The effect of training on older workers' wage: evidence from Europe

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Abstract

Financial deficits of many social security systems caused by ageing populations and stagnating economies are forcing workers to retire later from the labour market. An extended working life, combined with rapid technological progress undergoing in many sectors, may likely make older workers' skills attained at school obsolete. In this context, lifelong investment in training is widely recognized among the international research and policy community as a key element to increase or, at least, limit the decline in productivity of older workers. This paper investigates the impact of training undertaken by European older workers on their wages, relying on the *Survey of Health, Ageing and Retirement in Europe* (SHARE).

Taking part in training activities increases wages of European workers aged 50 years and older by up to 6.5 %. This return is sizable: it is comparable to attaining a upper and post-secondary instead of a primary and lower-secondary education degree. Return to training is *prima facie* higher in Continental and Southern than in Northern European countries, the latter group of countries being characterized by the highest incidence. Our results suggest that investment in training at older ages is an effective way to counteract human capital depreciation.

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1. Introduction

The long-term increase in longevity, which many countries are experiencing, is a direct reflection of the success of our societies in securing higher living standards. Such increasing life expectancy, together with low economic growth, has however put pressure on financial equilibrium of many PAYGO pension systems in Europe and in other industrialized countries. Governments have therefore often been forced to increase the average retirement age out of the labour force by either limiting access to early retirement or making early exit routes less attractive (see, e.g., Gruber and Wise 2004). An extended working life – combined with the rapid technological progress undergoing in many sectors – may likely make older workers' skills attained at school obsolete. In this context, lifelong investment in training is widely recognized among the international research and policy community as a key element to increase or, at least, limit the decline in productivity of older workers (see, e.g., OECD 2006).

The theoretical foundations of the effect of training on workers' productivity lie in the human capital theory (Becker 1964, 1993). According to this theory, training activities (and education) are investments, since they are undertaken to increase individuals' stock of knowledge, skills, competencies and abilities, which form the human capital. Based on the assumption of a perfectly competitive labour market, the human capital theory describes the individual's decision to invest in training as based upon a comparison of the net present value of costs (i.e. lower wages while trained and direct training costs) and benefits of such an investment. Since training is thought to make workers more productive, expected benefits of training are higher marginal products and higher wages[2]. Individuals invest in training during a period and receive returns to the investment in subsequent periods. One of the main prediction of this model is therefore that both participation and returns to training decline with increasing age, since the expected present value of future benefits reduces approaching the retirement age. Generous early retirement schemes may therefore discourage participation to training addressed to older workers (Fouarge and Schils 2009). Moreover, training courses are often designed without taking into account the employees age differences and are not tailored in forms and contents to older trainees (Zwick 2011; Gobel and Zwick 2010). From the supply side, personnel managers may be reluctant to offer training course to older employees because have the perception that older workers are less able or willing to learn than their younger peers (Warr and Birdi 1998). All this has led to a low incidence of training between older workers.

[2] Recent developments of the human capital model, which relax the assumption of a perfectly competitive labor market, are surveyed in Bassanini et al. (2007).

There is a wide literature on the impact of training on workers' productivity and/or wages; we summarize this literature in section 2. Most studies, however do not analyse age differences in participation and returns to training and little attention has been dedicated to older workers specifically (see next section). Moreover, most of the existing studies analyse one single country; it has been stressed that – due to different concepts and definitions of training across countries and data sets (see Bassanini et al. 2007) - comparability of results across countries is limited. Few studies circumvent parts of these limitations exploiting cross-countries data (OECD 1999, Bassanini et al. 2007, Ok and Tergeist 2003, Arulampalam et al. 2010). None of these last studies focuses, however, on the elderly.

In this paper, we investigate the impact of training undertaken by workers aged 50 and older on their wages. This exercise relies on the *Survey of Health, Ageing and Retirement in Europe* (SHARE), which provides information on wages and training for European individuals aged 50+. Besides its specific focus on older adults, this source of data is particularly suitable for international studies due to its wide country coverage and the harmonization in the definition of training in the country questionnaires.

The paper proceeds as follows. Section 2 reviews the existing literature, section 3 describes data and empirical strategy while section 4 contains the main findings. Section 5 provides some additional sensitivity analysis and section 6 concludes.

2. Literature review

A lot of research effort has been dedicated to empirically test the predictions of the human capital theory. A first bunch of this literature attempts to measure the effects of training on productivity directly, by modelling and estimating the firm production function. These studies commonly exploit information from linked employer-employee datasets or from survey of firms, which contain information on firms' value added and/or turnover (see, e.g., Ichniowski, Shaw and Prennushi 1997; Black and Lynch 2001; Dearden et al. 2006; Almeida and Carnero 2009; Göbel and Zwick 2010; Heywood et al. 2010). The second branch of this literature evaluates the effect of training on productivity indirectly, by means of its effect on workers' wages. It assumes that wages are a sufficient statistic for productivity (Dearden et al. 2006) and relies on the traditional neoclassical labour market model with perfectly competitive wages. However, in presence of a compressed

wage structure, this may not be true and it is possible that the effect of training on productivity will not automatically translated in an equal effect on wage (Acemoglu and Pischke 1999)[3].

Positive effects of training on wages are commonly found for most European countries as well as for the US.[4] Nevertheless, the size of the estimated effect varies widely across countries and, for the same country, depends on the data and analytical methods used. An extended empirical literature on this topic exists for the UK. Booth (1991) finds high returns (11% for men and 18% for women) of company training on UK workers' earnings. Relying on different data and methods, however, Booth (1993) finds a much lower effect (1%). Blundell et al. (1996) find positive returns ranging from 3% to 6% depending on the method and sample used, and Arulampalam and Booth (2001) find similar results. Positive effects of training on wages are also found for Norway (1% increase; Shone 2004), Switzerland (2% increase; see Gerfin 2004), and Portugal (30% for men and 38% for women; see Budria and Pereira 2007).

Results for Germany and France are less clear. Using the *German Socio-Economic Panel* (GSOEP) dataset, Pischke (2001) finds not significant wage returns to training, while Mühler, Beckmann and Schauenberg (2007) report a significant effect of about 5% to 6% for general training and no effect for firm-specific training. Kuckulenz and Zwick (2003) use data from the *Qualification and Career Survey* and show that internal training does not translate into higher earnings while external training does. Goux and Maurin (2000) find no significant wage effect of trained French workers; this result is partially confirmed by Fougère et al. (2001), who find a positive return to training only for job-switchers.

Few papers take a cross-country perspective. A study by the OECD (1999) reports that workers who have undergone further training after formal education have higher hourly wages in Australia, Canada, Germany, Italy and the UK, whereas the effect of training is insignificant in the case of France and the Netherlands. A more recent study by the OECD (2004) reports that average measures of the wage premium range from practically zero in France and the UK to a peak of almost 5% in Portugal. Bassanini et al. (2007), using the *European Community Household Panel* (ECHP) data, estimate a positive impact of training incidence on earnings for most of the analyzed countries; this return ranges from 3.7% for the Netherlands to 21.6% for Greece; results are, however, sensitive to the statistical method which is applied. Ok and Tergeist (2003) largely confirm these findings.

[3] Dostie and Leger (2011) show with Canadian data that the effect of firm-sponsored classroom training on productivity is much greater than the effect on wages

[4] The US pioneered this empirical literature exploiting the National Longitudinal Survey of Youth (NLSY) dataset, therefore focusing on young workers (see, e.g. Lynch 1992).

As mentioned above, few papers investigate the differentials in training returns and incidence between younger and older workers (Booth 1991, Bassanini 2006, Bassanini et al. 2007, Warr and Fay 2001, Lang 2012, Dostie and Leger 2011). These studies mostly confirm human capital theory predictions showing a lower impact of training and a lower training incidence for older workers compared to younger ones.

3. Data and empirical strategy

This study relies on SHARE data. SHARE (see www.share-project.org) is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks of more than 85,000 individuals (approximately 150,000 interviews) from 19 European countries (+Israel) aged 50 or over. Four waves of SHARE are currently available[5]. The common questionnaire and interview mode, and the standardization of procedures ensure cross-country comparability (Börsch-Supan and Jürges 2005). In SHARE waves 1 and 2, individuals have been asked whether they attended any educational or training course in the last month.[6] Trainees are also asked the frequency of training activities (but the response rate to this question is too low to be used in our study) and the motivation for their attendance. We exploit this last information for a robustness check (see section 5).

Based on this data, we estimate the following equation for log-wages:

$$\log(w_{it}) = x_{it}\beta + \tau_{it-n}\gamma + \varepsilon_{it} \qquad (1)$$

where $\log(w_{it})$ is the logarithm of net hourly wages of individual *i* at time *t*, *x* is a vector of exogenous demographic and job-related individual characteristics, τ is a dummy variable equal to one if individual *i* participated to any training activity at time *t-n*, and ε is a random term which satisfies the standard i.i.d. assumptions. The key parameter to be estimated is γ, which measures the causal impact of training on wages. In the main empirical specification of equation (1), *x* includes a

[5] In the third wave of SHARE (interview years 2008-2009), known as SHARELIFE, all respondents in waves 1 and 2 were asked to provide information on their entire life histories, including their whole past working career. From this retrospective survey, it is also possible to obtain some information on training episodes earlier in life. These training episodes are, however, recorded only if there is a gap of at least 6 months: i) between the end of continuous full-time education and the start of first job, or ii) between jobs. No information about training occurred *during* past employment spells is available. In addition, a first inspection to SHARELIFE revealed very few episodes of training, especially between jobs. For these reasons, we could not exploit SHARELIFE for an analysis of long-term impact of training on older workers' wages.

[6] In SHARE wave 4, individuals have been instead asked whether they attended any educational or training course in the last year. This question is similar to that included in the ECHP (used extensively for the analysis of training in Europe, see previous section). Noticeably, the ECHP ended in 2001, and the *European Union Statistics on Income and Living Conditions* (EU-SILC) - which has replaced the ECHP - does not include any information on training.

second order polynomial for age, (log of) tenure, dummy variables for main educational ISCED groups, gender, working in the public or private sector, country of residence, sector of work, occupation (ISCO 1-digit), and year of interview.

We estimate equation (1) exploiting the panel component of SHARE wave 1 (interview years 2004-2005) and 2 (interview years 2006-2007). In particular, information on training is obtained from wave 1 by means of the above mentioned question: "Have you attended any educational or training course in the last month?", while hourly wages are reconstructed from wave 2, combining information on i) last taken home payment from work, ii) frequency of payments ("How often do you get paid?: Every week, every two weeks,…every year), and iii) hours worked in a week. Therefore, we estimate the short-term impact of training on wages (i.e. n=1, 2, or 3 in equation 1).[7]

Our estimation sample includes employees aged 50 and older, working between 15 and 70 hours per week, and residing in one of the following 11 countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, and Switzerland. These countries were present in both waves 1 and 2; they cover Continental, Northern and Southern Europe. Unfortunately, Eastern Europe could not be represented in our analysis, since Czech Republic and Poland joined SHARE in its second wave. To account for outliners, we exclude the top and bottom 1% of the obtained hourly wage distribution.

Least squares (OLS) estimates of γ in equation (1) are consistent if $E(\tau_{it-n}\varepsilon_{it}\,|\,x_{it})=0$. This assumption does not hold if individuals select into training based on unobserved characteristics. On this point, it is worth mentioning that having had information on hourly wages for the same individuals in two points in time would have allowed to get rid of time-invariant unobserved heterogeneity, such as "ability" (which enters the error term ε). However, reconstruction of hourly wages for SHARE wave 4 is not possible. To investigate this selectivity/omitted variable issue, besides OLS, we estimate equation (1) with the method of instrumental variables (IV).

As exclusion restriction for the IV estimation of equation (1) we make use of the instrumental variable: "frequency in attending activities (excluding training) over the last 4 weeks". This variable is constructed in the following way. In SHARE individuals were asked whether they have been engaged in the following activities over the last 4 weeks: a) done voluntary or charity work, b) provided help to friends or neighbours, c) gone to a sport, social or other kind of club, d) taken part in activities of a religious organization (church, synagogue, mosque etc.), e) taken part in a political or community-related organization. Individuals were also asked the frequency in attending such activities: Almost daily =3, Almost every week = 2, Less often =1, Never=0. For each individual,

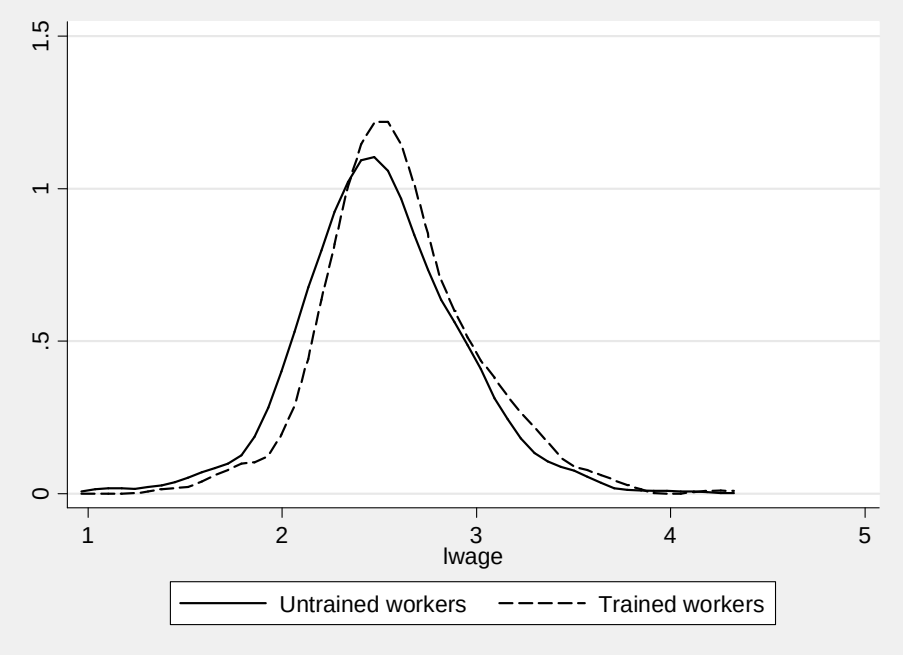
[7] The parameter estimate of an interaction term of τ with the variable n (distance from training, equal to 1, 2, or 3) turned out to be insignificant.

we weight the engagement in each of the mentioned activities with the frequency in attending them to obtain the variable of interest "frequency in attending activities (excluding training) over the last 4 weeks". The idea behind this choice is to classify individuals according to their "activism": those more active and lively are also more likely to participate to training activities. Villar and Celdran (2013) provide previous evidence for Spain that older people participating to training activities have a higher likelihood of being involved in cultural and social activities. As a confirmation of this, in our sample the mean of the constructed variable "frequency in attending activities in the last four weeks" is sensibly higher for trained than for untrained workers (2.07 versus 1.40, see Table 2). We will provide additional evidence of the strength of this instrument for training in the next section.[8] The validity of our instrument relies on the assumption that activism is uncorrelated with ability.

4. Results

Figure 1 reports some preliminary evidence of the log hourly wage distribution for our estimation sample, by training status. It highlights that the distribution of trained workers is somewhat shifted to the right with respect to that of untrained workers.

Figure 1 – Log hourly wage distribution, by training status



[8] Standardly used instruments (such as firm restructuring, see e.g. Kuckulenz and Zwick 2003, individual characteristics of the first job, see Blundell et al. 1996, Arulampalam and Booth 2001, having a second job and marital status, see Budria and Pereira 2007) were either unavailable in SHARE or turned out to be weak.

Table 1 shows descriptive statistics, by training status. Trained workers represent 17.78 % of a total sample of 2,312 individuals. On average, they receive higher wages than untrained ones: the difference between trained and untrained workers in the log hourly wage mean is statistically significant at 1% level. Females (55 % versus 43 %), public sector workers (28 % versus 22 %), and workers in the sector of economic activity education (34 % versus 11 %), represent a sensibly higher percentage of trained worker than of untrained workers. More than 50% of trained workers has a tertiary education degree (ISCED 5-6), whereas between untrained workers the upper and post secondary education (ISCED 3-4) is the most numerous education group.

Table 1. Estimation sample: descriptive statistics, by training status

	Untrained workers		**Trained workers**	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Log hourly wage	2.48	0.45	2.68	0.42
Log tenure	2.84	0.91	2.93	0.88
Female	0.43	0.50	0.55	0.50
Age	54.89	3.63	54.45	3.30
age^2 (/100)	30.26	4.12	29.75	3.67
public sector	0.22	0.42	0.28	0.45
Education (ISCED 97)				
No education (ISCED 0)	0.02	0.15	0.01	0.07
Primary and lower-secondary education (ISCED 1-2)	0.28	0.45	0.09	0.29
Upper and post-secondary education (ISCED 3-4)	0.40	0.49	0.39	0.49
Tertiary education (ISCED 5-6)	0.29	0.46	0.51	0.50
Sector of economic activity				
agriculture. hunting. forestry. Fishing	0.01	0.08	0.00	0.04
mining and quarrying	0.01	0.09	0.01	0.08
Manufacturing	0.19	0.39	0.11	0.31
electricity. gas and water supply	0.01	0.12	0.00	0.07
Construction	0.08	0.27	0.03	0.17
wholesale and retail trade	0.06	0.24	0.03	0.18
hotels and restaurants	0.03	0.18	0.01	0.10
transport. storage and communication	0.06	0.24	0.03	0.18
financial intermediation	0.03	0.17	0.02	0.12
real estate. renting and business activities	0.07	0.26	0.05	0.21
public administration and defence; compulsory social security	0.12	0.32	0.13	0.34
Education	0.11	0.32	0.34	0.47
health and social work	0.13	0.34	0.18	0.39
other community. social and personal services	0.08	0.28	0.06	0.24
Occupation				
legislator. senior official or manager	0.09	0.28	0.11	0.32
Professional	0.19	0.40	0.35	0.48
technician or associate professional	0.18	0.38	0.22	0.42
Clerk	0.14	0.35	0.14	0.34
service worker and shop and market sale	0.11	0.32	0.11	0.31
skilled agricultural or fishery worker	0.01	0.10	0.00	0.04
craft and related trades worker	0.09	0.29	0.04	0.19
plant and machine operator or assembler	0.08	0.27	0.02	0.13

elementary occupation	0.11	0.31	0.02	0.13
Country				
Austria	0.03	0.18	0.03	0.18
Germany	0.27	0.44	0.34	0.47
Sweden	0.07	0.25	0.12	0.33
Netherlands	0.05	0.23	0.05	0.22
Spain	0.13	0.33	0.07	0.25
Italy	0.13	0.34	0.07	0.25
France	0.18	0.39	0.13	0.33
Denmark	0.04	0.21	0.06	0.24
Greece	0.02	0.14	0.02	0.13
Switzerland	0.02	0.15	0.06	0.24
Belgium	0.05	0.21	0.06	0.24
Year of interview				
2006	0.68	0.47	0.69	0.46
Instrumental variables				
frequency in attending activities over the last 4 weeks	1.40	1.73	2.07	2.04
n. of observations	1901		411	

Source: SHARE wave 1-2

Table 2 shows OLS and IV parameters estimates of equation (1). The OLS point estimate for the training variable is equal to 0.065 and is significant at 1% level, therefore suggesting that having undertaken training activities in the recent past (one to three years earlier) determines a wage increase of about 6.5%. This effect is sizable, and is similar to the return of attaining a upper and post-secondary (ISCED 3-4) instead of a primary and lower-secondary (ISCED 1-2) education degree (0.22-0.16=6 %). All the control variables have the expected sign and are highly significant: hourly wages increase with log tenure, age (at a decreasing rate), and education attainment.

We then turn to the IV estimates. It is worth commenting on the participation to training (first stage regression, column i): remarkably, higher educated workers (ISCED > 2) take more training. Females take more training than males, while public sector workers participate less to training activities than those in the private sector (these last two variables are significant at 10% level). Participation to training increases with tenure and decreases with age; however, these parameters are imprecisely estimated. Notice that the instrumental variable "frequency in attending activities over the last four weeks" is highly significant (t=7.46, F=55, partial R-squared = 0.0239) and has the expected positive sign.

The IV parameter estimate (columns ii) for the impact of training on wages has a positive sign (and is similar in size to the OLS estimate: 0.092); however, it is very imprecise (s.e. 0.14) and not significantly different from zero. This result suggests from one side that at least part of the estimated impact of training on wages is likely to be due to unobserved heterogeneity. On the other side, the evidence obtained by the IV method is too weak to be considered as the unique basis upon

which to draw firm conclusions. The IV analysis also suffers from a rather small sample size, which leads to high standard errors. [9]

Table 2. Returns to training

	OLS	IV	
VARIABLES	Log hourly wage	(i) Participation to training	(ii) Log hourly wage
Training	0.065***		0.092
	(0.021)		(0.14)
Log tenure	0.067***	0.0074	0.067***
	(0.0087)	(0.0085)	(0.0087)
Female	-0.17***	0.028*	-0.17***
	(0.016)	(0.016)	(0.017)
Public sector	-0.063***	-0.035*	-0.063***
	(0.020)	(0.019)	(0.020)
Age – 50	0.017***	-0.0042	0.018***
	(0.0057)	(0.0055)	(0.0057)
Age- 50 squared	-0.0017***	-0.000058	-0.0017***
	(0.00043)	(0.00041)	(0.00042)
No education (ISCED 0)	-0.27***	-0.059	-0.27***
	(0.055)	(0.054)	(0.055)
Primary and lower-secondary education (ISCED 1-2)	-0.22***	-0.074***	-0.22***
	(0.026)	(0.025)	(0.028)
Upper and post-secondary education (ISCED 3-4)	-0.16***	-0.028	-0.16***
	(0.020)	(0.020)	(0.020)
Constant	2.74***	0.14	2.73***
	(0.11)	(0.11)	(0.11)
Exclusion restrictions:			
Frequency in attending activities over the last 4 weeks		0.033***	
		(0.0045)	
F(1,2270)		55.588	
Partial R-squared		0.0239	
Observations	2,312	2,312	2,312
R-squared	0.431	0.129	0.430

Source: SHARE wave 1-2

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Additional controls: dummy variables for country of residence, sector, occupation and year of interview; Reference categories: private sector, tertiary education (ISCED 5-6)

5. Sensitivity analysis

[9] Note, however, that the standard tests for endogeneity do not reject the null hypothesis that the training variable is exogenous (Durbin (score) $\chi 2$ (1) = 0.040, p = 0.84).

In this section, we first further test the reliability of the OLS results presented in the previous section, providing some (indirect) evidence that the positive effect found in the OLS regression is not entirely due to unobserved individual heterogeneity. Then, we investigate potential country heterogeneity in both training participation and in the impact of training on older workers' wage.

Health and cognitive abilities may affect both wages (see, e.g., Contoyannis and Rice 2001) and training participation. Therefore, we run an augmented specification, which additionally controls for individual health status and cognitive abilities at the time of training (i.e. SHARE wave 1). We measure individuals' health by means of the self-reported health status (measured on a 1 to 5 scale, where 1 is poor and 5 is excellent) and cognitive abilities by the average score on three different tests: numeracy skills, verbal fluency and memory (see, e.g., Mazzonna and Peracchi 2012). This exercise (results are available upon request) shows that results of Table 2 are unaffected by the inclusion of these additional variables in the model. Moreover there is no evidence that healthier workers and workers with higher level of cognitive ability (as measured at the time of training) take more training.

Table 3 shows OLS estimates of two additional models. Model (i) considers as dependent variable the log of wages *before* training (cf. with equation 1). The training variable turn out to be not significantly different from zero, indicating that the groups of trained and untrained workers are not characterized by a different wage prior to taking training. Column (ii) reports results for the model outlined in equation (1) but estimated on a sub sample of workers, which is defined exploiting information on the reason for undertaking training. As mentioned earlier, trained worked are asked this information in SHARE. The set of possible motivations includes: (a) to meet other people; (b) to contribute to something useful; (c) for personal achievement; (d) because I'm needed; (e) to earn money; (f) because I enjoy it; (g) to use my skills or to keep fit; (h) because I feel obligated to do it. We restrict our sample to those reporting as motivation for training attendance either (c), (d), (g) or (h). We exclude reason (e) – to earn money – for obvious endogeneity reasons; we also exclude those trainees expressing motivations related more to the personality or networking sphere rather than to the work-related sphere – i.e. motivations (a), (b) and (f). The selected subsample includes about 80% of trained workers. The effect of training on wages is almost of the same magnitude of that obtained for the full sample (cf. 6.1% with 6.5 %).

Table 3. Robustness checks

Dependent variable:	(i) Log wage *before* training	(ii) Log wage*
Training	0.043	0.061***
	-0.041	-0.023
Log tenure	0.066***	0.066***
	-0.018	-0.0089
Female	-0.20***	-0.17***
	-0.031	-0.017
Public sector	-0.070*	-0.063***
	-0.038	-0.02
Age – 50	0.0098	0.019***
	-0.011	-0.0058
Age- 50 squared	-0.0015*	-0.0018***
	-0.00086	-0.00043
No education (ISCED 0)	-0.29**	-0.28***
	-0.11	-0.056
Primary and lower Secondary education (ISCED 1-2)	-0.21***	-0.23***
	-0.051	-0.027
Upper and post-Secondary education (ISCED 3-4)	-0.11***	-0.17***
	-0.04	-0.021
Constant	2.49***	2.73***
	-0.24	-0.11
Observations	2,021	2,244
R-squared	0.174	0.435

Source: SHARE wave 1-2

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Additional controls: dummy variables for country of residence, sector, occupation and year of interview; Reference categories: private sector, tertiary education (ISCED 5-6); *Sample only includes trainees reporting as motivation for attending training: "for personal achievement", "because I'm needed", "to use my skills or to keep fit" , "because I feel obligated to do it".

In the introduction, we underlined that comparability of findings across countries is limited because of different concepts and definitions of training across countries and datasets. Some evidence of a negative association between incidence and return to training across countries at all working ages has been found (see, e.g., Bassanini et al. 2007). Exploiting the wide country coverage and the harmonization in the definition of training in SHARE, we allow for both training participation and the impact of training on wages to be heterogeneous across groups of European countries: Northern (Denmark, Sweden), Continental (Austria, Belgium, France, Germany, The Netherlands, and Switzerland) and Southern (Greece, Italy, Spain). Results of this exercise are reported in Table 4. The upper part of the table shows estimates for participation to training, whereas its bottom part reports results for the return to training. The highest training incidence is found for Northern countries, followed by Continental (reference country group) and finally by Southern countries. These two estimated differences are sizable and statistically significant. Returns to training are

higher in Continental and Southern than in Northern European countries[10]. Therefore, this evidence confirms the existence of a negative association between incidence and returns to training previously found in other (few) studies which do not explicitly focus on older workers[11].

Table 4. Incidence and return to training by group of European countries

Incidence of training Dep. Variable= participation into training	OLS Estimate
Continental (constant)	0.17
	(0.11)
Northern	0.064***
	(0.023)
Southern	-0.050***
	(0.019)
Observations	2,312
R-squared	0.092
Return to training Dep. Variable= log weekly wage	
Training (base=Continental)	0.100***
	(0.026)
Northern*training	-0.148***
	(0.056)
Southern*training	-0.054
	(0.057)
Observations	2,312
R-squared	0.432

Source: SHARE wave 1-2
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Additional controls: variables included in Table 2.

6. Results

This paper investigates the impact of training undertaken by European older workers on their wages, relying on SHARE data. We find that, for employees aged 50 and older residing in one the eleven analyzed European countries, taking part in training activities increases wages by up to 6.5 %. This effect is sizable, and is similar to the return of attaining a upper and post-secondary (ISCED 3-4) instead of a primary and lower-secondary (ISCED 1-2) education degree. With the data at our disposable, however, we cannot rule out the possibility that return to training is overestimated, due to unobserved individual heterogeneity. Some robustness checks provide, however, additional

[10] We prefer a qualitative interpretation of our findings; confidence intervals are large due to small sample size. From the pure statistical point of view, these findings indicate that training has a significant impact on wages only in Continental countries.

[11] We also experimented interacting training with individual's demographic and work-related characteristics (such as gender, public/private sector, educational levels, etc.). We did not find any significant effect for the interaction terms. Too little information in many of the interaction variables limits the feasibility of this exercise.

support to our main findings. Return to training is *prima facie* higher in Continental and Southern than in Northern European countries, the latter group of countries being characterized by the highest incidence. Such a negative association between incidence and returns to training which we obtain for older workers is common to what found by previous studies, which look at the whole working population.

There is a growing consensus among the research and policy community on the importance of training investments for keeping workers' skills updated and offsetting the productivity decline which is combined with the ageing process. Despite the social and political interest in these issues, the empirical evidence on the incidence and effect of training on older workers' productivity is scarce. One of the difficulties limiting research lies in the lack of datasets combining information on firm's productivity, training practices and workers' characteristics. Most studies – including this study – assume wage as a sufficient statistic for productivity. This may not hold, especially for older workers. In presence of a compressed wage structure, due to matching frictions and/or imperfect information, it may be possible that worker' changes in productivity are not captured by equal changes in workers' wage. This argument has two implications for the reading of our findings and for deriving policy implications. First, the estimated wage returns may underestimate the positive effect of training on workers' productivity. Therefore, they may not fully acknowledge the importance of training for firms' growth and competitiveness. Second, training may also be beneficial in preventing the premature exclusion of older workers from the labour market. In fact, in presence of downward wage rigidity (the impossibility of wages to be reduced below a certain threshold) when productivity declines, workers may be more likely to be laid off. Training may therefore increase the likelihood for workers to be retained by their employer.

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