Health, productivity and ageing

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Abstract

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Keywords: ageing, productivity, health

JEL Classification Numbers: I15, J11, J24

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1 Introduction

Demographic change is undoubtedly the most important development that will affect the European labour market over the next decades (Börsch-Supan (2003); Michaelis and Debus (2011); Fertig et al. (2009); Gangl (2002). The increasing life expectancy and rising proportion of older people in the total population will bring up questions and heated policy debates about the sustainability of welfare states and social security systems, primarily focussing on pensions.(Schmähl (1990); Fougère and Mérette (1999); Bloom et al. (2010)). This will lead to issues regarding the possibility of longer working lives and raising the retirement age to 70 (or above). One of the major concerns relates to the ability of older workers to remain on the labour market and earn their living due their oft assumed and discussed health issues.

The health status of older age groups is believed to be the main driver of their declining productivity, pushing them out of the labour market and/or lowering their labour income. Thus, from the macro perspective, concerns about the impact of ageing on productivity translate into worries about the future economic growth and public finances. To tackle these issues one needs a deeper understanding of the relationship between health, ageing and the individual economic consequences. Our paper aims at supplementing the existing literature by providing a comparative cross-countryanalysis of individual age-wage profiles for different health statuses, for which there is currently limited evidence available. We will attempt to answer the question about the relationship between individual health and productivity (proxied by wages, in line with the neoclassical theory) and its changes during the life cycle, thereby 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) has suggested that economic transformation and deep structural changes fasten the pace of productivity deterioration.

2 Health, productivity and age relationships

Most studies suggest that productivity peaks at the age of 30-45 and starts to decline at around the age of 50 (Cardoso et al., 2011; Cataldi et al., 2011; Goebel and Zwick, 2009; Skirbekk, 2008), although some authors find no decrease as people get older (Aubert and Crépon, 2003; Hellerstein et al., 1999). The rate at which productivity decreases varies considerably among different groups of workers, depending on their levels of human capital, the types of jobs they hold and their task-content [1]. The age gap in productivity levels is also higher among skilled workers (Lovász and Rigó, 2013). Furthermore, certain skills such as reading or the 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) is constantly increasing due to the skills-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 that older workers are less efficient (Van Dalen et al., 2010). In particular they are perceived to be less able to adapt to new solutions and technologies and thus less efficient at work (Turek and Perek-Bialas, 2013). Despite the fact that the effectiveness of investments in human capital decreases sharply over time (Cunha et al., 2010), the decline in productivity could be offset by education investments as employees get older (Katzman, 1993). Having said that, the life-long learning rates are very low for those aged 50+ (OECD, 2009, 2012).

Health is generally expected to worsen with age, although this relationship is not linear (Hunt et al., 1984). Several studies find increasing health inequalities during the life-cycle (Deaton and Paxson, 1998) as well as important cohort differences (Idler, 1993). The impact of health on productivity is also fairly obvious. Better health translates into a higher employability, higher accumulated human capital

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

(also due to more job experience), and therefore higher wages. At the same time higher productivity and higher incomes allow more money to be invested in the employees' own health and the health of their children, 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 rate of industrialised countries over the long term, while Cole and Neumayer (2006) state that health problems (such as malaria or malnutrition) have a negative impact on economic growth. Children who experience poor health have a significantly lower level of educational achievement, poorer health and lower social status as adults (Case et al., 2005; Smith, 2009; Currie et al., 2010) as well as a lower willingness to compete in the future (Bartling et al., 2012). Health problems at later stages in life also decrease income in the future (Luft, 1975; Savedoff and Schultz, 2000). Human capital and health are also perceived as the main drivers of economic growth and fertility (Ehrlich and Yin, 2014). Finally, Hashimoto and Tabata (2010)'s theoretical model predicts a lower per capita income growth rate resulting from increased health sector employment due to the ageing population, although this may only be true for small economies with limited capital Aisa and Pueyo (2013).

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 leave lead to lower wages, a higher probability of job separation and the lower probability of finding a new job. The self-perceived worse health status is also one of the most common reasons for early retirement (Bound et al., 1999). Nevertheless, the worsening of health with age may not apply to those productive age, but to the older cohorts. Ng and Feldman (2013) in their meta-analysis of extensive literature, found that older employees fare worse on clinical health indicators, but do not report higher levels of physical health problems and do not have more mental problems or suffer more from psychosomatic complaints. This is related to the so-called morbidity compression phenomenon, as higher life expectancy implies a

higher number of disability and disease-free years (Bloom et al. (2007). Worsening health may, however, impact the productivity of certain groups of workers, particularly those who are self-employed or those working in hot conditions; although this can be alleviated by redesigning the workplace (Shepard, 2000).

Individual productivity is difficult to examine and measure, which is why various proxies are used. For instance, the employees' age-specific contribution to the total company output is estimated by the firm's level data on value added and employment structure based on age. Some studies provide evidence about signals of higher or lower (potential) productivity, which include the health status or physical or mental abilities. From a macroeconomic perspective, estimates about the productivity of different age groups are usually based on the distribution of their employment rates. However, proxying employees' productivity with their individual wages remains the most popular approach, thereby reflecting the neo-classical theory. The information gap between the employer and employee may, however, affect optimum labour contracts being achieved, resulting in underpaying young workers (relative to their productivity) and overpaying those with more experience (Lazear, 1979), although the empirical evidence remains rather inconclusive in this respect (Skirbekk, 2008; Van Ours and Stoeldraijer, 2011). Among other things, Cardoso et al. (2011) suggest that young people's wage growth follows productivity dynamics, whereas this is not the case for employees of a prime working age. As a result, older people are worth their pay, which reflects their contribution to total output. Hellerstein et al. (1999) found 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 older ones.

3 Data and methods

We have based our analyses on semi-parametric regressions, which differ from the OLS in the way that they enable one or more regressors to be included without making a priori assumptions about the form of the functional relationship with

the endogenous variable. We model the age (g) - productivity (p) relationship in a non-parametric manner, 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 the Robinson (1988) estimator. Therefore, the parameters are estimated by applying OLS on transformed data:

$$p - E(p|g) = \sum_{j=1}^{n} \tilde{\alpha}_j (x_j - E(x_j|g)) + \sum_{i=1}^{4} \tilde{\beta}_i (h_i - E(h_i|g)) + f(g) + \epsilon \tag{2}$$

and the non-parametric relationship is calculated 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 by using kernel-weighted local polynomial smoothing with a Gaussian kernel.

The model is estimated by applying the EU-SILC 2005-2008 micro-data for 15 EU countries, separately for each country. EU SILC is an EU-wide representative survey on income and living conditions with detailed labour market information. It is supervised by Eurostat. We have used information about the type of job (occupation and sector defined by NACE 1 level) as well as personal characteristics (gender, education and tenure) as control variables, to explain the variations in the hourly wage. The initial sample size amounted to a total of 1,898,893 responses (Table 1). We have concentrated solely on employees, leaving us with a total of 584,554 individuals (from 13,440 in Portugal to 67,223 in Poland). The sample consists of working people between the age of 15 and 80 who reported their labour income. The exact number of responses is shown 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 statistics are provided in EU-SILC on a yearly basis. Hourly wages are calculated from the total labour income from wages and self-employment, divided by the number of hours worked. The denominator is calculated by applying the hours normally worked each week and the number of months spent at work over the last year. The hourly wage was normalised 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 were asked to assess their own health on a scale of one to five, 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 (Leroux et al., 2012; Idler and Benyamini, 1997).

The reported average health levels vary considerably across the different countries - on average only 50% of Latvian workers declare they have good health, while this

share is over 90% in Ireland. The disparities in health status among countries are much smaller amongst the youngest group of workers and increases considerably for the older groups. Table 2 shows the overall distribution of individuals according to their age and health status. The self-perceived health status clearly worsens with age. More than 90% of those aged 15-24 reported a good or very good health status, this figure is 81% for 25-44 year olds, 61% for 45-54 olds and 47% for those aged 55-64. The drop in at least good health levels is considerable for 65+ year olds. Similarly, although the share of individuals declaring bad or very bad health increases steadily with age (from 1.4% for the youngest group to 15.4% for 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

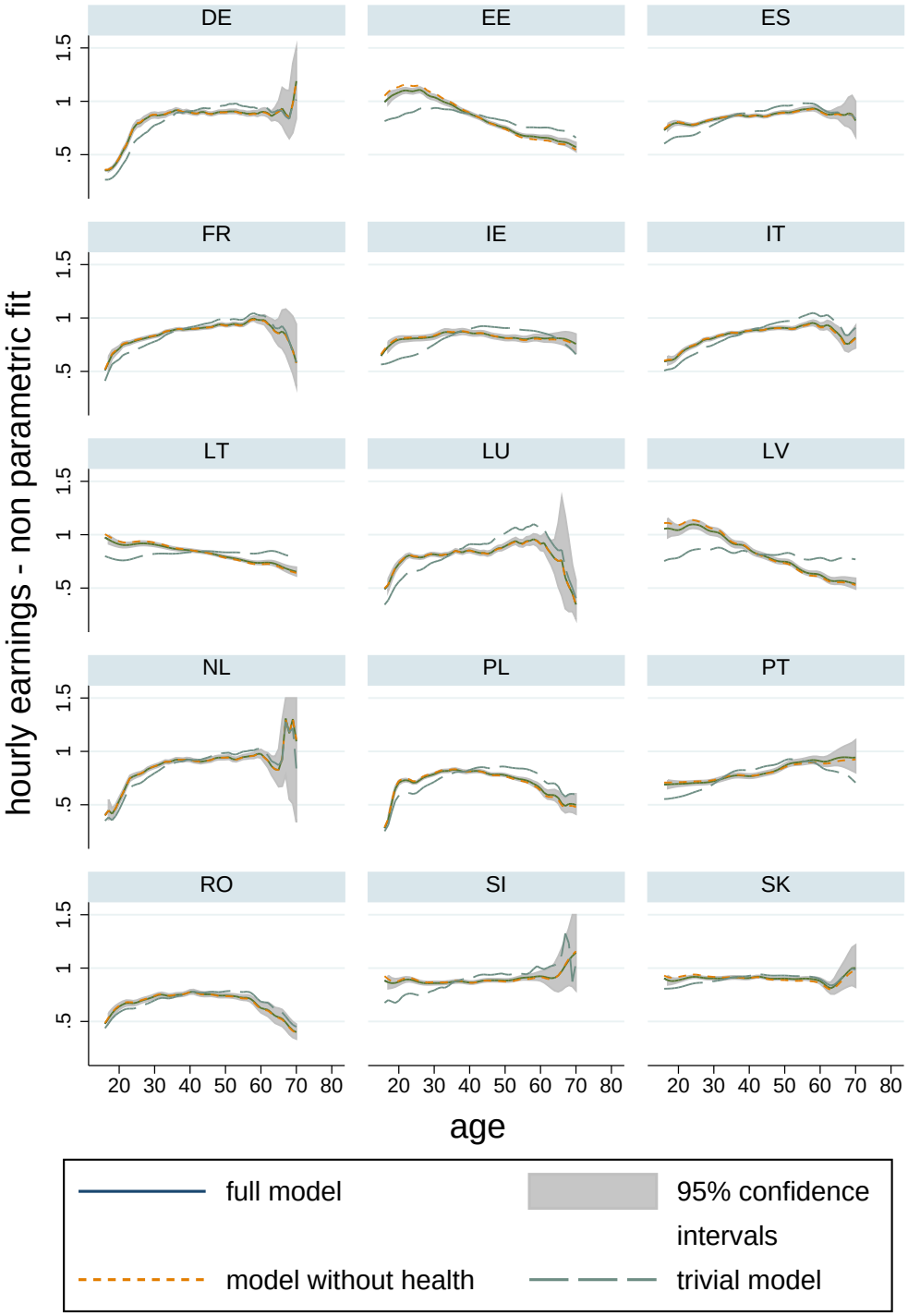
Source: Own calculations.

he declared health statuses are significantly better amongst the working population. More than 77% of workers reported good or very good health, compared to 49% non-employed. Bad or very bad health is much more frequent in the latter group. If we concentrate solely on the working population, the health status appears to be similar amongst both low and highly-paid workers. The distribution of workers with different health status is comparable among the wage quantiles, suggesting that wages are not influenced - on average - by health. Nevertheless, the question about whether this relationship remains stable throughout the whole life cycle remains valid and is dealt with in the next section.

4 Results

Table 3 summarises the results of the estimates. The impact of individual and company characteristics is in line with the theoretical predictions and the results of 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 the level of wages compared to people with tertiary level degrees. More work experience increases the probability of higher earnings, although this relationship is non-linear and the rate of increase drops slightly with age. Workplace characteristics also play an important role in determining workers' wages. With regards to the 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. The sector the company is in is also important: wages tend to be higher amongst employees working in manufacturing and financial services and lower in other sectors of the economy. These patterns are broadly consistent amongst all the analysed countries. Turning to our main variable of interest, the self-defined health status, we have found that its impact on wages is statistically significant in all EU member states. Workers declaring they are in good health are likely to earn lower wages compared to employees with very good health, and although the difference is relatively small, it is statistically significant in a great majority of cases. The negative coefficients associated with "fair" and "bad" health increase in scope 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 relationship to workers with "only" bad health is less obvious (the coefficients are smaller in Italy and Poland). The wage premium of very good health in relation to bad or very bad is about 10-20% and is of a similar size to the wage difference amongst men and women and significantly smaller than the educational, occupational or sector wage premium. Additionally,

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



Source: Own calculation.

Table 4 presents the results of the same analysis with the 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 shows the relationship with all the variables presented in Table 3, whereas the "model without health" line indicates the wage profile, factoring out the impact of health status. Firstly, the age-wage patterns (controlling for the set of characteristics described above) display three different broad patterns among EU member states. They resemble a U-shaped relationship in France, Italy, Luxembourg, Poland and Romania, whereas they are more flat in Spain, Ireland, Lithuania, Portugal, Slovenia and Slovakia (and Germany too, although the youngest workers experience steep rises at the beginning of their working careers). In Estonia and Latvia wages tend to decrease with age, while all the other indicators remain equal. Secondly, the key individual and workplace characteristics explains a large number of the differences in age-wage life-cycle profiles. In all countries, wages are therefore higher for younger people (than they would be if other factors had not been controlled for) and lower for older people (compared again to a simple age-wage profile).

If we focus on the main question of our analysis, it is evident that the self-reported health status has no impact on the age-productivity profiles of workers. Combining these results with the estimated statistically-significant coefficients associated with health levels, we can see that health influences the level of earnings, but has virtually no influence on the dynamics of 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 95% confidence intervals[2]. If regressors are included in the wage equation the age profiles are flattened, proving that age differences are mostly driven by the variation of cohort structures as well as by the life cycle dynamics in terms of sector, occupational

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

and educational characteristics.

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

5 Conclusions

Our study aimed at jointly analysing the relationship between workers' age, health and productivity. We studied data about individuals from 15 EU countries, separating the impact of age on productivity in a non-parametric manner and controlling for health status (together with other classical wage determinants). We found that the age-productivity profiles vary a lot from country to country, but that these differences are not significantly influenced by the self-perceived health in any country in the sample. Although the health status does impact the average level of individual wages, it does not affect the life cycle dynamics.

Our results suggest that the importance 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 an ageing workforce on productivity (and therefore economic growth) seem to be overstated, and health does not appear to be the crucial challenge for extending working lives and increasing the employment rates of older workers. At the same time a clear need is emerging to tackle other causes of falling productivity at an older age. These appear to be mostly driven by skills mismatches and the changing relative demand for tasks and cognitive abilities (Skirbekk, 2008), although the question about the different dynamics of these changes (or the fact

that we have not observed 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.