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Earnings returns to education, experience and health: Evidence from EU-SILC

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Earnings returns to education, experience and health:

Evidence from EU-SILC

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[Very preliminary version]

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ABSTRACT

Using individual-level panel data from European Union Statistics on Income and Living Conditions (2007-2010) we explore to what extent wage differentials across European countries are explained by differences in education, actual experience and health.

The human capital literature suggests an important role for these variables in explaining wage patterns. However, while there is a wide support in the empirical literature of the positive impacts of education and experience on wages, the relationship between wages and health is less clear-cut. What makes it most difficult to disentangle these effects is that education, experience, health and wages are interrelated. To deal with these issues, we implement an Efficient Generalized Instrumental Variable estimator. This procedure allows simultaneous control for the correlation between regressors and unobserved individual effects (as fixed effects) and to identify the estimates for the time-invariant covariates, such as education, as a random effects estimator. Furthermore, it eliminates the uncertainty associated with the choice of instruments, since exogenous included variables, and their means over time, are used as efficient instruments.

Our preliminary results suggest that taking this possible unobserved heterogeneity in education and experience into account does not significantly affect the estimation results. Instead, correcting for possible unobserved heterogeneity and/or measurement error in SRH status changes the estimation results dramatically. Still, we find that for both men and women in Europe education, actual experience and health have positive impacts on wages.

JEL Classification: D00, I10, I20, J24, J30

Keywords: Health, education, wages

1. Introduction

The human capital literature suggests an important role for education, experience and health in explaining wage patterns (see, e.g., Currie and Madrian, 1999, and references therein; Grossman, 2001, and references therein). While there is a wide support in the empirical literature of the positive impacts of education and experience on wages, the relationship between wages and health is less clear-cut. For instance, Brown *et al.* (2010) find no effect of health on British men's (reservation) wages and Jäckle and Himmler (2010) find, for Germany, a positive effect of health on wages for men but not for women. What makes it most difficult to disentangle these effects is that education, experience, health and wages are interrelated. Education has, for instance, been shown to affect health (see, e.g., Cutler and Lleras-Muney, 2006, and references therein), but also health (in early life) has been shown to affect education (see, e.g., Almond and Currie, 2011, and references therein). Moreover, more educated individuals, but also individuals with worse health may have less (actual) experience. A few studies have also explored the reverse causality of wages on health.¹ The empirical evidence on this issue is rather mixed and the models used often require additional assumptions for identification. For instance, Lee (1982) and Cai (2009), report a positive and no effect of wages on health for U.S. and Australian men, respectively.

Our aim in this paper is to disentangle the effects of education, experience and health on wages paying moreover attention to the age-period-cohort (APC) effects that, most probably simultaneously, affect these four variables.

¹ Currie and Madrian (1999) and Grossman (2001) discuss a theoretical model on this issue.

2. Background

Economic theoretical models suggest that education, experience and health, as components of human capital, affect wages. A person in bad health and/or with less education and/or with less experience is assumed to have a lower productivity and, hence, a lower wage rate (see, e.g., Becker, 1964; Grossman, 1972). Alternatively, Contoyannis and Rice (2001) argue that also the employer's beliefs that poor health is correlated with unobserved characteristics which are negatively associated with productivity, or discrimination against individuals who are perceived to be in poor health may be responsible for the (positive) relationship between poor health and low wages (see also Currie and Madrian, 1999, p. 3332–3, and references therein). [In progress]

3. Data and descriptive statistics

We use individual-level panel data from the latest release of the European Union Statistics on Income and Living Conditions (EU-SILC), a harmonized and representative cross-national panel of the European population aged 16 and over. This release includes four waves, conducted in 2007, 2008, 2009 and 2010, respectively, and 24 European countries from Northern, Continental, Anglo-Saxon, Mediterranean and Eastern Europe. EU-SILC contains household and individual-level information on, e.g., income, work and employment, poverty and social exclusion, housing, health, and other social indicators about living conditions.

Our empirical analysis is based on data for respondents aged 16–64. This selection yields ? observations for ? respondents. Panel attrition in EU-SILC is high; about ? percent by wave. Missing values forces an additional ? percent reduction in

sample size. The result is a unbalanced panel comprising ? total observations for ? male and ? female European respondents.

The (log) hourly net wage rate—measured in PPP’s adjusted 20?? €—is defined for paid job workers only and is obtained from dividing the amount of gross wages by the number of hours worked. Education is defined from the ISCED Code 1997 and includes three levels for lower secondary, upper secondary or tertiary education. Self-reported health (SRH) status is rated on a five-point scale (from 1 to 5: very good, good, fair, bad, and very bad). Experience refers to the actual years worked by the individual. Table 1 provides sample means on other demographic and socioeconomic characteristics used in the empirical analysis. The definitions of all variables are provided in Table A1 in the appendix.

<Insert Table 1 about here>

Figures 1 to 6 show kernel estimates of the density of hourly wages by levels of education, SRH status and experience for men and women in 24 European countries, respectively. As shown, individuals with, respectively, a higher educational level and more experience earn higher wages, while only in the Nordic countries, and for men mainly, individuals who report a better health earn higher wages. This suggests an important role for education and experience in explaining wage patterns, and *a priori* a minor role for health.

<Insert Figures 1 to 6 about here>

4. The empirical model

We use the following model to estimate the effects of health, education and experience on wages:

$$w_{it}^* = \beta_0 + \beta_1 H_{it}^* + \beta_2 Educ_{it} + \beta_3 Exp_{it} + \beta_4 Exp_{it}^2 + \beta_5 X_{it} + \beta_6 Z_{it} + u_{it} . \quad (1)$$

Equation (1) is a Mincerian type of wage equation (Mincer, 1974). All variables superscripted with an asterisk are latent variables. w_{it}^* is the logarithm of an individual i 's hourly gross market wage at time t , H_{it}^* is an individual i 's health at time t , $Educ_{it}$ is individual's educational attainment,² Exp_{it} is an individual's (actual) experience, X_{it} and Z_{it} are vectors of, respectively, time-varying and time-invariant characteristics that affect wages, and the error term u_{it} is a sum of two components, a random individual effect α_i , and a random effect η_{it} . $Educ_{it}$ is assumed to be an endogenous time constant regressor, as it may be correlated with ability which is included in α_i , and for the same reason also Exp_{it} is an endogenous, but time-varying regressor. H_{it}^* is also endogenous as it may be correlated with α_i , but also because it may suffer from measurement error bias. This is because the variable SRH status measures health with error for several reasons. This may be due to *pure* measurement error (see, e.g., Bound *et al.*, 2001; Crossley and Kennedy, 2002), due to a respondent justifying not working by reporting a

² In line with Grossman's 1972 model we use educational attainment (*Educ*) as a proxy for an individual's stock of knowledge or human capital exclusive of health capital (see also Currie and Madrian, 1999, p. 3312; Jäckle and Himmler, 2010). Since we examine the behavior of individuals after having completed their schooling, *Educ* is taken as a predetermined variable throughout the analysis.

lower than actual health status (see, e.g., Bound, 1991; Stern, 1989) and this is often referred to as justification bias, or due to the subjective judgment on which SRH is based and which may hinder a comparison across individuals (e.g., Kapteyn *et al.*, 2007; Meijer *et al.*, 2011).³ It is worth noting that the *pure* measurement error bias and the reporting differences are likely to attenuate the impact of SRH on wages, while the justification bias will most probably exaggerate its impact (e.g., Brown *et al.*, 2010). All these issues require that SRH is instrumented when estimating the wage equation. As a consequence, the Hausman and Taylor (1981) estimator is the most adequate, since it has been shown to be an Efficient Generalized Instrumental Variable (EGIV). This procedure allows simultaneous control for the correlation between regressors and unobserved individual effects (as fixed effects) and to identify the estimates for the time-invariant covariates, such as education, as a random effects estimator. Furthermore, it eliminates the uncertainty associated with the choice of instruments, since exogenous included variables, and their means over time, are used as efficient instruments.⁴ Finally, we estimate the model outlined above separately for men and women.

5. Estimation results

Table 3 contains the estimation results of the wage equation for men and women using the EGIV estimator; for comparison we also add the results from OLS. As shown,

³ Bound (1991) and Bound *et al.* (1999) identify on top of reporting bias *and* justification bias, a problem of state-dependence in self-reported subjective health answers to labor market outcomes and another one of financial incentives to identify oneself as disabled (see also Stern, 1989).

⁴ Finally, we notice that we do not observe the wages of non-employed individuals. We will take this sample selection in a further draft of this paper into account.

education, experience and health have positive impacts on wages for both men and women. Taking possible unobserved heterogeneity in education and experience into account does not significantly affect the estimation results. Instead, correcting for possible unobserved heterogeneity and/or measurement error in SRH status changes the estimation results dramatically.

<Insert Table 2 about here>

6. Conclusions

Theoretical economic models predict, based on productivity arguments, that an individual's health, educational attainment and level of experience affects his or her wage rate. While there is a wide support in the empirical literature of the positive impacts of education and experience on wages, the relationship between wages and health is less clear-cut. Our preliminary results suggest that also health has a positive impact on wages for both men and women in Europe. [In progress]

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APPENDIX

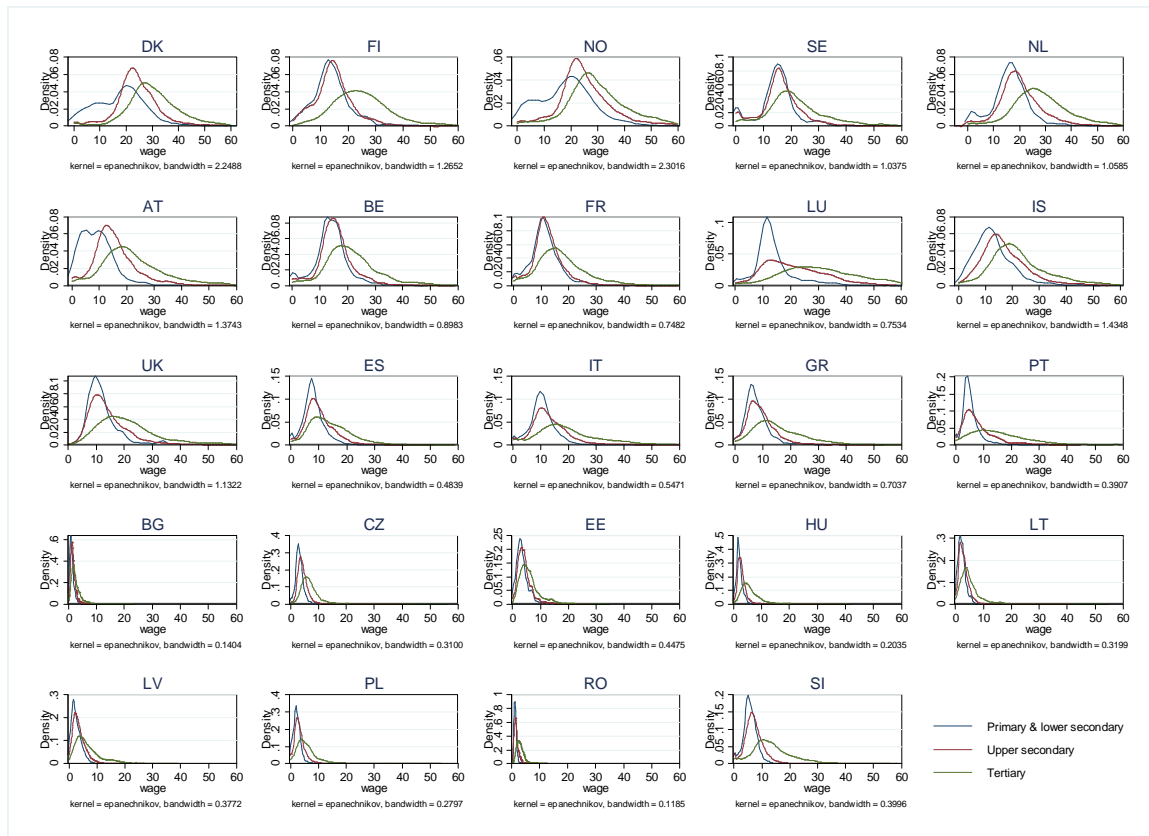
Table A1: Variable definitions

Variable	Definition
<i>Dependent variable</i>	
Log hourly (net) wage (in PPP's adjusted 2005 €)	Hourly net wages are measured in PPP's adjusted 2005 €. They are defined for paid job workers and obtained from dividing the amount of net wage-earnings by the number of hours worked. Both variables are from the main job. We treat extreme values in hourly net wages such as those below 1 and above 300 PPP-€ as missing.
<i>Respondent's Socioeconomic Characteristics</i>	
Education	Includes three levels of education defined from the ISCED Code 1997: no education, primary education, or lower secondary education (ISCED 0–2), upper secondary and postsecondary nontertiary education (ISCED 3–4), and tertiary education (ISCED 5–6).
Marital status	Marital status is equal to 1 if married or cohabiting, 0 otherwise (single or widowed).
Log household size	Includes the logarithm of the number of household members.
Age	Includes dummy variables for each age year. The reference category is 50–51 years.
Countries	Country dummies.
Time	Survey year.
<i>Respondent's Job Characteristics</i>	
Experience	Includes the actual years worked by the individual.
Occupation	Includes dummy variables for one-digit ISCO-88 skill level occupations.
<i>Respondent's Health</i>	
Self-reported health (SRH)	Includes five SRH categories, from 1 to 5: very good, good, fair, bad, and very bad.
CHRONIC	CHRONIC refers to chronic diseases; it is equal to 1 if a respondent has one or more conditions, 0 if none. Conditions are defined as hypertension, high blood cholesterol, diabetes, asthma, arthritis, osteoporosis, stomach condition, cataracts, and other conditions.

GALI

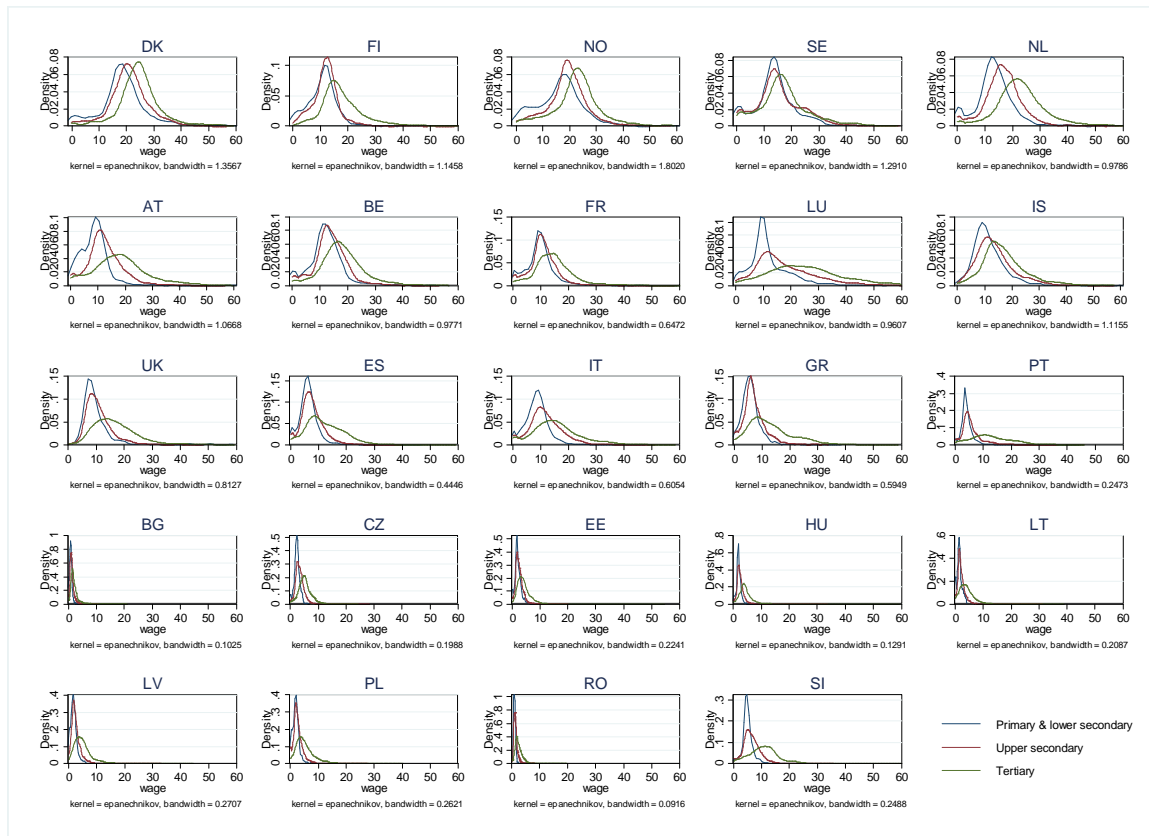
GALI refers to the global activity limitation indicator; it is equal to 1 if the respondent is limited, 0 if not. The question for this index is the following: "For the past six months at least, to what extent have you been limited because of a health problem in activities people usually do." The possible response range is "severely limited," "limited but not severely," and "not limited."

Figure 1: Kernel estimates of the density of hourly wages by levels of educational attainment for men aged 16–64 years in Europe



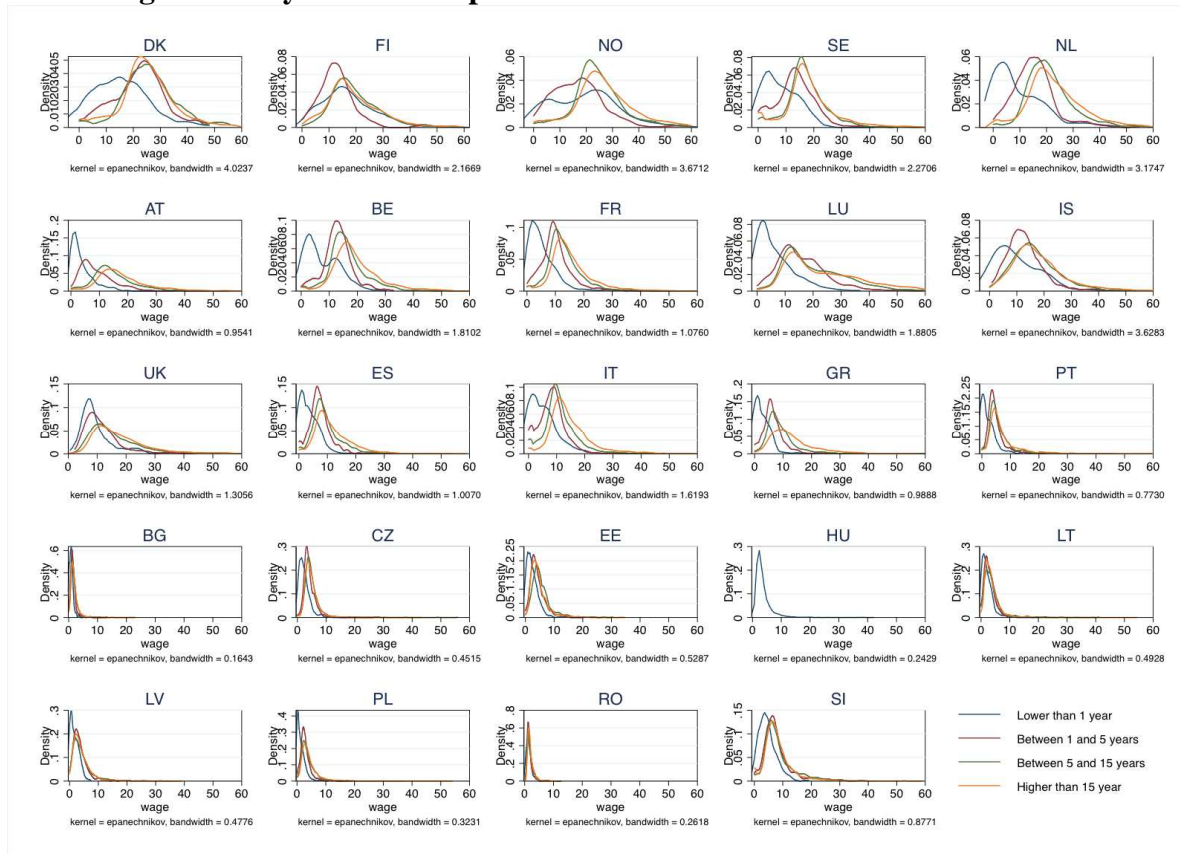
Source: Own calculations based on EU-SILC (2007-2010).

Figure 2: Kernel estimates of the density of hourly wages by levels of educational attainment for women aged 16–64 years in Europe



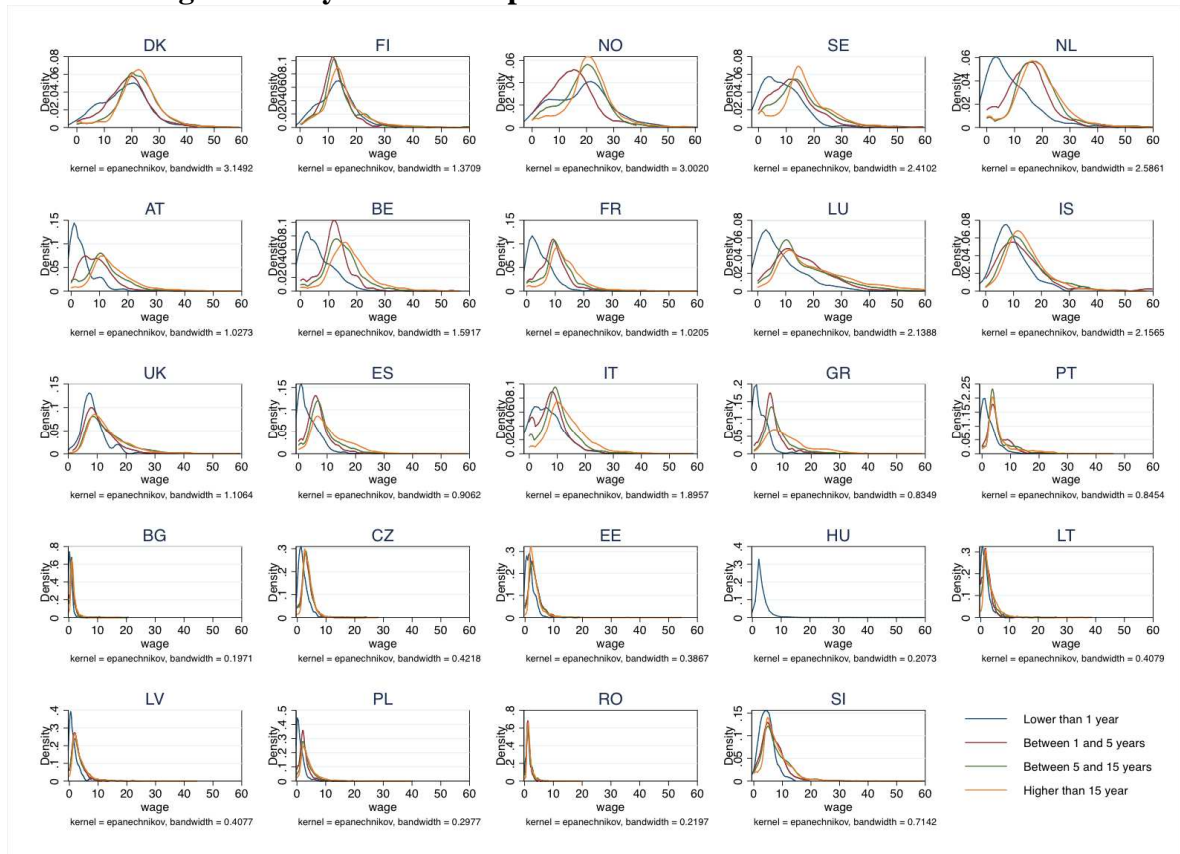
Source: Own calculations based on EU-SILC (2007-2010).

Figure 3: Kernel estimates of the density of hourly wages by levels of experience for men aged 16–64 years in Europe



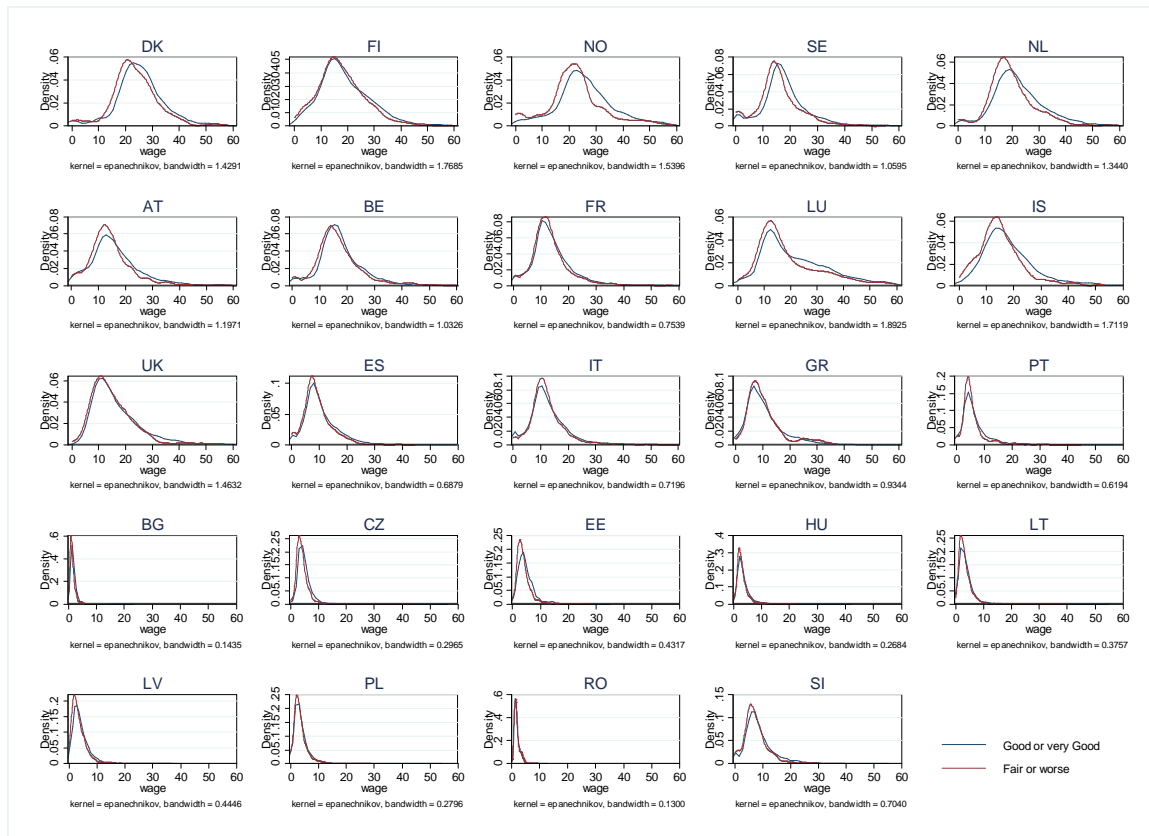
Source: Own calculations based on EU-SILC (2007-2010).

Figure 4: Kernel estimates of the density of hourly wages by levels of experience for women aged 16–64 years in Europe



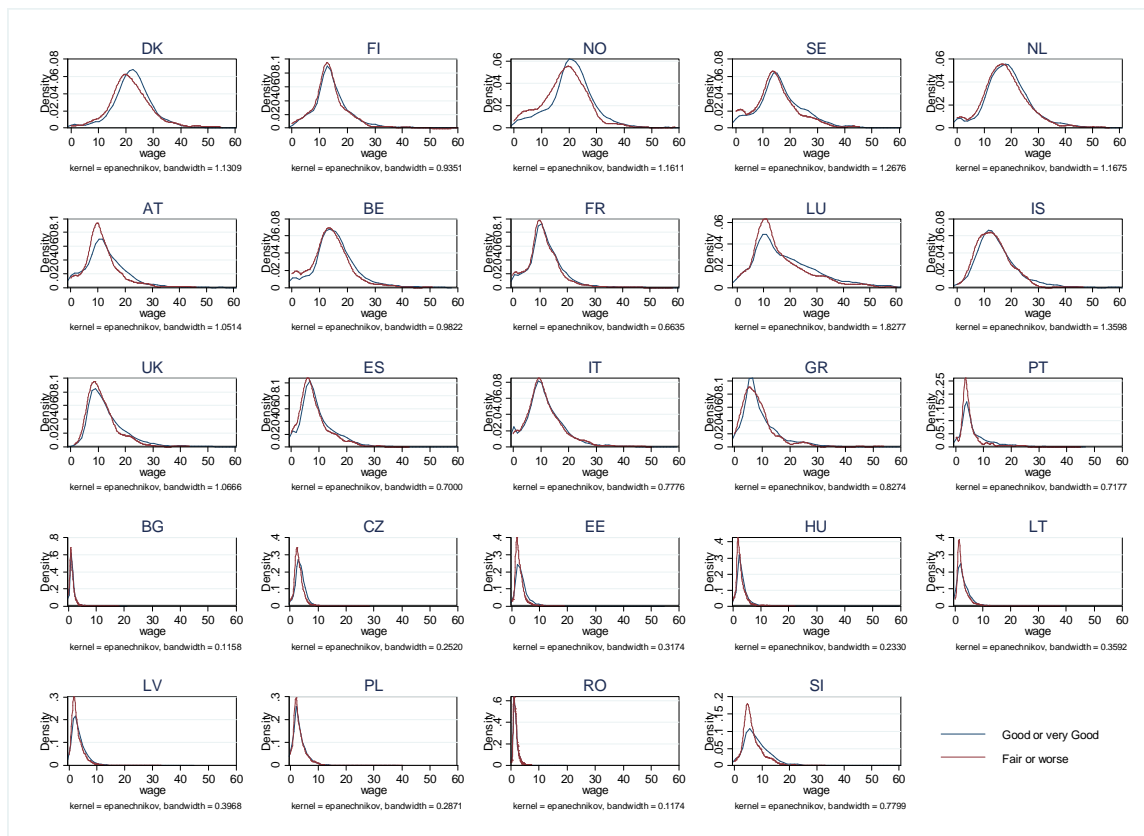
Source: Own calculations based on EU-SILC (2007-2010).

Figure 5: Kernel estimates of the density of hourly wages by levels of SRH status for men aged 16–64 years in Europe



Source: Own calculations based on EU-SILC (2007-2010).

Figure 6: Kernel estimates of the density of hourly wages by levels of SRH status for women aged 16–64 years in Europe



Source: Own calculations based on EU-SILC (2007-2010).

Table 2: Estimation results of the wage equation

	Men		Women	
	OLS	EGIV	OLS	EGIV
Experience	0.038*** 0.000	0.044*** 0.001	0.035*** 0.001	0.037*** 0.002
Experience2	-0.001*** 0.000	-0.001*** 0.000	-0.001*** 0.000	-0.000*** 0.000
Upper secondary education	0.134*** 0.004	0.143*** 0.012	0.105*** 0.005	0.182*** 0.014
Tertiary education	0.397*** 0.005	0.407*** 0.015	0.396*** 0.006	0.414*** 0.017
Good+ health	0.111*** 0.004	0.016*** 0.004	0.065*** 0.004	0.012** 0.005
Observations	153788	153788	145345	145345

Notes: Coefficient/standard error estimates. Significance levels: * p<.1, ** p<.05, *** p<.01.