not correlated with the difference between the top and the bottom of the distribution. The Pearson's correlation coefficient between OLS and the θ75-θ25 quantile difference is even negative.

Tab. 3. Correlation between OLS and QR coefficients

	Pearson	Spearman
θ=0.10	0.782	0.664
θ=0.25	0.778	0.624
θ=0.50	0.903	0.885
θ=0.75	0.812	0.711
θ=0.90	0.633	0.448
θ90-θ10	0.074	0.265
θ75-θ25	-0.048	0.004

6. Conclusions

In this article we have applied OLS and QR techniques to the last 2007 EU-SILC wave in order to clear up a possible puzzling presence of inter-industry inequality wage premia for full-time male workers in Portugal.

We have found high dispersion of OLS returns amongst the 12 considered sectors of the Portuguese economy, but a weak correlation between OLS and the magnitude of 2 quantile benchmarking differences (θ95-θ5 and θ75-θ25). Furthermore, we have demonstrated that if sectors are ranked by OLS coefficients and divided in 2 groups (high and low returns), the inter-quantile difference is small (and for the difference θ75-θ25 is even negative). Tests on the 2 linear hypothesis θ95-θ5=0 and θ75-θ25=0 are found to be not significant while OLS are well correlated with almost all the QR coefficients but not with the difference between the top and the bottom of the distribution.

Our results show that in Portugal, unobserved heterogeneity possibly generated by the quality of workers is still irrelevant in the wage determination, despite reforms of the educational system during the 1990s, aimed at improving the quality of individual skills and favoring a stronger link with the job market. Therefore, the evidence suggests that the effect of these reforms on the wage premium of human capital, seems to have not come yet, while other factors such as the relative strength of industries in a small country may play a more important role.

References

Budria, S. (2010) Economic Inequality in Portugal: A Picture in the Beginnings of the 21st century, *Journal of Income Distribution*, **19** (2), 79-110.

Gibbons, R. and L. Katz (1992) Does Unmeasured Ability Explain Inter-Industry Wage Differentials?, *Review of Economic Studies,* **59**, 515–535.

Hartog, J., Pereira, P.T., and J.C. Vieira (2000) Inter-industry wage dispersion in Portugal: high but falling, *Empirica,* **27**, 353–364.

Koenker, R. and G. Bassett (1978) Regression quantiles, *Econometrica,* **46**, 33– 50.

Krueger, A. and L. Summers (1988) Efficiency Wages and the Inter-Industry Wage Structure, *Econometrica* **56**, 259–293.

Martins P. (2004) Industry Wage Dispersion: Evidence from the Wage Distribution, *Economics Letters*, **83**(2), 157-163.

OECD (2010) Economic Policy Reforms: Going for Growth. Paris: OECD.