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Abstract

The age-productivity and age-employment profiles in each of the 28 European countries are investigated jointly using the harmonized survey of income and living conditions (EU-SILC). Based on the employment rates and the age of leaving the labour market, we propose four clusters of countries: with high employment rates and long employment, low employment rates and short employment and the two intermediate categories. With non-parametric and semi-parametric methods, we find evidence that the process of leaving the labour market is highly selective in countries with short employment pattern. Those leaving the labour market earliest are those with lowest productivity in countries with short employment, contrary in countries with long employment and low employment rates and we find no evidence of selection in countries with high employment rates and long employment.

Keywords: productivity, wage-profile, ageing, life-cycle dynamics

JEL Codes: C14, J21, J24

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1 Introduction

The aim of the paper is to investigate the relationship between changes in productivity and employment with age. I present a comparison of the age-earnings profiles in selected European countries in relation to the age-employment structures. The average age-earnings profiles are affected by the selectivity of the transition out of the labour market.

This work adds to the existing empirical results by presenting a cross-country comparison of hourly wages by age with 1-year grid, attempting to take into consideration the general and specific human capital. In most of the available articles, the age-earnings profiles are presented in 5-10 year age groups, with the oldest being 65+. That makes it impossible to draw any conclusions about the earnings of the oldest workers. What is more, the presented results are not restricted to wages, but all labour related earnings are taken into consideration. The analysis sheds light on the interaction between the employment and productivity profiles among European countries.

There are significant differences in the age-wage patterns across countries, which can hardly be attributed to changes in the ability to perform certain tasks with age. The results of the semi-parametric regression enable us ascribe most of the differences in the behaviour of average hourly earnings to the changes in the working force structure. The decline of hourly wages is smallest in countries with the longest working life and the lowest retirement replacement rate, indicating that the structure of pension entitlements strongly affects not only employment, but also the wage structure of the population.

2 Literature overview

The human capital theory, which originates from [Becker, 1964, Ben-Porath, 1967, Mincer, 1974], constituted the basic perspective of analysing life-cycle wage determination. The human capital theory offers an explanation and points to the rise of specific human capital during the first years of work [Mincer and Ofek, 1982, Topel, 1990]. The rise in productivity occurs due to education, on-the-job training and learning by doing, not age per se. Recently, the theory of human capital has been developed by including the heterogeneity of skills and tasks [Acemoglu, 2002, Acemoglu et al., 2011, Autor and Dorn, 2013, Autor et al., 2003, Goos et al., 2009] as well as by including the psychological and neurological findings of human development [Heckman et al., 2006, Heckman, 2000, Cunha and Heckman, 2007, Cunha et al., 2006]. The alternative view of the age-wage relationship puts pressure on the asymmetry of information between employers and employees. It is a crucial part of the search theory [Merz, 1995, Mortensen, 1986] and of the signalling effect hypothesis [Stiglitz, 1975, Layard and Psacharopoulos, 1974, Weiss, 1995, Card, 1999]. Agents learn about the productivity of the employer-workplace match and therefore that the wage could rise with experience and indirectly with age. The older the employees become the more of them are better matched and, as a result, the average productivity also rises with age.

The literature about changes in ability to perform working tasks with age concludes that, thanks to the general education and learning-by-doing, ability rises over the first 10 years of the working life, reaching its maximum at about the age of 30-35. Then it becomes stable until around the age of 50, when it starts to decline [Cardoso et al., 2011, Cataldi et al., 2011, Goebel and Zwick, 2009, Skirbekk, 2008, Hertzog et al., 2008].

Individual productivity is hard to measure directly and therefore the evolution of workers' productivity during their lifespan cannot be directly observed. Value-added or total productivity are evaluated at company level and not personal level. What is more, the productivity of a worker does not just depend on his/her abilities and skills but also on the workplace characteristics and the structure of labour demand. However, there are still observable variables that indicate productivity changes. First of all, since the deterioration of a health condition affects workers' productivity, especially in later life, the general health status can be observed. Also, the ability to perform specific tasks (physical or intellectual) during a lifetime may be tested. Finally, the employment rates and earnings of various age groups and cohorts are measured by using social surveys or administrative sources. Neoclassical economics contends that wages mirror marginal productivity and apart from personal wealth, retirement options and preferences, it is low productivity that pushes people out of work. There are also some studies that research firm' productivity, trying to disentangle the effects of the age structure of the workforce on the value added or total factor productivity. In this section, we summarise the main conclusions from the enumerated strands of literature.

The process of declining productivity is rather slow and strongly depends on both personal and job characteristics [Goebel and Zwick, 2009, Hellerstein et al., 1999, Van Loo et al., 2001, Neuman and Weiss, 1995]. Among workers, both the ability to work as well as the age interval of rapid depreciation vary greatly depending on the type of tasks and the human capital they possess [Oster and Hamermesh, 1998, Castellucci et al., 2011, Desjardins and Warnke, 2012]. Some abilities like reading, vocabulary or ability to work in a team depreciate very slowly, whereas cognitive speed and memory are more prone to decline with age. Unused abilities tend to depreciate fastest [Arthur Jr et al., 1998, De Grip et al., 2007]. Fitness levels (e. g. precision and hand-eye coordination) are lost most quickly [Verhaeghen and Salthouse, 1997, Waldman and Avolio, 1986, Park et al., 1999, Maitland et al., 2000]. Roger and Wasmer [2011] have confirmed that productivity drops faster in low-skilled, manual occupations. The faster depreciation of both manual abilities and skills that are not being used is common not only to human beings but also to other primates [Le Bourg and Minois, 1999]. These processes can be partially offset by certain behaviours. Katzman [1993] argues that participating in educational courses increases the synaptic density in the neocortical association cortex, and could therefore delay the onset of dementia by up to 4 to 5 years. In the seminal work Cattell [1971] introduced a distinction between fluid and crystal intelligence. The former concerns the ability to understand things without prior knowledge and depreciates faster than crystal intelligence. The latter refers to acquired or learned abilities where depreciation can be slowed to a large extent [McArdle et al., 2000, Baltes, 1993].

Another important aspect of the productivity loss which accelerates the deterioration competences, is the fact that tasks are constantly changing [Levy et al., 2003]. The more rapid the technological change, the faster competences become out-of-date [Börsch-Supan et al., 2005, Bertschek and Meyer, 2009]. When accelerating technological progress is combined with the loss of ability and motivation to gain new competences, accompanied by the shorter expected working time of older people, they become more prone to a loss in productivity, employment and earnings. Partial confirmation of these process have been found by Mahlberg et al. [2013b], who showed that age-productivity patterns differed strongly across regions and sectors in Austria.

The loss of health, flexibility and cognitive and manual skills with age is off-set by increased experience and a better attitude to work [Barth et al., 1993]. Borsch-Supan and Weiss [2008] tested these effects with the use of precise data on an assembly line in the manufacturing industry. The output and production times of every worker were able to be precisely measured. Consequently, they found that the loss of flexibility was cancelled out by experience and, as a result, the profiles of productivity remain flat until the age of 63.

To better describe the process of declining employment rates at older age, the concepts of work capacity or employability have been coined by [Robertson and Tracy, 1998, Forrier and Sels, 2003, Vandenberghe et al., 2013]. These terms resemble the change in life-time employment to the life-time ability to be employed. This strand of literature confirms that the ability to work is not the main factor forcing people to leave the labour market. A report by the International Labour Organisation even concludes that it is out of the question that older workers can remain competitive, but rather the question is how to convince employers that older workers are competitive and it is worth adapting the workplace for them (cited by Robertson and Tracy [1998]).

According to neo-classical economic theory, wages mirror marginal productivity. However, this basic assumption has been challenged both theoretically and empirically. Research into concepts of asymmetric and incomplete information offers an explanation about why wages might not precisely reflect the age pattern of productivity. For instance, in some types of jobs the youngest workers may be underpaid and the oldest overpaid. Information asymmetry between the employer and employee explains this phenomenon as follows. Labour contracts are constructed in such a way that it is ideal to underpay young workers and overpay those with more experience [Lazear, 1979]. 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]. Naomi and Kazuhiko [2013] have shown that according to human capital theory, earnings rise with tenure at a decreasing speed, whereas wages show a different pattern. Therefore workers are overpaid in junior years and later in their career.

Empirical evidence about the relationship between wages and productivity is mixed. Applying an employer-employee dataset for the Netherlands [Van Ours and Stoeldraijer, 2011] and Austria [Mahlberg et al., 2013a] showed little evidence of an age-related pay-productivity gap. These authors also reject a drop in productivity among older workers. Similarly, the productivity and wage age profiles mirror each other according to the results of Hellerstein and Neumark [1995]. Contrary to this, Cardoso et al. [2011] have shown that wages peak at the age of 40-44 whereas productivity peaks at 50-54. They measure productivity by looking at the value added and the age structure of employees. Vandenberghe et al. [2013] and Cataldi et al. [2012] found a significant decline in the productivity of Belgian workers. Other empirical results about this phenomenon are not definitive (see Skirbekk [2008] and de Hek and van Vuuren [2011] for an overview). Apart from age, Hellerstein and Neumark [1999] could not find any significant gender differences between productivity, measured as the value added per worker, and wages. With the same data Hellerstein et al. [1999] found no systematic difference in the relationship between the relative wages and relative productivity of Afro-Americans.

A combined analysis of wages and employment profiles is performed by Myck [2010]. They studied wage and employment profiles together, although only using data from Germany and Great Britain. They found that the wages of those retiring in the coming year are significantly lower than those who are still working.

Most studies dealing with the relationship between age-productivity and age-earnings focus on one country on even one industry within a country, with the exception of the OECD [1998] report. Therefore any evidence about the relationship between labour market institutions and the life-cycle dynamics of productivity and wages regarding employment is rather scarce. We are attempting to fill this gap.

3 Methods and data

We have used the non-parametric kernel estimators and semi-parametric regression models that best enable us to show the hourly earnings profiles. Every model is estimated separately for each country. The kernel estimators are well-suited for checking the continuous relation between age and earnings without the need for any functional form assumption. To make the analysis more extensive, the semi-parametric regression models are estimated. In the semi-parametric approach, assumptions are made about the functional relationships between some variables, but the key relationship between age and earnings remains free of functional assumptions. As a consequence, we can present the changes in the smooth wage-earnings profile after factoring out some variables. In all the specifications, we have chosen the Epanechnikov kernel with a value 0 (mean smoothing), and the bandwidth is chosen based on the ROT method for asymptotically-optimum constant bandwidth [Fan and Gijbels, 1996]. The semi-parametric estimator is a double residual Robinson [1988] estimator.

The semi-parametric regressions differ from the ordinary least square estimator (OLS) in that they enable the inclusion of one or more regressors without a priori assumptions about the form of the functional relationship with the endogenous variable. We model the age (g) - productivity (p) relationship non-parametrically and the other control variables (x) affecting productivity are included in a linear parametric way:

$$p = \alpha_0 + \sum_{j=1}^{n} \alpha_j x_j + f(g) + \epsilon \qquad (1)$$

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

$$p - E(p|g) = \sum_{j=1}^{n} \alpha_j (x_j - E(x_j|g)) + \epsilon \qquad (2)$$

and non-parametric relationship is obtained from the following equation:

$$f(g) = E(p|g) - \sum_{j=1}^{n} (\alpha_j x_j - E(x_j|g)) \qquad (3)$$

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

EU-SILC is a harmonized household income survey run in 28 European countries delivering reliable data on labour income, working time and job-related characteristics, that can be compared between countries. Income is reported for the whole of the previous year. It includes all sources of personal and household income, with a distinction between wages and self-employment, as well as the earnings structure (wage, taxes and social security contributions). In practice, however, the biggest sample of data available for most countries concerns gross earning so we therefore decided to use that. The results of surveys from 2004-2009 (earnings from 2003-2008) are pooled, after first being normalised with the mean hourly earnings for a given country. The hourly earnings are based on variables indicating the gross annual earnings (from self-employment and wage labour), the number of months in employment and the average number of hours worked per week. In order to avoid any influence by outliers, one percent of the highest and lowest earners were excluded. We obtain the relative hourly earnings for every person, with 1 indicating the average hourly earnings in any country in any year. Due to the unreliable data about the number of months spent working, especially for youngsters in Iceland and the UK, the sample was cut to only those working the whole year. As the robustness tests show, this restriction does not influence the results. Due to its small sample, Malta has been excluded from the analysis.

In the final sample, almost 3.1 million people over the age of 15, and over 1 million earners were looked at. The distribution by year/country is presented in Annex 1. There are differences in the year/country composition of the sample, but we do not expect it to influence the results. However, we verify it by adding yearly dummy variables to the regressions.

4 Results

4.1 Employment clusters

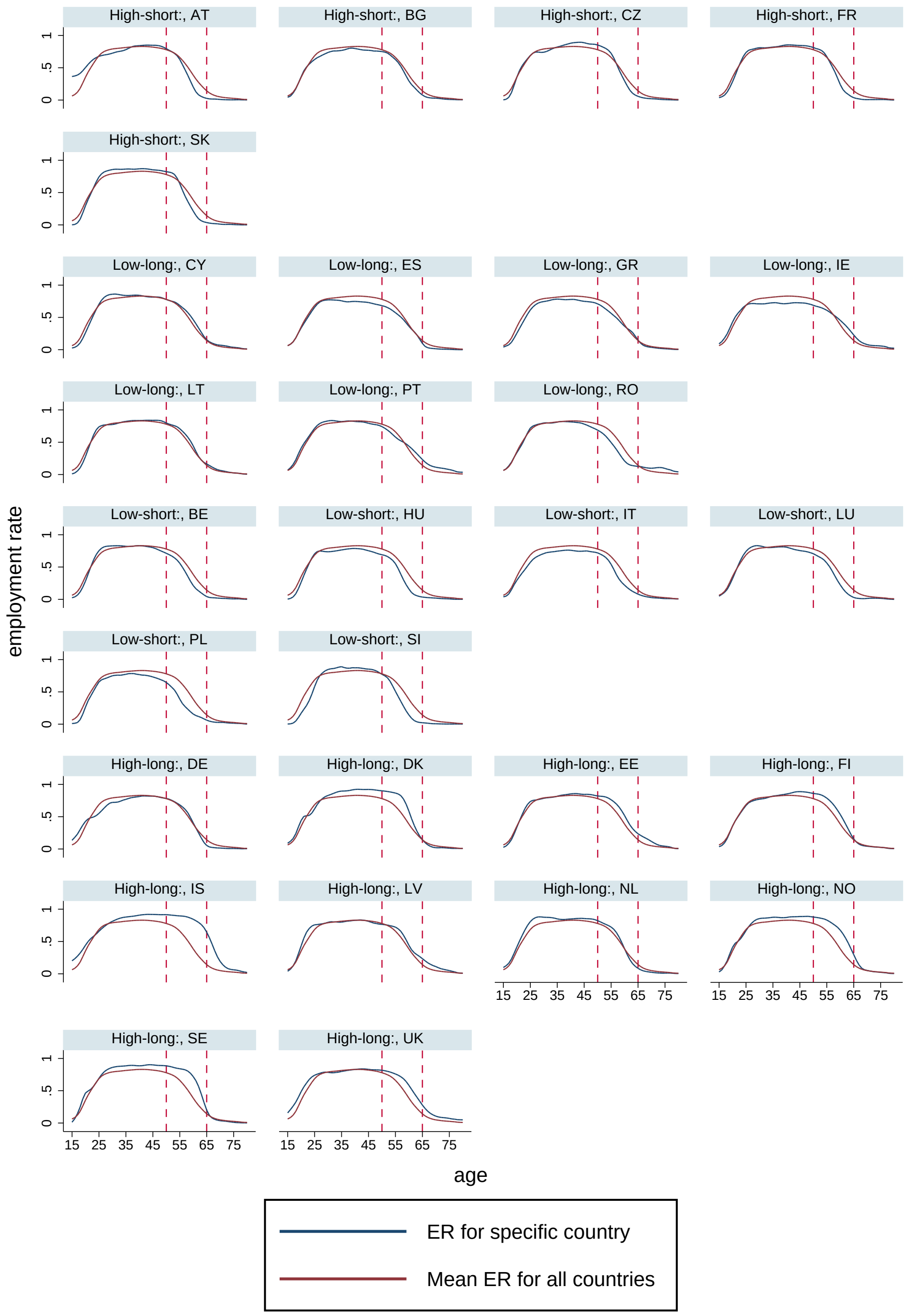
The actual loss in productivity and the ability to work at older age manifests itself on the extensive side – by quitting employment - as well as on the intensive side by shortening the working hours and reducing the hourly wage rate. They all mirror the loss in productivity, the ability and motivation to work as well as the labour market institution arrangements in the country, including common beliefs, laws and political institutions. In order to take this complexity into account I first present the age-employment profiles and group countries which have similar patterns. The employment rates by age group should contain the most important dimensions of the labour market institutions.

The general cross-country pattern of employment rates across age groups is as follows. It starts at low levels of around 20% for the 15-19 age group and grows to approx. 80% for the 25-55 age group, only to drop below 20% at around the age of 65. There are some interesting outliers in the employment rates in relation to the averages for (see Figure 1). In Denmark, Norway, Sweden, Iceland and the United Kingdom, the whole employment profile is above the mean for all countries. Despite their institutional differences, these countries are the best examples of effective activation policies, especially among people over the age of 45. At the other end of the spectrum are countries where the generally low level of employment is magnified in older age groups, such as Poland or Hungary. They are characterized by very low levels of effective retirement age, especially among women.

Based on the LFS employment rates of people above the age of 50, I conducted a clustering of countries which created a framework for further analysis. With the use of LFS employment rates for 5-year age groups above the age of 50, four groups of countries can be distinguished (see Figures 2 and 3). The clusters of countries are best characterized by two dimensions: the employment rate at the age of 51-55 and the average length of employment.

The first group (Austria, France, Czech Republic, Slovakia and Bulgaria) is called high-short because it contains countries with high employment rates of 50 year olds which drop sharply thereafter. It is worth noting that it does not necessarily imply a high employment rate throughout the prime age. The second group is entitled low-long (Ireland, Cyprus, Portugal, Spain, Greece, Lithuania and Romania). The employment rate is not as high at the prime age, but remains quite high after the age of 50. Countries with the weakest labour markets are called low-short (Belgium, Luxemburg, Italy, Hungary, Slovenia and Poland) as they have low employment rates which drop quickly after the age of 50. The final group of countries with the healthiest labour markets is characterized by high employment rates at all ages and is called high-long (Norway, Sweden, Finland, Netherlands, Denmark, Germany, Latvia, Estonia, Iceland, and the United Kingdom: see Figure

Figure 1: Employment rates by age for European countries against the mean employment rate for EU countries

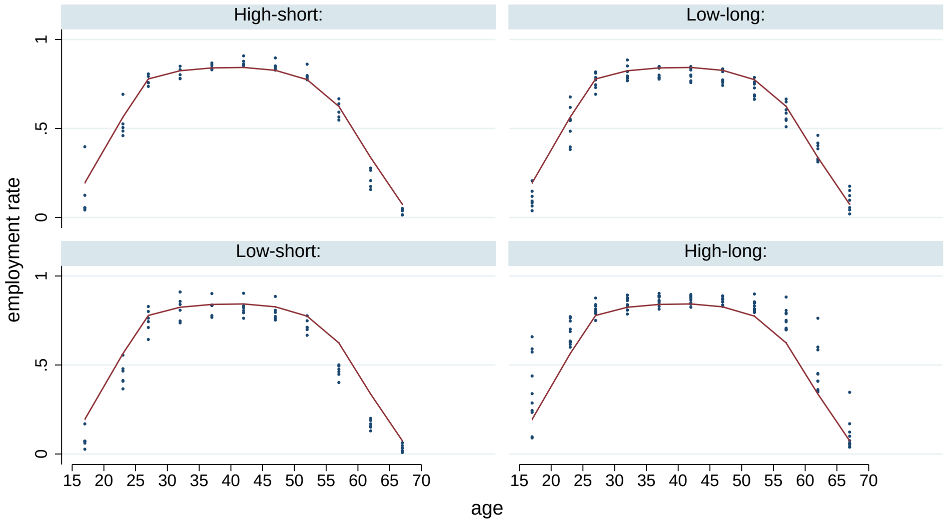


Source: Own calculation on EU-SILC data.

2). We will stick to these clusters in the further analysis because they are more informative in the context of age-earnings than the traditional institutional classifications such as North, Central-Eastern, South, Continental or Liberal (e.g. Ebbinghaus and Whiteside [2012]).

There are some controversial classifications amongst the clusters. In Belgium and Slovenia, the employment rates at prime age are similar to the average of all countries, but as they start to drop before the age of 50, I classify these countries in the low-short group and not in the high-short group. In Romania, employ-

Figure 2: Employment rates by cluster

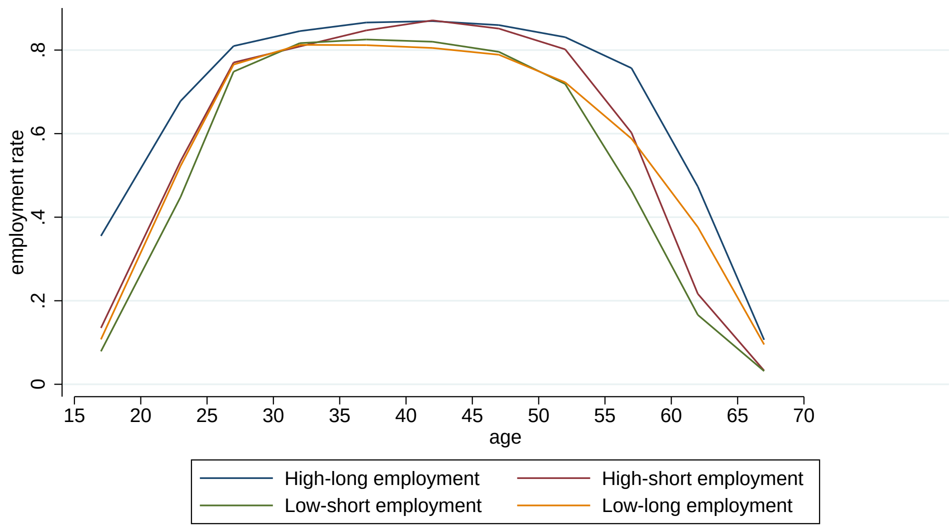


Remarks: Dots stand for particular countries, the line represents the unweighted mean employment rates for all countries.
Source: Own calculation based on LFS data.

ment rates start to go down before the age of fifty but remain high after 65, and therefore are is classified as low-long and not low-short. To be sure that the final results are not attributed to these decisions, I check if these cases affect the final results.

Differences between countries in the age-employment profiles for people below the age of 45 are commonly attributed to the variety of labour market institutions, cultural differences and the prevalence of part-time

Figure 3: Mean employment rates in clusters by age group



Remarks: the profiles for a cluster obtained by averaging the profile for all countries from given cluster.
Source: Own calculation.

jobs. However, the variation in the employment rate of people above the age of 50 is mostly ascribed to the structure of the pension system. The younger people are entitled to retirement benefits, the earlier they leave the labour market and the employment rate therefore drops [Blöndal and Scarpetta, 1999].

4.2 Productivity profiles among clusters

The employment rates at older ages and the working time affect average wages. If older people work part-time, combining retirement and social benefits with labour income, one can expect a drop in monthly wages. As this phenomenon is already well documented [O'Reilly and Fagan, 1998], we focus our attention strictly on hourly wages which should not be affected by the working time.

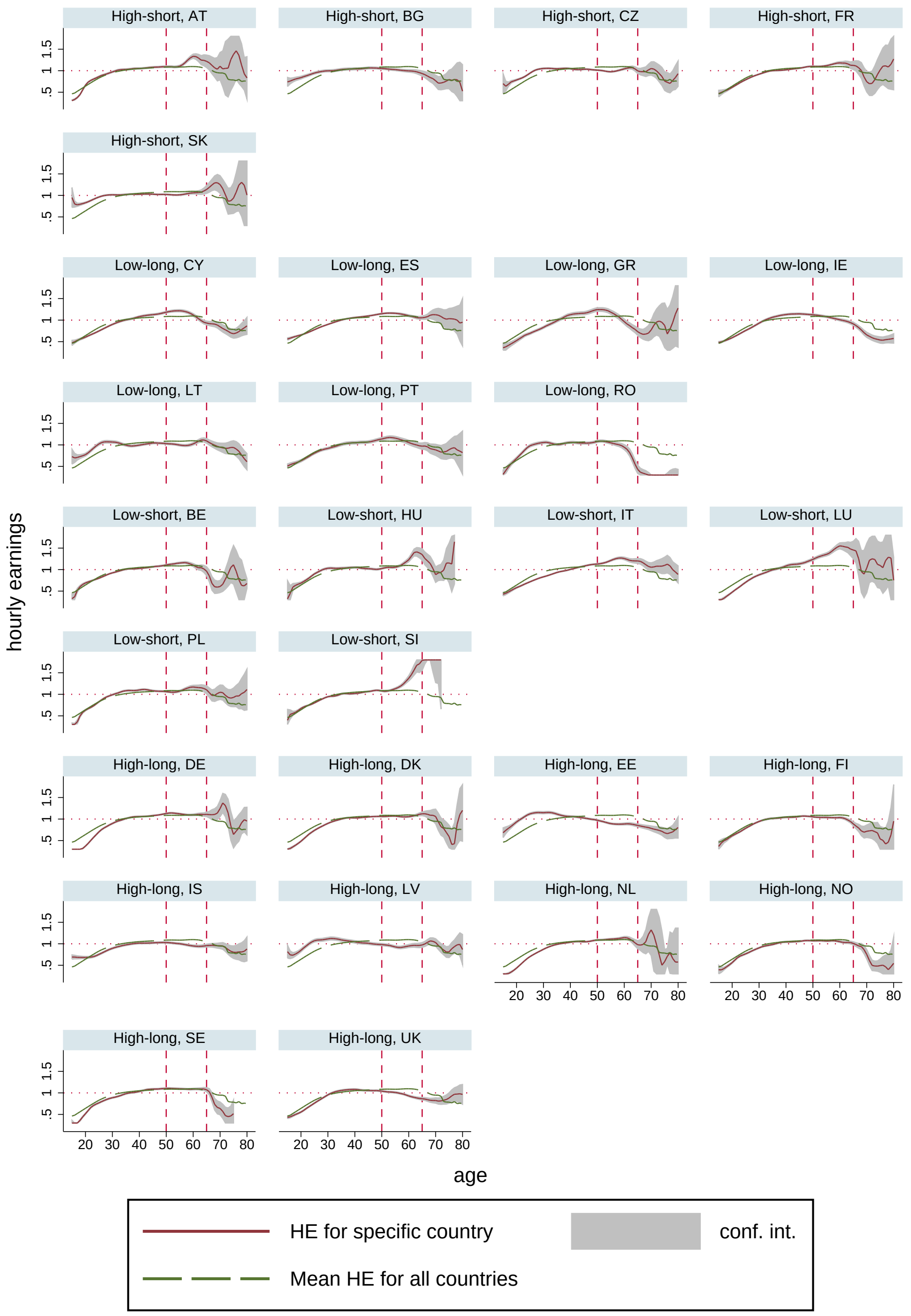
The mean hourly wage is, however, susceptible to influence from the effect of averaging across the population. Leaving employment is not a purely random process. On the one hand, the least productive people may leave first, as a low wage creates weaker incentives to work. As a result, the average wage might increase significantly. On the other hand, low-paid workers may have the lowest retirement benefits (out options) and therefore may be forced to work longer than better paid people with higher benefits and savings. Finally, different abilities depreciate at different rates which might also make the work-retirement transition non-random. To control these factors, we show not only average age-wage profiles, but we also run a semi-parametric regression to control for characteristics such as education, occupation and gender.

The average hourly earnings-age profiles are quite similar amongst the countries. They double to triple from the age of 15 to 35, partly due to higher educated people entering the labour market after age of 20, then they flatten out with a slight downturn after the age of 50 or 60. Due to the drop in the sample size (employment rates are less than 10%) and growth in variance, the standard error becomes too big to draw any conclusions for the 70 plus age group.

There are some outlier countries in terms of the age-earning pattern. In Luxembourg the profile is much steeper than average, with the peak being around 60. This may, however, reflect the true behaviour of earnings, as the structure of the Luxembourg economy differs significantly from that of other countries: it is just one big city with a huge financial sector and many affluent residents. In Romania it is the opposite: the profile plunges after the age of 60 with quite high employment rates after that time indicating the large number of elderly people working. We attribute this effect to the low retirement benefits and a huge and low-productive agricultural sector in which the elderly workers are concentrated [Roman and Roman, 2002, Parlevliet and Xenogiani, 2008]. It is hard to find an explanation for the peak at 25 years of age and then the steep drop in earnings afterwards in Latvia and Estonia (see Figure 4). However, these are small post-communist countries with a high premium on people with qualifications, who are more suited to a technology-based market economy, than for workers with qualifications that are more suitable for the previous economy. It is therefore a consequence of the interaction of age and technological progress in these countries. Taking the above points into account, we will check our results by excluding the questionable countries from the sample.

Averaging the profiles within clusters reveals the relationship between employment and earnings age patterns. For the countries with the healthiest labour markets (high employment rates and long employment), the hourly productivity profiles are flattest, and virtually don't change between the age of 35 and 67. On the contrary, for all the remaining clusters, there are quite interesting dynamics after the age of 45. In low-long countries, there is no flat interval in the whole profile; the peak of average earnings comes at 50 and then drops quickly afterwards. In countries with low-short employment, the average hourly wage starts to grow

Figure 4: Hourly earnings by age in European countries



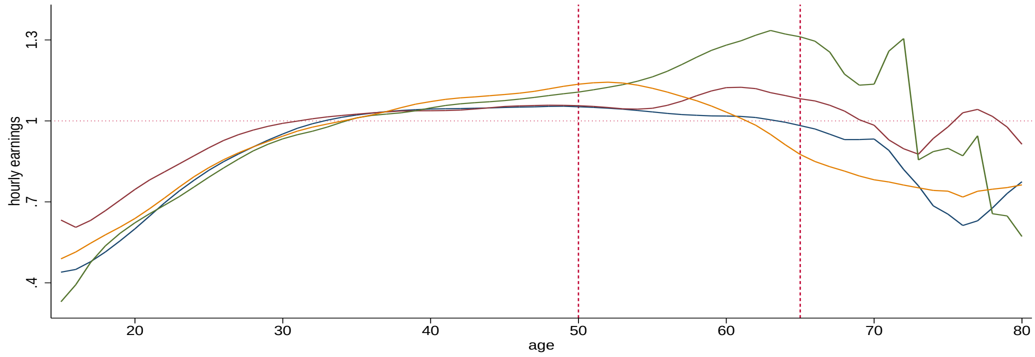
Remarks: hourly earnings are normalized so that the mean hourly earnings equals 1 for every country, 95% confidence interval.
Source: Own calculation based on EU-SILC data.

at about the age of 50, peaks at sixty and then drop sharply after 65. The profile for countries with a high-short employment pattern combines the features of high-long and low-short countries. It is flat until the age of 55 like in high-long countries, and then resembles low-short countries as it grows until the age of 60 and then drops (see Figure 5).

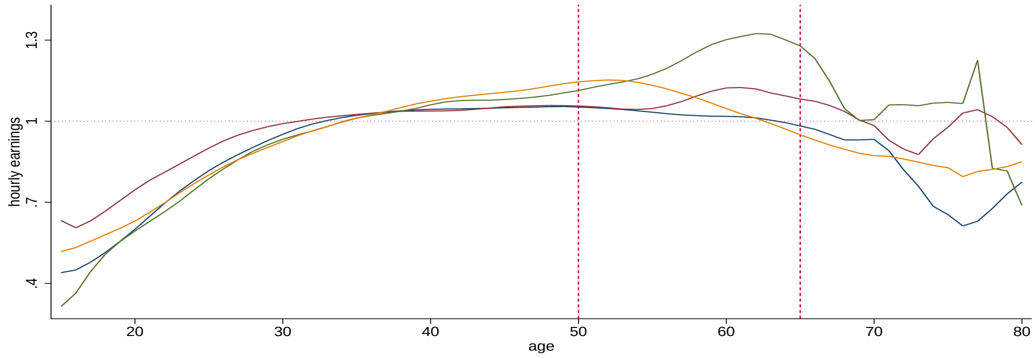
To sum up, the joint analysis of age-employment and age-productivity patterns showed unexpected results.

Figure 5: Mean hourly earnings profiles for clusters

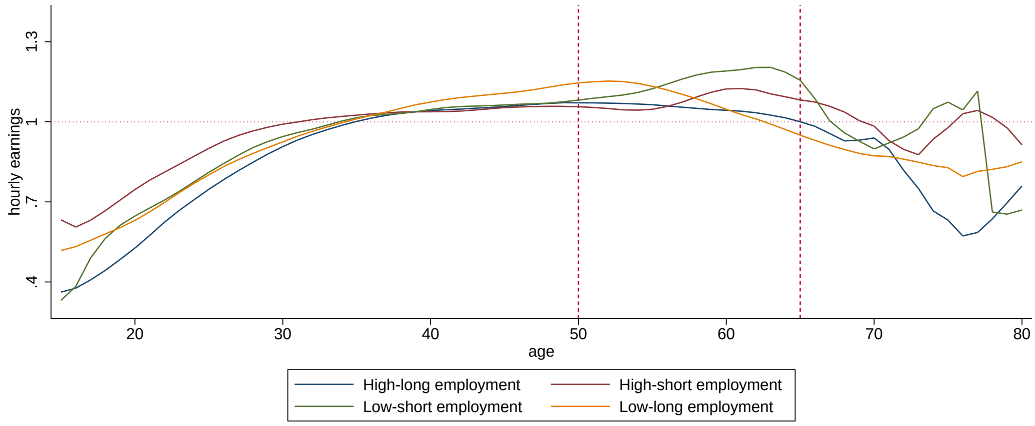
All countries included



Excluding outliers in respect to the classification to employment clusters - Belgium, Slovenia, Romania



Excluding outliers in respect to specific productivity profiles - Estonia, Latvia, Luxembourg, Romania, Slovenia



Source: Own calculation based on EU-SILC data.

In countries with an earlier retirement age, the average wage rises strongly after the age of 50. The higher the employment among older people, the weaker the observed effect is. In countries with a low but long employment pattern the drop in productivity starts earlier, indicating that less productive workers have to remain on the labour market longer. We analyse this phenomenon in detail in the following section.

4.3 Semi-parametric regression

The documented rise in productivity after the age of 50 needs further examination. There are at least two reasons to expect that the observed dynamics are driven by the selectivity of people leaving the labour market rather than the life-cycle dynamics of wages. Firstly, as has been shown in the analysis of employment dynamics (see Figure 1), the drop in employment rates is the most prevailing phenomenon in that lifespan on the labour market. Secondly, a jump in wages in the late fifties does not correspond to any convincing theory of wage determination. Further analysis verifies these hypotheses.

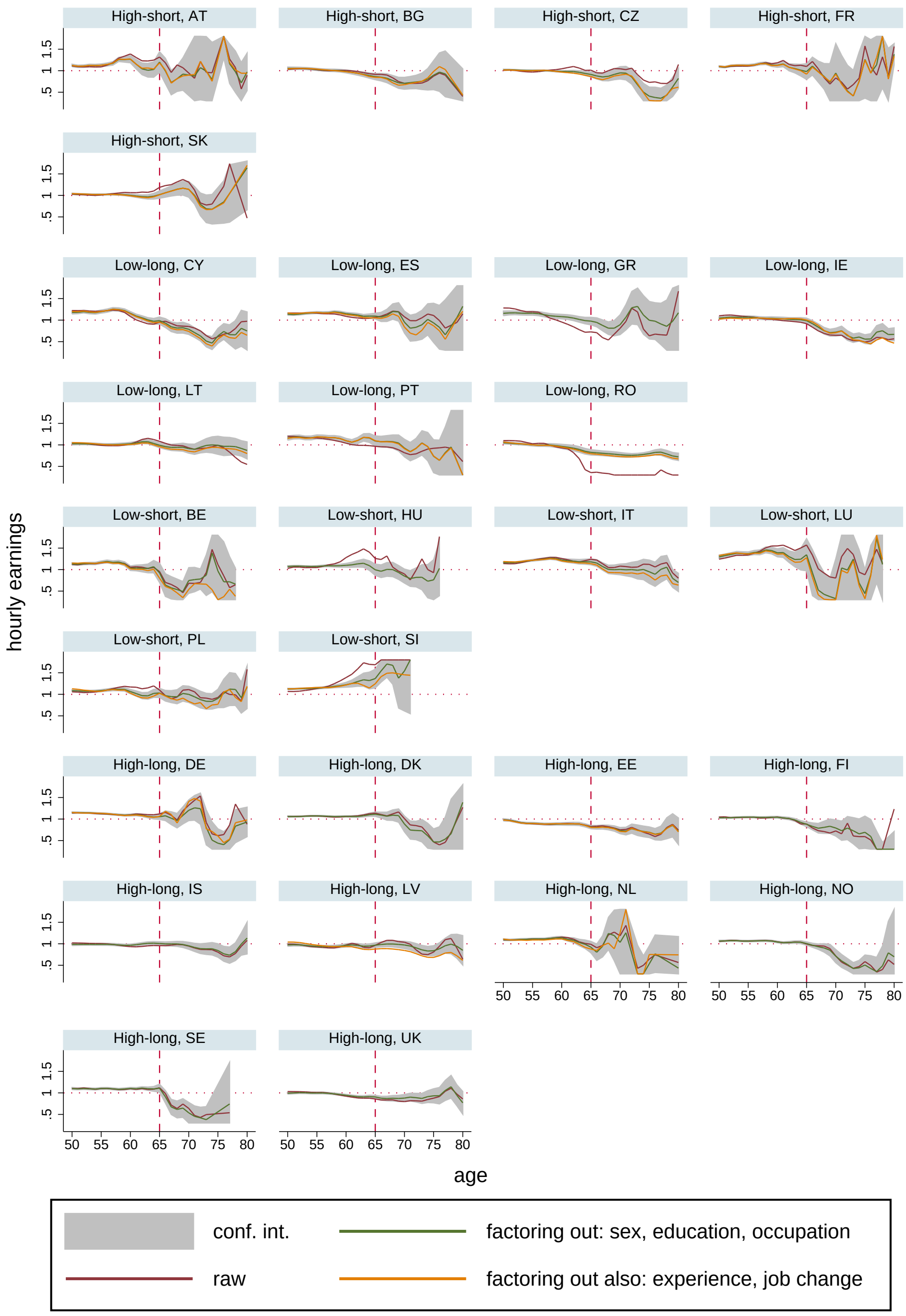
Using semi-parametric wage regressions we check if this is due to the heterogeneity of the retirement effect. Applying semi-parametric regression to each country enables us to factor out the differences in the gender, educational, occupational and health differences amongst the age groups. The parametric estimation results for specifying the with and without tenure effect can be found in Tables 3 and 4. Gender, education, health and tenure affect wages in the established way [Lis and Magda, 2014, Cataldi et al., 2011, Blau and Kahn, 1999, Christofides et al., 2013, OECD, 2012]. Men earn 10-30% more than women, higher education brings a 20-30% premium, such as working in blue-collar occupations. Bad health decreases productivity by 5-20%. Due to the lack of data about tenure and job changes for some countries the model extended to include these variables was only estimated for a sample of countries. The results are reported in Table 4. The inclusion of tenure hardly changes the impact of other variables. All models deliver reasonable estimates but it is the impact of age which requires special attention.

The non-parametric relationship between earnings and age, after checking all other variables, is shown in Figure 6. For countries in which a variable tenure is available, both profiles are reported. The patterns are similar to the previous ones, but in general all the profiles flatten by including additional variables into the equation. By including tenure the profiles are flattened further. They flatten especially in countries with low-short and low-long employment clusters. This suggests that the selectivity of retirement decisions is strongest in these countries.

Sticking to the averaging effects leads us to the conclusion that in high-long employment countries, the transitions to retirement are evenly distributed across workers and these transitions are quite smooth. The drop in earnings around the age of 70 occurs due to the drop in productivity and because only those with very weak opt-out options (retirement benefits or capital income) remain in employment. The conclusion is supported by the fact that the employment rate at the age of 70 only exceeds 10 per cent in countries with quite liberal pension systems - with either low replacement rates (Estonia, Latvia and the United Kingdom) or a high effective retirement age (Romania and Portugal). Furthermore, earnings start to drop quite steeply after the age of 70, which should, however, be treated with caution due to the small samples (see Figure 6).

In countries with high-short and low-short employment patterns, the growth in average hourly wages reflects the pattern of low-paid workers leaving the labour market prematurely. In such systems, the availability of early retirement benefits or social aid discourages lower-paid workers from working, as the replacement rate for them is high compared to higher paid workers. The average replacement rate for countries with short employment is around 53%, whereas in countries with long employment it is around 45%. Unfortunately, the OECD only reports the average replacement rate and does not report the replacement rate by age or wage-decile. Additionally the effective age of retirement for short employment countries is about 60, and for long employment countries almost 65. Therefore we argue that the rise in average hourly earnings before the age of 60 is a result of being entitled to benefits at a younger age and the higher replacement rates in these countries (see Figures 7 and 8).

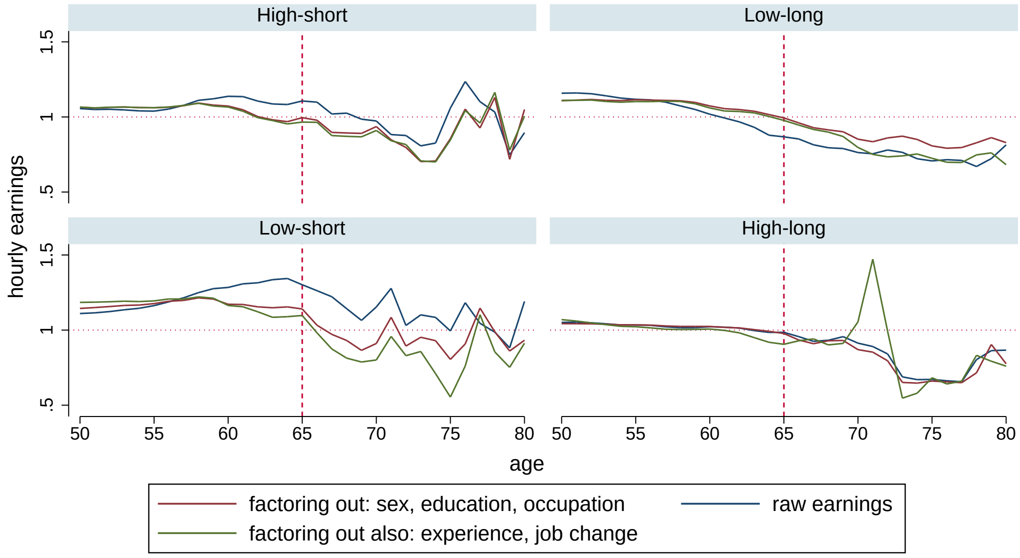
Figure 6: Hourly earnings by age and countries - semi-parametric regression results



Remarks: hourly earnings are normalized so that the mean hourly earnings equals 1 for every country, 95% confidence interval.
Source: Own calculation.

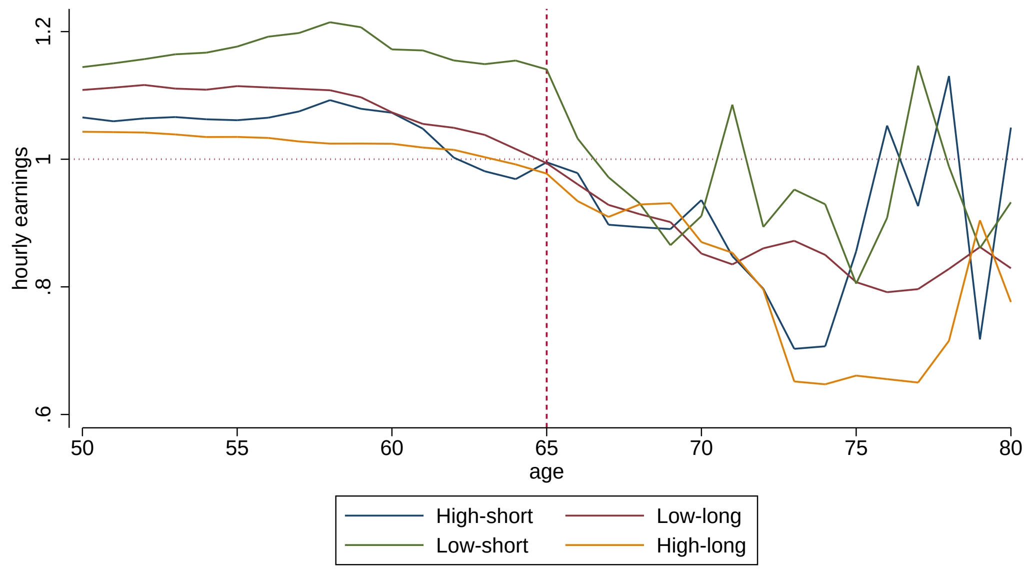
The profile for low-long countries presents a similar story. The effect of prematurely leaving employment starts earlier and the loss of average productivity after age 60 is deeper than in other countries. Although the employment rates after 65 are quite high, lower-paid workers dominate amongst those who remain in employment. In effect, the average hourly earnings drop below the mean before the age of 65, the earliest amongst all clusters of countries.

Figure 7: Hourly earnings-age profiles by employment clusters - effects of factoring out general and specific human capital



Source: Own calculation.

Figure 8: Hourly earnings-age profiles by employment clusters - factoring out the effect of sex, education and occupation



Source: Own calculation.

The semi-parametric regression has a different effect on specific clusters (see Figure 8). For high-long countries, the profiles do not change when the characteristics are taken into account, whereas for all other clusters the results differ significantly. The effect of factoring out gender, education and occupation generally influences the patterns much more than further including general experience and a recent change in job. Taking into account all the characteristics, the earning profiles flatten in all the clusters. In high-short and low-short countries, the bump noticed after 50 years almost disappears and the resulting profiles become much more alike among the clusters. In low-short employment countries, there still seems to be a more important drop in hourly earnings after the age of 65.

In low-long countries the earnings of people over the age of 55 rise due to the factoring out of structural characteristics. It means that lower-earners remain in the labour force longer. This phenomenon is especially visible in Romania, Portugal and Greece (see Figure 6). It is the opposite result to low-short countries. I would expect that it is due to a large number of low-paid individuals who are not entitled to retirement. Romania provides confirmation of this statement. The relatively high level of employment after the age of 60 leads to a drop in average earnings by about 70%, but when taking into account gender, education and occupation this drop reduces to just 20%. This confirms the previous result, that a high employment rate for older people in Romania can be attributed to low-qualified people staying in employment due to the lack of retirement benefits [Roman and Roman, 2002].

The institutional arrangements in the countries (see Table 1) confirm that it is the generous out-options that drive people to leave the labour market. The mean replacement rate is 47% in long employment countries and 54% in short employment countries. Similarly the official and actual age of retirement is highest in high-long and lowest in low-short countries. The drop in productivity does not seem to shorten the duration of employment.

The earlier retirement of less productive workers is also consistent with the pay-as-you-go (PAYG) based benefit retirement system. The idea of the PAYG system is that the benefits paid by the system are set at a minimum level (Anglo-Saxon Beveridge system) or bound to the wage (continental Bismarck system). The Beveridge system exhibits a stronger redistribution from higher earners to lower earners [Kolmar, 2007, Cigno, 2009]. The existence of this mechanism creates stronger incentives for lower earners to retire earlier as the absolute and relative change in their income when retired compared to when working is smaller. As a result we would observe a rise in the productivity profile of wages with age.

To sum up, there are significant differences in the age-wage patterns across the countries which can hardly be attributed to changes in the ability to perform working tasks with age. The detected regression enables most of the differences in the behaviour of the average hourly earnings to be ascribed to changes in the structure of the workforce. The decline in hourly wages is smallest in countries with the longest working life, and with the lowest retirement replacement rate, indicating that the structure of pension entitlements not only strongly affects employment, but also the wage structure of the population. Additionally, the results support the shift of the retirement age to 65-75 as the results show only mild losses of hourly wages after the age of 60.

Table 1: Pension replacement rates and retirement age in EU countries

Country	Cluster	Aggregate replacement rate	Official retirement age men (women)	Average exit age from the labour market
Austria	HS	0.64	65	60.9a
Belgium	LS	0.45	65	61.6a
Bulgaria	HS	0.34	63 (60)	64.1b
Cyprus	LL	0.37	65	62.8c
Czech Republic	HS	0.51	65 (62-65)	60.5
Denmark	HL	0.42	67	62.3
Estonia	HL	0.52	63	62.6c
Finland	HL	0.48	65	61.7c
France	HS	0.66	60	60.2
Germany	HL	0.47	67	62.4
Greece	LL	0.41	65	61.5c
Hungary	LS	0.62	65	59.7
Ireland	LL	0.48	66/65	64.1b
Italy	LS	0.51	65 (60)	60.4
Latvia	HL	0.34	62	62.7d
Lithuania	LL	0.48	62.5 (60)	59.9b
Luxembourg	LS	0.62	65	59.4e
Netherlands	HL	0.44	65	63.5c
Norway	HL	0.52	67	63.2c
Poland	LS	0.56	65 (60)	59.3a
Portugal	LL	0.5	65	62.6a
Romania	LL	0.55	63 (58)	64.3b
Slovakia	HS	0.55	62	58.8c
Slovenia	LS	0.45	63	59.8b
Spain	LL	0.5	65	62.3
Sweden	HL	0.6	65	64.4
United Kingdom	HL	0.44	68	63c
Means for clusters				
High-long	HL	0.47	65.4 (65.4)	62.9
High-short	HS	0.54	63 (62.1)	60.9
Low-short	LS	0.54	64.7 (63)	60
Low-long	LL	0.47	64.4 (63.3)	62.5

Source: OECD (2011), Eurostat (2013). Data for the year 2010, unless indicated otherwise: a 2007, b 2006, c 2009, d 2008, e 2005

5 Conclusions

The comparison of just the employment rates amongst countries shows that there are huge differences in labour market participation at all ages, and there is lot of scope for increasing the employment levels in some countries, especially at older ages. There are also huge drops in employment rates when people become eligible for retirement benefits. As the ageing research shows, the quick decline in the employment rate does not correspond to a loss of the ability to perform work-related tasks. Therefore the retirement age seems to artificially shorten the working life of individuals in all countries, but these phenomena vary greatly among countries.

The decline in the hourly earnings of older people is smallest in countries with the highest employment rates in all age groups, and increases in importance after the age of 70. Most of the dynamics of the average wage can be attributed to changes in the labour force structure and not to changes in personal productivity. Combining evidence for a large group of countries (28) enables us to observe that countries with higher employments rates after the age of 60 do not show a quicker decline in wages than countries with a lower employment rate of older people. This would be the case if personal productivity were to drop quickly afterwards. Therefore we can conclude that the falling employment rates at the qualifying age for retirement benefits can hardly be attributed to a drop in personal productivity or earning ability.

The intellectual ability to perform more complicated and productive tasks depreciates slower with age than physical condition, which is mostly needed in lower-paid jobs. The expected consequence of this is that people who are engaged in non-manual tasks would work longer, thus driving the earnings profile up. We only found evidence of average earnings rising before the age of 65 in countries where the employment rates after the age of 50 are low and in the event of flat earning profiles in countries with high employment rates. In the 65-75 age group, we observed a decline in the average hourly earnings in almost all countries. The latter result remains true after factoring out personal and job-related characteristics which seem to reflect not only the averaging effects but also the loss of productivity at that age. However, losses in earnings are not greater that 2-3 percent per year after the age of 65. Therefore it is lower-paid individuals who leave the labour market prematurely in countries with low employment rates, and with some signs of an actual loss of hourly earnings after the age of 65. Most of the changes in average wages before the age of 65 should be attributed to institutional differences among European countries and not to individual life-cycle productivity profiles.

We have provided preliminary answers to the following question: to what extent do labour market institutions and pension systems affect the average and individual life-cycle earnings profiles? We have found evidence that the younger eligibility for retirement benefits and the higher replacement rates make lower-paid individuals exit labour market prematurely, i.e. before they lose the ability to perform work-related tasks. This conclusion still needs to be verified with the use of longitudinal data.

We have also found that the age structure of the workforce strongly affects the dynamics of average earnings and therefore that the comparison of the dynamics of wages, which ignores the age structure of the population, might lead to confusing results. As we used cross-section data, we could not take into account the cohort effects, so this issue remains open for further research.

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Table 2: Data description: Number of observations of hourly earnings for every country and every year

	year						
Country	2004	2005	2006	2007	2008	2009	Total
AT	4499	5326	6070	6870	5708	5629	34102
BE	4684	4430	5306	5907	5913	5649	31889
BG				4042	4656	5994	14692
CY		4728	4647	4453	4238	3773	21839
CZ		4341	7328	9581	11359	9735	42344
DE		11132	12374	12611	11750	11683	59550
DK	7844	7062	6835	6936	6859	3331	38867
EE	4332	4738	6620	6162	5668	5372	32892
ES			12465	13023	13374	12061	50923
FI	12499	12556	11942	12514	12225		61736
FR	9378	9212	9390	9957	9935	9844	57716
GR				5423	6238		11661
HU		6201	6866	7995	7941	8374	37377
IE	5055	5597	5209	4913	4370	4111	29255
IS	4465	4569	4570	4799	4893		23296
IT				19281	19051	18190	56522
LT		4590	4729	5262	4997	4921	24499
LU	3775	3921	4232	4417	4376	4583	25304
LV				4505	5367	5180	15052
NL		9321	10010	11459	11375	5496	47661
NO	7565	7375	6862	6996	6680		35478
PL		14349	14171	13880	13847	12352	68599
PT	396	320	281	4234	4184	4305	13720
RO				7226	6764	6391	20381
SE	6146	6371	7328	8186	8622		36653
SI		10882	12970	12010	12363	12606	60831
SK		6338	6328	6476	7398	7115	33655
UK		9798	9321	8807	8139	6961	43026
Total	70638	153157	175854	227925	228290	177084	1032948

Source: Own calculations.

Table 3: Parameter estimates for model with sex, education, occupation, health

	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE
female	-0.211**	-0.097**	-0.208**	-0.192**	-0.202**	-0.313**	-0.150**	-0.287**	-0.145**	-0.233**	-0.151**	-0.256**	-0.134**	-0.108**
	(0.012)	(0.010)	(0.016)	(0.013)	(0.007)	(0.007)	(0.010)	(0.010)	(0.008)	(0.011)	(0.008)	(0.016)	(0.010)	(0.015)
primary	-0.461**	-0.311**	-0.503**	-0.337**	-0.691	-0.167**	-0.282	-0.286**	-0.609**	-0.421**	-0.400**	-0.851**	-0.676**	-0.795**
	(0.093)	(0.022)	(0.056)	(0.021)	(0.387)	(0.043)	(0.221)	(0.066)	(0.012)	(0.036)	(0.014)	(0.024)	(0.047)	(0.021)
lower secondary	-0.478**	-0.253**	-0.359**	-0.387**	-0.438**	-0.175**	-0.142**	-0.220**	-0.546**	-0.406**	-0.342**	-0.782**	-0.595**	-0.684**
	(0.021)	(0.016)	(0.030)	(0.025)	(0.016)	(0.015)	(0.015)	(0.020)	(0.012)	(0.016)	(0.013)	(0.030)	(0.019)	(0.021)
upper secondary	-0.326**	-0.197**	-0.290**	-0.256**	-0.342**	-0.167**	-0.099**	-0.165**	-0.373**	-0.341**	-0.316**	-0.606**	-0.529**	-0.482**
	(0.015)	(0.012)	(0.023)	(0.017)	(0.010)	(0.007)	(0.012)	(0.012)	(0.012)	(0.013)	(0.010)	(0.023)	(0.013)	(0.020)
post secondary	-0.127**	-0.196**	-0.161*	-0.285**	-0.275**	-0.067**	-0.136	-0.138**	-0.441**	-0.105		-0.565**	-0.391**	-0.528**
	(0.021)	(0.040)	(0.077)	(0.050)	(0.025)	(0.016)	(0.221)	(0.019)	(0.045)	(0.095)		(0.046)	(0.023)	(0.027)
lower-skill non-manual	-0.171**	-0.110**	-0.314**	-0.603**	-0.243**	-0.226**	-0.206**	-0.410**	-0.239**	-0.210**	-0.326**	-0.208**	-0.313**	-0.202**
	(0.015)	(0.013)	(0.025)	(0.018)	(0.010)	(0.009)	(0.013)	(0.015)	(0.011)	(0.016)	(0.011)	(0.023)	(0.014)	(0.019)
skilled manual	-0.414**	-0.240**	-0.181**	-0.544**	-0.263**	-0.414**	-0.299**	-0.322**	-0.316**	-0.313**	-0.385**	-0.466**	-0.350**	-0.223**
	(0.016)	(0.016)	(0.024)	(0.019)	(0.009)	(0.010)	(0.014)	(0.013)	(0.012)	(0.014)	(0.011)	(0.022)	(0.014)	(0.020)
lower-skill manual	-0.363**	-0.268**	-0.364**	-0.719**	-0.365**	-0.470**	-0.292**	-0.479**	-0.368**	-0.269**	-0.417**	-0.433**	-0.448**	-0.235**
	(0.020)	(0.020)	(0.028)	(0.021)	(0.013)	(0.015)	(0.019)	(0.016)	(0.014)	(0.024)	(0.013)	(0.030)	(0.019)	(0.025)
2005	-0.078**	-0.041**		-0.171**	-0.292**	0.009	-0.120**	-0.444**	-0.331**	-0.126**	-0.058**	-0.394**	-0.206**	-0.110**
	(0.017)	(0.016)		(0.018)	(0.012)	(0.010)	(0.015)	(0.015)	(0.012)	(0.015)	(0.011)	(0.023)	(0.014)	(0.021)
2006	-0.074**	-0.019		-0.157**	-0.196**	0.080**	-0.094**	-0.355**	-0.082**	-0.098**	-0.029*	-0.375**	-0.079**	-0.057**
	(0.017)	(0.015)		(0.018)	(0.010)	(0.011)	(0.015)	(0.014)	(0.012)	(0.016)	(0.011)	(0.023)	(0.014)	(0.021)
2007	-0.053**	-0.014	-0.265**	-0.073**	-0.107**	-0.016	-0.014	-0.199**	-0.035**	-0.040*	-0.030**	-0.020	-0.092**	-0.034
	(0.016)	(0.014)	(0.020)	(0.018)	(0.009)	(0.010)	(0.014)	(0.014)	(0.012)	(0.017)	(0.011)	(0.022)	(0.013)	(0.020)
2009	0.053**	0.059**	0.249**	0.059**	0.177**	0.024*	0.049**	0.104**	0.059**	0.009	0.016	0.030	0.066**	0.037
	(0.017)	(0.014)	(0.017)	(0.018)	(0.009)	(0.010)	(0.014)	(0.015)	(0.012)	(0.015)	(0.011)	(0.021)	(0.013)	(0.020)
fair	-0.096**	0.022	-0.089**	-0.046**	-0.062**	-0.079**	-0.032*	-0.086**	-0.036**	-0.070**	-0.055**	-0.119**	-0.062**	-0.096**
	(0.013)	(0.013)	(0.017)	(0.015)	(0.007)	(0.007)	(0.013)	(0.010)	(0.009)	(0.012)	(0.009)	(0.022)	(0.009)	(0.023)
bad or vary bad	-0.127**	-0.044	-0.089**	-0.023	-0.188**	-0.106**	0.001	-0.141**	-0.129**	-0.149**	-0.120**	-0.304**	-0.096**	-0.084
	(0.029)	(0.027)	(0.034)	(0.025)	(0.014)	(0.016)	(0.028)	(0.019)	(0.018)	(0.028)	(0.017)	(0.044)	(0.017)	(0.071)
pre-primary		-0.432**	-0.462**	-0.226**				0.110			-0.414**	-1.136**	-0.559*	
		(0.068)	(0.135)	(0.035)				(0.287)			(0.039)	(0.083)	(0.226)	
R^2	0.25	0.16	0.25	0.37	0.38	0.24	0.19	0.31	0.33	0.24	0.30	0.37	0.36	0.25
N	10,306	9,055	6,262	8,756	15,476	24,804	7,121	11,788	22,217	12,165	18,363	9,794	13,381	9,619

	IS	IT	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SI	SK	UK
female	-0.173**	-0.179**	-0.203**	-0.190**	-0.216**	-0.180**	-0.278**	-0.223**	-0.149**	-0.194**	-0.182**	-0.201**	-0.054**	-0.176**	-0.241**
	(0.021)	(0.007)	(0.012)	(0.018)	(0.014)	(0.031)	(0.010)	(0.012)	(0.009)	(0.023)	(0.013)	(0.014)	(0.012)	(0.008)	(0.010)
primary	-0.387**	-0.740**	-0.435**	-0.556**	-0.296**	-0.473**	-0.358**	-0.082	-0.757**	-1.629**	-1.139**	-0.176**	-0.692**	-0.454*	
	(0.071)	(0.014)	(0.061)	(0.029)	(0.053)	(0.057)	(0.025)	(0.260)	(0.018)	(0.041)	(0.042)	(0.033)	(0.028)	(0.176)	
lower secondary	-0.335**	-0.691**	-0.483**	-0.385**	-0.421**	-0.392**	-0.331**	-0.180**		-1.419**	-1.014**	-0.161**	-0.739**	-0.326**	-0.299**
	(0.031)	(0.011)	(0.027)	(0.030)	(0.026)	(0.046)	(0.015)	(0.020)		(0.043)	(0.030)	(0.025)	(0.027)	(0.020)	(0.015)
upper secondary	-0.281**	-0.504**	-0.433**	-0.336**	-0.353**	-0.269**	-0.288**	-0.139**	-0.540**	-0.980**	-0.672**	-0.130**	-0.613**	-0.251**	-0.209**
	(0.027)	(0.010)	(0.017)	(0.022)	(0.017)	(0.048)	(0.012)	(0.014)	(0.013)	(0.045)	(0.025)	(0.017)	(0.018)	(0.010)	(0.011)
post secondary	-0.253**	-0.510**	-0.380**	-0.369**	-0.323**	-0.226*	-0.194**	-0.032	-0.501**	-1.342**	-0.508**	-0.021	-0.397**	-0.257**	-0.253**
	(0.037)	(0.016)	(0.015)	(0.049)	(0.023)	(0.094)	(0.023)	(0.033)	(0.020)	(0.168)	(0.030)	(0.027)	(0.036)	(0.039)	(0.021)
lower-skill non-manual	-0.149**	-0.237**	-0.399**	-0.447**	-0.366**	-0.316**	-0.198**	-0.198**	-0.375**	-0.380**	-0.362**	-0.196**	-0.288**	-0.232**	-0.392**
	(0.028)	(0.009)	(0.018)	(0.025)	(0.019)	(0.039)	(0.013)	(0.017)	(0.014)	(0.033)	(0.025)	(0.019)	(0.018)	(0.010)	(0.012)
skilled manual	-0.300**	-0.346**	-0.284**	-0.595**	-0.281**	-0.327**	-0.286**	-0.252**	-0.508**	-0.519**	-0.527**	-0.370**	-0.391**	-0.232**	-0.445**
	(0.028)	(0.009)	(0.016)	(0.025)	(0.018)	(0.041)	(0.016)	(0.017)	(0.012)	(0.033)	(0.022)	(0.019)	(0.018)	(0.010)	(0.014)
lower-skill manual	-0.171**	-0.425**	-0.515**	-0.582**	-0.491**	-0.427**	-0.283**	-0.236**	-0.543**	-0.522**	-0.575**	-0.396**	-0.441**	-0.379**	-0.509**
	(0.045)	(0.012)	(0.019)	(0.033)	(0.020)	(0.046)	(0.023)	(0.041)	(0.016)	(0.038)	(0.029)	(0.038)	(0.025)	(0.014)	(0.016)
2005	-0.281**	-0.406**	-0.441**	-0.075**	-0.758**		-0.166**	-0.194**	-0.346**	-2.033**		-0.165**	-0.137**	-0.399**	0.021
	(0.030)	(0.010)	(0.017)	(0.025)	(0.021)		(0.015)	(0.018)	(0.012)	(0.066)		(0.020)	(0.019)	(0.011)	(0.014)
2006	-0.089**	-0.347**	-0.330**	-0.032	-0.712**		-0.106**	-0.107**	-0.198**	-1.831**		-0.184**	-0.107**	-0.326**	0.028*
	(0.030)	(0.010)	(0.017)	(0.025)	(0.019)		(0.015)	(0.018)	(0.012)	(0.071)		(0.020)	(0.018)	(0.011)	(0.014)
2007	-0.084**	-0.010	-0.159**	0.001	-0.354**		-0.053**	-0.062**	-0.118**	-0.014	-0.138**	-0.161**	-0.042*	-0.195**	0.106**
	(0.030)	(0.010)	(0.016)	(0.025)	(0.018)		(0.014)	(0.018)	(0.012)	(0.025)	(0.015)	(0.019)	(0.017)	(0.011)	(0.014)
2009	-0.421**	0.068**	0.162**	0.059*	0.201**		0.022	0.033	0.212**	0.026	0.065**	0.107**	0.086**	0.194**	-0.111**
	(0.028)	(0.010)	(0.017)	(0.024)	(0.017)		(0.014)	(0.017)	(0.012)	(0.025)	(0.015)	(0.018)	(0.017)	(0.011)	(0.014)
fair	-0.039	-0.049**	-0.067**	-0.040	-0.107**	-0.005	-0.037**	-0.067**	-0.067**	-0.076**	-0.026	-0.078**	-0.053**	-0.073**	-0.074**
	(0.027)	(0.007)	(0.012)	(0.021)	(0.014)	(0.030)	(0.013)	(0.016)	(0.008)	(0.022)	(0.015)	(0.019)	(0.012)	(0.008)	(0.013)
bad or vary bad	-0.078	-0.081**	-0.102**	-0.054	-0.191**	0.071	-0.015	-0.167**	-0.115**	-0.151**	-0.030	-0.249**	-0.101**	-0.126**	-0.175**
	(0.074)	(0.017)	(0.021)	(0.036)	(0.021)	(0.100)	(0.035)	(0.032)	(0.015)	(0.036)	(0.040)	(0.042)	(0.020)	(0.013)	(0.033)
pre-primary		-0.795**	-0.670		-0.233	-0.977*	-0.461**	-0.268	-0.723**				-0.621**		
		(0.049)	(0.558)		(0.268)	(0.446)	(0.113)	(0.145)	(0.067)				(0.215)		
R^2	0.19	0.32	0.35	0.35	0.41	0.31	0.26	0.19	0.34	0.49	0.48	0.20	0.43	0.39	0.23
N	3,750	35,606	11,181	6,048	9,861	1,180	10,420	6,343	25,141	5,291	7,342	6,714	7,285	12,783	19,117

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

Table 4: Parameter estimates for model with sex, education, occupation, health, tenure, job change

	AT	BE	BG	CY	CZ	DE	EE	ES	FR	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SI	SK
female	-0.203**	-0.089**	-0.224**	-0.171**	-0.190**	-0.316**	-0.285**	-0.114**	-0.142**	-0.089**	-0.161**	-0.198**	-0.149**	-0.213**	-0.134**	-0.264**	-0.145**	-0.195**	-0.179**	-0.057**	-0.177**
	(0.013)	(0.010)	(0.020)	(0.014)	(0.008)	(0.008)	(0.010)	(0.009)	(0.008)	(0.022)	(0.007)	(0.012)	(0.019)	(0.014)	(0.036)	(0.011)	(0.010)	(0.024)	(0.013)	(0.012)	(0.008)
primary	-0.451**	-0.341**	-0.547**	-0.359**	0.000	-0.160**	-0.296**	-0.635**	-0.412**	-0.807**	-0.782**	-0.438**	-0.598**	-0.308**	-0.497**	-0.360**	-0.799**	-1.642**	-1.142**	-0.716**	-0.445*
	(0.093)	(0.023)	(0.072)	(0.021)	(0.000)	(0.046)	(0.066)	(0.013)	(0.014)	(0.028)	(0.014)	(0.061)	(0.029)	(0.053)	(0.058)	(0.026)	(0.021)	(0.042)	(0.042)	(0.029)	(0.176)
lower secondary	-0.480**	-0.273**	-0.383**	-0.400**	-0.420**	-0.176**	-0.227**	-0.565**	-0.354**	-0.673**	-0.728**	-0.490**	-0.423**	-0.432**	-0.412**	-0.330**		-1.431**	-1.023**	-0.755**	-0.338**
	(0.021)	(0.016)	(0.038)	(0.026)	(0.018)	(0.016)	(0.020)	(0.013)	(0.013)	(0.027)	(0.012)	(0.027)	(0.031)	(0.026)	(0.047)	(0.016)		(0.043)	(0.030)	(0.027)	(0.020)
upper secondary	-0.332**	-0.211**	-0.325**	-0.268**	-0.331**	-0.166**	-0.171**	-0.384**	-0.325**	-0.470**	-0.530**	-0.443**	-0.375**	-0.368**	-0.275**	-0.292**	-0.590**	-0.992**	-0.688**	-0.629**	-0.262**
	(0.015)	(0.013)	(0.030)	(0.017)	(0.012)	(0.008)	(0.012)	(0.012)	(0.010)	(0.026)	(0.010)	(0.017)	(0.022)	(0.017)	(0.047)	(0.012)	(0.016)	(0.045)	(0.025)	(0.018)	(0.011)
post secondary	-0.131**	-0.208**	-0.132	-0.302**	-0.263**	-0.065**	-0.142**	-0.449**		-0.504**	-0.529**	-0.387**	-0.423**	-0.340**	-0.237*	-0.207**	-0.556**	-1.357**	-0.523**	-0.406**	-0.267**
	(0.021)	(0.040)	(0.100)	(0.050)	(0.028)	(0.017)	(0.019)	(0.045)		(0.036)	(0.016)	(0.015)	(0.049)	(0.023)	(0.094)	(0.023)	(0.023)	(0.168)	(0.030)	(0.036)	(0.039)
lower-skill non-manual	-0.172**	-0.111**	-0.358**	-0.597**	-0.222**	-0.220**	-0.410**	-0.236**	-0.325**	-0.205**	-0.238**	-0.390**	-0.446**	-0.357**	-0.304**	-0.195**	-0.387**	-0.376**	-0.358**	-0.289**	-0.228**
	(0.015)	(0.013)	(0.032)	(0.018)	(0.010)	(0.009)	(0.015)	(0.011)	(0.011)	(0.024)	(0.009)	(0.018)	(0.025)	(0.019)	(0.039)	(0.013)	(0.016)	(0.033)	(0.025)	(0.018)	(0.011)
skilled manual	-0.417**	-0.244**	-0.223**	-0.545**	-0.251**	-0.398**	-0.320**	-0.321**	-0.385**	-0.240**	-0.355**	-0.271**	-0.610**	-0.269**	-0.325**	-0.293**	-0.526**	-0.512**	-0.522**	-0.391**	-0.232**
	(0.016)	(0.016)	(0.031)	(0.019)	(0.010)	(0.011)	(0.013)	(0.012)	(0.011)	(0.028)	(0.009)	(0.016)	(0.025)	(0.018)	(0.041)	(0.016)	(0.014)	(0.033)	(0.022)	(0.018)	(0.010)
lower-skill manual	-0.363**	-0.252**	-0.431**	-0.701**	-0.345**	-0.452**	-0.473**	-0.349**	-0.405**	-0.223**	-0.414**	-0.500**	-0.568**	-0.465**	-0.414**	-0.266**	-0.547**	-0.513**	-0.562**	-0.427**	-0.374**
	(0.020)	(0.020)	(0.037)	(0.021)	(0.014)	(0.015)	(0.016)	(0.014)	(0.014)	(0.032)	(0.012)	(0.019)	(0.033)	(0.020)	(0.047)	(0.024)	(0.018)	(0.038)	(0.029)	(0.025)	(0.014)
2005	-0.077**	-0.050**		-0.176**	-0.294**	0.009	-0.447**	-0.331**	-0.060**	0.000	-0.411**	-0.446**	-0.081**	-0.770**		-0.167**	0.000	-2.031**		-0.133**	-0.400**
	(0.018)	(0.016)		(0.018)	(0.011)	(0.010)	(0.015)	(0.012)	(0.012)	(0.000)	(0.010)	(0.017)	(0.025)	(0.021)		(0.015)	(0.000)	(0.066)		(0.019)	(0.011)
2006	-0.072**	-0.024		-0.158**	-0.197**	0.000	-0.355**	-0.081**	-0.028*	0.000	-0.353**	-0.333**	-0.037	-0.715**		-0.109**	-0.209**	-1.833**		-0.107**	-0.325**
	(0.017)	(0.015)		(0.018)	(0.009)	(0.000)	(0.014)	(0.012)	(0.011)	(0.000)	(0.010)	(0.017)	(0.025)	(0.019)		(0.015)	(0.013)	(0.070)		(0.018)	(0.011)
2007	-0.051**	-0.013	0.000	-0.073**	-0.107**	-0.017	-0.200**	-0.035**	-0.030**	-0.034	-0.013	-0.160**	0.000	-0.356**		-0.056**	-0.120**	-0.012	-0.140**	-0.043*	-0.197**
	(0.016)	(0.014)	(0.000)	(0.018)	(0.008)	(0.009)	(0.014)	(0.012)	(0.011)	(0.021)	(0.010)	(0.016)	(0.025)	(0.018)		(0.014)	(0.013)	(0.025)	(0.015)	(0.017)	(0.011)
2009	0.054**	0.058**	0.245**	0.058**	0.000	0.024*	0.103**	0.060**	0.015	0.043*	0.069**	0.161**	0.059*	0.197**		0.025	0.205**	0.029	0.064**	0.087**	0.193**
	(0.017)	(0.014)	(0.019)	(0.018)	(0.000)	(0.009)	(0.015)	(0.012)	(0.011)	(0.022)	(0.010)	(0.017)	(0.024)	(0.017)		(0.014)	(0.013)	(0.025)	(0.015)	(0.017)	(0.011)
fair	-0.096**	0.024	-0.110**	-0.047**	-0.055**	-0.074**	-0.087**	-0.038**	-0.053**	-0.116**	-0.051**	-0.068**	-0.049*	-0.110**	-0.004	-0.037**	-0.065**	-0.074**	-0.026	-0.056**	-0.073**
	(0.013)	(0.013)	(0.021)	(0.015)	(0.007)	(0.008)	(0.010)	(0.009)	(0.009)	(0.029)	(0.007)	(0.012)	(0.021)	(0.014)	(0.030)	(0.013)	(0.010)	(0.022)	(0.015)	(0.012)	(0.008)
bad or vary bad	-0.124**	-0.034	-0.137**	-0.024	-0.173**	-0.101**	-0.141**	-0.135**	-0.123**	-0.149	-0.076**	-0.096**	-0.059	-0.192**	0.076	0.000	-0.128**	-0.149**	-0.033	-0.102**	-0.125**
	(0.029)	(0.027)	(0.047)	(0.025)	(0.015)	(0.017)	(0.019)	(0.018)	(0.017)	(0.100)	(0.017)	(0.021)	(0.036)	(0.021)	(0.100)	(0.036)	(0.018)	(0.036)	(0.040)	(0.020)	(0.013)
tenure	0.002*	0.006**	0.005**	0.004**	0.001	0.001**	0.004**	0.006**	0.003**	0.004**	0.007**	0.007**	0.010**	0.011**	0.006**	0.003**	0.011**	0.000	0.005**	0.004*	0.003*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
no job change	0.097**	0.106**	0.096*	0.168**	0.060**	0.216**	0.017	0.090**	0.069**	0.055	0.021	0.110**	0.268**	0.084**	0.115*	-0.006	0.024	0.208**	0.035	0.133**	0.072**
	(0.031)	(0.030)	(0.037)	(0.026)	(0.016)	(0.018)	(0.016)	(0.018)	(0.022)	(0.046)	(0.014)	(0.023)	(0.040)	(0.026)	(0.055)	(0.023)	(0.024)	(0.054)	(0.042)	(0.032)	(0.014)
pre-primary		-0.451**	-0.564**	-0.258**			0.087		-0.422**		-0.813**	-0.746		-0.249	-1.061*	-0.475**	-0.748**			-0.655**	
		(0.068)	(0.160)	(0.035)			(0.287)		(0.039)		(0.049)	(0.557)		(0.268)	(0.446)	(0.116)	(0.088)			(0.215)	
R^2	0.25	0.17	0.21	0.38	0.34	0.24	0.32	0.34	0.31	0.24	0.32	0.35	0.36	0.42	0.31	0.27	0.34	0.50	0.48	0.43	0.39
N	10,184	9,024	4,657	8,756	11,968	20,722	11,762	21,808	17,942	6,018	35,338	11,147	6,018	9,824	1,172	10,122	19,297	5,266	7,341	7,259	12,760

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

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