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Old-age employment and hours of work trends: empirical analysis for four European countries

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Abstract

For the last two decades, the increase of employment among individuals aged 50+ has been a policy objective on the European employment agenda. The present paper focuses on the case of Belgium, France, Germany, and The Netherlands over the period 1997–2011. First, we provide descriptive analysis of older workers' employment using data from the European Union Labour Force Survey. Second, we use econometric techniques to explain the different employment and hours of work patterns for various sub-groups of older workers over time. We find evidence of catching up of older generation's employment rates—with no rupture at the financial crisis in 2007. Third, we use micro-simulation techniques to decompose the effects of structural changes, as well as extensive and intensive labor supply changes.

JEL Classification: J08, J21, J26

Keywords: Retirement, Employment, Hours of work

1 Introduction

Most European Union (EU) countries face the challenge of an aging population and the associated issue of short- and long-term sustainability of pay-as-you-go public pension schemes. Several factors are at stake. Some are demographic: in 2010, the first baby-boomers reached the age of retirement, with an average life expectancy 10 years higher than workers who retired in 1980; the baby-boomers cohort is replaced in the labor market by a substantially smaller baby-bust cohort born in the early 1990s. Some others are often associated with social norms and regulations—though demography also plays its role, e.g., an increased reliance on part-time work before (and after) the full retirement age or the long-run increase in female labor force participation among all age groups.

The age group 50+ has benefited from a special attention on behalf of researchers and policy-makers alike—likely also motivated by the low observed employment rates (ERs) in numerous countries during the early 1980s up to the mid-1990s. Gruber and Wise (2004) and Wise (2016) illustrated the powerful role of incentives towards early retirement built into many pension and early pension systems. Increased employment, on the other hand, is associated with a triple benefit: First, improve pension system finances by keeping older workers paying social security contributions and less people

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collecting retirement benefits. Second, improve health outcomes through active aging such as recommended by the WHO (2002) and European Commission (2012).[1] Third, prevent female old-age poverty by completing otherwise shorter and more interrupted careers.

For the purpose of the analysis of employment patterns in Europe, two key moments can be identified in the recent two decades. The first one corresponds to the arrival of the open method of coordination (OMC) on the European policy agenda in 2000. Higher ERs among older workers became a new explicit and central target of public policy, among others to keep pension schemes sustainable and to avoid labor supply shortages. Though the OMC and its successors have remained non-prescriptive in the means to reach the targets, it can be associated with a paradigm shift on the policy level.[2] It is even irrelevant whether the OMC caused different policies or whether it merely coincided with an array of national policies in this field. The key element is that the early 2000s correspond to a changeover from a period of policies aimed at retiring people from the labor market to free up space for younger workers towards an approach of increased employment targets for older workers.[3]

The second defining moment is no doubt the financial crisis that erupted in 2007. While the nature and the depth of its effects have been felt differently across the EU, it represents a breaking point in the working of European economies and hence exerts a major shock to the labor market. For example, in the USA, Hoynes et al. (2012) showed that older workers have suffered smaller decreases in employment than younger ones after the onset of the financial crisis.

The four countries we investigate in this paper (Belgium, France, Germany, and The Netherlands) provide particularly interesting insights. On the one hand, they all have comparable levels of economic development, with mostly Bismarckian social protection systems. On the other hand, they differ markedly on labor market outcomes and policy-making. Also, while they all face demographic aging, the timing and the severity of the process are somewhat different with Germany aging the fastest. Finally, the macro-fiscal consequences of the financial crisis have hit these countries in different (and sometimes opposing) ways—in turn with German government bond rates solidly in negative territory for usual maturities.

Figure 1 shows the evolution of ERs separately for women and men in the age group 50–64.[4] ERs followed a rather similar time pattern across these countries: up to the middle of the 1990s, a relatively stable or slightly increasing path is observable for women (e.g., The Netherlands) and a decreasing one for men. From the mid-1990s on, an upward trend can be observed for both sexes—in line with experience in other advanced economies as documented by Coile (2015).

Figure 1 also provides evidence that labor market outcomes still remain heterogeneous—with Belgium being the country with the lowest overall ER in the sample of countries. While some degree of catching up of women' s ER to men's ER has occurred, substantial differences sometimes subsist like in Belgium where female employment remains distinctly lower.

Figure 2 illustrates the evolution of the average hours of work among women and men aged 50 to 64 years old. As expected, women work less hours per week than men in the four countries and the gap is particularly large in the case of The Netherlands—a country with a long-standing tradition of part-time work—where women on average work less than

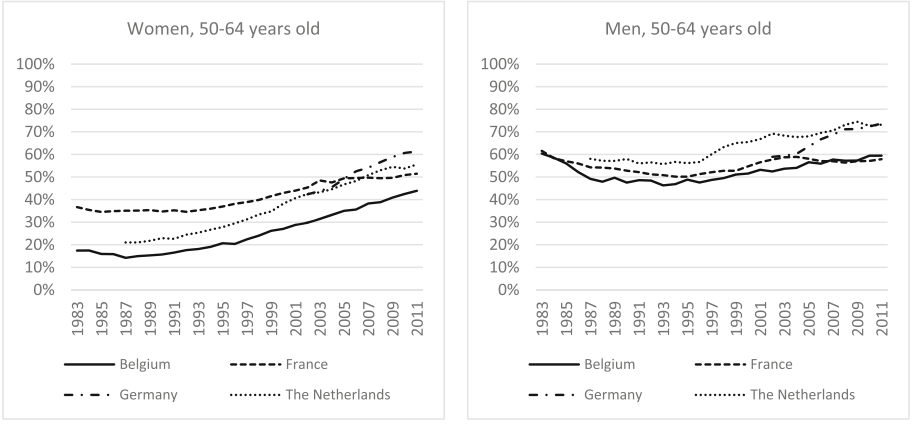

Fig. 1 Employment rate

25 h/week. In Belgium, hours of work for both women and men are declining over the whole period in line with the popularization of specific old-age part-time arrangements.

The above policy and economic settings also influence our general approach in this paper. We take a three-stepped approach based on aggregate indicators of labor market outcomes over time and across countries using micro-data from the EU Labour Force Survey (EU-LFS).

First, we comprehensively assess the trends in aggregate employment (ER) and unemployment rates for the people aged 50 to 64.

Second, we provide econometric analysis of employment and hours of work data over the time period 1997–2011 to identify underlying drivers for these variables. While ER surveillance is by now part of the usual policy-making process, the same does not hold true for hours of work indicators that are often missing in policy debates. Hours of work effects are however important when considering questions such as the following: is part-time employment the price paid to reach higher ERs?; did the financial crisis affect hours of work differently than employment among older workers?; did some socio-economic groups react differently in employment and in hours of work than others?

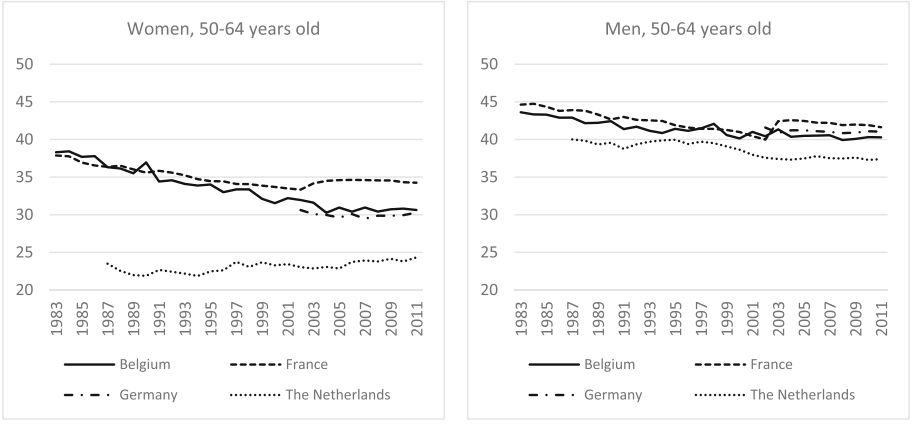

Fig. 2 Average usual working hours

More specifically, we estimate probit models of employment determinants and Heckman (1979) selection models in which the dependent variable is the usual hours of work and among the explanatory variables, other than age, education, and country of birth, the years of job tenure on the current job. In both types of models and for each country and gender, we econometrically test the differences in ER and hours of work across periods.

Third, we provide micro-simulations regarding the combined effect of changes in ER and hours of work on total work hours. We adopt the methodology suggested by Blundell et al. (2013) for the computation of structural and behavioral changes in hours of work, this way carefully distinguishing behavioral from purely structural effects.

The paper is organized as follows. In Section 2, we provide some brief background statistics on labor market trends for the elderly. Section 3 describes our empirical approach and presents the detailed results of probit model estimations with employment as the dependent variable. Section 4 extends the reflection beyond ERs by focusing on the effects of socio-economic factors on hours of work. In Section 5, we provide micro-simulation results regarding the combined effect of ER and hours of work changes on total work hours. Section 6 contains the main conclusions of this paper.

2 Labor market outcomes

To provide a descriptive analysis of the labor market outcomes in the four countries, we split the population aged 50–64 into three successive sub-groups (50–54, 55–59, and 60–64).[5] Furthermore, we focus our attention on the time period 1997–2011 where we also distinguish three 5-year sub-periods: 1997–2001, 2002–2006, and 2007–2011.[6] All three correspond to distinct events in the overall policy and economic environment. 2002–2006 versus 1997–2001 corresponds to a comparison of the aftermath and the period immediately leading towards the "paradigm shift" around the OMC. 2007–2011 corresponds to a period right after the onset of the worldwide financial crisis, hence representing a potentially large shock to the labor markets. Proceeding this way, we try to identify different labor market responses across periods for the four countries.

We propose two broad types of comparisons with counterfactual situations: on the one hand, with the evolution of ERs among the prime-agers 25–49, and on the other hand, with the evolution of ERs observed for women and men in the same age groups but living in neighboring countries.

Figure 3 illustrates the evolution of ERs, for four age categories—25–49, 50–54, 55–59, and 60–64 years old—over the period 1997–2011—with vertical lines marking the three sub-periods of study 1997–2001, 2002–2006, and 2007–2011. First of all, we observe that even if in all cases ER grew without discontinuity after 2001 among the 55–59- and the 60–64-year-olds, at the end of the period, important gaps subsist with respect to younger individuals. Second, in most cases, the gap between the 50–54- and the 25–49-year-olds is small indicating that the 50–54-year-olds are often still an integral part of the prime-age working population, except for women in Belgium and in The Netherlands. Third, ER increases much stronger among the 60–64-year-olds of both sexes in Germany and The Netherlands than in Belgium and France.[7]

To further investigate the characteristics of the above growth in ER, we provide the analysis of Table 1. It reports the observed changes in ER and in UR (unemployment rate with respect to total population) across the three sub-periods and age categories, by country and by sex. First, it shows that among the 50- to 64-year-olds, ER changes

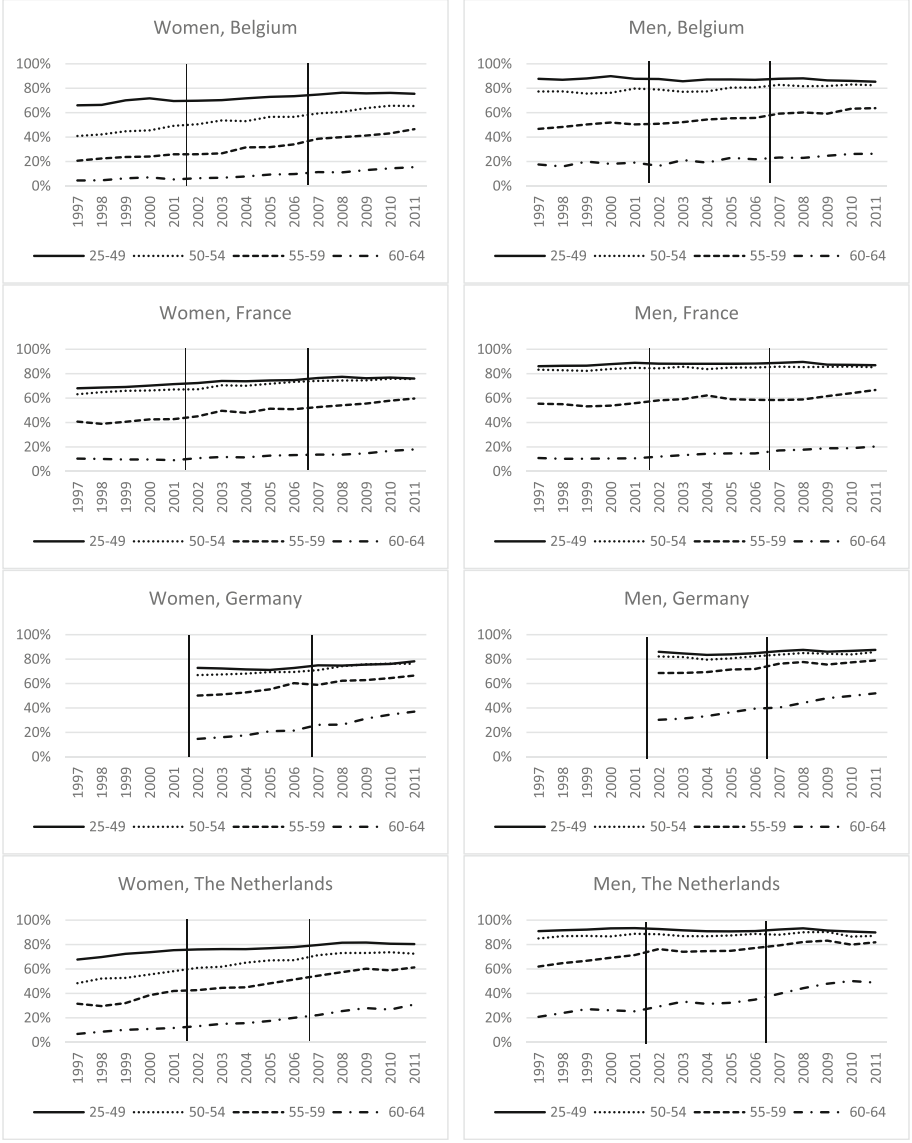

Fig. 3 Employment rate, by country, sex, and age group

were positive in all cases and, with only a few exceptions for the 60–64-year-olds, higher than among the 25–49-year-olds. Second, it also illustrates that in the large majority of cases, the increase in ER found its strongest counterpart in lower inactivity rates rather than in a mere decrease of the unemployment rate. More specifically, even if changes in UR were negative for several sub-groups, they were in general very low compared with positive changes in ER, the only exception being the 55- to 59-year-olds in Germany with UR decreases close to 3 % points.

Additional dimensions are included in the analysis in order to account for the role of other individual characteristics: educational attainment, country of birth, and later in the econometric analysis also marital status. This allows us to identify to what extent the observed labor market patterns were favorable to particular categories of workers, like the low skilled and foreigners. Tables 2 and 3 present ERs for two of these three dimensions, education and country of birth, over the analyzed period for the population aged 50–64.

Table 1 Changes in employment and unemployment across periods (population % points)

Age category	Women				Men			
	2002–2006 versus 1997–2001		2007–2011 versus 2002–2006		2002–2006 versus 1997–2001		2007–2011 versus 2002–2006	
	ΔER (%)	ΔUR (%)	ΔER (%)	ΔUR (%)	ΔER (%)	ΔUR (%)	ΔER (%)	ΔUR (%)
Belgium								
25–49	2.9	−0.5	4.1	−0.4	−1.2	0.6	−0.2	0.1
50–54	9.5	0.4	8.9	0.5	1.6	−0.2	3.4	0.8
55–59	6.8	0.1	11.8	1.0	4.3	−0.4	7.3	0.7
60–64	2.5	0.2	5.1	0.3	2.2	−0.1	4.4	0.2
France								
25–49	4.4	−2.2	2.7	−0.4	1.0	−1.3	−0.1	0.2
50–54	5.0	−1.0	4.3	−0.5	1.3	−1.1	0.8	−0.4
55–59	8.0	−0.8	6.8	0.5	4.8	−1.0	2.5	0.4
60–64	2.2	0.2	3.4	0.1	3.3	0.1	4.9	0.5
Germany								
25–49	–	–	3.6	−1.8	–	–	2.2	−2.3
50–54	–	–	6.2	−2.7	–	–	3.2	−3.0
55–59	–	–	8.7	−2.4	–	–	6.8	−3.0
60–64	–	–	13.2	0.5	–	–	12.9	−0.3
The Netherlands								
25–49	5.0	−0.1	4.1	−0.4	−0.9	0.7	0.1	−0.2
50–54	10.9	0.1	8.3	0.3	0.8	1.2	0.7	−0.1
55–59	11.6	0.5	11.9	0.5	8.4	1.3	5.8	0.5
60–64	6.7	0.1	10.4	0.5	7.6	0.7	14.0	0.9

Source: authors' calculations based on the EU-LFS micro-data

In both tables and for most categories, the ER follows over time the general trend observed in previous figures, particularly among women. However, looking in details at the numbers reported in Table 2, it is interesting to note that among highly educated men and women, ER differences are relatively small, not higher than 15.0 % points (74.1 vs. 59.2 % for Belgium in 2007–2011), while the gender gap for people with low education varies substantially, from 25.0 % points for The Netherlands (64.8 vs. 39.2 %) to less than 10.0 % points for France (48.1 vs. 41.3 %) in 2007–2011.

In Table 3, as expected, ERs are lower among people born abroad but the gap varies from near 0 to 15.0 % points when comparing men's ER in France in 2007–2011 (57.1 vs. 57.0 %) with 1997–2001 in The Netherlands (65.7 vs. 50.9 %). Moreover, there is no clear common pattern in the evolution of ER by country of birth. In some cases, specifically in Belgium and The Netherlands, the gap is slightly increasing between women born abroad and born in the country, while decreasing in others, e.g., ER among men in France and in The Netherlands.

3 Employment estimations

We are interested in identifying differences in employment controlling at the same time for differences across age categories, educational attainment, country of birth, and marital status. For this purpose, we use the representative EU-LFS micro-data to

Table 2 Employment rate by country and education, 50–64 years old

Education	Women			Men		
	1997–2001 (%)	2002–2006 (%)	2007–2011 (%)	1997–2001 (%)	2002–2006 (%)	2007–2011 (%)
Belgium						
Low	17.3	22.1	27.3	38.4	42.4	45.1
Medium	32.8	40.6	47.2	60.4	61.3	62.1
High	49.8	53.1	59.2	73.0	71.0	74.1
France						
Low	34.4	40.6	41.3	44.5	49.7	48.1
Medium	47.2	52.8	54.9	57.8	60.2	58.5
High	62.7	63.7	63.5	74.0	74.1	72.2
Germany						
Low	–	33.8	42.0	–	46.2	54.5
Medium	–	48.1	58.6	–	59.2	69.1
High	–	65.7	74.3	–	74.6	81.8
The Netherlands						
Low	26.1	33.2	39.2	55.0	61.3	64.8
Medium	42.7	51.3	59.3	65.7	68.6	72.7
High	59.7	65.3	71.8	75.8	76.4	80.1

Source: authors' calculations based on the EU-LFS micro-data

estimate probabilistic models in which the dependent variable is to be employed or not and, as explanatory variables, binary variables representing age groups, educational attainment, country of birth, and marital status.

The EU-LFS micro-data contains detailed individuals' information on labor market participation for a representative sample of the population on a yearly basis. The EU-LFS data allow us to use econometric modeling to explain changes in ERs across periods, distinguishing the targeted age groups (50–54, 55–59, and 0–64) from the benchmark group aged 25–49.[8]

Table 3 Employment rate by country and country of birth, 50–64 years old

Country of birth	Women			Men		
	1997–2001 (%)	2002–2006 (%)	2007–2011 (%)	1997–2001 (%)	2002–2006 (%)	2007–2011 (%)
Belgium						
Belgium	26.3	33.9	42.0	51.8	55.8	59.3
Abroad	21.6	27.5	33.7	43.9	45.8	51.6
France						
France	42.3	48.9	50.8	53.9	58.4	57.1
Abroad	36.8	43.1	46.8	53.4	56.6	57.0
Germany						
Germany	–	48.3	59.9	–	63.6	73.1
Abroad	–	41.6	50.2	–	55.5	63.6
The Netherlands						
Netherlands	36.0	45.6	54.2	65.7	69.7	73.9
Abroad	33.4	40.8	48.1	50.9	58.8	63.8

Source: authors' calculations based on the EU-LFS micro-data

We test econometrically to which degree differences in ER levels between age groups are significant across periods. Considering those aged 25 to 49 as the counterfactual, we interpret the estimated marginal changes in ER, with respect to the counterfactual, as the consequence of reforms undertaken. Equation (1) depicts the general relation we estimate. It assumes that the probability of individual i to be in employment in year t is the expectation of $\text{empl}_{it} = 1$ conditional on Ω_{it}, a transformation of a set of explanatory variables. In this case, we use a probit model: the transformation function Ω_{it} is assumed to be the cumulative standard normal distribution function $\Phi[.]$ and the explanatory variables' individual characteristics, age, education, country of birth, and marital status, represented by dummy variables[9]:

$$\Pr(\text{empl}_{it} = 1|\Omega_{it}) = \Phi\left[\alpha + \sum_{j=2}^{4}\beta_j.\text{age}_j + \sum_{k=2}^{3}\gamma_k.\text{edu}_k + \sum_{l=2}^{2}\delta_l.\text{birth}_l + \sum_{m=2}^{3}\eta_m.\text{stat}_m\right], \tag{1}$$

where age_j indicates the age category, with $j = 1,\ 2,\ 3,\ 4$ corresponding to the successive groups 25–49, 50–54, 55–59, and 60-64, respectively; edu_k the individual educational attainment dummies, with $k = 1,\ 2,\ 3$ corresponding to high (higher than secondary school), medium (secondary school), and low (primary school) levels, respectively; birth_l the country of birth, with $l = 1,\ 2$ indicating if the individual was born in the country she/he currently lives in (Belgium, France, Germany, or The Netherlands) or was born abroad, respectively[10]; and stat_m the marital status dummies, with $m = 1,\ 2, 3$ indicating unmarried, married, or widowed, respectively.[11] Finally, α, β_j, γ_k, δ_l and η_m are the parameters to be estimated for $j,k,l,m > 1$.

Beyond these purely static estimates, our interest is also on how the ER among those 50–54, 55–59, and 60–64 evolved after 2001, compared with changes for the group 25–49, our control group. For this purpose, we estimate for each country, and for female and male separately, a single probit model allowing all the coefficients in Eq. (1) to vary over the three sub-periods in which we divided the whole period. However, in order to identify the impact of changes from period to period, and for presentation purposes, we proceed in two steps. In a first step, we estimated Eq. (2) for the period 1997 to 2006 making the distinction between the two sub-periods 1997–2001 and 2002–2006 periods, and in a second step, we estimate Eq. (3) for the period 2002 to 2011 making the distinction between the 2002–2006 and 2007–2011 sub-periods.

In Eq. (2), $\text{per}_2 = 1$ for years 2002–2006, and $\text{per}_2 = 0$ for years 1997–2001:

$$\begin{aligned}\Pr(\text{empl}_{it} = 1|\Omega_{it}) = \Phi\Bigg[&\alpha_1 + \sum_{j=2}^{4}\beta_{j,1}.\text{age}_j + \sum_{k=2}^{3}\gamma_{k,1}.\text{edu}_k + \sum_{l=2}^{2}\delta_{l,1}.\text{birth}_l + \sum_{m=2}^{3}\eta_{m,1}.\text{stat}_m + ,\tilde{\alpha}_2.\text{per}_2 \\ &+ \sum_{j=2}^{4}\tilde{\beta}_{j,2}.\text{age}_{j,it}.\text{per}_2 + \sum_{k=2}^{3}\tilde{\gamma}_{k,2}.\text{edu}_k.\text{per}_2 + \sum_{l=2}^{2}\tilde{\delta}_{l,2}.\text{birth}_l.\text{per}_2 + \sum_{m=2}^{3}\tilde{\eta}_{m,2}.\text{stat}_m.\text{per}_2\Bigg],\end{aligned} \tag{2}$$

where coefficients $\tilde{\alpha}_2$, $\tilde{\beta}_{j,2}$, $\tilde{\gamma}_{k,2}$, $\tilde{\delta}_{l,2}$ and $\tilde{\eta}_{m,2}$ are, by construction, equivalent to differences in variable effects between the second and first sub-periods: $\tilde{\alpha}_2 = \alpha_2 - \alpha_1$, $\tilde{\beta}_{j,2} = \beta_{j,2} - \beta_{j,1}$, $\tilde{\gamma}_{k,2} = \gamma_{k,2} - \gamma_{k,1}$, $\tilde{\delta}_{l,2} = \delta_{l,2} - \delta_{l,1}$ and $\tilde{\eta}_{m,2} = \eta_{m,2} - \eta_{m,1}$, respectively.

Our attention focuses on the sign and the statistical significance of coefficients $\tilde{\beta}_{j,2}$. They allow us to identify changes, from 1997–2001 to 2002–2006, in estimated

employment probabilities among older workers, not explained by inter-period general changes, driven mainly by the economic environment and caught by $\tilde{\alpha}_2$, nor by changes in employment probabilities explained by education, country of birth, and marital status, caught by $\tilde{\gamma}_{k,2}$, $\tilde{\delta}_{l,2}$, and $\tilde{\eta}_{m,2}$, respectively. We are interested in the sign and the significance of estimated marginal effects on employment probabilities of older groups compared with those 25–49—hinting at any employment effects as a result of the "paradigm" shift in employment policies towards the elderly. Because of the abovementioned data limitations of the EU-LFS, we only perform this analysis for Belgium, France, and The Netherlands.

In a second step, we proceed in the same way for the period 2002 to 2011, making the distinction between the 2002–2006 and 2007–2011 sub-periods. In this case, $\text{per}_3 = 1$ for period 2007–2011, and $\text{per}_3 = 0$ otherwise:

$$\Pr(\text{empl}_{it} = 1|\Omega_{it}) = \Phi\left[\alpha_2 + \sum_{j=2}^{4}\beta_{j,2}.\text{age}_j + \sum_{k=2}^{3}\gamma_{k,2}.\text{edu}_k + \sum_{l=2}^{2}\delta_{l,2}.\text{birth}_l + \sum_{m=2}^{3}\eta_{m,2}.\text{stat}_m + ,\tilde{\alpha}_3.\text{per}_3 + \sum_{j=2}^{4}\tilde{\beta}_{j,3}.\text{age}_j.\text{per}_3 + \sum_{k=2}^{3}\tilde{\gamma}_{k,3}.\text{edu}_k.\text{per}_3 + \sum_{l=2}^{2}\tilde{\delta}_{l,3}.\text{birth}_l.\text{per}_3 + \sum_{m=2}^{3}\tilde{\eta}_{m,3}.\text{stat}_m.\text{per}_3\right] \quad (3)$$

where $\tilde{\alpha}_3 = \alpha_3 - \alpha_2$, $\tilde{\beta}_{j,3} = \beta_{j,3} - \beta_{j,2}$, $\tilde{\gamma}_{k,3} = \gamma_{k,3} - \gamma_{k,2}$, $\tilde{\delta}_{l,3} = \delta_{l,3} - \delta_{l,2}$, and $\tilde{\eta}_{m,3} = \eta_{m,3} - \eta_{m,2}$.

We make the assumption that these parameters, in particular the period-specific age parameters $\tilde{\beta}_{j,3}$, and their corresponding estimated marginal effects on employment probabilities capture the period-specific dynamics resulting from either ongoing implementation of reformed labor market policies/regulations or the financial crisis.

Tables 4 and 5 report the marginal effects corresponding to probit models (2) and (3), respectively. In both tables, we make the distinction between the reference period, at the top of the table, and the second period, at the bottom. It is important to note that for the reference period, the marginal effects correspond to cross section variations with respect to the reference group (25–49 years old, high education, living in the country of birth, and unmarried), while for the second period, the marginal effects correspond to variations in these cross-sectional effects across periods.

From the top of Table 4, we observe that the results for the period 1997–2001 confirm the sharp drop in ER among the 55- to 59- and 60- to 64-year-olds and in all cases higher slowdown for men than for women. As expected, education and country of birth matters too; in all cases, the sign of coefficients are statistically significant. For women and men, these effects are rather similar, with the exception of The Netherlands, where the drop in ER is sharper among women with low education (−28.3 vs. −18.4 % points) and for men born abroad (−25.4 vs. −12.6 % points).

The results at the bottom of Table 4 present the extra effect of period 2002–2006 for the different variables listed—which we refer to as the "crossed" effect (an underlying variable crossed with the second sub-period 2002–2006). When looking at the crossed effect linked to age, we see that the marginal effect of men aged 55–59 and 60–64 was positive and significant in all three countries—pointing at a catching-up phenomenon with respect to the baseline group aged 25–49. For women, we observe either no significant gap with respect to the reference group (like in France for the 60–64-year-olds) or a smaller effect than among men (4.0 and 6.9 % points less among

Table 4 Probit model employment determinants. Estimated marginal effects in % points, by country and sex (1997–2006)

Variable	Belgium		France		The Netherlands	
	Women	Men	Women	Men	Women	Men
Period 1997–2001						
Intercept (a_1)	*89.0****	*91.9****	*83.9****	*88.1****	*92.1****	*94.5****
Age (ref: 25–49)						
50–54 ($\beta_{2,1}$)	−13.7***	−14.3***	−0.4*	−7.9***	−9.2***	−13.3***
55–59 ($\beta_{3,1}$)	−34.7***	−45.7***	−19.6***	−41.5***	−25.1***	−39.9***
60–64 ($\beta_{4,1}$)	−65.5***	−72.5***	−59.5***	−78.6***	−58.3***	−74.7***
Education (ref: high)						
Medium ($\gamma_{2,1}$)	−15.7***	−10.6***	−10.0***	−5.7***	−10.4***	−6.3***
Low ($\gamma_{2,1}$)	−35.8***	−27.8***	−22.3***	−17.0***	−28.3***	−18.4***
Country of birth (ref: country)						
Abroad ($\delta_{2,1}$)	−14.9***	−18.2***	−11.0***	−8.4***	−12.6***	−25.4***
Marital status (ref. unmarried)						
Married ($\eta_{2,1}$)	−4.3***	10.2***	−1.6***	10.5***	−12.9***	8.4***
Widow ($\eta_{3,1}$)	−2.9***	3.1***	2.6***	4.0***	−13.0***	−0.5
Period (ref: 1997–2001)						
2002–2006 ($\tilde{a}_2$)	−0.5	−0.5	0.9***	1.7***	0.2	0.7
Crossed effects (2002–2006)						
Age (ref: 25–49)						
50–54 $\left(\tilde{\beta}_{2,2}\right)$	5.0***	4.3***	1.2***	1.7***	2.9***	3.3***
55–59 $\left(\tilde{\beta}_{3,2}\right)$	3.3***	7.3***	3.6***	4.3***	2.6***	9.5***
60–64 $\left(\tilde{\beta}_{4,2}\right)$	3.3***	3.3***	0.5	2.8***	2.2***	3.5***
Education (ref: high)						
Medium $\left(\tilde{\gamma}_{2,2}\right)$	1.4**	0.5	1.2***	−0.8**	0.6	0.3
Low $\left(\tilde{\gamma}_{3,2}\right)$	2.0**	1.0	1.0**	−0.7	1.7***	4.2***
Country of birth (ref: country)						
Abroad $\left(\tilde{\delta}_{2,2}\right)$	−0.9	2.2**	−0.3	1.4***	−1.4**	5.7***
Marital status (ref. single)						
Married $\left(\tilde{\eta}_{2,2}\right)$	2.4***	−1.0***	0.5*	−1.2***	6.5***	−0.5**
Widow $\left(\tilde{\eta}_{3,2}\right)$	3.0***	1.1	−0.6**	−0.1	8.2***	0.7
Sample size						
# obs. (×1000)	151.7	146.4	511.4	480.1	375.6	365.2

Notes: in italic, estimated employment probability in % points for the reference category
***, **, *Statistically significant coefficients at 1, 5, and 10 % thresholds (χ^2 test), respectively (robust estimation)

the 55-59-year-old women in Belgium and The Netherlands, respectively). Remember that our findings are purely descriptive in this sense neither the proof nor the invalidation of any specific policy measure. They rather document that in the aftermath of the Lisbon summit, there has been an increase in employment and some degree of catching up—whether caused by policy change or not.

From the results of Table 4, it is further noticeable that among women in most cases, ER grew faster for low and medium educated workers than for highly educated—all other things being equal. Among men, the same evolution is only observed in The Netherlands for low educated (+4.2 % points).

Table 5 Probit model employment determinants. Estimated marginal effects in % points, by country and sex (2002–2011)

Variable	Belgium		France		Germany		The Netherlands	
	Women	Men	Women	Men	Women	Men	Women	Men
Period 2002–2006								
Intercept (α_2)	*88.5****	*91.6****	*84.8****	*89.5****	*88.7****	*89.6****	*92.2****	*94.8****
Age (ref: 25–49)								
50–54 ($\beta_{2,2}$)	−8.8***	−10.1***	0.8***	−6.0***	−1.3***	−8.5***	−6.2***	−10.0***
55–59 ($\beta_{3,2}$)	−31.4***	−38.4***	−16.0***	−37.2***	−12.8***	−21.9***	−22.5***	−30.4***
60–64 ($\beta_{4,2}$)	−62.2***	−69.1***	−59.0***	−76.1***	−51.4***	−60.2***	−56.1***	−71.3***
Education (ref: high)								
Medium ($\gamma_{2,2}$)	−14.4***	−10.1***	−8.8***	−6.5***	−11.0***	−14.8***	−9.8***	−6.0***
Low ($\gamma_{3,2}$)	−33.8***	−26.8***	−21.3***	−17.6***	−25.5***	−28.7***	−26.6***	−14.1***
Country of birth (ref: country)								
Abroad ($\delta_{2,2}$)	−15.7***	−16.1***	−11.3***	−6.9***	−5.8***	−5.2***	−14.0***	−19.7***
Marital status (ref. unmarried)								
Married ($\eta_{2,2}$)	−2.0***	9.2***	−1.1***	9.2***	−7.0***	9.4***	−6.4***	7.9***
Widow ($\eta_{3,2}$)	0.0	4.1***	2.0***	4.0***	−2.7***	1.8***	−4.8***	0.3
Period (ref: 2002–2006)								
2007–2011 ($\tilde{\alpha}_3$)	1.8***	0.3	1.5***	1.6***	1.7***	3.2***	1.3***	−0.2
Crossed effects (2007–2011)								
Age (ref: 25–49)								
50–54 $\left(\tilde{\beta}_{2,3}\right)$	2.3***	3.1***	1.0***	3.1***	1.4***	1.0*	1.6***	1.4**
55–59 $\left(\tilde{\beta}_{3,3}\right)$	6.7***	6.5***	3.5***	6.7***	3.5***	1.7**	5.7***	8.4***
60–64 $\left(\tilde{\beta}_{4,3}\right)$	3.4***	1.8***	1.7***	4.2***	11.1***	5.9***	6.6***	8.5***
Education (ref: high)								
Medium $\left(\tilde{\gamma}_{2,3}\right)$	0.6	0.3	−0.4	−2.8***	0.1	0.0	0.0	−0.9**
Low $\left(\tilde{\gamma}_{3,3}\right)$	0.3	−1.3*	−1.7***	−4.0***	−1.3*	−3.7***	−1.3***	−1.8***
Country of birth (ref: country)								
Abroad $\left(\tilde{\delta}_{2,3}\right)$	−0.2	1.1*	−0.6*	0.4	−3.3***	−1.2**	−1.6***	1.9***
Marital status (ref. single)								
Married $\left(\tilde{\eta}_{2,3}\right)$	−0.2	−0.2	0.5***	−0.6***	1.5***	0.6***	3.0***	0.8***
Widow $\left(\tilde{\eta}_{3,3}\right)$	0.0	0.7	0.7***	0.2	1.0*	1.0**	1.2**	0.9
Sample size								
# obs. (×1000)	238.2	228.7	838.8	782.0	469.2	465.4	414.8	400.6

Notes: in italic, estimated employment probability in % points for the reference category
***, **, *Statistically significant coefficients at 1, 5, and 10 % thresholds (χ^2 test), respectively (robust estimation)

Table 5 reports similar results for the second period of analysis 2002–2011. Results of the top panel of Table 5 are broadly comparable with those of Table 4. For Germany, which was not present in Table 4, the marginal effects of education and country of birth are all comparable to those observed for the other countries and statistically significant. More remarkable in the case of Germany is that no major differences appear between the marginal effects across women and men and that age effects are less dramatic, particularly for the 55- to 59-year-olds, −12.8 and −21.9 % points compared to drops in ERs going from −16.0 to near −38.4 % points in the neighboring countries.[12] The effect of marital status is rather heterogeneous across periods and

countries, but they confirm the observation that among women, ERs are higher for single than for married and that the opposite situation holds true for men.

The second part of Table 5 reveals some surprising results. First, our estimates indicate that contrary to what one might have expected after the onset of the financial crisis, the ER for the population improved from 2007 to 2011 as witnessed by the positive marginal effect of this second sub-period. This is particularly true for women and men in Germany ($\tilde{\alpha}_3 = +1.7\,\%$ and $\tilde{\alpha}_3 = +3.2\,\%$ points, respectively) and in France ($\tilde{\alpha}_3 = +1.5\,\%$ and $\tilde{\alpha}_3 = +1.6\,\%$ points, respectively), as well as among women in Belgium (+1.8 % points) and The Netherlands (+1.3 % points)—showing that the aftermath of the financial crisis has not everywhere been a period of low and decreasing employment. Quite to the contrary, some countries seem to have made important advances in the post-crisis world—be they the result of explicit policy measures (such as continued implementation of employment strategies) or not.

Second, we observe a positive and significant additional effect among the aged. Among the 55- to 59-year-olds, the marginal effect, corresponding to the $\tilde{\beta}_{3,3}$ coefficient, is in several cases higher than 5 % points (the only exceptions are men in Germany and women in France), while for the 60- to 64-year-olds (coefficient $\tilde{\beta}_{4,3}$), the marginal rates are between 5 and 10 % points for Germany and The Netherlands and between 1.7 and 4.2 % points for Belgium and France. These results confirm observations made for the USA by Hoynes et al. (2012) and Laroque and Osotimehin (2014) who report that aged workers were proportionally less affected by the crisis, than younger ones.

Looking at groups of individuals that are often associated with increased vulnerabilities—namely the less skilled and those born abroad—they seem to have fared less favorably in the aftermath of the financial crisis—ceteris paribus. The coefficients $\tilde{\gamma}_{3,3}$ and $\tilde{\delta}_{2,3}$ are in both cases negative or statistically non-significant. It is interesting to notice that this is exactly the reverse of what we observed in Table 4 for the $\tilde{\gamma}_{3,2}$ and $\tilde{\delta}_{2,2}$ coefficients, which were in nearly several cases positive for the 2002–2006 period—indicating a catch-up of those groups in the run-up to the financial crisis.

4 Hours of work analysis

The present section proposes a complementary analysis of hours of work. The starting point is that merely looking at ERs for measuring labor utilization gives a very partial picture of reality—be it for the population at large or those aged 50+. There is ample potential for a general link between employment and hours of work: reduced pre-retirement work schedules, part-time retirement, etc. are all reminders of the conceptual relevance of taking hours of work into account when evaluating government policies. Our working hypothesis is that ER versus hours of work substitution is an important issue—with associated consequences for economic activity and policy-making.

In practice, it can mean that increases in employment for a given age group can be associated with lower hours of work for members of this age group, potentially leading total hours of work to decrease. In what follows, we thus investigate two specific questions: In this section, we explore how individual hours of work have evolved over the period 1997–2011. In the next section, we propose a decomposition of the change of average total hours of work into its various components.

We use information on usual hours of work reported in the EU-LFS micro-data and estimate a Heckman (1979) selection model with usual hours of work as the dependent variable. To take into account a potential selection bias, due to the observability of data (hours at work) exclusively for individuals in employment, the model includes among explanatory variables the inverse Mills ratio derived from the estimation of ER probabilities under the probit model presented in Section 3. For estimation purposes, we rely on the full maximum likelihood Heckman procedure available in STATA.

As for the study of ER in Section 3, we proceed in two steps. In the first step, we estimate a model for the first two sub-periods, 2002–2006 versus 1997–2001, and in a second step, 2007–2011 versus 2002–2006. Equations 4 and 5 present the parametric linear relation we choose to model hours of work for periods 1997–2006 and 2001–2011, respectively[13]:

$$\begin{aligned}\text{hour}_{it} = \alpha_1 + \sum_{j=2}^{4}\beta_{j,1}.\text{age}_{j,it} + \sum_{k=2}^{3}\gamma_{k,1}.\text{edu}_{k,it} + \sum_{l=2}^{2}\delta_{l,1}.\text{birth}_{\text{l},it} + \tau_1.\text{senior}_{it} \\ + \tilde{\alpha}_2.\text{per}_2 + \sum_{j=2}^{4}\tilde{\beta}_{j,2}.\text{age}_{j,it}.\text{per}_2 + \sum_{k=2}^{3}\tilde{\gamma}_{k,2}.\text{edu}_{k,it}.\text{per}_2 + \sum_{l=2}^{2}\tilde{\delta}_{l,2}.\text{birth}_{2,it}.\text{per}_2 \\ + \tilde{\tau}_2.\text{senior}_{it}.\text{per}_2, \end{aligned} \tag{4}$$

$$\begin{aligned}\text{hour}_{it} = \alpha_2 + \sum_{j=2}^{4}\beta_{j,2}.\text{age}_{j,it} + \sum_{k=2}^{3}\gamma_{k,2}.\text{edu}_{k,it} + \sum_{l=2}^{2}\delta_{l,2}.\text{birth}_{\text{l},it} + \tau_2.\text{senior}_{it} \\ + \tilde{\alpha}_3.\text{per}_3 + \sum_{j=2}^{4}\tilde{\beta}_{j,3}.\text{age}_{j,it}.\text{per}_3 + \sum_{k=2}^{3}\tilde{\gamma}_{k,3}.\text{edu}_{k,it}.\text{per}_3 + \sum_{l=2}^{2}\tilde{\delta}_{l,3}.\text{birth}_{3,it}.\text{per}_3 \\ + \tilde{\tau}_3.\text{senior}_{it}.\text{per}_3, \end{aligned} \tag{5}$$

where hour_{it} corresponds to the number of hours per week usually at work, senior_{it} corresponds to seniority in the current employment in years, and the other variables are as defined before. To allow model identification, we assume that marital status, an explanatory variable in the ER model, is not relevant to explain hours of work. We are aware that this is a strong assumption, but we did not identify any other variable in the EU-LFS better suited for identification purposes.[14]

In Tables 6 and 7, we report the estimated coefficients for sub-periods 1997–2006 and 2002–2011, respectively. In all cases, the Mills ratio appears to be negative and statistically significant indicating that the results would be biased upward downward without taking into account a potential selection bias. Also, for the period 2002–2006, the direct effects $\tilde{\alpha}_2$ indicate an insignificant or an increasing effect on hours at work. This is the case of women in Belgium and France, with +0.77 and +1.36 h, respectively, and of men in France (+1.31 h). A similar, but somewhat less pronounced, effect is observed for 2007–2011 for the same categories of workers (women and men in France and for women in Belgium). A significant and slight decrease in hours of work (−0.23 % points h) is observed for men in The Netherlands. By construction, these effects are associated with the reference group in the analysis, in this case the 25-49-year-olds. For the other time-independent explanatory variables, such as age, it is difficult to identify a general pattern of direct effects: women in France and Belgium and men in The Netherlands appear to work fewer hours when aging, while men in France increase significantly the number of hours of work. Also, less educated workers work in

Table 6 Heckman model. Estimated marginal effects in hours, by country and sex (1997–2006)

Variable	Belgium		France		The Netherlands	
	Women	Men	Women	Men	Women	Men
Period 1997–2001						
Intercept (a_1)	32.7***	41.4***	33.2***	41.6***	29.6***	38.3***
Age (ref: 25–49)						
50–54 ($\beta_{2,1}$)	−0.58**	0.31*	−0.84***	0.79***	0.10	−1.00***
55–59 ($\beta_{3,1}$)	0.04	1.97***	−2.41***	0.79***	0.63***	−2.17***
60–64 ($\beta_{4,1}$)	−0.30	3.70***	−2.86***	3.90***	2.19***	−3.73***
Education (ref: high)						
Medium ($\gamma_{2,1}$)	0.57***	−0.13	0.23***	−0.17**	−1.79***	1.22***
Low ($\gamma_{2,1}$)	−0.77***	−0.69***	−1.30***	−1.24***	−2.68***	0.89***
Country of birth (ref: country)						
Abroad ($\delta_{2,1}$)	1.34***	0.25	−0.85***	−0.63***	3.72***	−0.90***
Others						
Seniority (τ_1)	0.06***	−0.01	0.16***	0.01***	0.05***	0.12***
Period (ref: 1997–2001)						
2002–2006 ($\tilde{a}_2$)	0.77***	0.15	1.36***	1.31***	0.00	0.06
Crossed effects (2002–2006)						
Age (ref: 25–49)						
50–54 $\left(\tilde{\beta}_{2,2}\right)$	−1.11***	−0.92***	0.96***	0.53***	0.15	−0.25**
55–59 $\left(\tilde{\beta}_{3,2}\right)$	−1.65***	−2.20***	1.57***	1.69***	0.48**	−0.26*
60–64 $\left(\tilde{\beta}_{4,2}\right)$	−0.35	−3.05***	1.82***	0.77**	2.18***	−0.13
Education (ref: high)						
Medium $\left(\tilde{\gamma}_{2,2}\right)$	−1.85***	−0.82***	−1.61***	−1.34***	−0.47***	0.08
Low $\left(\tilde{\gamma}_{3,2}\right)$	−2.60***	−1.24***	−1.54***	−1.87***	0.76***	0.21**
Country of birth (ref: country)						
Abroad $\left(\tilde{\delta}_{2,2}\right)$	−0.62**	−0.58***	0.08	−0.08	0.07	0.18
Others						
Seniority ($\tilde{\tau}_2$)	0.00	0.05***	−0.05***	−0.01***	−0.03***	−0.03***
Mills ratio	−0.66***	−1.08***	−0.61***	−1.83***	−4.41***	−0.52***
Sample size						
# obs. (×1000)	78.1	97.1	301.1	333.6	337.6	352.1

***, **, *Statistically significant at 1, 5, and 10 % thresholds (χ^2 test), respectively (robust estimation)

general fewer hours than highly qualified workers, as expected. Finally, seniority appears in general associated with more hours at work.

Looking at crossed effects, we can identify period-specific effects of changes in these independent variables—either from 1997–2001 to 2002–2006 (Table 6) or from 2002–2006 to 2007–2011 (Table 7). As in the previous sections, we are interested in the sign and the significance of estimated marginal effects on hours of work, particularly crossed effects between age and periods. For example, we observe that for the case of Belgium, nearly all groups show a decline in hours compared to the reference group. This effect nearly represents 1 h each period for the 55–59-year-olds, with an even stronger effect for the age group 60–64 where $\tilde{\beta}_{4,2} = \quad -3.05 \quad$ h for men in 2002–2006.

Table 7 Heckman model. Estimated marginal effects in hours, by country and sex (2002–2011)

Variable	Belgium		France		Germany		The Netherlands	
	Women	Men	Women	Men	Women	Men	Women	Men
Period 2002–2006 (direct effects)								
Intercept (a_2)	33.5***	41.6***	34.5***	42.9***	34.1***	42.4***	29.5***	38.3***
Age (ref: 25–49)								
50–54 ($\beta_{2,2}$)	−1.68***	−0.61***	0.13	1.31***	−0.50***	0.29***	0.13*	−1.25***
55–59 ($\beta_{3,2}$)	−1.57***	−0.20	−0.93***	2.47***	0.18*	0.18***	0.73***	−2.41***
60–64 ($\beta_{4,2}$)	−0.56	0.72**	−1.39***	4.63***	1.99***	−0.54***	3.31***	−3.81***
Education (ref: high)								
Medium ($\gamma_{2,2}$)	−1.26***	−0.94***	−1.42***	−1.51***	−2.60***	−2.27***	−2.42***	1.30***
Low ($\gamma_{3,2}$)	−3.33***	−1.91***	−2.94***	−3.11***	−2.88***	−2.48***	−2.36***	1.12***
Country of birth (ref: country)								
Abroad ($\delta_{2,2}$)	0.74***	−0.31**	−0.83***	−0.71***	0.81***	−0.74***	3.56***	−0.71***
Others								
Seniority (τ_2)	0.06***	0.04***	0.11***	−0.00	0.21***	0.05***	0.02***	0.08***
Period (ref: 2002–2006)								
2007–2011 ($\tilde{a}_3$)	0.75***	−0.04	0.80***	0.24***	0.00	0.09	0.10	−0.23***
Crossed effects (2007–2011)								
Age (ref: 25–49)								
50–54 $\left(\tilde{\beta}_{2,3}\right)$	−0.21	−0.01	−0.71***	−0.49***	−0.46**	−0.54***	−0.67***	0.08
55–59 $\left(\tilde{\beta}_{3,3}\right)$	−0.77***	−0.89***	−0.51***	−1.23***	−0.74***	−1.08***	−1.21***	−0.33***
60–64 $\left(\tilde{\beta}_{4,3}\right)$	−1.24**	−0.30	−1.21***	−2.46***	−0.71**	1.19***	−3.13***	−1.54***
Education (ref: high)								
Medium $\left(\tilde{\gamma}_{2,3}\right)$	−0.89***	−0.27**	−0.60***	−0.38***	−1.05***	−0.37***	−0.64***	−0.23***
Low $\left(\tilde{\gamma}_{3,3}\right)$	−0.89***	−0.12	−0.93***	−0.35***	−0.76***	−1.13***	−1.01***	−0.05
Country of birth (ref: country)								
Abroad $\left(\tilde{\delta}_{2,3}\right)$	−0.16	0.18	−0.11	−0.09	−0.65***	−0.20	0.05	0.06
Others								
Seniority ($\tilde{\tau}_3$)	−0.00	0.02	0.02***	0.04***	0.01	0.04***	0.02***	0.03***
Mills ratio	−0.73***	−1.14***	−0.31***	−1.81***	−8.15***	−1.39***	−3.46***	−0.58***
Sample size								
# obs. (×1000)	131.7	145.0	538.0	581.9	296.4	355.4	249.1	330.1

***, **, *Statistically significant at 1, 5, and 10 % thresholds (χ^2 test), respectively (robust estimation)

For France and The Netherlands, the results are contrasted, positive, and statistically significant for women and men aged 50 and more during 2002–2006, with the only exception of women in The Netherlands, and negative in all cases for 2007–2011. Also for Germany, where the results are only available for 2007–2011, there is a downward trend with the only exception of men aged 60–64.[15]

Finally, crossed effects between period and education indicate a significant decrease in hours worked per week among less skilled workers in both periods. The only exceptions are women and men with low education in The Netherlands during 2002–2006 where the corresponding values are $\tilde{\gamma}_{3,2} = \quad + 0.76$ and $+ 0.21$ h, respectively. To be born abroad has no clear universal pattern of effects. Broadly speaking, these latter

results indicate that the lower educated have overall seen rather pronounced declines in their working hours and this across all countries studied. Being born abroad on the other hand has no clear effect on hours of work, which contrasts with the results in terms of ERs where both vulnerable groups were more heavily affected after the onset of the financial crisis.

These latter findings have immediate policy relevance. They confirm our working hypothesis that the reliance on a single indicator such as ER for evaluating employment performance might lead to inadequate conclusions and thus inappropriate policies—as leaving aside work intensity.

5 Micro-simulation of changes in total hours of work

Now that we have established that hours of work change at the individual level, the second question remains unanswered: what is the effect of the various drivers of average total work hours for a given age-sex group? We propose a decomposition analysis that separates out the effect of three factors: changes in the socio-economic structure of the population in any given age group, employment rate, and hours of work per worker.[16] For this purpose, we use the methodology proposed by Blundell et al. (2013). We propose one major change with respect to Blundell et al. (2013) in that we rely on the results of the econometric models from the previous sections to perform the micro-simulation decomposition exercise.[17]

More specifically, for each age category a, we estimate the rate of change in average total hours worked from period $p-1$ to period p, $H_{a,p}/H_{a,p-1}$, as the product of structural ($S_{a,p}$) and behavioral changes ($B_{a,p}$), with the latter being the product of changes in extensive and intensive margins, $E_{a,p}$ and $I_{a,p}$, respectively:

$$\frac{H_{a,p}}{H_{a,p-1}} = S_{a,p}.B_{a,p}, \quad \text{with} \quad B_{a,p} = E_{a,p}.I_{a,p}. \tag{6}$$

For each age category a (25–49, 50–54, 55–59, and 60–64), $S_{a,p}$ corresponds to the total change in hours of work due to changes in the socio-economic stratification (structure) within the given age category—in our case changes in the educational attainment, country of birth, and marital status, indicated as $m = 1, 2 \ldots M$:

$$S_{a,p} = \sum_{m=1}^{M} \left(\frac{s_{m,p}}{s_{m,p-1}} \right) . \mathrm{empl}_{m,p-1}^{p-1} . \mathrm{hour}_{m,p-1}^{p-1}, \tag{7}$$

where $s_{m,p}$ and $s_{m,p-1}$ indicate the share of category m in the age group at two successive periods and $\mathrm{empl}_{m,p-1}^{p-1}$ and $\mathrm{hour}_{m,p-1}^{p-1}$ are the average estimated ER and hours of work for the corresponding categories m in period $p-1$. For this purpose, we use individuals' predictions of ER and hours of work by application of estimated parameters for the base period, $p-1$, indicated in superscript.

Changes on the extensive and intensive margins are computed using as counterfactual the base period sample but using the estimates for period p (ER coefficients in the case of the extensive margin and hours of work coefficients in the case of the intensive margin):

$$E_{a,p} = \sum_{m=1}^{M} s_{m,p-1} \cdot \left(\frac{\text{empl}_{m,p-1}^{p}}{\text{empl}_{m,p-1}^{p-1}} \right) . \text{hour}_{m,p-1}^{p-1}, \text{ and } I_{a,p} = \sum_{m=1}^{M} s_{m,p-1} . \text{empl}_{m,p-1}^{p-1} \left(\frac{\text{hour}_{m,p-1}^{p}}{\text{hour}_{m,p-1}^{p-1}} \right) . \quad (8)$$

In Table 8, we report the results obtained for all age groups (by sex) for the four countries—and this for the periods of study 1997–2006 and 2002–2011. A reported value of 1.10 represents a 10 % increase from one sub-period to the next, a value of 0.95 a 5 % decrease. We are particularly interested on the net result of extensive and intensive changes, reported in the last columns of Table 8 as they represent the *behavioral change*—in a way the only endogenous parameters in the short run.

We observe that average total hours of work for the different age-sex groups are mainly driven by behavioral changes for age groups 50+. Structural change is positive as a result of the progressive upward shift in education profiles of the various groups. Behavioral change for the 50+ is always positively signed and is generally larger for women than for men—influenced by the seminal increase in female employment (and labor force participation) and some targeted policy measures (such as the progressive upward adjustment of the female retirement age in Belgium). France provides the noticeable deviation to this pattern for the age group 60–64 with substantially stronger employment effects for men ultimately leading to a larger behavioral effect for men than for women. Changes for prime-age workers aged 25–49 obey a different pattern, with overall smaller reactions in individual hours of work and overall more modest employment effects. Employment effects for prime-age workers are overall smaller post-crisis than pre-crisis—except for Belgian males—whereas the opposite is generally true for workers aged 55+—in line with the previously cited results of Hoynes et al. (2012) for older US workers.

Table 8 also illustrates that positive changes at the extensive margin (in ERs) have largely compensated for any observed negative changes at the intensive margin (hours of work). As a result, average members of the age group 50+ contribute to a larger degree to the economic activity and hence implicitly also to the financing of public and social sectors—and this beyond any more demographic cohort size effects. However, the results also indicate substantial offsetting behavior in some cases. This is particularly true in Belgium with its increasingly popular old-age part-time work arrangements, where for all age groups and all periods, the change at the intensive margin has been negative, reaching 8 % for women aged 55–59 in the first period. Finally, the simulation results also show that the growth at the extensive margin has not suffered a major slowdown as a result of the financial crisis starting in 2007—in line with the observed absence of a downward trend on Figs. 1 and 2.

6 Conclusions

European welfare states are under stress: demographic and social changes are leading to increasing demands in terms of expenditures at a time when the population in working age is shrinking. In the face of this observation, academic economists have been promoting the idea of increasing the employment rate of the elderly as one key policy area. With the arrival of the open method of coordination and the Lisbon criteria in 2001, this policy objective has also been put on the agenda of policy-makers—either explicitly or implicitly.

Table 8 Changes in hours of work for an average person

Change	2002–2006 versus 1997–2001								2007–2011 versus 2002–-2006							
	Belgium		France		Germany		The Netherlands		Belgium		France		Germany		The Netherlands	
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
	25–49 years old								25–49 years old							
Total ($H_{a,p}/H_{a,p}$)	1.04	0.99	1.05	1.01	–	–	1.10	1.01	1.07	1.00	1.06	1.00	1.03	1.03	1.05	0.99
Structural ($S_{a,p}$)	1.02	1.00	1.02	1.00	–	–	1.03	1.00	1.03	1.00	1.02	1.00	1.02	1.00	1.02	1.00
Behavioral ($B_{a,p}$)	1.02	0.99	1.03	1.00	–	–	1.07	1.01	1.04	1.00	1.04	1.00	1.01	1.04	1.03	1.00
Extensive ($E_{a,p}$)	1.04	0.99	1.03	1.00	–	–	1.08	1.02	1.03	1.00	1.02	0.99	1.04	1.03	1.03	1.00
Intensive ($I_{a,p}$)	0.98	1.00	0.99	1.00	–	–	0.99	1.00	1.01	1.00	1.02	1.01	0.98	1.00	0.99	1.00
	50–54 years old								50–54 years old							
Total ($H_{a,p}/H_{a,p}$)	1.18	1.02	1.09	1.02	–	–	1.26	1.02	1.14	1.04	1.06	1.02	1.06	1.05	1.08	1.01
Structural ($S_{a,p}$)	1.05	1.01	1.02	1.00	–	–	1.04	1.00	1.04	1.00	1.01	1.00	1.03	0.99	1.03	0.99
Behavioral ($B_{a,p}$)	1.13	1.02	1.07	1.02	–	–	1.21	1.03	1.10	1.03	1.04	1.02	1.04	1.06	1.05	1.02
Extensive ($E_{a,p}$)	1.20	1.03	1.06	1.01	–	–	1.22	1.04	1.10	1.03	1.05	1.02	1.07	1.06	1.08	1.01
Intensive ($I_{a,p}$)	0.94	0.99	1.00	1.01	–	–	0.99	0.99	1.00	1.00	1.00	1.00	0.97	1.00	0.97	1.01
	55–59 years old								55–59 years old							
Total ($H_{a,p}/H_{a,p}$)	1.22	1.08	1.23	1.11	–	–	1.40	1.14	1.32	1.09	1.15	1.06	1.14	1.09	1.19	1.08
Structural ($S_{a,p}$)	1.09	1.03	1.05	1.02	–	–	1.06	1.01	1.07	1.01	1.02	1.00	1.03	1.00	1.03	1.00
Behavioral ($B_{a,p}$)	1.13	1.06	1.18	1.09	–	–	1.31	1.13	1.23	1.08	1.13	1.06	1.10	1.08	1.16	1.08
Extensive ($E_{a,p}$)	1.22	1.10	1.15	1.06	–	–	1.31	1.15	1.26	1.10	1.12	1.08	1.14	1.10	1.21	1.08
Intensive ($I_{a,p}$)	0.92	0.96	1.02	1.03	–	–	1.00	0.98	0.98	0.98	1.00	0.99	0.96	0.99	0.95	1.00
	60–64 years old								60–64 years old							
Total ($H_{a,p}/H_{a,p}$)	1.60	1.14	1.29	1.37	–	–	1.78	1.31	1.46	1.16	1.27	1.28	1.69	1.39	1.40	1.37
Structural ($S_{a,p}$)	1.16	1.07	1.10	1.05	–	–	1.09	1.02	1.15	1.07	1.09	1.03	1.08	1.03	1.06	1.01

Table 8 Changes in hours of work for an average person *(Continued)*

Behavioral ($B_{a,p}$)	1.37	1.07	1.18	1.30	–	–	1.64	1.28	1.27	1.08	1.16	1.24	1.56	1.36	1.32	1.36
Extensive ($E_{a,p}$)	1.44	1.12	1.15	1.28	–	–	1.56	1.29	1.32	1.09	1.19	1.29	1.62	1.37	1.46	1.40
Intensive ($I_{a,p}$)	0.96	0.95	1.03	1.01	–	–	1.06	0.98	0.96	0.99	0.98	0.96	0.96	0.99	0.90	0.97

Micro-simulation based on estimates underlying Tables 3, 4, 5, and 6

The present paper provides a fresh look at the question using the European Union Labour Force Survey micro-data. It innovates with respect to the literature in two areas. First, it takes a comparative approach between Belgium, France, Germany, and The Netherlands—four rather comparable countries. Second, it extends the usual benchmarking based on employment rates alone to also include hours of work data.

Our results are threefold. First, we construct probit models of employment and show that older workers aged 50+ have by and large a significantly larger increase in employment than the one observed for the general population over the time period 1997–2011. Our findings indicate some "catching-up" phenomenon with older age groups looking increasingly like prime-age ones. We find substantial differences between men and women, pointing to the need to take the gender dimension into account when considering labor market policies. Our results further document vulnerable groups—such as less educated and first-generation immigrants—faring less well.

Second, we complement the employment rate analysis by an hours of work analysis at the individual level. More specifically, we investigate to which degree—if any—there has been substitution between employment and hours of work for the individuals under study. For this purpose, we estimate a Heckman selection model and evaluate the changes in hours of work. The results show that for some groups in the 55–64 age bracket, reductions in observed average hours of work can be as important as 8 % for the case of Belgium.

Third, to evaluate the relative importance of the above factors, we complete the analysis by a micro-simulation approach that decomposes the change in average total hours of work for the various age-sex groups into a structural margin and a behavioral one. Our results—based on estimated parameters—indicate that in the period of observation, changes in employment rates are more the result of changes on the behavioral margin, with increases at the extensive (employment) margin having been sufficiently strong to offset any opposing observed tendencies on the intensive (hours) margin. We find little evidence of a distinctive effect of the financial crisis on these findings.

Our results have immediate policy relevance. First, they imply that a given observed increase in employment rates might hide very different realities (different work intensities). As a result, a policy merely focused on employment rates might be heavily misguided as it ignores the sometimes opposite-signed effect at the intensive margin.

Endnotes

[1]Active aging means keeping professional or non-professional activities. Moreover, in a recent study, Bonsang et al. (2012) found a positive correlation between early retirement and cognitive decline.

[2]The OMC was introduced by the European Council (2000) as part of the Lisbon Strategy and included the improvement of women's employment to a rate of 60 % or more as a goal for member countries in 2010. One year later, the European Council (2001) established an extended list of indicators in the field of social inclusion and social protection (Laeken indicators) and new OMC goals. One of them—a pension sustainability indicator—targeted the increase of the ER of the 55- to 64-year-olds to 50 % or more.

[3]For a test and the rejection of the fixed labor demand hypothesis, see Gruber and Wise (2010). Lefebvre (2013) provides an overview of the roles of employers, workers, and the government in shaping the early retirement pathways in Belgium.

[4]Employment and hours of work data are from the EU-LFS micro-data, a large-scale survey dataset that has been collected in a harmonized way since 1983. EU-LFS data series are complete for Belgium and France (1983 to 2011) but incomplete for The Netherlands (starting in 1987) and for Germany (starting in 2001).

[5]A finer breakdown of age is not possible as in EU-LFS data age is only available in 5-year brackets.

[6]Given the 5-year age brackets inherited from the EU-LFS data, our choice of 5-year sub-periods is convenient de facto allowing a tracing of cohorts across time (e.g., those 50–54 in 1997–2001 are aged 55–59 in 2002–2006).

[7]Steiner (2015) observed the same evolution in 60–64-year-olds' ER in Germany using the Socio-economic Panel (SOEP) data.

[8]In what follows, we will discuss the effects for ages 55+ only, as the age group 50–54 is more of a knife-edge situation.

[9]Employment is as defined by the derived variable ILOSTAT in the EU-LFS (Eurostat 2015)—essentially work effort of at least 1 h during a reference period (last week).

[10]A finer breakdown of the category of people born abroad between those born in EU-15, the rest of the EU, and outside of EU would be preferable. However, the relevant indicators cannot be traced harmoniously across time as the EU-LFS data and methodology reflect the change from 15 to 27 members during the period under study, with sample size further limiting such breakdowns into sub-groups.

[11]Unmarried is defined as the residual category.

[12]For Germany, we performed sensitivity analysis by restricting the sample to Western Germany—with substantially unchanged results.

[13]Note that we use the same parameter notation for probit models (Eqs. 1 and 2) and for OLS models (Eqs. 4 and 5) for simplification purposes.

[14]We also estimated the same Heckman selection models including the marital status dummy variables. Results were in most cases very close to those presented here.

[15]For Germany, we again performed sensitivity analysis by restricting the sample to Western Germany—with substantially unchanged results.

[16]Notice that the total hours concept used does not include changes in the size of the age-sex group itself. Hence, mere increases in the size—as opposed to the composition—of the demographic group would have to be added when evaluating revenue implications of total hours of work changes for tax or social insurance administrations.

[17]In what follows, we present the derivation of a Laspeyres index, using period $p - 1$ as reference. The computation of the Paasche index, with period p as reference, is straightforward. Results reported in Table 7 correspond to the weighted Fisher index, i.e., the geometric mean of the Laspeyres and Paasche indexes, to correct for sample bias and to neutralize the effect of the choice of a specific reference period. We further present the changes in ER and in hours of work in ratio form and not in absolute differences.

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