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Abstract

The Greek labour market has undergone dramatic changes during the last 10 years. Wage inequality, especially at the bottom end of the earnings distribution, increased sharply. At the same time, the past trend towards educational upgrading of the labour force has further been boosted. In this paper, we analyze the relationship between education and the dispersion of male earnings, using Labour Force Survey data for years 2006 and 2016. We address the issue of unobserved heterogeneity by employing a quantile regression approach. We also account for potential endogeneity by employing the IVQR approach introduced by Chernozhukov and Hansen (2008). Our best estimates suggest that education exerts a negative effect on earnings inequality in the pre-crisis period. However, during the recession, the returns to education appear to be significantly higher at the upper end of the wage spectrum, thereby contributing to increased inequality. We also find evidence that the impact of education on the dispersion of earnings is stronger in the private sector. Finally, we also account for the incidence of over-education. Interestingly, the penalty that overqualified workers suffer, declines across the conditional earnings distribution and disappears completely at the highest quantile in 2016.

Keywords: Returns to education; Wage inequality; Quantile regression

JEL codes: C29; J31; I21

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1 Introduction

Rising inequality and the trade-offs between efficiency and equity have become some of the most hotly debated issues by policymakers and researchers alike. In *Capital in the twenty first century*, Piketty (2014) argues that it is free-market capitalism behind the within-country worsening of income distribution. More precisely, Piketty contends that the fact the rate of return on capital always exceeds the rate of growth of output, renders inequality a self-fulfilling prophecy. However, while macroeconomists mainly focus on the evolution of Capital and Labour income, the unequal dispersion of wages and its causes has received the lion's share of attention in the labour economics literature (Checchi and García-Peñalosa, 2008).[1] Skill-biased technological change, globalization in the forms of offshoring and outsourcing, labour market institutions and the relative supply of skills, have long been identified by existing work as the main drivers of earnings inequality.

For example, it is well-documented in the literature, that information and communication technology (ICT) is increasingly substituting employees with intermediate skills in repetitive and routine tasks. At the same time, ICT complements complex and abstract tasks performed by high-skilled workers, thereby contributing to *job polarization* and increased inequality (see, among others, Autor et al. 2006; Goos and Manning, 2007; Dustmann et al., 2009; Acemoglu and Autor, 2010).[2] Likewise, there is ample evidence that offshoring (i.e. the relocation of jobs abroad) is skill-biased, that is, increases (decreases) the high-skilled (low-skilled) wage (see, for example, Crinò, 2012; Hummels et al., 2014) On the other hand, Card and DiNardo (2002); Piketty et al. (2014) and Koeniger et al. (2007), among others, raise the important point that institutions, such as minimum wages, employment protection legislation and trade unions, are equally important to technology in explaining the evolution of earnings inequality. A related strand of the literature, also pays attention to the issue of wage inequality between different types of workers in terms of educational attainment. For example, Card

1 For a detailed summary of the relevant literature, see Lemieux (2007).

[2] Note, however, that the idea that ICT impacts negatively on the employment opportunities of workers in the middle-skill occupations had initially been put forward as primarily hurting the low-skilled ones.

and Lemieux (2001); Goldin and Katz (2008) and Verdugo (2014) conclude that earnings inequality in the US and France is negatively correlated with the share of college graduates.

In the public discourse, education is often regarded as a means to combat inequality. However, contrary to this popular belief, there is a considerable amount of evidence that equally productive workers, in terms of their observable human capital characteristics, often earn different wages, mainly because of unobserved employee and employer heterogeneity. For example, several previous studies have shown that the returns to education are higher at the upper end of the wage spectrum (see, among others, Buchinsky, 1994; Hartog, Pereira and Pieira, 2001; Fersterer and Winter-Ebmer, 2003; Martins and Pereira, 2004; Budría and Pereira, 2005; Prieto-Rodriguez, Barros and Vieira (2008); Patrinos, Ridao-Cano and Sakellariou, 2009; Tansel and Bodur, 2012). Consequently, the effect of education on the dispersion of earnings is debatable.

This study examines the impact of education on male wage inequality. Following the quantile regression approach of Tansel and Bodur (2012), we estimate the effects of schooling on wages, controlling for a set of employee and employer characteristics. The underlying assumption is that fitting a quantile regression model, accounts for the placement of workers across the conditional salary distribution, which stems from factors not directly observable, related to heterogeneity in workers' productivity, as well as to differences in the ability of firms to pay.[3]

Most previous studies for the Greek economy have focused on the mean effect of schooling on wages. For instance, Magoula and Psacharopoulos (1999) based on the 1993-1994 household survey data and Mincerian regressions find that the returns to education in the private sector are higher than the corresponding returns in the public sector. Prodromidis and Prodromidis (2008) also using household surveys for the 1988-1999 period report evidence that the returns to education for female university graduates exceed the respective ones of their male counterparts. More recently, Livanos and

[3] As summarized in Papapetrou and Tsalaporta (2017), with respect to employer heterogeneity, most of the economics literature has focused on compensating differentials (i.e. some firms offer higher wages to compensate workers for unsafe working conditions) and efficiency wages or rent-sharing.

Pouliakas (2011) estimate the returns to university disciplines based on the 2002 and 2003 waves of the European Labour Force Survey and the quantile regression modelling. They emphasize on considerable heterogeneity across disciplines and the different patterns in the returns to education between civil servants and private sector employees. A related strand of the literature fits earnings equations for different types of workers, in terms of gender or nationality (see, for example, Kanellopoulos and Mavromaras 2002; Livanos and Núñez, 2012; Demoussis, Giannakopoulos and Zografakis, 2010; Chletsos and Roupakias, 2017) and suggests that women and migrants have an earnings disadvantage which, in part, is explained by labour market discrimination.

The work closest to ours is Martins and Pereira (2004) who use data from the Greek Household Budget Survey for 1994. Their main finding is that, among several European countries, Greece stands as a notable outlier, which deviates from the common pattern that the returns to education are higher at the upper end of the wage distribution. By contrast, Budría and Pereira (2005) exploiting updated information (until 1999) from the same source, find that education contributed towards rising earnings inequality. More recently, Prieto-Rodriguez et al. (2008), using data from the European Community Household Panel for the years 1994–2001, also conclude that education shifts the earnings distribution rightwards.

However, our knowledge on the inequality effects of schooling in Greece is largely based on very limited data. The studies mentioned above rely on relatively small datasets for the 1990s or analyze net (after tax) wages, and thus their results may be driven by the confounding effect of progressive taxes across different wage quantiles. More importantly, there is yet another potential identification problem in most previous studies. As argued by Card (1999), the choice to acquire education may be endogenous due to unobserved ability. What is more, measurement error in the schooling variable can also cause downward bias in OLS estimates.

Our study constitutes an attempt to tackle these methodological issues. To that end, we exploit data from two recent waves of the Greek Labour Force Survey (GRLFS) for 2006 and 2016. In contrast to existing research, this relatively large sample dataset contains information on gross (before tax)

wages, thereby heightening the level of confidence in the results. To address potential endogeneity, we pursue the instrumental variables strategy put forward by Chernozhukov and Hansen (2008), which is designed for quantile regression modelling. We are not aware of any study that tackles both heterogeneity and endogeneity problems with respect to the returns to schooling on the Greek labour market. In addition, there is yet another contribution of this paper to the literature. While there is ample evidence on the effects of education upon the dispersion of earnings during expansion, scant is the evidence over periods of economic downturn. Greece offers a unique environment for this empirical exercise. The repercussions of the 2008 fiscal crisis on the Greek labour market were overwhelming. To combat huge unemployment rates, successive governments has adopted a series of reforms intended to create more flexible labour market institutions. At the same time, however, the latest available data show a reversal of the past trend towards a relatively flat wage distribution. Thus, it may be highly informative to test whether the relationship between education and earnings inequality is different during recessions. Finally, we also contribute to the literature of overeducation, extending the approach proposed by Tansel and Bodur (2012) by examining whether there are systematic differences between *adequately-matched* and *overqualified* workers. To the best of our knowledge, such analysis for the case of Greece has yet to be undertaken.

Our findings can be summarized as follows: Our preferred IV quantile regressions indicate that the pattern of the relationship between education and the dispersion of earnings has changed. Before the crisis, the elasticity of earnings with respect to education appears to be higher at the bottom end of the spectrum. On the contrary, over the course of the current depression, education is positively correlated with wage inequality. A comparison with the conventional quantile regression estimates suggests that the returns to schooling are understated when potential endogeneity is not accounted for. Interestingly, these findings appear to be more pronounced among private sector employees. Finally, we find that overqualified workers are penalized, in terms of wages across the conditional earnings distribution, but this result is only consistently detected before the outburst of the recession.

The remainder of the paper is organised as follows. Section 2 provides some background information on Greek education system and labour market. Section 3 explains the estimation procedures and describes the data. Section 4 presents the results. Finally, Section 5 concludes.

2 Background

2.1 A brief overview of the Greek debt crisis

Greece has been the hardest hit country by the Great Recession,[4] losing more than 25% of its GDP from 2008 onwards. However, contrary to other Western countries, it was not exposure to toxic assets that sank Greece into a deep and prolonged recession, but its structural problems prior the crisis (reduced competitiveness, declining productivity, weak institutions, imprudent borrowing, nepotism, to name a few), which caused a severe sovereign debt crisis.[5] As a result, Greece have lost access to capital markets and to avert outright bankruptcy, resorted to European Union and International Monterary Fund's bailout programme. Successive governments have implemented, though reluctantly, a series of fiscal consolidation and internal devaluation measures, as well as other reforms aimed at improving flexibility in product and labour markets.

At the peak of crisis in 2013, the unemployment rate skyrocketed to 27.5 percent. Meanwhile, wages adjusted downwards, albeit somewhat faster and deeper in the private sector than in the public one (Christopoulou and Monastiriotis, 2015).[6] However, as discussed in Meghir, Pissarides, Vayanos and Vettas (2017), limited response of prices prevented the alleviation of the burden imposed by the nominal wage cuts. Since 2014, unemployment has been showing signs of slow de-escalation. Yet, the

[4] We refer to the period started with the collapse of Lehman brothers in 2007.

[5] For a thorough review on Greek economy's weaknesses follow the discussion in Xafa (2017).

[6] Note, however, that the Greek labour market was far from being characterized as the archetypical flexible labour market, and as a result the wage adjustment did not start immediately after the outburst of the economic crisis. This is reflected in existing studies (see, for example, Livanos, 2010; Daouli, Demoussis, Giannakopoulos and Laliotis, 2016) which report little evidence in favour of the wage curve hypothesis, until 2012 (i.e. wages are not strongly correlated to local unemployment rates). Yet, more recent evidence suggests that wages have become more responsive to negative demand shocks, only after the implementation of the labour market reforms agreed with the first Memorandum of Understanding in 2010 (see e.g. Cholezas and Kanellopoulos, 2015).

recovery is characterized by the explosion of *low-quality*, temporary or part-time jobs and the rise of earnings inequality, a pattern completely different to what have happened between the mid-1970s and the late 2000s.

2.2 Education system in Greece

Since the establishment of the Modern Greek state in the late 1820s, education has always been considered as a key factor for upward mobility within the society (Tsakloglou and Cholezas, 2005). However, after the restoration of democracy in 1974 and mainly during the period of rapid economic growth between the early 1990s and the mid-2000s, the spread of mass education has been unpreceded. Consistent with the strong demand for education, government spending exhibited a constant upward trend over this same period, though Greece still falls short of other advanced countries in terms of the fraction of resources allocated on education.

The educational system in Greece is formulated around three pillars: primary, secondary and tertiary. Primary education begins at the age of six and ends at the age of twelve. Secondary education is mainly divided into lower secondary (*gymnasium*), high-school (*lyceum*) and vocational training. Tertiary education involves Universities and Technological Education Institutions. Compulsory education, which lasts for nine years, is made up by primary and lower secondary education. With the notable exception of tertiary education, which is offered exclusively by the public sector, both the public and the private sector are involved in the provision of the remaining types of education.[7]

3 Data and empirical specification

Our data are drawn from the Greek Labour Force Survey (GRLFS) for 2006 and 2016. Since 1998, the GRLFS is carried out every quarter on a sample of around 65,000 households. It contains rich information on background characteristics such as sex, age, education attainment, employment status,

[7] Some private colleges provide tertiary education, but the degrees which they award are not equivalent to the public ones.

gross monthly earnings and others. Until 2014, a limitation of the GRLFS is that wages are reported in intervals, namely, <€250, €251-€500, €501-€750, €751-€1000, €1001-€1250, €1251-€1500, €1501-€1750, €1751-€2000 and >€2000. However, from 2015 onwards, wages are reported as precise figures. Thus, for 2006, we follow common practise and use the median wage per band in our estimations.[8] For the open-ended band, we assume that the median wage is €2,125 (i.e. we set the upper limit to €2,250) as in Christopoulou and Monastiriotis (2014; 2015).[9] Though it is not the optimal solution, there are not many other options to choose from. We then compute real wages by using the CPI from the AMECO database. Finally, hourly wages are obtained by dividing real wages by 4.3 and then by the reported weekly hours usually worked.

The main reason why we focus solely on male wage earners is to avoid selection issues into paid employment, usually present in female earnings equations due to lower participation rates. Furthermore, women usually have a less continuous working life, thereby rendering infeasible any attempt to construct a reliable proxy of actual labour market experience. Before proceeding to formal empirical analysis, we first offer some descriptive evidence in Table 1. As can be seen, two patterns emerge clearly from the figures which are reported in upper part of this table. First, top-end inequality (i.e. the 90-75 and 90-50 gaps) remained literally unchanged within the 10-year interval. Second, the difference between the higher percentiles and the lower ones increased by more than 20%. Notably, however, earnings inequality exhibited the most substantial increase at the bottom end of the spectrum. For example, the difference between the 50th percentile and the 10th percentile widened by more than 60%. Such a pattern might stem from the fact that the reforms in 2011, aimed at decentralizing the wage setting system, made less-skilled workers more vulnerable to negative demand shocks.

[8] See, for example, Livanos (2010); Christopoulou and Monastiriotis (2014); Daouli et al. (2017).

[9] As shown by Christopoulou and Monastiriotis (2014) the results are not sensitive to alternative definitions of the open-ended band or without considering employees who fall into this group.

[Insert Table 1 here]

Table 1, also summarizes educational attainment measured in years of schooling as well as the percentage of labour force belonging to each of the following education categories (which correspond to the ISCED levels reported in parenthesis) with respect to overall labour force in Greece: No schooling (0), Primary education (1), Lower Secondary education (2), High school (3-7), Vocational training (8), and Tertiary education (9–13). As can be verified, between 2006 and 2016, average years of schooling increased by about 8.85 per cent. Consistent with this figure, the share of more educated workers (i.e. high-school or above) appears to be substantially higher in 2016. On the other hand, the shares of unskilled employees fell dramatically.

Notably, a well-documented feature in the Greek labour market is that a significant proportion of the workforce is over-qualified or not adequately matched (Patrinos, 1997; Livanos, 2010). Figure 1 shows the evolution of the incidence of overeducation across different wage quantiles. Following Verdugo and Verdugo (1989), a worker is considered as overeducated if his education is more than one standard deviation above the average for his 2-digit GLFS occupation. Not surprisingly, the ratio of overqualified employees increased from nearly 13% to about 17%, over the period under consideration. This trend is consistent with the idea that more educated individuals are more likely to accept low-skill jobs during periods of weak labour demand.

[Insert Figure 1 here]

Following common practice in the literature, we estimate the following quantile regression model (see Koenker and Bassett, 1978; Buchinsky, 1994):

$$lnW_i = x_i'\beta_\theta + u_{\theta i} \qquad \text{with} \qquad Quant_\theta(lnW_i|x_i) = x_i'\beta_\theta \qquad (i = 1, \dots, n)$$

where the dependent variable is the natural logarithm of gross hourly wage of individual i, x_i' is a vector of employee and employer characteristics, namely years of schooling completed, work experience

(we also introduce the squared term of this variable, to account for non-linearity),[10] dummy variable for nationality, dummy variable for living in an urban area, dummy variable for public-private employment, firm size dummies, and industry dummies at the one-digit NACE level. [11] $Quant_\theta(lnW|x)$ denotes the θth conditional quantile of lnW given x'.

The θth regression quantile, $0 < \theta < 1$, is defined as the solution to the following minimization problem:

$$\beta_\theta = \min_\beta \sum_i \rho_\theta(lnW_i - x_i'\beta_\theta)$$

where ρ_θ is the check function defined as $\rho_\theta\ \varepsilon\ = \theta\varepsilon$ if $\varepsilon \geq 0$ or $\rho_\theta\ \varepsilon\ = (\theta - 1)\varepsilon$ if $\varepsilon < 0$.

4 Results

Table 2 offers OLS, IV and quantile estimates utilizing the natural logarithm of hourly wage, deflated by CPI, as the dependent variable. Our main explanatory variable of interest, education, is measured as years of schooling completed by each respondent. The upper part of the table includes evidence for year 2006, while the lower one for 2016.[12] By estimating OLS as well as quantile regression models, we can compare and contrast the *average* effects of schooling with the ones at different quantiles. Beginning with the 2006 data, our estimates in column 1 suggest that education is positively correlated with earnings. Ceteris paribus, one additional year of education is associated with a 0.029 log points higher hourly wage.

[10] Unfortunately, the GRLFS does not include any information on actual experience. Following Borjas (2003), we calculate potential experience as the difference between age and age of entry into the labor market. We assume that individuals with compulsory schooling enter the labor market at age 15, high school graduates at 18, individuals with vocational training at 19, individuals with tertiary education at 22.

[11] Following the literature inspired by the influential work by Krueger and Summers (1988), we introduce the industry dummies to control for inter-industry wage differentials. These estimates are reported in Appendix Tables A1 and A2.

[12] Sample sizes differ for OLS and IV because the latter exploits data for married men only.

However, that empirical result may not reflect the true effect of schooling due to potential endogeneity.[13] To gauge the average causal effects of education, we employ an instrumental variable strategy. A valid instrument for education has to be highly correlated with it, but not correlated with the error term in the second stage regression. Borrowing from the marriage market literature, we use spousal education as instrument of potentially endogenous education, as in Trostel, Walker and Woolley (2002) and Wang (2013). The underlying identification assumption is that individuals tend to marry somebody with similar characteristics. This pattern is usually referred in the literature as assortative mating effect (see, for example, Weiss, 1999). Indeed, the first stage results, (not reported, available upon request), indicate that our instrument is a strong predictor of men's educational attainment. What is more, the relevant F-statistics statistics are well above the rule of thumb of 10 and the Stock and Yogo critical values characterizing weak instruments. Interestingly, the IV estimates shown in column 2 increase in size, and thus, are consistent with previous literature, which suggests that OLS underestimates the effects of education on earnings (see, for example, Card, 1999).

We now turn to the effect of schooling along the conditional earnings distribution. It is apparent from the last four columns that education coefficients are significant and almost identical across different quantiles. Hence, the pattern for the pre-crisis period is not much consistent with the idea that education contributes to increased inequality.

We next examine whether this pattern emerges during the fiscal crisis as well. From a theoretical perspective, the returns to education could be higher over periods of weak labour demand, insofar negative shocks impinge disproportionally on the employment opportunities of the least productive workers (Blundell, Crawford and Jin, 2014). Indeed, the results reported in Panel B of Table 2 suggest that the elasticity of our hourly wage measure with respect to years of schooling is 0.035 for the 2016 data. Thus, education returns appear to be counter-cyclical, i.e. they increase during an economic

[13] As summarized in Trostel et al. (2002), there are two opposing perspectives regarding the direction of bias in OLS estimates. In particular, upward bias arises when there is positive correlation between unobserved ability and the wage rate. On the other hand, downward bias can arise when employees with high discount rates refrain from acquiring high levels of education.

downturn. This pattern also emerges when we employ our preferred IV approach. The main coefficient of interest becomes 0.009 log points higher than the one we found for the pre-crisis period.

[Insert Table 2 here]

A comparison of the results between 2006 and 2016 for the remaining covariates, reveals that most coefficients lie within the same ballpark. As can be easily verified, the hourly wage rate is inverse U-shaped in experience. Interestingly, however, the effect of experience becomes smaller in magnitude during the recession. Though experience is not perfectly identical with tenure, this finding might stem from the government-imposed freezes of *maturity* wage increases in the public sector (i.e. increases related to job tenure) during that period. Age is positively associated with earnings. With respect to public sector employment two patterns emerge clearly. First, earnings are significantly higher for individuals employed in the public sector. Second, in line with existing international evidence, the premium of public sector employment over private sector employment is higher at the bottom end of wage distribution. Interestingly, it appears to be more conservative after the implementation of horizontal salary cuts in the public sector than it was before the outburst of the crisis. The urban dummy usually enters significantly with a positive coefficient across specifications. Considering results according to the size of the firm, individuals working in firms with less than ten employees, earn higher wages than those who fall in the remaining categories.

Table 3 examines the relationship between education and the wage rate, by introducing three categorical variables, namely high-school education, vocational training and tertiary education. The reference category is compulsory education or less. This modification relaxes the assumption that the returns to education are identical irrespective of the type of education considered. Consistent with the evidence reported in Table 2, returns to each level of schooling are again positive and significant across specifications. Overall, we find little evidence that education affects the dispersion of earnings for 2006 (i.e., education rewards are relatively homogeneous across different quantiles). Only returns to having a university degree are higher at high-paid occupations However, we find that there is a positive linkage between education and wage inequality for 2016. This result is consistently detected for individuals

with vocational training or university degree. On the contrary, the pattern relative to the returns to having high-school education is consistent with the idea of polarization. That is, rewards are higher at the lower and upper end of the spectrum, and lower at $\theta = 0.50$.

[Insert Table 3 here]

Notably, however, there is evidence of rising inequality across skill groups. As can be seen, while returns to having a high-school diploma remain relative constant within the 10-year interval, returns to vocational training and tertiary education are substantially higher in 2016, especially at $\theta = 0.75$ and $\theta = 0.90$. In light of the fact that the supply of more educated workers has increased dramatically over that period, a potential explanation for this finding is that technological progress might have more than counterbalanced the negative effects of the educational expansion of the labour force on the earnings of skilled labourers. To put it another way, such a pattern seems to be consistent with the idea that technology tends to exert a positive influence on the demand for more able and more educated employees.

Table 4 reports the interquantile estimates of the earnings functions. For both years, the q90-q10 gap is greater than the q75-q25 gap. With the exception of the effect of schooling on the q75-q25 gap for the pre-crisis period, this variable enters with a positive and significant coefficient at the remaining specifications. At the lower part of this table, we observe that the impact of education on the earnings gap is greater within the group of university graduates. Positive and significant effects of schooling are also detected for individuals with vocational training in 2016. On the other hand, the effects of having a high-school diploma on within group inequality are barely significant at conventional levels.

[Insert Table 4 here]

Following Patrinos et al. (2009), we then test the hypothesis that the correlations established above differ systematically between the public and the private sector by plugging into eq.(1) the interaction term schooling*pub, where pub is a dummy variable equal to one if the worker is civil servant and zero otherwise; and the interaction term schooling*pr, where pr is a dummy variable equal

to one if the worker is employed in the private sector and zero otherwise. The underlying assumption is that wages in the public sector are not much closely related to productivity as in the private sector. As can easily be observed in Table 5, schooling is better compensated in the public sector. Overall, the results indicate that our previous findings, are mainly driven by the effects of education on private earnings (i.e. education contributes to increased wage dispersion in the private sector). Notably, however, while the public returns to education are relatively homogeneous across the conditional earnings distribution for the pre-crisis period, they appear to be more dispersed in 2016, but the dispersion still falls short of that in the private sector. Substituting different education levels for years of schooling reveals that it is tertiary education that makes the greater contribution on within-groups inequality in both years and vocational training in 2016.

[Insert Table 5 here]

As already discussed above, an important issue is that there is a poor match in the Greek labour market that stems from the fact that many individuals are employed in occupations that require less skills than they have. As argued by Fersterer and Winter-Ebmer (2003) and Martins and Pereira (2004), among others, a potential explanation that education contributes to a more dispersed distribution of earnings is overeducation. That is, high-skilled individuals are employed in unskilled, low-paid occupations, and thus, returns to education appear to be higher at the upper end of the wage distribution. However, with the notable exceptions of McGuinnessa and Bennett (2007) and Budría and Moro-Egido (2008), evidence is scant that over-qualification indeed contributes to higher earnings inequality.

Following the well-established practice of Verdugo and Verdugo (1989), described in Section 3, we distinguish between matched and over-qualified workers, to test whether poor match in the labour market explains the results reported above. As can be seen in Table 6, the pattern of the estimated coefficients of the years of schooling variable is practically the same, irrespective of the group of workers considered. That is, there is considerable dispersion either for matched or for overqualified employees. However, detailed analysis using different education levels instead of years of schooling reveals that

there are systematic differences between the two groups at the high-school and vocational training levels. In particular, in 2006, returns to having a high-school diploma or vocational training among over-qualified employees appear to be higher at higher quantiles, a pattern completely different to that observed about the returns to schooling among their matched counterparts. On the other hand, returns to vocational training, among overqualified workers fall over the wage distribution while the opposite is true for those adequately matched. Before concluding, there is yet another point worth mentioning. Though there is significant variation across groups, overall the wage penalty that overqualified workers suffer falls from 2006 to 2016 as we move towards the top end of the wage distribution and becomes earnings advantage at the highest quantile.

[Insert Table 6 here]

The results so far suggest that education has a positive impact on earnings. Furthermore, the distributional effect of schooling appears be different before and during the Greek crisis. As we have already shown, however, the estimated conditional mean effects of education may be biased due to measurement error and potential endogeneity. Likewise, conventional quantile regression might not capture a causal relationship between education and wages. To address this issue, we employing the Chernozhukov-Hansen (2008) instrumental variables quantile regression approach (IVQR), generating exogenous variation by using spousal education.[14] Figure 2 displays the results of this empirical exercise. As can be seen, the IVQR estimates are uniformly greater than the ones we found using the simple QR model. Notably, however, the pattern of the point estimates in 2006 is not consistent with idea that education shifts the earnings distribution rightwards (i.e. the returns to education are higher at lower quantiles). This result is in line with the evidence reported for the 1990's by Martins and Pereira (2014). On the contrary, we find that this pattern goes in the opposite direction in 2016, that is, the estimated causal effect is higher from the 60th to the 90th percentile. All in all, the relationship

[14] The IVQR approach was carried out in STATA through the routine developed by Do Won Kwak (available for download at: http://faculty.chicagobooth.edu/christian.hansen/research/). We omit the technical details for brevity and refer the reader to the relevant reference. An excellent summary of the IVQR developed by Chernozhukov and Hansen is also provided in Autor, Houseman and Kerr (2017).

between education and the dispersion of earnings is different before and during the fiscal crisis, confirming our previous finding that the impact of education on the dispersion of earnings is more significant during the period of the current recession.

[Insert Figure 2 here]

5 Conclusion

Education is one of the most important determinants of wages. However, there is ample evidence that its effects are not uniform across different wage quantiles, mainly, due to unobserved heterogeneity. The main objective of the present paper was to analyze the relationship between education and the dispersion of earnings using a quantile regression modelling. Apart from heterogeneity, we also address potential endogeneity due to unobserved ability and measurement error. Employing two recent Labour Force Surveys for 2006 and 2016, we find evidence that the returns to education have increased within the 10-year interval. This result might stem from the fact that the employment opportunities of unskilled workers are disproportionately affected by negative demand shocks (i.e. their share into paid employment declines during contraction). Importantly, our best estimates suggest that the returns to education were higher at the bottom end of the spectrum for the period before the recession. On the contrary, education appears to shift the wage distribution rightwards for 2016. Detailed analysis by separate education categories indicates that this finding is mainly driven by the dramatic rise of the returns to having vocational training and tertiary education at the top quantiles.

Our analysis also sheds light on across skill groups earnings inequality. We provide evidence that the returns to more educated individuals followed an upward trend from 2006 to 2016, despite the educational upgrading of the workforce. On the other hand, returns to having a high-school diploma remained relatively stagnant over this same period. Skill biased technological progress seems to be a plausible explanation for these findings. On balance, these results appear to be driven by the developments in the private sector. Finally, we investigate the evolution of the wage penalty associated with overeducation. Interestingly, our analysis reveals different patterns before and during the crisis.

In particular, we find evidence consistent with the idea that over-qualified workers earn significantly lower wages than their matched counterparts before the economic downturn. To the contrary, over-education is not much associated with lower earnings in 2016.

Overall, our analysis suggests that returns to education is an important determinant of earnings inequality in the Greek labour market. Our study also highlights the need for considering measures to protect unskilled workers. For instance, investment in vocational education appears to boost the earnings relative to the ones of individuals with a high-school diploma or less. Finally, future work is needed to identify the impact of other potential drivers of the dispersion of earnings, such as technology and labour market institutions.

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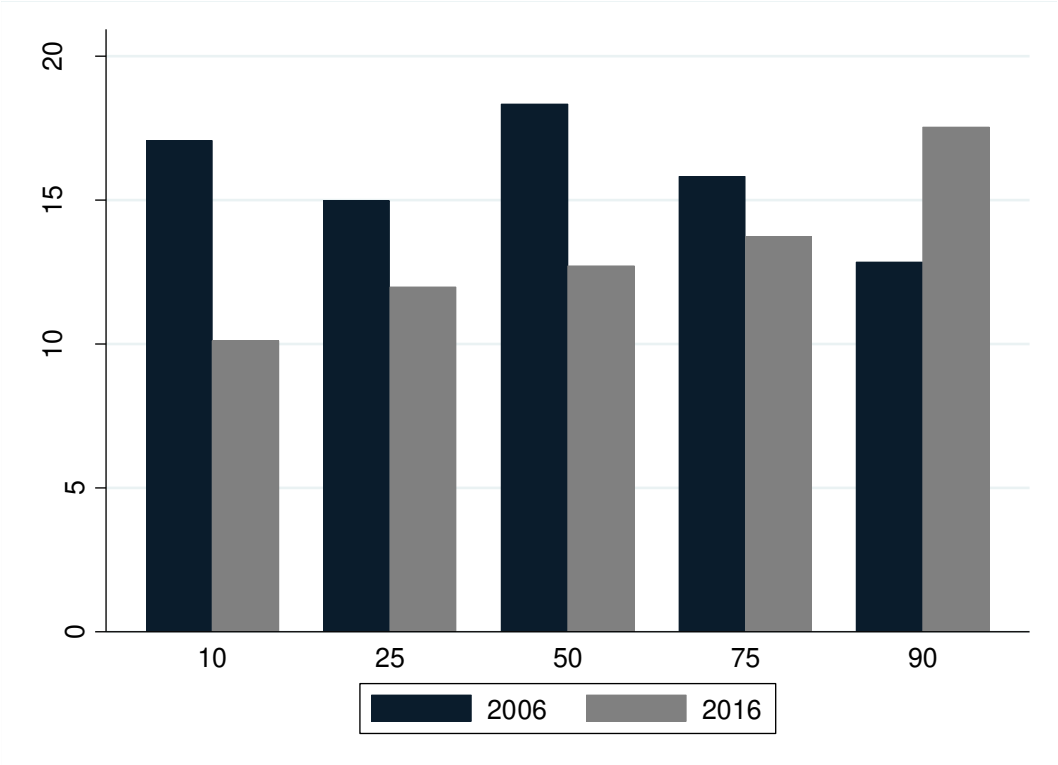

Figure 1 Overeducation rates by wage quantile. Source: author's calculations on Greek Labour Force Survey data, 2006 and 2016.

Table 1.

Summary Measures of Wage Inequality and Educational Distribution for Full-time Male Wage-Earners, 2006 and 2016

Real hourly wage	2006	2016	Change (%)
Mean	6.42	5.29	-17.60
Standard deviation	2.27	2.33	2.64
Quantiles			
q10	4.13	2.91	-29.54
q25	4.81	3.78	-21.41
q50	5.78	4.94	-14.53
q75	7.43	6.4	-13.86
q90	9.08	7.85	-13.55
Log wage dispersion			
ln q90-ln q75	0.20	0.20	0.00
ln q90-ln q50	0.46	0.46	0.00
ln q90-ln q10	0.79	0.99	25.32
ln q75-ln q50	0.26	0.26	0.00
ln q75-ln q25	0.44	0.53	20.45
ln q50-ln q25	0.18	0.27	50.00
ln q50-ln q10	0.33	0.53	60.61
Education attainment			
Years of schooling	11.3	12.3	8.85
No schooling (%)	0.67	0.36	-46.27
Primary education (%)	19.52	9.73	-50.15
Lower secondary (%)	13.38	10.24	-23.47
High school (%)	38.43	41.13	7.03
Vocational training (%)	7.21	8.32	15.40
University (%)	20.78	30.21	45.38

Table 2.

OLS, IV and Quantile Regression Estimates of the Wage Equations, 2006 and 2016

	OLS	IV	q10	q25	q50	q75	q90
2006							
Schooling	0.029***	0.032***	0.026***	0.028***	0.027***	0.029***	0.030***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Experience	0.025***	0.018***	0.022***	0.027***	0.025***	0.023***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Experience	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
squared	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cohort 25-	0.006	0.041	0.056***	-0.050***	0.010	-0.006	0.017
44	(0.008)	(0.031)	(0.013)	(0.010)	(0.008)	(0.009)	(0.013)
Cohort 45-	0.022**	0.050	0.100***	-0.053***	0.020*	0.011	0.038**
64	(0.011)	(0.034)	(0.018)	(0.014)	(0.011)	(0.013)	(0.019)
Public	0.128***	0.140***	0.160***	0.170***	0.141***	0.109***	0.076***
employment	(0.006)	(0.008)	(0.010)	(0.008)	(0.006)	(0.007)	(0.010)
Foreign-born	-0.109***	-0.163***	-0.110***	-0.110***	-0.106***	-0.126***	-0.105***
	(0.005)	(0.008)	(0.009)	(0.007)	(0.006)	(0.006)	(0.009)
Urban	0.025***	0.017***	0.017***	0.021***	0.011***	0.024***	0.024***
	(0.004)	(0.005)	(0.006)	(0.005)	(0.004)	(0.004)	(0.006)
Firm size	-0.119***	-0.118***	-0.115***	-0.098***	-0.106***	-0.107***	-0.125***
11-19	(0.005)	(0.007)	(0.008)	(0.006)	(0.005)	(0.006)	(0.008)
Firm size	-0.073***	-0.088***	-0.052***	-0.053***	-0.074***	-0.074***	-0.094***
20-49	(0.006)	(0.007)	(0.009)	(0.007)	(0.006)	(0.007)	(0.010)
Firm size>50	-0.044***	-0.053***	-0.033***	-0.029***	-0.042***	-0.043***	-0.048***
	(0.006)	(0.008)	(0.010)	(0.008)	(0.006)	(0.007)	(0.010)
Firm size	-0.056***	-0.067***	-0.045***	-0.047***	-0.060***	-0.053***	-0.049***
unknown>10	(0.006)	(0.008)	(0.010)	(0.008)	(0.006)	(0.007)	(0.010)
Constant	1.039***	1.319***	1.250***	1.326***	1.352***	1.348***	1.335***
	(0.040)	(0.163)	(0.180)	(0.140)	(0.110)	(0.127)	(0.183)
Observations	32,204	16,107	32,204	32,204	32,204	32,204	32,204
2016							
Schooling	0.035***	0.041***	0.031***	0.027***	0.031***	0.035***	0.041***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Experience	0.023***	0.018***	0.027***	0.021***	0.019***	0.023***	0.023***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Experience	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
squared	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cohort 25-	0.002	-0.045	0.007	-0.009	-0.003	0.006	-0.003
44	(0.013)	(0.047)	(0.024)	(0.017)	(0.014)	(0.016)	(0.026)
Cohort 45-	0.039**	-0.009	0.036	0.024	0.026	0.026	0.057*
64	(0.017)	(0.050)	(0.030)	(0.022)	(0.017)	(0.021)	(0.034)
Public	0.118***	0.151***	0.145***	0.149***	0.138***	0.098***	0.058***

employment	(0.009)	(0.011)	(0.016)	(0.011)	(0.009)	(0.011)	(0.018)
Foreign-born	-0.096***	-0.105***	-0.125***	-0.111***	-0.080***	-0.091***	-0.086***
	(0.008)	(0.010)	(0.013)	(0.010)	(0.008)	(0.009)	(0.015)
Urban	0.020***	-0.005	0.016*	0.020***	0.024***	0.019***	0.006
	(0.005)	(0.007)	(0.009)	(0.006)	(0.005)	(0.006)	(0.010)
Firm size 11-19	-0.204***	-0.192***	-0.175***	-0.176***	-0.175***	-0.185***	-0.203***
	(0.006)	(0.008)	(0.011)	(0.008)	(0.006)	(0.008)	(0.012)
Firm size 20-49	-0.119***	-0.091***	-0.111***	-0.103***	-0.100***	-0.113***	-0.126***
	(0.007)	(0.010)	(0.013)	(0.009)	(0.008)	(0.009)	(0.015)
Firm size>50	-0.066***	-0.071***	-0.031**	-0.058***	-0.063***	-0.057***	-0.100***
	(0.007)	(0.010)	(0.013)	(0.009)	(0.007)	(0.009)	(0.014)
Firm size unknown>10	-0.100***	-0.094***	-0.068***	-0.052***	-0.082***	-0.110***	-0.148***
	(0.007)	(0.010)	(0.013)	(0.009)	(0.008)	(0.009)	(0.015)
Constant	0.914***	0.951***	0.691	0.847**	0.812***	0.711*	0.730
	(0.106)	(0.089)	(0.530)	(0.379)	(0.303)	(0.364)	(0.591)
Observations	19,459	10,166	19,459	19,459	19,459	19,459	19,459

Notes: All regressions include industry dummies which are not reported for brevity. Standard errors in parenthesis. Authors' estimates using 2006 and 2016 GR Labour Force Survey

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 3.

OLS and the Quantile Regression Estimates of the Wage Equations with Educational Categories, 2006 and 2016

	OLS	q10	q25	q50	q75	q90
2006						
High school	0.093***	0.085***	0.097***	0.079***	0.094***	0.088***
	(0.004)	(0.007)	(0.006)	(0.004)	(0.005)	(0.006)
Post secondary, non tertiary	0.125***	0.135***	0.125***	0.103***	0.125***	0.123***
	(0.007)	(0.012)	(0.009)	(0.007)	(0.008)	(0.010)
University	0.287***	0.270***	0.278***	0.265***	0.287***	0.323***
	(0.006)	(0.009)	(0.008)	(0.006)	(0.007)	(0.008)
2016						
High school	0.098***	0.105***	0.078***	0.089***	0.106***	0.121***
	(0.006)	(0.012)	(0.008)	(0.007)	(0.008)	(0.011)
Post-secondary, non tertiary	0.155***	0.141***	0.127***	0.135***	0.163***	0.211***
	(0.010)	(0.018)	(0.012)	(0.010)	(0.012)	(0.016)
University	0.313***	0.271***	0.246***	0.271***	0.326***	0.407***
	(0.008)	(0.015)	(0.010)	(0.009)	(0.010)	(0.014)

Notes: Each cell contains coefficient estimates for the education variable (given at the first column) from a separate regression. All regressions include the set of covariates which are reported in Table 2, as well as industry dummies. For brevity, we do not report these estimates, but they are available upon request. Standard errors in parentheses. Authors' estimates using 2006 and 2016 GR Labour Force Survey

* $p < .1$, ** $p < .05$, *** $p < .01$

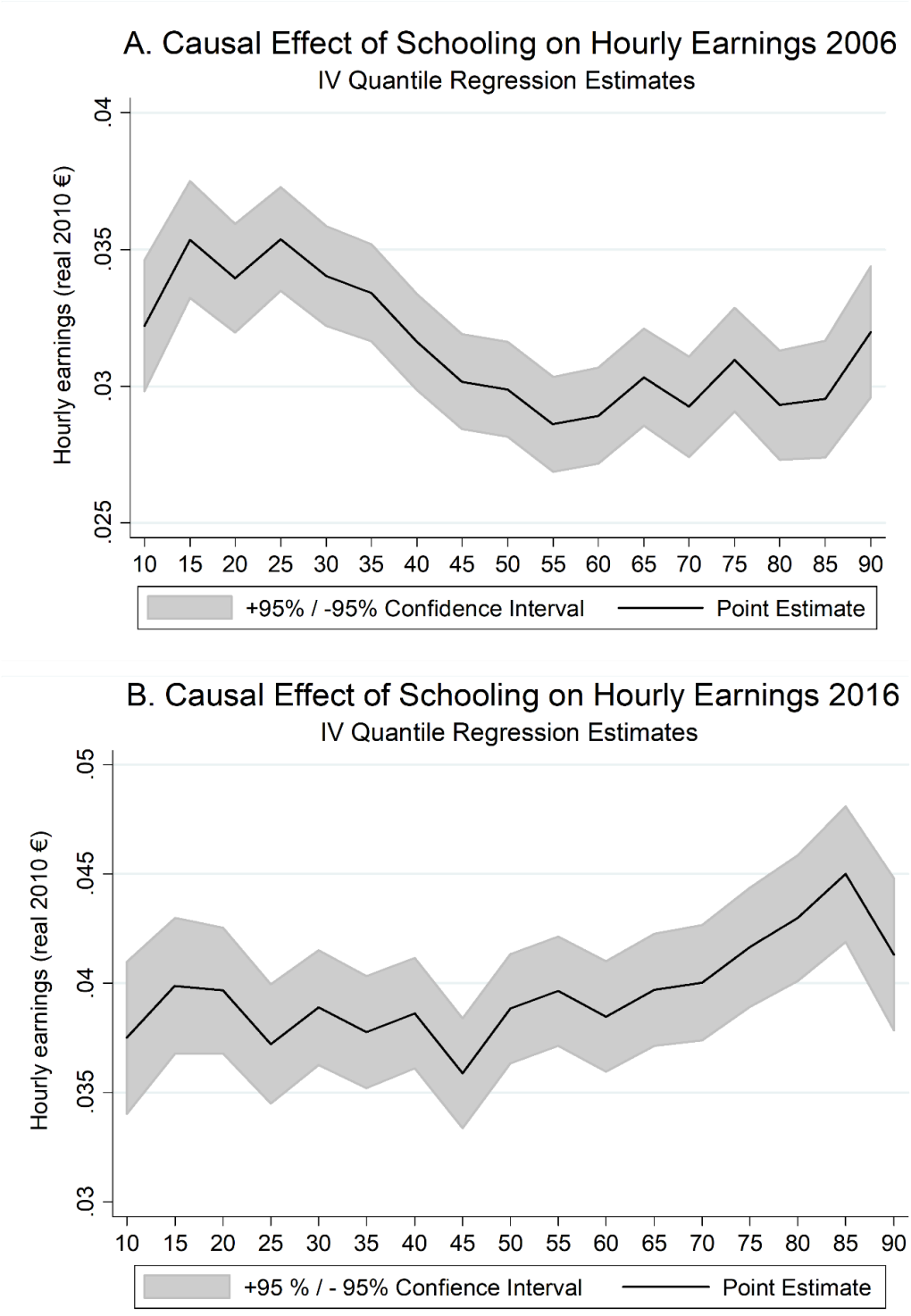

Figure 2 IVQR estimates for hourly earnings. Coefficient estimates are on the vertical axis and the quantile index is on the horizontal axis. The shaded region is the 95% confidence interval.

Table 4.

Interquantile Estimates of the Wage Equations, 2006 and 2016

	2006		*2016*	
	q75-q25	*q90-q10*	*q75-q25*	*q90-q10*
Schooling	0.001	0.003**	0.008***	0.010***
	(0.001)	(0.002)	(0.001)	(0.002)
Experience	-0.004***	0.001	0.002*	-0.005*
	(0.001)	(0.002)	(0.001)	(0.002)
Experience squared	0.000***	0.000	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Cohort 25-44	0.044***	-0.040	0.015	-0.010
	(0.012)	(0.027)	(0.022)	(0.037)
Cohort 45-64	0.064***	-0.062**	0.001	0.020
	(0.017)	(0.030)	(0.025)	(0.042)
Public employment	-0.060***	-0.084***	-0.051***	-0.087***
	(0.009)	(0.015)	(0.016)	(0.030)
Foreign-born	-0.015*	0.005	0.020*	0.039*
	(0.008)	(0.013)	(0.011)	(0.022)
Urban	0.003	0.007	-0.002	-0.010
	(0.005)	(0.008)	(0.006)	(0.013)
Firm size 11-19	-0.009	-0.009	-0.009	-0.028**
	(0.007)	(0.012)	(0.009)	(0.014)
Firm size 20-49	-0.022***	-0.043***	-0.010	-0.015
	(0.007)	(0.014)	(0.012)	(0.021)
Firm size >49	-0.014	-0.015	0.001	-0.069***
	(0.010)	(0.011)	(0.008)	(0.018)
Firm size unknown>10	-0.006	-0.004	-0.058***	-0.080***
	(0.009)	(0.015)	(0.009)	(0.017)
Education levels				
High school	-0.003	0.003	0.029***	0.015
	(0.007)	(0.009)	(0.010)	(0.016)
Post-secondary, non tertiary	0.001	-0.012	0.036***	0.069***
	(0.010)	(0.016)	(0.014)	(0.023)
University	0.009	0.052***	0.080***	0.136***
	(0.010)	(0.017)	(0.014)	(0.020)

Notes: All regressions include industry dummies which are not reported for brevity. Standard errors in parenthesis. Authors' estimates using 2006 and 2016 GR Labour Force Survey

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 5. OLS and Quantile Regression Estimates of the Wage Equations, 2006 and 2016

	(1) OLS	(2) q10	(3) q25	(4) q50	(5) q75	(6) q90
2006						
Schooling*matched	0.033***	0.031***	0.034***	0.031***	0.032***	0.035***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Schooling*overeducation	0.027***	0.025***	0.027***	0.024***	0.027***	0.029***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High-school*matched	0.112***	0.096***	0.122***	0.095***	0.113***	0.110***
	(0.005)	(0.008)	(0.006)	(0.005)	(0.005)	(0.007)
High-school*overeducation	0.040***	0.049***	0.028***	0.035***	0.029***	0.022**
	(0.007)	(0.012)	(0.009)	(0.007)	(0.008)	(0.010)
Vocational*matched	0.151***	0.157***	0.147***	0.131***	0.145***	0.142***
	(0.008)	(0.013)	(0.010)	(0.008)	(0.009)	(0.012)
Vocational*overeducation	0.070***	0.038	0.110***	0.041***	0.062***	0.116***
	(0.013)	(0.023)	(0.017)	(0.014)	(0.015)	(0.020)
Tertiary*matched	0.339***	0.319***	0.341***	0.309***	0.326***	0.358***
	(0.006)	(0.011)	(0.008)	(0.006)	(0.007)	(0.009)
Tertiary* overeducation	0.209***	0.173***	0.185***	0.181***	0.220***	0.236***
	(0.008)	(0.013)	(0.010)	(0.008)	(0.009)	(0.012)
2016						
Schooling*matched	0.037***	0.034***	0.031***	0.034***	0.037***	0.040***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Schooling*overeducation	0.035***	0.032***	0.028***	0.032***	0.035***	0.042***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
High-school*matched	0.100***	0.119***	0.083***	0.092***	0.110***	0.120***
	(0.007)	(0.013)	(0.008)	(0.007)	(0.008)	(0.011)
High-school*overeducation	0.048*	-0.007	0.039	0.080***	0.063**	0.078*
	(0.026)	(0.050)	(0.031)	(0.028)	(0.031)	(0.044)
Vocational*matched	0.159***	0.150***	0.133***	0.139***	0.167***	0.214***
	(0.010)	(0.019)	(0.012)	(0.011)	(0.012)	(0.017)
Vocational*overeducation	0.109***	0.144**	0.085**	0.090**	0.061	0.043
	(0.032)	(0.063)	(0.039)	(0.035)	(0.040)	(0.056)
Tertiary*matched	0.336***	0.310***	0.282***	0.292***	0.332***	0.400***
	(0.009)	(0.017)	(0.011)	(0.010)	(0.011)	(0.015)
Tertiary* overeducation	0.290***	0.259***	0.209***	0.243***	0.319***	0.411***
	(0.009)	(0.018)	(0.011)	(0.010)	(0.011)	(0.016)

Notes: Each cell contains coefficient estimates for the education variable (given at the first column) from a separate regression. All regressions include the set of covariates which are reported in Table 2, as well as industry dummies. For brevity, we do not report these estimates, but they are available upon request. Standard errors in parentheses. * p < .1, ** p < .05, *** p < .01

Table 6. OLS and Quantile Regression Estimates of the Wage Equations, 2006 and 2016

	(1) OLS	(2) IV	(3) q10	(4) q25	(5) q50	(6) q75
2006						
Schooling* pub	0.035***	0.036***	0.038***	0.034***	0.034***	0.034***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Schooling*pr	0.025***	0.023***	0.024***	0.023***	0.025***	0.028***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
High-school*public	0.187***	0.215***	0.215***	0.175***	0.162***	0.150***
	(0.006)	(0.011)	(0.009)	(0.007)	(0.007)	(0.009)
High-school*pr	0.066***	0.055***	0.061***	0.054***	0.066***	0.069***
	(0.005)	(0.008)	(0.007)	(0.005)	(0.005)	(0.007)
Vocational*public	0.195***	0.191***	0.232***	0.188***	0.178***	0.149***
	(0.012)	(0.020)	(0.017)	(0.012)	(0.012)	(0.017)
Vocational*pr	0.109***	0.120***	0.093***	0.083***	0.107***	0.122***
	(0.008)	(0.014)	(0.011)	(0.008)	(0.009)	(0.012)
Tertiary*public	0.358***	0.376***	0.377***	0.343***	0.324***	0.336***
	(0.007)	(0.013)	(0.010)	(0.007)	(0.008)	(0.010)
Tertiary*pr	0.272***	0.232***	0.234***	0.250***	0.290***	0.335***
	(0.007)	(0.012)	(0.010)	(0.007)	(0.007)	(0.010)
2016						
Schooling*pub	0.041***	0.038***	0.035***	0.038***	0.039***	0.043***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Schooling*pr	0.033***	0.028***	0.025***	0.028***	0.033***	0.040***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
High-school*public	0.196***	0.215***	0.188***	0.213***	0.185***	0.154***
	(0.010)	(0.018)	(0.013)	(0.011)	(0.012)	(0.018)
High-school*pr	0.075***	0.099***	0.053***	0.064***	0.078***	0.099***
	(0.007)	(0.013)	(0.009)	(0.008)	(0.008)	(0.013)
Vocational*public	0.241***	0.274***	0.250***	0.231***	0.210***	0.224***
	(0.016)	(0.030)	(0.021)	(0.018)	(0.019)	(0.030)
Vocational*pr	0.138***	0.118***	0.097***	0.119***	0.146***	0.215***
	(0.011)	(0.020)	(0.014)	(0.012)	(0.013)	(0.020)
Tertiary*public	0.381***	0.396***	0.345***	0.370***	0.359***	0.385***
	(0.011)	(0.020)	(0.014)	(0.012)	(0.013)	(0.020)
Tertiary*pr	0.309***	0.244***	0.225***	0.265***	0.336***	0.433***
	(0.009)	(0.017)	(0.012)	(0.010)	(0.011)	(0.016)

Notes: All regressions include the set of covariates which are reported in Table 2, as well as industry dummies. For brevity, we do not report these estimates, but they are available upon request. Standard errors in parentheses. Authors' estimates using 2006 and 2016 GR Labour Force Survey

* p < .1, ** p < .05, *** p < .01

Appendix

Table A1

Industry effects - 2006

Industry	OLS	q10	q25	q50	q75	q90
Agriculture, hunting and forestry	-0.157	0.169	0.181	0.266	0.279	-0.001
Other community …	-0.136	0.115	0.158	0.19	0.189	0.074
Transport, storage and communications	-0.065	0.037	0.072	0.098	0.118	0.102
Education	-0.062	0.081	0.085	0.059	0.089	0.045
Hotels and restaurants	-0.049	0.042	0.049	0.063	0.088	-0.032
Real estate, renting and business activities	-0.043	0.014	0.047	0.07	0.094	0.027
Financial intermediation	-0.042	0.016	0.058	0.067	0.063	0.114
Manufacturing	-0.035	0.034	0.044	0.054	0.069	0.006
Wholesale and retail trade …	-0.021	0.013	0.019	0.028	0.051	-0.07
Fishing	-0.013	0.051	0.025	-0.035	-0.031	-0.069
Construction	-0.007	0.005	0.01	0.032	0.03	0.011
Health and social work	-0.003	0.002	-0.008	-0.006	0.038	0.02
Mining and quarrying	-0.002	0.007	-0.021	-0.003	0.053	0.14
Electricity, gas and water supply	-0.002	-0.003	-0.007	0.003	0.022	0.077
Activities of private households …	0.103	-0.118	-0.135	-0.143	-0.051	-0.206
Extraterritorial organizations and bodies	0.23	-0.075	-0.22	-0.368	-0.511	-0.393
Tests						
Joint significance of industry effects						
F-test	73.96	54.70	43.12	64.45	44.63	19.15
p-value	0.00	0.00	0.00	0.00	0.00	0.00

Table A2

Industry effects - 2016

Industry	OLS	q10	q25	q50	q75	q90
Arts, entertainment and recreation	-0.016	-0.068	-0.018	0	0.064	0.046
Wholesale and retail trade ….	0.056	0.006	0.015	0.011	-0.001	-0.023
Water supply, sewerage ….	0.057	-0.036	0.043	-0.008	0.023	0.053
Education	0.06	0.013	0.071	0.036	0.014	-0.036
Human health and social work activities	0.074	-0.011	0.04	0.019	0.038	0.033
Activities of households as employers …	0.084	0.012	-0.098	-0.016	-0.002	-0.067
Other service activities	0.088	-0.16	-0.018	-0.013	0.085	0.176
Construction	0.09	-0.066	-0.008	0.014	0.035	0.058
Manufacturing	0.109	-0.045	0.014	0.006	0.017	0.026
Public administration and defence …	0.131	0.025	0.055	0.028	0.013	-0.014
Real estate activities	0.157	-0.373	0.243	0.068	0.143	-0.05
Professional, scientific and technical activities	0.17	-0.106	-0.026	0.019	0.034	0.108
Transportation and storage	0.184	-0.15	-0.067	-0.001	0.042	0.151
Information and communication	0.197	-0.042	0.028	-0.001	0.017	0.059
Electricity, gas, steam …	0.301	-0.068	-0.036	0.04	0.073	0.035
Financial and insurance activities	0.315	-0.043	0.031	0.015	0.013	0.038
Mining and quarrying	0.363	-0.19	0.025	0.041	0.108	0.086
Arts, entertainment and recreation	-0.016	-0.068	-0.018	0	0.064	0.046
Wholesale and retail trade ….	0.056	0.006	0.015	0.011	-0.001	-0.023
Water supply, sewerage ….	0.057	-0.036	0.043	-0.008	0.023	0.053
Tests						
Joint significance of industry effects						
F-test	68.26	16.66	40.32	66.87	57.97	33.73
p-value	0.00	0.00	0.00	0.00	0.00	0.00