Health, productivity and ageing *

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Abstract

We provide a comparative cross-country analysis of individual age-wage profiles for different health statuses. Using semi-parametric regressions run on EU-SILC data we aim at answering the question on the relationship between individual health and productivity and its changes in the life cycle, separating the impact of health from traditional wage determinants. We find that although the age-productivity profiles vary much among countries, these differences are not influenced by the self-perceived health status.

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1 Introduction

Demographic change is undoubtedly the most important development that will affect the European labour market in the next decades. Increasing life expectancy and rising shares of older people in total population bring about questions and heated policy debates about the sustainability of welfare states and social security systems, mostly old-age pensions. These lead to the question on the possibility of longer working lives and raising the retirement age up to the levels of 70 (or more). One of the major concerns relates to the ability of older workers to remain on the labour market and earn their living due their -commonly assumed and discussed - health issues.

Health status of older cohorts is believed to be the main driver of their declining productivity, pushing them out of the labour market or lowering their labour incomes. Thus, from the macro perspective, concerns about the impact of ageing on productivity translate into worries about the future economic growth and public finance. To tackle these one needs a deeper understanding of the relationship between health, ageing and its individual economic consequences.

Our paper aims at extending the existing literature by providing a comparative cross-country analysis of individual age-wage profiles for different health statuses, where the available evidence is scarce. We seek to answer the question on the relationship between individual health and productivity (proxied by wages, in line with the neoclassical theory) and its changes in the life cycle, separating the impact of health from traditional wage determinants. We are also interested in verifying whether the decrease in productivity at older age is quicker in Central and Eastern European countries, as Lovász and Rigó (2013) suggested that economic transformation and deep structural changes fasten the pace of productivity deterioration.

Health, productivity and age relationships

Most studies suggest that productivity tops at the age of 30-45 and starts to decline around 50 years of age (Cardoso et al., 2011; Cataldi et al., 2011; Goebel and Zwick, 2009; Skirbekk, 2008), although some authors find no decrease at older age (Aubert and Crépon, 2003; Hellerstein et al., 1999). The rate at which productivity decreases varies considerably among groups of workers, depending on their human capital levels, types of jobs held and their task content [1]. Age gap in the productivity levels is also higher among skilled workers (Lovász and Rigó, 2013). Furthermore, certain skills, such as reading or ability to cooperate deteriorate slowly, while cognitive speed and memory activities are more likely to worsen quickly with age (Verhaeghen and Salthouse, 1997; Waldman and Avolio, 1986; Maitland et al., 2000). Finally, there is evidence that the rate at which human capital and skills depreciate (and thus productivity declines) keeps increasing, due to the skill biased technological change (Börsch-Supan et al., 2005; Bertschek and Meyer, 2009). The relationship between age and productivity is also perceived as a trade off in the eyes of employers, who assume older workers to be less efficient (Van Dalen et al., 2010). In particular they are perceived to have lower abilities to adapt to new solutions and technologies and thus to be less efficient at work (Turek and Perek-Bialas, 2013). Despite the fact that the effectiveness of investments in human capital is decreasing sharply with age (Cunha et al., 2010), productivity decline could be offset by education investments at older age (Katzman, 1993). Yet, the life long learning rates are very low for those aged 50+ (OECD, 2009, 2012).

Health is commonly expected to worsen with age, but the relationship is not linear (Hunt et al., 1984). Several studies find increasing health inequalities along the life-cycle (Deaton and Paxson, 1998) and important cohort differences (Idler, 1993). Also the impact of health on productivity is rather obvious. Better health translates into higher employment probability, higher accumulated human capital (also via longer job experience), and thus higher wages. At the same time higher productivity and higher labour incomes allow investing more in own and children's health, although not all health problems can be alleviated with financial resources (e.g. disability or chronic diseases). Empirical studies confirm the statistically significant impact of health on productivity, both at the macro and micro level. Arora (2001) finds that health influences the GDP growth pace of industrialized countries over long term, while Cole and Neumayer (2006) state that health problems (such as malaria of malnutrition) have a negative impact on economic growth. Children who experience poor health have significantly lower educational attainment, poorer health, and lower social status as adults (Case et al., 2005; Smith, 2009; Currie et al., 2010) and lower willingness to compete in the future (Bartling et al., 2012). Health problems at

[1] Some studies concentrate on the analysis of age-productivity profiles for selected occupations: scholars and researchers (Oster and Hamermesh, 1998) or Formula 1 drivers (Castellucci et al., 2011)

later stages in life also decrease future incomes (Luft, 1975; Savedoff and Schultz, 2000). The human capital and health are also perceived as the main driver of economic growth and fertility (Ehrlich and Yin, 2014).

At the same time the impact of health on age-productivity profiles is far from obvious. Worsening health, longer and more frequent career breaks and sick leaves lead to lower wages, higher probability of job separation and lower probability of finding a new job. Self perceived worse health status is also one of the most common reasons for early retirement (Bound et al., 1999) . Yet, the worsening of health along with age may not apply to those in the productive age, but to the older cohorts. Ng and Feldman (2013) in their meta analysis of an extensive literature find that older employees fare more poorly on clinical health indicators, but do not self-report higher levels of physical health problems and do not have poorer mental, nor do they suffer more from psychosomatic complaints. Worsening health may however impact the productivity of certain groups of workers, particularly those in self-paced occupations or those working in hot conditions; though it can be alleviated with workplace redesign (Shepard, 2000).

Individual productivity is difficult to observe and measure, therefore various proxies are used. For instance, employees' age-specific contribution to total firm's output is estimated with the use of firm's level data on value added and employment structure by age. Some studies provide evidence on the signals of higher or lower (potential) productivity, which include health status or physical or mental abilities. From the macroeconomic perspective, the estimates of productivity of different cohorts are usually based on the distribution of their employment rates. Yet, proxying employees' productivity with their individual wages remains the most popular approach, reflecting the neo-classical theory. Asymmetric information between employer and employee may however affect their optimal labour contracts, resulting in underpaying young workers (relative to their productivity) and overpaying those with more experience (Lazear, 1979), though the empirical evidence remains rather inconclusive in this respect (Skirbekk, 2008; Van Ours and Stoeldraijer, 2011). Among other, Cardoso et al. (2011) suggest that young people's wage growth follows productivity dynamics, whereas it does not among prime age workers. As a result, older people are worth their pay, which reflects their contribution to total output. Hellerstein et al. (1999) find that the wage growth reflects productivity growth with age, whereas Cataldi et al. (2011) state that young workers are paid below their productivity levels, contrary to the older ones.

2 Data and methods

We base our analyses on semi-parametric regressions, which differ from the OLS in the way that they enable including one or more regressors without a priori assumptions about the form of the functional relation with the endogenous variable. We model the age (g) - productivity (p) relation non-parametrically, whereas the self-perceived health (h) and other control variables (x) affecting productivity are included in a parametric way:

$$p = \alpha_0 + \sum_{j=1}^{n} \alpha_j x_j + \sum_{i=1}^{4} \beta_i h_i + f(g) + \epsilon \tag{1}$$

The parameters as well as the function $f(g)$ are estimated with the use of Robinson (1988) estimator. Therefore the parameters are estimated with the use of OLS on transformed data:

$$p - E(p|g) = \sum_{j=1}^{n} \alpha_j (x_j - E(x_j|g)) + \sum_{i=1}^{4} \beta_i (h_i - E(h_i|g)) + f(g) + \epsilon \tag{2}$$

and non-parametric relation is obtained from:

$$f(g) = E(p|g) - \sum_{j=1}^{n} (\tilde{\alpha_j} x_j - E(x_j|g)) - \sum_{i=1}^{4} \tilde{\beta_i}(h_i - E(h_i|g)) \tag{3}$$

All conditional expectations $(E(p|g), E(x_j|g), E(h_i|g))$ are calculated with the use of kernel weighted local polynomial smoothing with Gaussian kernel.

The model is estimated with the use of the EU-SILC 2005-2008 micro-data for 15 EU countries, separately for each one of them. EU SILC is an EU-wide representative survey on income and living conditions with detailed labour market information. It is supervised by the Eurostat. We use information on the job held (occupation and firm's sector defined by the NACE 1 level) as well as on personal characteristics (gender, education, tenure) as control variables, to explain the variation of the hourly wage. The initial sample size amounts to a total of 1 898 893 observations (Table 1). We concentrate on workers only, which leaves us with a total of 584 554 individuals

(13 440 in Portugal to 67 223 in Poland). The sample consist of working persons who reported their labour income, aged 15-80. The exact number of observations is reported in the results tables (Tables: 3 , 4).

Table 1: Descriptive statistics of the sample

	observations		at least good health among				
country	total	workers	all	workers	workers 15-24	workers 25-54	workers 55-64
DE	152034	58354	62.7	75.1	90.8	75.7	57.6
EE	80399	32228	52.8	65.6	88.6	68.8	38.5
ES	224302	49897	68.4	82.7	94.0	83.9	65.2
FR	151200	56555	69.1	82.4	93.1	82.7	68.7
IE	83328	28662	83.5	92.8	97.0	93.6	86.8
IT	328560	55390	60.6	76.5	91.7	78.0	55.6
LT	62030	24005	46.4	57.5	84.7	59.3	26.7
LU	61504	24792	73.8	82.8	91.5	82.9	73.6
LV	59417	14748	42.0	50.2	78.3	51.6	22.3
NL	121892	46703	74.0	86.1	91.3	87.0	77.1
PL	216759	67223	55.4	72.4	92.4	72.8	42.3
PT	75586	13440	46.9	59.7	82.9	63.7	28.3
RO	57711	19971	69.2	85.8	97.2	88.4	62.0
SI	146059	59609	53.7	70.4	84.9	71.0	51.6
SK	78112	32977	55.9	66.6	90.5	66.8	35.0
total	1898893	584554	63.4	77.6	92.0	78.6	58.7

Source: Own calculations.

All income statistic are delivered in EU-SILC on yearly bases. Hourly wage is calculated as the sum of the labor income from wages and self-employment divided by the number of hours worked. The denominator is calculated with the use of the hours worked usually a week and the number of months spent at work in the last year. The hourly wage was normalized with the $mean = 1$ for each year and country in order to make the values comparable in time and space. In the regression the natural logarithm of the wage is used.

The health information we use is a subjective measure, as individuals are asked to assess their own health on a five level scale, from very-good to very-bad. These self-perceived health indicators are then included in the regression as dummies. Subjective health measures, despite their drawbacks in measuring health problems, are very good proxies of objective health indicators and mortality, at least within a country [TEN FRAGMENT DO DYSKUSJI] (Leroux et al., 2012; Idler and Benyamini, 1997).

The reported average health levels vary considerably across countries - on average only 50%

of Latvian workers declare at least good health, while this share amounts to over 90% in Ireland. The disparities in health status among countries are much smaller for the youngest workers and increase considerably for the oldest. Table 2 presents the overall distribution of individuals according to their age and health status. Self perceived health level clearly worsens with age. More than 90% of those age 15-24 report a good or very good health status, this figure stands at 81% for the 25-44 year olds, 61% for the 45-54 olds and 47% for those aged 55-64. The drop in at least good health levels is considerable for the 65+ year olds. Similarly, though the share of individuals declaring bad or very bad health is increasing steadily along with age (from 1.4% among youth to 15.4% among those aged 55-64), this rise is sharp in the 65-80 age group (27.7%).

Table 2: Distribution of health status among subpopulations

health	age					working		hourly wage quantile				
status	15-24	25-44	45-54	55-64	65-80	yes	no	1	2	3	4	5
very good	43.9	24.1	10.9	6.6	2.8	21.5	13.5	22.5	21.5	22.0	22.6	24.2
good	48.1	56.9	50.9	40.3	25.0	56.1	35.7	53.8	56.3	56.3	57.6	58.3
fair	6.6	15.5	28.6	37.8	44.5	19.2	32.1	19.7	19.1	18.8	17.4	15.4
bad	1.1	3.0	8.0	12.8	21.8	2.9	14.8	3.6	2.9	2.6	2.2	1.9
very bad	0.3	0.6	1.6	2.6	5.9	0.3	3.8	0.4	0.3	0.2	0.2	0.2

Source: Own calculations.

Declared health levels are significantly better among the working population. More than 77% of workers report good or very good health levels, vs. 49% among those non-employed. Bad or very bad health is much more frequent among the latter. Once we concentrate on the working population only, the health appears to be similar among low and high paid workers. The distribution of workers with different health status is comparable among the wage quantiles, suggesting that wages may not be influenced - on average - by workers' health. Yet, the question whether this relationship remains stable along the life cycle, remains valid and is answered in the next section.

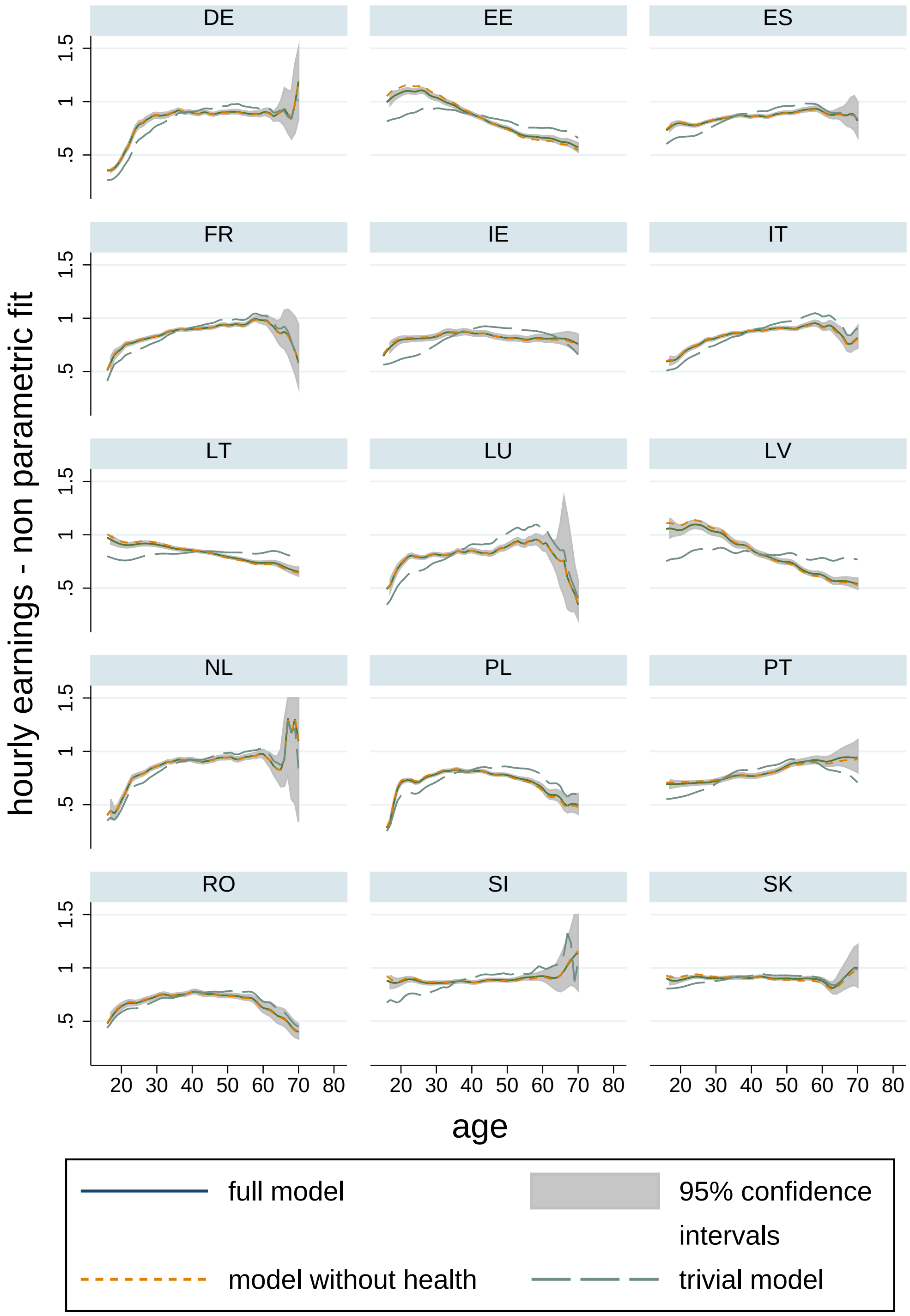
3 Results

Table 3 summarizes the results of the estimates. The impact of individual and firm level characteristics is in line with the theoretical predictions and results found in several previous studies (Cataldi et al., 2011). Coefficients associated with women are negative and statistically significant in all countries. The estimated difference in wages of 10-30% is similar to that observed in other studies (Blau and Kahn, 1999; Christofides et al., 2013; OECD, 2012). Secondary and lower levels of education decrease wages with respect to tertiary level diplomas. Longer job experience increases the probability of earning a higher wage, and though this relationship is non linear and the rate of increases goes slightly down with age. Workplace characteristics also play an important role in determining workers' wages. With respect to jobs' task content, employees in skilled, non manual occupations are likely to earn higher wages, while manual occupations, in particular those requiring lower skills, are associated with lower earnings. Firm's sectoral affiliation is also important : wages tend to be higher among employees in industry and financial services and lower in other sections of the economy. These patterns are broadly consistent among all the analysed countries.

Turning to our main variable of interest, the self defined health status, we find that its impact on wages is statistically significant in all EU member states. Workers declaring good health status are likely to earn lower wages compared to employees with very good health, the difference is relatively small in size but statistically significant in a great majority of cases. The negative coefficients associated with "fair" and "bad" health increase in size and become significant in all countries. Workers reporting a very bad health status are likely to earn less than those with very good health, but the relation with workers with "only" bad health is less obvious (the coefficients are smaller in size Italy and Poland). The wage premium of very good health in relation to bad or vary bad is about 10-20% and is of similar magnitude as the wage difference among men an women and significantly smaller then the educational, occupational or sectoral wage premia. Additionally, Table 4 presents the results of the same analysis with health status excluded from the set of control variables. The estimated parameters associated with other individual and job characteristics remain virtually the same.

Figure 1 presents the non parametric results on the age - wage profiles in the analysed countries. The "trivial" model estimates refer to the basic non parametric age-wage pattern. The "full model" line presents the relationship with all the variables presented in Table 3, whereas the "model without health" line describes the wage profile not accounting for the health status impact. Firstly, the age-wage patterns (controlling for the set of characteristics described above) display three different broad patterns among EU member states. Their resemble a U-shape

Figure 1: Productivity and age - non parametric part of wage regressions



Source: Own calculation.

relationship in France, Italy, Luxembourg, Poland and Romania, whereas they are rather flat in Spain, Ireland, Lithuania, Portugal, Slovenia and Slovakia (and Germany but for the youngest workers experiencing steep increases at the beginning of the working careers). In Estonia and Latvia wages tend to decrease with age, all other things equal. Secondly, controlling for individual and workplace characteristics explains a large part of the differences in age-wage life-cycle profiles. In all countries wages are thus higher for younger people (than they would had other factors not been controlled for) and lower for older people (comparing again to a simple age-wage profile).

Once we focus on the main question in our analysis, it is evident that the self reported health status has no impact on the age-productivity profiles among workers. Combining this result with the estimated statistically significant coefficients associated with health levels, we see that health influences the level of earnings, but hardly their dynamics in the workers' life cycles. The estimates of the age-wage relationship in the model which does not control for health are virtually the same as for the model with health included, or fall into the 95% confidence intervals[2] . Including regressors to the wage equation flattens the age profiles, proving that age differences are mostly driven by the variation of cohort structures as well as by the life cycle dynamics in terms of sectoral, occupational and educational characteristics.

Regarding the question on the cohort differences in Central and Eastern European countries which have experienced rapid structural change, we do not observe them with respect to the health impact on age-productivity profiles. However, in most of the CEEs we do see a pattern of decreasing productivity among older workers (in the Baltic States this concerns already those in the prime age group), which is likely to be related to the skill obsolescence among older cohorts and their mismatch to the changing labour markets (as postulated by Lovász and Rigó (2013)), rather than worse health.

4 Conclusions

Our study aimed at answering the question on the relationship between workers' age, health and productivity. We studied data on individuals from 15 EU countries, separating the impact of age on productivity in a non-parametric way and controlling for the health status (together

[2]The standard errors rise very quickly with the decreasing sample size at the age of retirement.

with other classical wage determinants). We found that the age-productivity profiles vary much among countries, but these differences are not significantly influenced by the self-perceived health in any country in the sample. Health status does impact the average level of individual wages, but not their life cycle dynamics.

Our results suggest that the role of health for the age-performance relationship is much lower than commonly assumed, which is an important conclusion both for policymakers and management practitioners. The concerns about the impact of ageing on productivity seem to be overstated, and health does not appear to be the crucial challenge for extending working lives. At the same time a clear need emerges to tackle other reasons behind the falling productivity at older age. These appear to be mostly driven by skills mismatches and the changing relative demand for tasks and cognitive abilities (Skirbekk, 2008), though the question on the different dynamics of those changes (or the fact that we do not observe a fall in productivity at older age in several countries) remains open.

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Table 3: Parameter estimates of wage regressions, full set of control variables

y = ln(hourly wage)	DE	EE	ES	FR	IE	IT	LT	LU	LV	NL	PL	PT	RO	SI	SK
gender - female	-0.203	-0.273	-0.137	-0.107	-0.124	-0.145	-0.219	-0.133	-0.221	-0.158	-0.174	-0.206	-0.232	-0.129	-0.194
	(0.006)**	(0.008)**	(0.006)**	(0.005)**	(0.014)**	(0.005)**	(0.009)**	(0.008)**	(0.013)**	(0.007)**	(0.006)**	(0.014)**	(0.011)**	(0.008)**	(0.006)**
Highest educational level - ISCED - tertiary as reference level															
pre-primary		-0.131		-0.297		-0.404			-0.832	-0.335	-0.456			-0.358	
		(0.173)		(0.028)**		(0.040)**			(0.265)**	(0.084)**	(0.058)**			(0.144)*	
primary	-0.286	-0.420	-0.329	-0.287	-0.460	-0.441	-0.467	-0.384	-0.524	-0.307	-0.496	-0.735	-0.704	-0.503	-0.453
	(0.036)**	(0.043)**	(0.009)**	(0.012)**	(0.022)**	(0.013)**	(0.053)**	(0.013)**	(0.081)**	(0.018)**	(0.013)**	(0.026)**	(0.039)**	(0.020)**	(0.164)**
lower secondary	-0.267	-0.263	-0.274	-0.227	-0.358	-0.349	-0.420	-0.295	-0.426	-0.272	-0.572	-0.560	-0.625	-0.517	-0.315
	(0.013)**	(0.014)**	(0.008)**	(0.009)**	(0.019)**	(0.009)**	(0.019)**	(0.014)**	(0.022)**	(0.010)**	(0.057)**	(0.025)**	(0.025)**	(0.019)**	(0.017)**
upper secondary	-0.161	-0.173	-0.177	-0.183	-0.276	-0.211	-0.356	-0.233	-0.336	-0.215	-0.321	-0.434	-0.385	-0.384	-0.198
	(0.006)**	(0.009)**	(0.007)**	(0.006)**	(0.016)**	(0.008)**	(0.012)**	(0.010)**	(0.016)**	(0.007)**	(0.009)**	(0.024)**	(0.020)**	(0.012)**	(0.008)**
post secondary	-0.099	-0.165	-0.174	-0.175	-0.236	-0.194	-0.291	-0.201	-0.318	-0.146	-0.243	-0.442	-0.271	-0.152	-0.129
	(0.010)**	(0.014)**	(0.025)**	(0.434)	(0.021)**	(0.011)**	(0.011)**	(0.024)**	(0.023)**	(0.015)**	(0.014)**	(0.091)**	(0.026)**	(0.023)**	(0.037)**
Occupation, skilled non-manual as reference level															
lower skill non-manual	-0.202	-0.389	-0.115	-0.221	-0.220	-0.100	-0.301	-0.246	-0.331	-0.171	-0.299	-0.224	-0.338	-0.172	-0.195
	(0.007)**	(0.011)**	(0.008)**	(0.007)**	(0.015)**	(0.007)**	(0.013)**	(0.011)**	(0.017)**	(0.008)**	(0.009)**	(0.019)**	(0.020)**	(0.012)**	(0.008)**
skilled manual	-0.323	-0.313	-0.177	-0.271	-0.229	-0.195	-0.288	-0.384	-0.268	-0.198	-0.396	-0.295	-0.393	-0.318	-0.220
	(0.009)**	(0.010)**	(0.009)**	(0.008)**	(0.020)**	(0.007)**	(0.013)**	(0.013)**	(0.018)**	(0.010)**	(0.009)**	(0.021)**	(0.020)**	(0.012)**	(0.008)**
lower skill manual	-0.429	-0.496	-0.203	-0.298	-0.215	-0.274	-0.514	-0.462	-0.478	-0.275	-0.433	-0.363	-0.423	-0.331	-0.326
	(0.013)**	(0.013)**	(0.010)**	(0.010)**	(0.022)**	(0.010)**	(0.015)**	(0.014)**	(0.020)**	(0.015)**	(0.011)**	(0.024)**	(0.023)**	(0.016)**	(0.011)**
NACE - industry(C,D,E) as reference level															
(A,B)	-0.350	-0.272	-0.370	-0.448	-0.940	-0.376	-0.306	-0.314	-0.353	-0.442	-0.926	-0.311	-1.314	-0.406	-0.147
	(0.021)**	(0.014)**	(0.013)**	(0.014)**	(0.030)**	(0.013)**	(0.016)**	(0.023)**	(0.023)**	(0.020)**	(0.010)**	(0.032)**	(0.017)**	(0.026)**	(0.015)**
(F)	-0.196	0.144	-0.071	-0.098	-0.021	-0.067	0.106	-0.193	0.074	-0.042	-0.115	-0.028	-0.041	-0.143	-0.091
	(0.013)**	(0.012)**	(0.009)**	(0.010)**	(0.025)	(0.010)**	(0.015)**	(0.015)**	(0.021)**	(0.013)**	(0.011)**	(0.022)	(0.020)*	(0.016)**	(0.010)**
(G)	-0.245	-0.074	-0.202	-0.182	-0.150	-0.157	-0.143	-0.296	-0.109	-0.145	-0.215	-0.095	-0.064	-0.130	-0.133
	(0.010)**	(0.013)**	(0.010)**	(0.009)**	(0.023)**	(0.008)**	(0.014)**	(0.015)**	(0.020)**	(0.011)**	(0.010)**	(0.021)**	(0.018)**	(0.013)**	(0.010)**
(H)	-0.456	-0.063	-0.256	-0.293	-0.289	-0.269	-0.217	-0.405	-0.167	-0.298	-0.211	-0.224	-0.069	-0.255	-0.152
	(0.021)**	(0.021)**	(0.013)**	(0.017)**	(0.031)**	(0.014)**	(0.028)**	(0.018)**	(0.035)**	(0.022)**	(0.020)**	(0.028)**	(0.039)	(0.022)**	(0.016)**
(I)	-0.147	0.090	-0.022	-0.048	-0.047	0.021	0.029	0.119	0.064	-0.056	0.003	0.157	0.013	-0.019	0.024
	(0.013)**	(0.014)**	(0.012)	(0.012)**	(0.028)	(0.012)	(0.016)	(0.017)**	(0.022)**	(0.013)**	(0.011)	(0.032)**	(0.020)	(0.016)	(0.011)*
(J)	0.134	0.278	0.162	0.069	0.201	0.223	0.280	0.116	0.193	0.149	0.082	0.378	0.171	0.151	0.045
	(0.013)**	(0.037)**	(0.017)**	(0.013)**	(0.031)**	(0.015)**	(0.034)**	(0.016)**	(0.045)**	(0.016)**	(0.020)**	(0.044)**	(0.041)**	(0.023)**	(0.018)*
(K)	-0.179	-0.064	-0.105	-0.068	-0.054	-0.073	0.004	-0.147	-0.007	-0.036	-0.146	-0.013	-0.022	-0.084	-0.082
	(0.011)**	(0.016)**	(0.012)**	(0.011)**	(0.024)*	(0.010)**	(0.023)	(0.015)**	(0.027)	(0.011)**	(0.013)**	(0.030)	(0.028)	(0.015)**	(0.012)**
(L)	-0.118	-0.009	0.174	-0.093	0.142	0.102	0.130	0.166	0.086	0.060	0.034	0.179	0.058	0.004	0.021
	(0.010)**	(0.016)	(0.011)**	(0.009)**	(0.024)**	(0.010)**	(0.018)**	(0.016)**	(0.024)**	(0.012)**	(0.013)**	(0.025)**	(0.029)*	(0.016)	(0.010)*
(M)	-0.099	-0.074	0.218	-0.128	0.125	0.145	0.001	0.170	-0.044	-0.080	0.102	0.183	-0.056	0.037	-0.086
	(0.012)**	(0.014)**	(0.013)**	(0.011)**	(0.027)**	(0.011)**	(0.015)	(0.017)**	(0.024)	(0.013)**	(0.012)**	(0.028)**	(0.026)*	(0.016)*	(0.011)**
(N)	-0.183	-0.092	0.041	-0.084	0.012	0.082	-0.103	-0.004	-0.018	-0.053	-0.191	0.051	-0.044	-0.025	-0.131
	(0.010)**	(0.017)**	(0.012)**	(0.010)**	(0.024)	(0.011)**	(0.017)**	(0.016)	(0.027)	(0.011)**	(0.013)**	(0.028)	(0.027)	(0.017)	(0.012)**
(O,P,Q)	-0.231	-0.185	-0.188	-0.255	-0.195	-0.141	-0.105	0.010	-0.065	-0.171	-0.114	-0.034	0.054	-0.112	-0.132
	(0.012)**	(0.018)**	(0.012)**	(0.010)**	(0.030)**	(0.010)**	(0.019)**	(0.015)	(0.029)*	(0.017)**	(0.015)**	(0.030)	(0.028)	(0.020)**	(0.013)**

Table 3 (part 2): Parameter estimates of wage regressions, full set of control variables

	DE	EE	ES	FR	IE	IT	LT	LU	LV	NL	PL	PT	RO	SI	SK
tenure (years)	0.028	0.019	0.021	0.016	0.029	0.015	0.011	0.029	0.016	0.016	0.016	0.029	0.007	0.022	0.011
	(0.001)**	(0.002)**	(0.001)**	(0.001)**	(0.003)**	(0.001)**	(0.002)**	(0.002)**	(0.004)**	(0.001)**	(0.001)**	(0.003)**	(0.002)**	(0.002)**	(0.002)**
tenure squared	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)	(0.000)**	(0.000)	(0.000)**	(0.000)**	(0.000)**	(0.000)	(0.000)**	(0.000)**
Self defined health status, very good as reference level															
good	-0.024	-0.095	-0.017	-0.016	-0.060	-0.005	-0.031	-0.023	-0.087	-0.021	-0.034	-0.019	-0.036	0.010	-0.034
	(0.007)**	(0.013)**	(0.007)*	(0.005)**	(0.012)**	(0.007)	(0.018)	(0.007)**	(0.030)**	(0.006)**	(0.008)**	(0.021)	(0.012)**	(0.010)	(0.007)**
fair	-0.066	-0.198	-0.059	-0.056	-0.132	-0.053	-0.081	-0.043	-0.188	-0.048	-0.090	-0.079	-0.059	-0.051	-0.084
	(0.009)**	(0.015)**	(0.009)**	(0.008)**	(0.023)**	(0.009)**	(0.019)**	(0.011)**	(0.031)**	(0.010)**	(0.009)**	(0.023)**	(0.019)**	(0.012)**	(0.008)**
bad	-0.106	-0.283	-0.134	-0.130	-0.104	-0.106	-0.139	-0.109	-0.310	-0.054	-0.150	-0.176	-0.056	-0.125	-0.166
	(0.017)**	(0.022)**	(0.018)**	(0.015)**	(0.073)	(0.017)**	(0.025)**	(0.021)**	(0.037)**	(0.024)*	(0.015)**	(0.033)**	(0.046)	(0.019)**	(0.014)**
very bad	-0.140	-0.300	-0.155	-0.154	-0.397	-0.099	-0.195	-0.038	-0.163	-0.040	-0.138	-0.200	-0.164	-0.228	-0.211
	(0.046)**	(0.084)**	(0.051)**	(0.046)**	(0.190)*	(0.044)*	(0.076)*	(0.069)	(0.079)*	(0.083)	(0.049)**	(0.070)**	(0.144)	(0.043)**	(0.036)**
Year dummy - 2008 as reference level															
2005	0.015	-0.007		-0.001	0.000		-0.018	-0.023		0.060	-0.051	-0.532		-0.019	-0.018
	(0.006)*	(0.010)		(0.007)	(0.000)		(0.011)	(0.009)*		(0.008)**	(0.007)**	(0.032)**		(0.011)	(0.007)*
2006	0.000	0.007	0.025	0.007	0.000		0.006	-0.011		0.033	-0.020	-0.525		0.006	-0.021
	(0.000)	(0.009)	(0.006)**	(0.007)	(0.000)		(0.011)	(0.009)		(0.008)**	(0.007)**	(0.033)**		(0.010)	(0.007)**
2007	-0.002	0.022	0.006	0.011	0.008	0.000	-0.013	-0.014	0.043	-0.006	-0.018	0.000	-0.020	-0.002	-0.009
	(0.006)	(0.010)*	(0.006)	(0.006)	(0.011)	(0.005)	(0.011)	(0.009)	(0.011)**	(0.007)	(0.007)*	(0.012)	(0.010)*	(0.010)	(0.007)
R^2	0.24	0.28	0.26	0.26	0.34	0.24	0.32	0.47	0.31	0.28	0.38	0.38	0.58	0.31	0.21
N	33,652	21,699	36,954	35,719	8,447	37,219	18,234	16,348	9,571	19,381	54,122	8,532	13,456	15,540	25,337

* $p < 0.05$; ** $p < 0.01$

NACE 1.1 sectors: A- Agriculture, hunting and forestry; B- Fishing; C- Mining and quarrying; D- Manufacturing; E- Electricity, gas and water supply; F- Construction; G- Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; H- Hotels and restaurants; I- Transport, storage and communication; J- Financial intermediation; K- Real estate, renting and business activities; L- Public administration and defence; compulsory social security; M- Education; N- Health and social work; O- Other community, social and personal service activities; P- Activities of households; Q- Extra-territorial organizations and bodies.

Table 4: Parameter estimates of wage regressions, control variables without health

y = ln(hourly wage)	DE	EE	ES	FR	IE	IT	LT	LU	LV	NL	PL	PT	RO	SI	SK
gender - female	-0.204	-0.276	-0.140	-0.109	-0.124	-0.147	-0.226	-0.135	-0.230	-0.159	-0.178	-0.215	-0.236	-0.132	-0.200
	(0.006)**	(0.008)**	(0.006)**	(0.005)**	(0.014)**	(0.005)**	(0.009)**	(0.008)**	(0.013)**	(0.007)**	(0.006)**	(0.014)**	(0.011)**	(0.008)**	(0.006)**
Highest educational level - ISCED - tertiary as reference level															
pre-primary		-0.144		-0.308		-0.410			-0.909	-0.341	-0.478			-0.364	
		(0.165)		(0.028)**		(0.040)**			(0.266)**	(0.084)**	(0.058)**			(0.145)*	
primary	-0.291	-0.443	-0.333	-0.296	-0.474	-0.448	-0.471	-0.390	-0.570	-0.311	-0.506	-0.753	-0.711	-0.523	-0.433
	(0.036)**	(0.043)**	(0.009)**	(0.012)**	(0.022)**	(0.013)**	(0.052)**	(0.013)**	(0.082)**	(0.018)**	(0.013)**	(0.026)**	(0.039)**	(0.020)**	(0.165)**
lower secondary	-0.273	-0.280	-0.277	-0.231	-0.363	-0.356	-0.426	-0.299	-0.446	-0.274	-0.582	-0.571	-0.630	-0.531	-0.327
	(0.013)**	(0.014)**	(0.008)**	(0.009)**	(0.019)**	(0.009)**	(0.019)**	(0.014)**	(0.022)**	(0.010)**	(0.057)**	(0.025)**	(0.024)**	(0.019)**	(0.017)**
upper secondary	-0.163	-0.182	-0.179	-0.185	-0.277	-0.216	-0.363	-0.235	-0.344	-0.217	-0.326	-0.440	-0.387	-0.389	-0.202
	(0.006)**	(0.009)**	(0.007)**	(0.006)**	(0.016)**	(0.008)**	(0.012)**	(0.010)**	(0.016)**	(0.007)**	(0.009)**	(0.024)**	(0.020)**	(0.012)**	(0.008)**
post secondary	-0.102	-0.169	-0.175	-0.216	-0.238	-0.199	-0.295	-0.204	-0.328	-0.147	-0.246	-0.439	-0.274	-0.149	-0.131
	(0.010)**	(0.014)**	(0.025)**	(0.435)	(0.021)**	(0.011)**	(0.011)**	(0.024)**	(0.023)**	(0.015)**	(0.014)**	(0.091)**	(0.026)**	(0.023)**	(0.036)**
Occupation, skilled non-manual as reference level															
lower skill non-manual	-0.204	-0.398	-0.116	-0.223	-0.223	-0.102	-0.301	-0.249	-0.340	-0.173	-0.302	-0.224	-0.338	-0.176	-0.199
	(0.007)**	(0.011)**	(0.008)**	(0.007)**	(0.015)**	(0.007)**	(0.013)**	(0.011)**	(0.017)**	(0.008)**	(0.009)**	(0.019)**	(0.020)**	(0.012)**	(0.008)**
skilled manual	-0.328	-0.321	-0.180	-0.275	-0.232	-0.199	-0.288	-0.389	-0.278	-0.201	-0.402	-0.300	-0.395	-0.327	-0.226
	(0.009)**	(0.010)**	(0.009)**	(0.008)**	(0.020)**	(0.007)**	(0.012)**	(0.013)**	(0.018)**	(0.010)**	(0.009)**	(0.021)**	(0.020)**	(0.012)**	(0.008)**
lower skill manual	-0.436	-0.515	-0.207	-0.305	-0.221	-0.280	-0.514	-0.467	-0.499	-0.277	-0.441	-0.369	-0.426	-0.346	-0.336
	(0.013)**	(0.013)**	(0.010)**	(0.010)**	(0.022)**	(0.010)**	(0.014)**	(0.013)**	(0.020)**	(0.015)**	(0.011)**	(0.024)**	(0.023)**	(0.016)**	(0.011)**
NACE - industry(C,D,E) as reference level															
(A,B)	-0.353	-0.271	-0.370	-0.446	-0.944	-0.376	-0.302	-0.311	-0.355	-0.441	-0.931	-0.314	-1.313	-0.402	-0.151
	(0.021)**	(0.014)**	(0.013)**	(0.014)**	(0.030)**	(0.013)**	(0.015)**	(0.023)**	(0.023)**	(0.020)**	(0.010)**	(0.032)**	(0.017)**	(0.026)**	(0.015)**
(F)	-0.197	0.157	-0.072	-0.098	-0.020	-0.067	0.105	-0.194	0.078	-0.042	-0.114	-0.029	-0.040	-0.142	-0.092
	(0.013)**	(0.012)**	(0.009)**	(0.010)**	(0.025)	(0.010)**	(0.015)**	(0.015)**	(0.021)**	(0.013)**	(0.011)**	(0.022)	(0.020)*	(0.016)**	(0.010)**
(G)	-0.248	-0.069	-0.202	-0.183	-0.151	-0.156	-0.140	-0.296	-0.104	-0.145	-0.216	-0.096	-0.065	-0.129	-0.133
	(0.010)**	(0.013)**	(0.010)**	(0.009)**	(0.023)**	(0.008)**	(0.014)**	(0.015)**	(0.020)**	(0.011)**	(0.010)**	(0.021)**	(0.018)**	(0.013)**	(0.010)**
(H)	-0.457	-0.056	-0.258	-0.295	-0.293	-0.269	-0.218	-0.407	-0.154	-0.299	-0.211	-0.225	-0.071	-0.253	-0.154
	(0.021)**	(0.021)**	(0.013)**	(0.017)**	(0.031)**	(0.014)**	(0.027)**	(0.018)**	(0.035)**	(0.022)**	(0.020)**	(0.028)**	(0.039)	(0.022)**	(0.016)**
(I)	-0.147	0.098	-0.022	-0.047	-0.048	0.023	0.026	0.120	0.071	-0.057	0.005	0.160	0.012	-0.015	0.029
	(0.013)**	(0.013)**	(0.012)	(0.012)**	(0.028)	(0.012)*	(0.015)	(0.017)**	(0.022)**	(0.013)**	(0.011)	(0.032)**	(0.020)	(0.016)	(0.011)**
(J)	0.133	0.292	0.164	0.069	0.205	0.225	0.283	0.115	0.202	0.149	0.082	0.386	0.168	0.154	0.050
	(0.013)**	(0.036)**	(0.017)**	(0.013)**	(0.031)**	(0.015)**	(0.034)**	(0.016)**	(0.045)**	(0.016)**	(0.020)**	(0.044)**	(0.041)**	(0.023)**	(0.018)**
(K)	-0.180	-0.057	-0.105	-0.069	-0.053	-0.073	0.010	-0.149	0.002	-0.035	-0.148	-0.011	-0.021	-0.081	-0.082
	(0.011)**	(0.016)**	(0.012)**	(0.011)**	(0.025)*	(0.010)**	(0.022)	(0.015)**	(0.027)	(0.011)**	(0.013)**	(0.030)	(0.028)	(0.015)**	(0.013)**
(L)	-0.121	0.006	0.173	-0.093	0.143	0.101	0.125	0.165	0.091	0.059	0.034	0.177	0.059	0.005	0.025
	(0.010)**	(0.016)	(0.011)**	(0.009)**	(0.024)**	(0.010)**	(0.018)**	(0.016)**	(0.024)**	(0.012)**	(0.013)**	(0.025)**	(0.029)*	(0.017)	(0.010)*
(M)	-0.102	-0.072	0.217	-0.130	0.126	0.142	0.002	0.169	-0.044	-0.081	0.103	0.184	-0.055	0.038	-0.086
	(0.012)**	(0.014)**	(0.013)**	(0.011)**	(0.027)**	(0.011)**	(0.015)	(0.017)**	(0.024)	(0.013)**	(0.012)**	(0.028)**	(0.026)*	(0.016)*	(0.011)**
(N)	-0.184	-0.095	0.041	-0.084	0.008	0.081	-0.099	-0.004	-0.012	-0.053	-0.190	0.054	-0.045	-0.023	-0.132
	(0.010)**	(0.017)**	(0.013)**	(0.010)**	(0.024)	(0.011)**	(0.017)**	(0.016)	(0.027)	(0.011)**	(0.013)**	(0.028)	(0.027)	(0.017)	(0.012)**
(O,P,Q)	-0.235	-0.177	-0.190	-0.256	-0.195	-0.142	-0.104	0.011	-0.062	-0.169	-0.115	-0.038	0.052	-0.111	-0.136
	(0.012)**	(0.018)**	(0.012)**	(0.010)**	(0.030)**	(0.010)**	(0.019)**	(0.015)	(0.029)*	(0.017)**	(0.015)**	(0.030)	(0.028)	(0.020)**	(0.013)**

Table 4 (part 2): Parameter estimates of wage regressions, control variables without health

	DE	EE	ES	FR	IE	IT	LT	LU	LV	NL	PL	PT	RO	SI	SK
tenure (years)	0.028	0.019	0.022	0.016	0.029	0.015	0.012	0.030	0.017	0.016	0.016	0.029	0.007	0.022	0.012
	(0.001)**	(0.002)**	(0.001)**	(0.001)**	(0.003)**	(0.001)**	(0.002)**	(0.002)**	(0.004)**	(0.001)**	(0.001)**	(0.003)**	(0.002)**	(0.002)**	(0.002)**
tenure squared	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)**	(0.000)	(0.000)**	(0.000)	(0.000)**	(0.000)**	(0.000)**	(0.000)	(0.000)**	(0.000)**
Year dummy - 2008 as reference level															
2005	0.010	-0.016		-0.001	0.000		-0.026	-0.021		0.059	-0.054	-0.527		-0.022	-0.022
	(0.006)	(0.010)		(0.007)	(0.000)		(0.011)*	(0.009)*		(0.008)**	(0.007)**	(0.032)**		(0.011)*	(0.007)**
2006	0.000	-0.003	0.022	0.008	0.000		0.001	-0.009		0.032	-0.024	-0.524		0.005	-0.026
	(0.000)	(0.009)	(0.006)**	(0.007)	(0.000)		(0.011)	(0.009)		(0.008)**	(0.007)**	(0.034)**		(0.010)	(0.007)**
2007	-0.006	0.012	0.003	0.012	0.008	-0.000	-0.015	-0.012	0.042	-0.006	-0.019	-0.002	-0.021	-0.002	-0.011
	(0.006)	(0.009)	(0.006)	(0.006)	(0.011)	(0.005)	(0.010)	(0.009)	(0.011)**	(0.007)	(0.007)*	(0.012)	(0.010)*	(0.010)	(0.007)
R^2	0.23	0.27	0.26	0.25	0.34	0.24	0.31	0.46	0.30	0.28	0.38	0.38	0.58	0.31	0.20
N	33,708	22,393	36,964	35,736	8,451	37,530	19,097	16,351	9,571	19,386	54,122	8,533	13,456	15,544	25,387

* $p < 0.05$; ** $p < 0.01$

NACE 1.1 sectors: A- Agriculture, hunting and forestry; B- Fishing; C- Mining and quarrying; D- Manufacturing; E- Electricity, gas and water supply; F- Construction; G- Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; H- Hotels and restaurants; I- Transport, storage and communication; J- Financial intermediation; K- Real estate, renting and business activities; L- Public administration and defence; compulsory social security; M- Education; N- Health and social work; O- Other community, social and personal service activities; P- Activities of households; Q- Extra-territorial organizations and bodies.