Ageing Europe – An Application of National Transfer Accounts for Explaining and Projecting Trends in Public Finances

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Analysis of Long Term Life Course Factors Affecting Retirement Decisions Using Longitudinal Survey Data from 13 European Countries

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Author:	János Divényi, Gábor Kézdi (kezdig@ceu.hu)
Coordinator:	OEAW-VID

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1 Contents

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Abstract

Retrospective life history data from 13 European countries from the harmonized SHARE survey is used to examine the relationship between long-term life course factors and the age of retirement. The hazard of retirement is investigated in models that control for the statutory retirement age as well as other important covariates. Middle educated people are found to retire substantially earlier than low-educated people in most countries. People who spend more of their active years unemployed retire later in Spain, Italy, France, and Poland, but they retire earlier in Denmark and the Czech Republic, and their later retirement became more prevalent during the economic crisis. Longer marriages and more children are associated with later retirement in Italy, and the age of the youngest child is associated with earlier retirement in Germany, Italy, Sweden, and Denmark. The fraction of active years spent working is found to be negatively associated with the age of retirement.

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Introduction

There is a large literature showing the importance of proximate causes of retirement, such as retirement incomes relative to attainable earnings (Stock and Wise, 1990; Samwick, 1998), health and health insurance (Anderson and Burkhauser, 1985; Madrian, 1994), or the retirement decisions of spouses (Hurd, 1990). Some of these factors are related to institutional rules and features of social security systems and pension plans, while others exert their effect in interaction with those rules and features (Gruber and Wise, 1997, 2002 and 2004; Börsch-Supan, 2000). While these proximate causes are relatively well established less is known about the long-run life-course factors that may operate in the background as ultimate causes. In particular, labor market history, family history and fertility history may affect all of the proximate factors. Moreover, important variation in observed retirement age is left unexplained by the proximate factors (Lumsdaine and Mithcell, 1999; Banks, Emmerson and Tetlow, 2007)

In this paper we investigate the role of such long-run life course factors in the timing of retirement in 13 European countries using panel data and retrospective life histories from the harmonized SHARE survey. We investigate the extent to which differences in labor market history (unemployment spells), family history, and parenthood explain differences in retirement behavior. We focus on retirement decisions between 2003 and 2013. An important result of our analysis is that the relationship of long-run factors and retirement timing shows no significant differences in the pre-recession years (2004 through 2008) and the recession years (2009 through 2013).

We decompose differences into those that are caused by institutional factors and those that are not. In particular, we investigate the role of the statutory retirement age, and the early retirement age if it exists, in the observed differences. We pay special attention to differences by gender and immigrant status. Gender differences in retirement have been in the focus of research for a long time. Differences by immigrant status have received less attention (but see

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Hum and Simpson, 2010, for an exception), and investigating the role of parenthood is also rare (see Hank and Kormbacher, 2013, for an example on a subset of the dataset we use).

We find that some of the long-run life-course factors are important determinants of the age of retirement in the 13 countries we analyze, but the patterns vary across countries. We find interesting associations of the age of retirement with immigrant status, education, unemployment histories, family histories and fertility histories. Immigrants are found to retire later in France and at around the same age in other countries. Middle educated people are found to retire substantially earlier, and high-educated somewhat earlier, than low-educated people in most countries. People who spend more of their active years unemployed retire later in Spain, Italy, France, and Poland, but they retire earlier in Denmark and the Czech Republic. Longer marriages and more children are associated with later retirement in Italy, and the age of the youngest child is associated with earlier retirement in Germany, Italy, Sweden, and Denmark.

We also find that the fraction of active years spent working is negatively associated with the age of retirement. Since this may in principle reflect rules in retirement eligibility or that are related to employment spells on top of age provisions we check the robustness of our other findings controlling for employment history as well. We find that our findings are robust to including employment history among the control variables.

1 Data

The backbone of our analysis is the SHARELIFE data. The SHARELIFE data is the third wave of the cross-country longitudinal harmonized SHARE survey. SHARE started 2004 on nationally representative samples of respondents who were 50 years or older in European countries, and it re-interviews the same people approximately every two years. The first two waves collected multidisciplinary data on health, employment, retirement and economic conditions, while the third

wave, SHARELIFE, was a special survey with retrospective life histories. It was collected in 2008/2009.

The job history and marital history information in SHARELIFE data was cleaned and made publicly available recently as the SHARE Job Episodes Panel dataset (Antonova, Aranda, Pasini and Trevisan, 2014). We add job history and information about retirement from later survey waves (4 and 5) to this data, extending our sample to 2013. Our sample is all individuals from this dataset who were born between 1930 and 1950 and were in the labor force when they were 50 years old, either as employed or unemployed. Table 1 shows the numbers of observations in the original dataset and the restricted sample of our analysis by country. The analysis sample is about two thirds of the original sample.

Table 1. Number of observations

Country	Total sample			Analysis sample		
	Male	Female	Total	Male	Female	Total
Austria	340	501	841	233	187	420
Germany	861	987	1,848	601	416	1,017
Sweden	846	1,043	1,889	589	666	1,255
Netherlands	1,004	1,203	2,207	649	365	1,014
Spain	898	1,135	2,033	553	194	747
Italy	1,127	1,362	2,489	773	352	1,125
France	1,075	1,400	2,475	606	525	1,131
Denmark	957	1,178	2,135	571	538	1,109
Greece	1,274	1,674	2,948	780	350	1,130
Switzerland	558	737	1,295	357	257	614
Belgium	1,265	1,559	2,824	768	475	1,243
Czech Rep.	790	1,082	1,872	529	649	1,178
Poland	848	1,064	1,912	417	385	802
Total	11,843	14,925	26,768	7,426	5,359	12,785

Note: The analysis sample includes individuals born in 1930-50 and were in the labor force at age 50.

The dependent variable of our analysis is the age of retirement. It is a right-censored variable: many individuals in the sample are still not retired. The hazard modeling framework handles right censoring assuming that the shape of

the baseline hazard will be the same in the censored part of the sample as in the uncensored part.

Our most important explanatory variables are:

- Gender (female = 0 or 1);
- Education (two variables: years of education or an indicator of years of education 8 grades or less);
- Year of birth;
- Immigrant status: whether the individual was born in the country of observation, except East Germany (two variables: immigrant = 0 or 1; immigrant from non-EU country = 0 or 1)
- Percent of active years working: the percentage fraction of active years spent working (active years: years between end of education and retirement if retired, and end of education and age at observation if not retired)
- Percent of active years unemployed
- Percent of active years with spouse or partner
- Number of children: number of children ever born to the individual
- Age of youngest child when respondent was 50 years old

An important feature of the data we use is information on the statutory retirement age for each individual. This information is merged on the individual SHARE data by country and demographic information (year of birth) from the Mutual Information System on Social Protection (MISSOC) informational database of the OECD. Besides the statutory retirement age the statutory age for early retirement is also available for the countries that have such schemes. We created an indicator variable for whether the respondent in the sample is eligible for early retirement age or not.

Table 2 shows the summary statistics of the variables used in our analysis in the analysis sample restricted by birth cohort and labor force participation in age 50.

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Table 2. Summary statistics of the variables

Variable	Mean	Standard Deviation	Minimum	Maximum	N
Actual retirement age	60.71	4.49	19.00	81.00	11105
Retired	0.87	0.34	0.00	1.00	12785
Statutory retirement age	63.37	2.67	52.00	67.00	12479
Statutory early retirement age	59.33	2.91	44.00	64.00	8280
Female	0.42	0.49	0.00	1.00	12785
Years of education	12.46	3.90	7.00	20.00	12785
Percent of active years unemployed	1.79	6.91	0.00	92.00	12785
Percent of active years employed	87.56	15.43	2.90	100.00	12785
Percent of active years with spouse/partner	73.89	23.36	0.00	100.00	12785
Number of children	2.04	1.27	0.00	15.00	12785
Age of youngest child when 50	18.60	5.68	0.00	36.00	11292
Immigrant	0.06	0.24	0.00	1.00	12783
Immigrant from outside Europe	0.01	0.12	0.00	1.00	12785

75 percent of the sample is retired, and the average retirement age among them is 60. The age of retirement is self-reported and some reports seem erroneous (below age 50 whereas one of the inclusion criteria was in the labor force at age 50). We kept all of the self-reported retirement age variables as they occur in the data; discarding the ones that appear erroneous does not affect any of the results. The statutory retirement age varies considerably in the sample, mostly across countries but also across gender and year if birth within some countries. About two thirds of the individuals in the sample are or were eligible for early retirement, and the early retirement age for them was four years lower on average than the regular retirement age.

Average years of education is slightly over 12. These numbers are also self-reported; we recoded low levels to 7 years and levels higher than 20 to 20. This recoding does not affect our results as we use categories of 0 to 8, 9 to 12 and 13+ years of education in the main analysis. 6 percent of our sample is immigrant, defined as born outside their country of residence, but only 1 percent were born outside the current European Union. On average, slightly less than 2 percent of active years are spent unemployed and 88 years spent employed, and

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both percentages have substantial variation. Individuals in our sample spend 74 percent of their active years with a spouse or partner on average.

These characteristics of the sample are in part due to its selected nature. The total sample is somewhat less educated, more likely to be female and spent somewhat less time unemployed and employed.

2 Methods

The basis of our analysis is a set of hazard models. These models estimate differences in the hazard rate of retirement by the right hand side variables. The hazard rate is the probability of retiring in a given year conditional on not having retired earlier. Empirically, it is the fraction of people who retire from among non-retired people. Higher hazard rates mean earlier retirement. Compare two groups, group A and group B. If a larger fraction of non-retired people in group A retire in all examined years than in group B the members of group: there is going to be fewer and fewer people still working in group A than in group B. Therefore members in group A will retire earlier, on average, than members in group B.

Our main analysis makes use of Cox proportional hazard models. The setup of such models is the following. Consider individual i; in principle, she can retire in any age T. The probability that she hasn't retired by age a is $\Pr(T > a)$. The hazard rate of retiring at age a is

$$\lambda_i(a) = \lim_{\Delta \to 0} \frac{\Pr(a \le T < a + \Delta)/\Delta}{\Pr(T > a)} \quad (1)$$

In principle this hazard rate could vary with age in any way: it can be an increasing function, then a decreasing then again increasing, etc. Parametric hazard models such as the exponential or Weibull put restrictions on this relationship (no relationship in the first, monotonically increasing or decreasing relationship in the second). Cox proportional hazard models are free from such

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assumptions: they allow for an unrestricted relationship between age and the hazard rate. They assume that all individuals share the same functional form, and the individual hazard rates are proportional to the same so-called "baseline hazard." Observable characteristics place individuals in groups that may be characterized by proportionally higher or lower hazard rates than this baseline hazard:

$$\lambda_i(a \mid x_i) = \lambda_0(a)\exp(\beta' x_i) \tag{2}$$

so that

$$\ln \lambda_i(a \mid x_i) = \ln \lambda_0(a) + \beta' x_i \tag{3}$$

The Cox proportional hazard model partials out the baseline hazard $\lambda_0(a)$ that is assumed to be common for all individuals, and it estimates the shift parameters β. Consider a vector of right hand side variables $[x_{1i}, x_{2i}, \ldots]'$ that is multiplied by the coefficient vector $[\beta_1, \beta_2, \ldots]$. The interpretation of β_1 is the following. Compare two people that are different in terms of characteristic x_1 but are similar in all other characteristics. The person that has one unit larger x_1 is approximately $\beta_1 \times 100\%$ more likely to retire at any age than the other person.

We estimate a series of Cox hazard models for each right hand side variable to uncover its association with the age of retirement. Model (1) includes the variable in focus on the right hand side as the only variable. Model (2) adds the statutory retirement age variables. Model (3) adds the year of birth fixed effects, and Model (4) adds the country fixed effects. We complement the results in the pooled sample with country-by-country estimates of the same Cox hazard models to see if there are significant differences across countries in terms of the associations.

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3 Gender, Immigrant Status, Education, Year of Birth

3.1 Gender

We start with differences by gender. Table 3 shows the results of the four Cox hazard models as described above, and Figure 1 summarizes the country-by-country results. While the table shows the coefficient estimates and are therefore interpreted as differences in the log hazards, the figures show the proportionality between women and men (so that values greater than one imply higher hazard rates for women, while values less then one imply higher hazard rates for men).

Table 3. Hazard of retirement by gender

	(1)	(2)	(3)	(4)
female	0.127**	-0.184**	-0.127**	-0.135**
	(0.019)	(0.022)	(0.025)	(0.025)
retirement age		-0.145**	-0.132**	-0.132**
		(0.0051)	(0.0074)	(0.0076)
early retirement age		-0.028**	-0.027**	-0.032**
		(0.0054)	(0.0068)	(0.0069)
early retirement possible		1.695**	1.765**	2.132**
		(0.32)	(0.40)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12785	12479	12479	12479

Standard errors in parentheses. * p<0.05, ** p<0.01
Results from Cox proportional hazard models. Coefficients show log differences hazard rates

Women retire earlier on average in the 13 countries (column 1 in Table 3). At each age they are estimated to retire with 10 percent higher likelihood than men. However, Figure 1 reveals substantial heterogeneity: women have higher hazard rates in Austria, Germany, Switzerland, Belgium, and, especially in the

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Czech Republic and Poland. They have lower hazard rates in the Netherlands and Spain.

However, that the earlier retirement of women is in large part due to the fact that the retirement age is lower for women. If we compare the retirement hazard of men and women conditional on the statutory retirement age (and year of birth), women have a substantially lower retirement hazard and thus higher retirement age (columns 2 through 4). The retirement hazard conditional on the statutory retirement age is higher for women only in Austria, Germany and Poland, and it is significantly lower for women in most other countries (including the Czech Republic that shows the largest raw difference of higher female hazard).

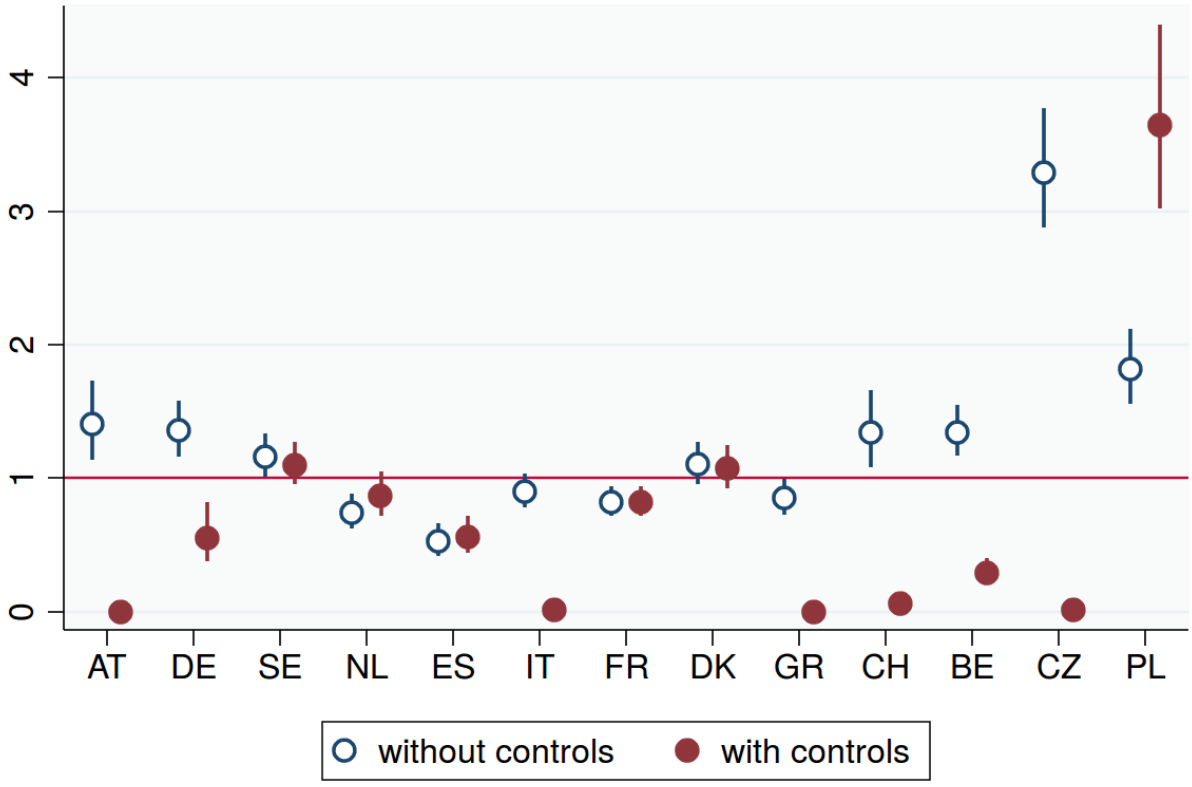

Figure 1.

The retirement hazard of women as the proportion of men

Not surprisingly, higher statutory retirement age is negatively related to the retirement hazard and is thus associated with higher age of retirement. If early retirement is also possible the retirement hazard is substantially higher. If the early retirement age is higher it is weakly associated with higher retirement age.

3.2 Immigrants

We continue with differences by immigrant status. Table 4 shows the results of the four Cox hazard models as described above, and Figure 2 summarizes the country-by-country results.

Table 4. Hazard of retirement by immigrant status.

	(1)	(2)	(3)	(4)
immigrant	-0.112**	-0.105*	-0.178**	-0.187**
	(0.040)	(0.041)	(0.042)	(0.042)
retirement age		-0.133**	-0.113**	-0.112**
		(0.0049)	(0.0065)	(0.0066)
early retirement age		-0.023**	-0.022**	-0.027**
		(0.0055)	(0.0068)	(0.0069)
early retirement possible		1.408**	1.514**	1.867**
		(0.33)	(0.40)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12783	12477	12477	12477

Standard errors in parentheses. * p<0.05, ** p<0.01
Results from Cox proportional hazard models. Coefficients show log differences hazard rates

Immigrants retire later on average in the 13 countries (column 1 in Table 4); they are estimated to retire with 11 percent lower likelihood than men when we do not control for retirement age rules, and with a 19 percent lower likelihood when we do. Figure 2 shows that this difference is statistically significant only in France, where the immigrant sample is also the largest and thus leads to the most precise estimates. These differences are robust to controlling for the

statutory retirement age and birth cohort: the estimate in column 2 is essentially the same as the results in column 1, and the estimates in columns 3 and 4 are even stronger.

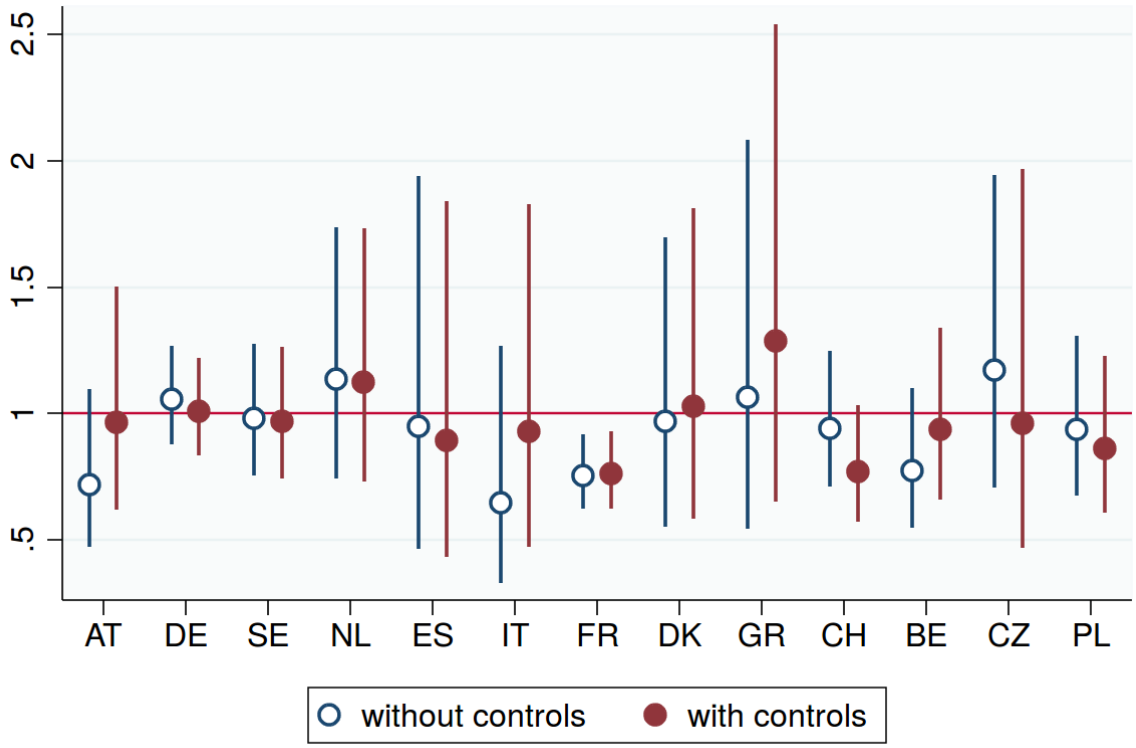

Figure 2.

The retirement hazard of immigrants as the proportion of non-immigrants

There is not enough power to estimate the differences for immigrants from non-EU countries. If anything, however, the retirement hazards of non-EU immigrants are even lower compared to natives than the retirement hazards of EU immigrants. The difference again is due to France; we don't show the corresponding graph, which looks very similar to figure 2. with substantially wider confidence bounds. Table 5 shows the results of the cox hazard models.

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Table 5. Hazard of retirement by immigrant status; non-EU immigrants differentiated

	(1)	(2)	(3)	(4)
immigrant	-0.118**	-0.052	-0.148**	-0.153**
	(0.045)	(0.046)	(0.047)	(0.047)
non-EU immigrant	0.026	-0.209*	-0.125	-0.138
	(0.092)	(0.093)	(0.094)	(0.094)
retirement age		-0.134**	-0.114**	-0.112**
		(0.0049)	(0.0065)	(0.0066)
early retirement age		-0.023**	-0.022**	-0.028**
		(0.0055)	(0.0068)	(0.0069)
early retirement possible		1.393**	1.516**	1.871**
		(0.33)	(0.40)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12783	12477	12477	12477

Standard errors in parentheses. * p<0.05, ** p<0.01.
Results from Cox proportional hazard models. Coefficients show log differences hazard rates

To summarize our results, there is little evidence that immigrants would retire at different age than non-immigrants in most of the countries. France is an exception where immigrants retire later. This is true for immigrants both from EU member states and outside the EU.

3.3 Education

Our third right hand side variable in focus is education. We compare secondary educated (9-12 years of education) and tertiary educated (13+ years) people to lower educated people (8 years of education or less). Table 6 shows the results of the four Cox hazard models as described above, and Figures 3 and 4 summarize the country-by-country results.

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The hazard of retirement is nonlinear in education if averaged across the 13 countries. The results are qualitatively similar across specifications, but controlling for the statutory retirement age shows larger differences. Compared to low-educated people, people with secondary education have a substantially higher hazard and thus retire earlier. People with tertiary education have a somewhat lower hazard than secondary educated people and thus retire somewhat later, but still substantially earlier than people with low levels of education.

Table 6. Hazard of retirement by years of education

	(1)	(2)	(3)	(4)
education 9-12 years	0.161**	0.291**	0.204**	0.198**
	(0.027)	(0.028)	(0.030)	(0.030)
education 13+ years	0.094**	0.202**	0.130**	0.119**
	(0.025)	(0.026)	(0.029)	(0.029)
early retirement age		-0.132**	-0.114**	-0.113**
		(0.0049)	(0.0065)	(0.0066)
early retirement possible		-0.035**	-0.024**	-0.029**
		(0.0056)	(0.0069)	(0.0070)
early retirement age		2.139**	1.608**	1.937**
		(0.33)	(0.41)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12783	12477	12477	12477

Standard errors in parentheses. * p<0.05, ** p<0.01

Results from Cox proportional hazard models. Coefficients show log differences hazard rates

The figures reveal that the retirement hazard is higher or the same at higher levels of education in almost all of the countries, implying that, on average, higher educated people retire earlier or around the same age as low-educated

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people in all of the examined European countries. The highest hazard group in all of the countries are the secondary-educated (9 to 12 years of education), although the differences are not statistically significant anywhere. The magnitudes of the education-related differences vary considerably. The retirement hazard differences are largest in Germany, followed by the Czech Republic and France. Some of the differences are statistically significant and positive in Spain, Italy, and Poland as well.

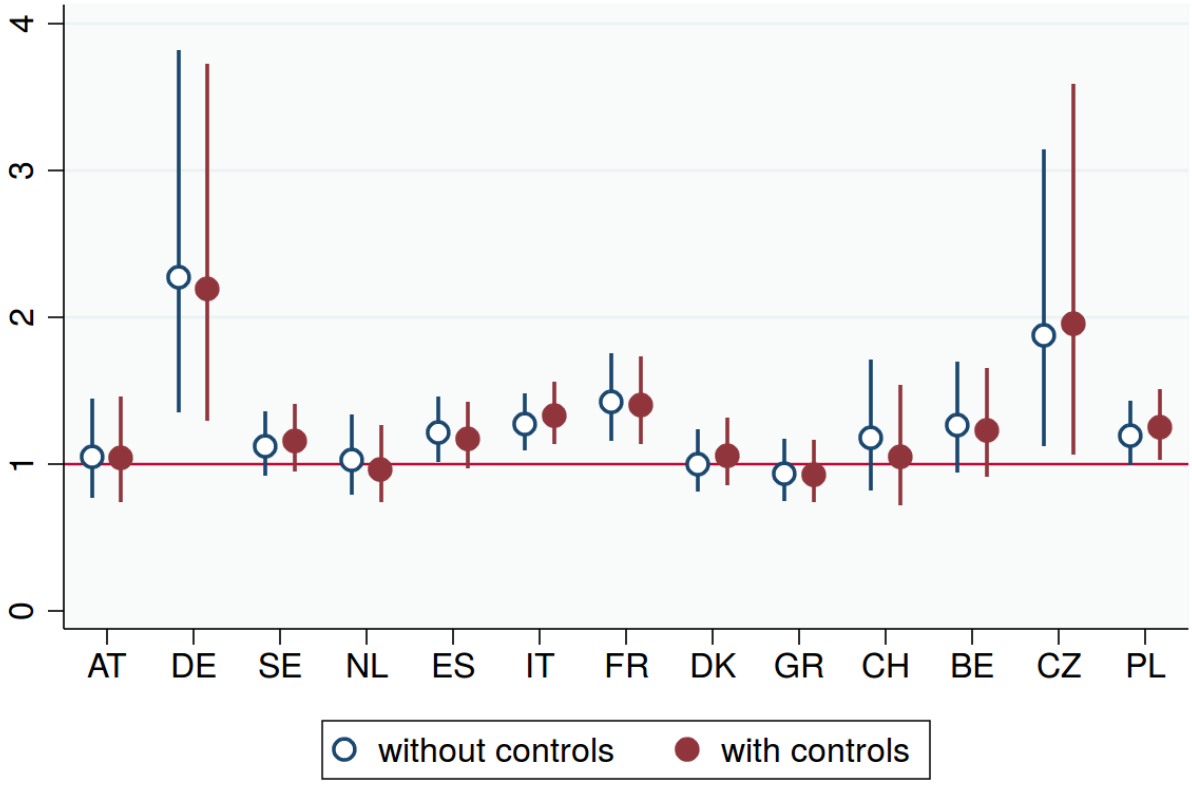

Figure 3.

The retirement hazard of 9-12 years of education as the proportion of 0-8 years

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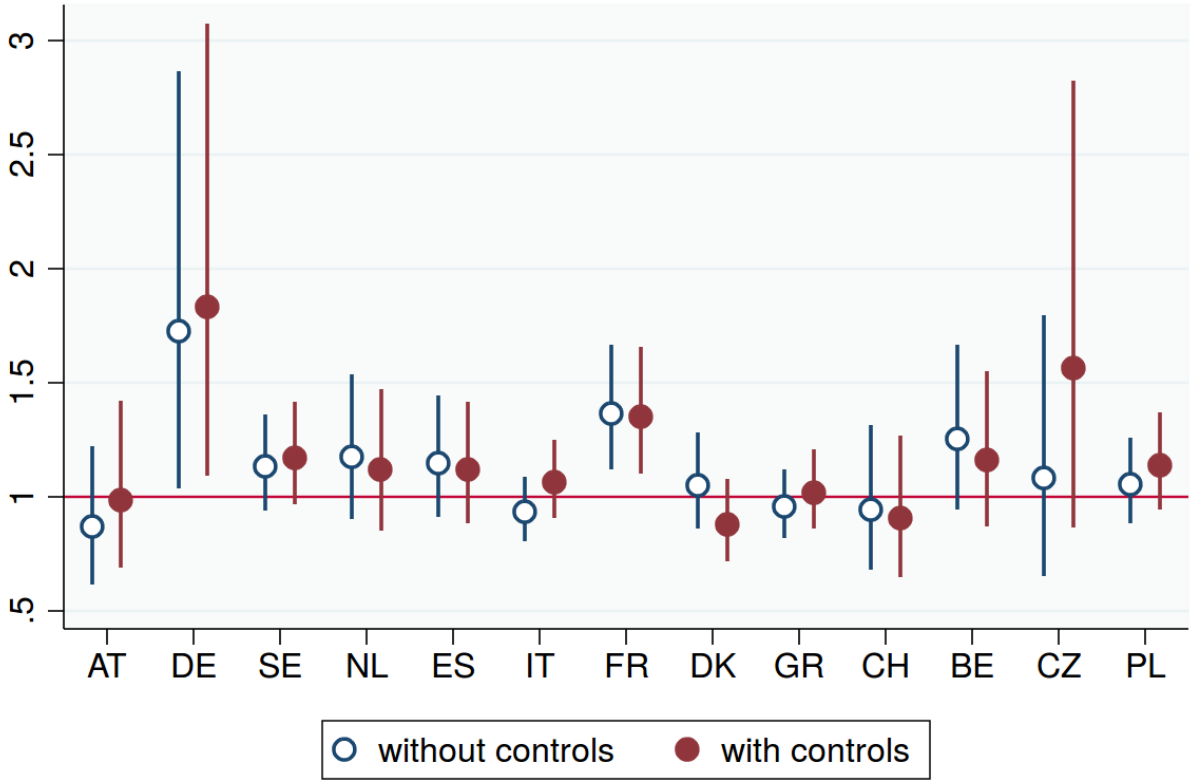

Figure 4.

The retirement hazard of 13+ years of education as the proportion of 0-8 years

4 Labor Market History

Labor market history is a complex feature of individual life courses with potentially complex effects on retirement decisions. In this analysis we focus on two aspects of labor market history: the percentage fraction of years spend working and the percentage fraction of years spent unemployed. Both are calculated using the potential labor market experience from years of education and age and the number of years spend in each labor market status. Tables 7 and 8 show the results of the four Cox hazard models, and Figures 5 and 6 summarize the country-by-country results.

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Table 7. Hazard of retirement by percent of years working

	(1)	(2)	(3)	(4)
percent of years working	0.015**	0.017**	0.018**	0.017**
	(0.00070)	(0.00071)	(0.00073)	(0.00073)
retirement age		-0.140**	-0.141**	-0.140**
		(0.0049)	(0.0066)	(0.0067)
early retirement age		-0.036**	-0.022**	-0.027**
		(0.0054)	(0.0068)	(0.0069)
early retirement possible		2.042**	1.300**	1.628**
		(0.32)	(0.41)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12783	12477	12477	12477

Table 8. Hazard of retirement by percent of years unemployed

	(1)	(2)	(3)	(4)
percent of years working	-0.005**	-0.008**	-0.010**	-0.010**
	(0.0014)	(0.0014)	(0.0015)	(0.0015)
retirement age		-0.133**	-0.115**	-0.114**
		(0.0049)	(0.0065)	(0.0066)
early retirement age		-0.025**	-0.023**	-0.028**
		(0.0055)	(0.0068)	(0.0069)
early retirement possible		1.531**	1.530**	1.886**
		(0.32)	(0.40)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12783	12477	12477	12477

Standard errors in parentheses. * p<0.05, ** p<0.01

Results from Cox proportional hazard models. Coefficients show log differences hazard rates

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Perhaps surprisingly, the hazard of retirement is increasing in the percent of years worked and decreasing in the percent of years spend unemployed. Both of these results are stronger when the statutory retirement year and year of birth are controlled. According to the richest specifications (columns 4) 10 percentage points more years spent working correspond to 17 percent higher retirement hazard, and 10 percentage points more years spent unemployed corresponds to 10 percent lower retirement hazard.

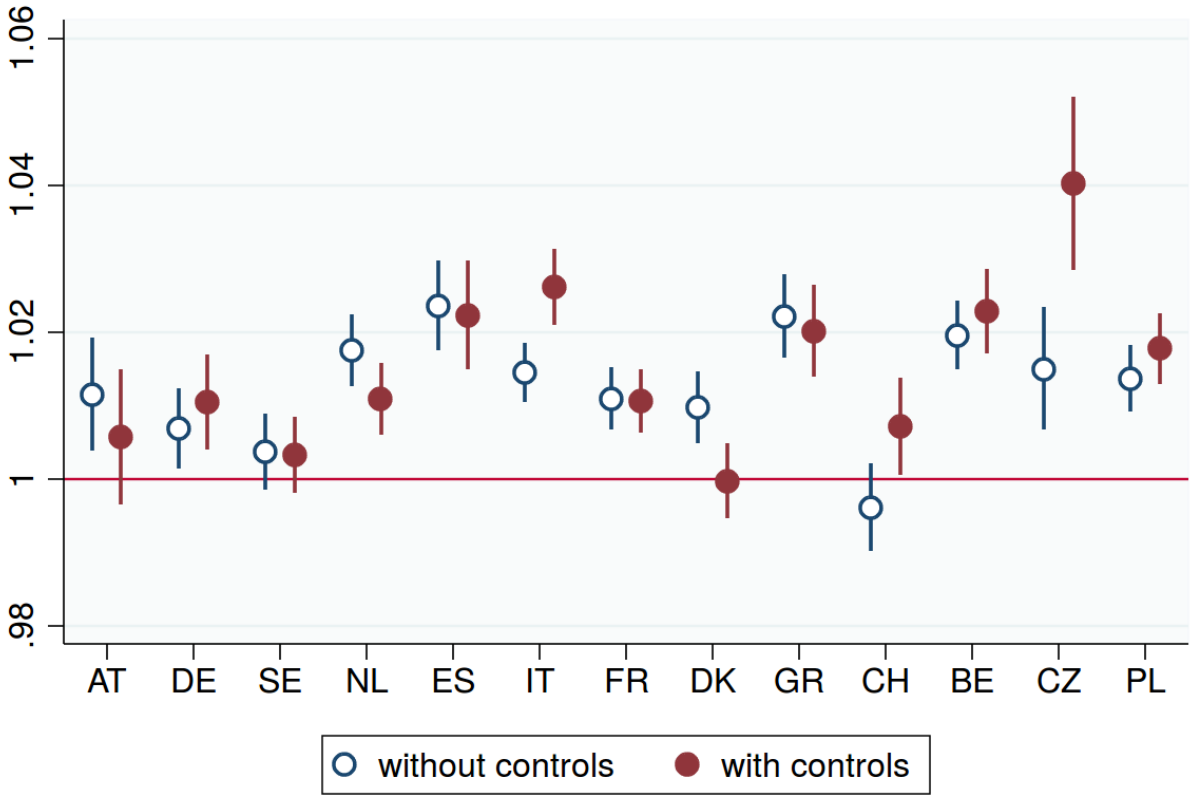

Figure 5.

The proportional shift of the retirement hazard corresponding to one percent more years spent employed

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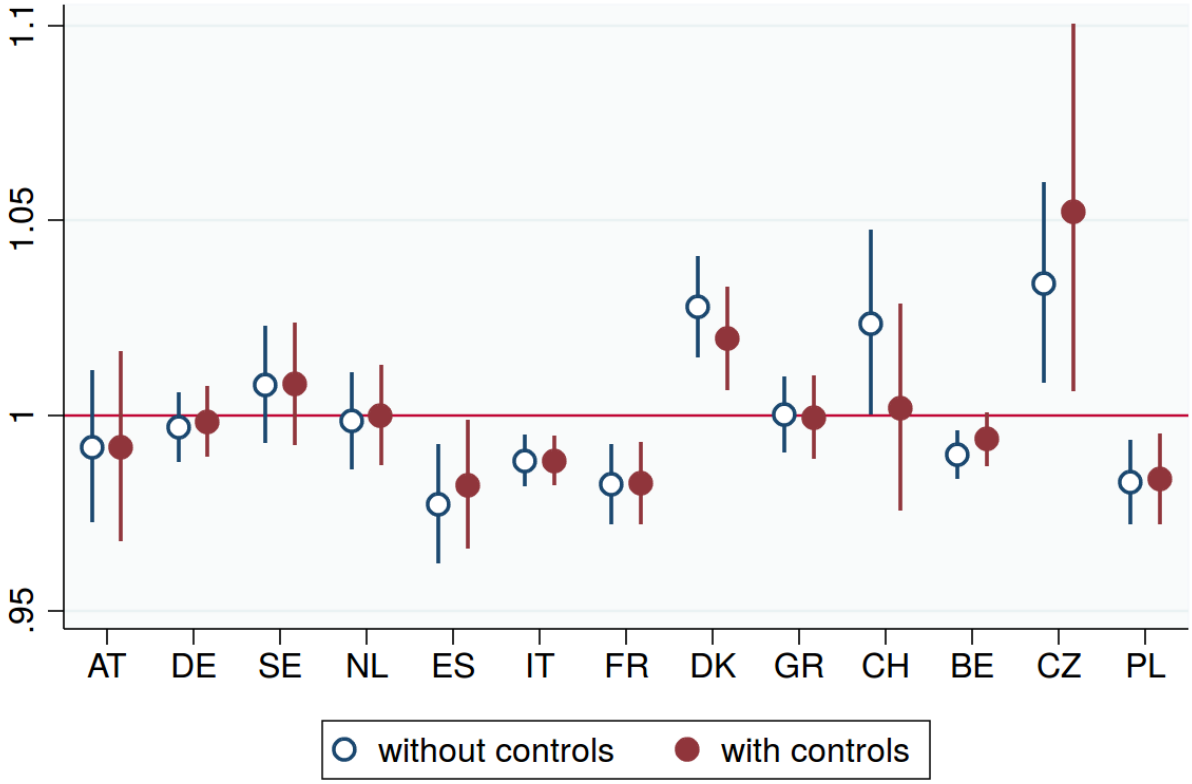

Figure 6.

The proportional shift of the retirement hazard corresponding to one percent more years spent unemployed

At the same time, the cross-country results reveal substantial heterogeneity. In most countries the estimated hazard is significantly positively related to the percent of years worked. Sweden, Denmark and perhaps Austria are exceptions with zero differences when the statutory retirement age and other variables are controlled for. At the same time the associations with the percent of years spent unemployed vary considerably. People with longer unemployment spell retire earlier in Denmark and the Czech Republic, on average, and retire later in Spain, Italy, France and Poland.

These results are quite intriguing. They suggest that people who spend more of their active years working tend to retire earlier than people who spend fewer of

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their active years working but are of the same country and birth cohort and face the same statutory retirement age rules. As we shall see later, the results are robust to the inclusion of education and other control variables. One would expect people with longer employment histories have higher productivity and thus higher wage offers in old age as well, which would in itself provide incentive for them to stay longer in the labor force and retire later. The fact that we see the opposite relationship is consistent with a rule by which people retire as early as possible when they are old enough or have enough employment history accumulated.

5 Marriage History

In contrast with the strong, robust and interesting results with respect to labor market history, we find no relationship of retirement age with marital history averaged across all countries. At the same time, there is a small but statistically significant negative relationship between the percent of years with a spouse or partner and retirement hazard in Italy, and a similar but statistically insignificant difference in Spain. Table 9 shows the average results across the 13 countries, and Figure 7 shows the country-by-country results.

Table 9. Hazard of retirement by percent of years with spouse/partner

	(1)	(2)	(3)	(4)
percent of years with spouse or partner	-0.000 (0.00041)	0.000 (0.00041)	-0.000 (0.00041)	-0.000 (0.00041)
retirement age		-0.132** (0.0049)	-0.113** (0.0065)	-0.112** (0.0066)
early retirement age		-0.026** (0.0055)	-0.022** (0.0068)	-0.027** (0.0069)
early retirement possible		1.562** (0.33)	1.525** (0.40)	1.867** (0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12783	12477	12477	12477

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As we shall see the difference in Italy is due to the retirement behavior of men. Note that in these countries and birth cohorts being with a spouse or partner means being married. We therefore find that married men in Italy, and perhaps Spain, retire later. This is a new and interesting result. It may suggest that the institutional setting or the gender division of labor in the Southern countries makes married men retire later.

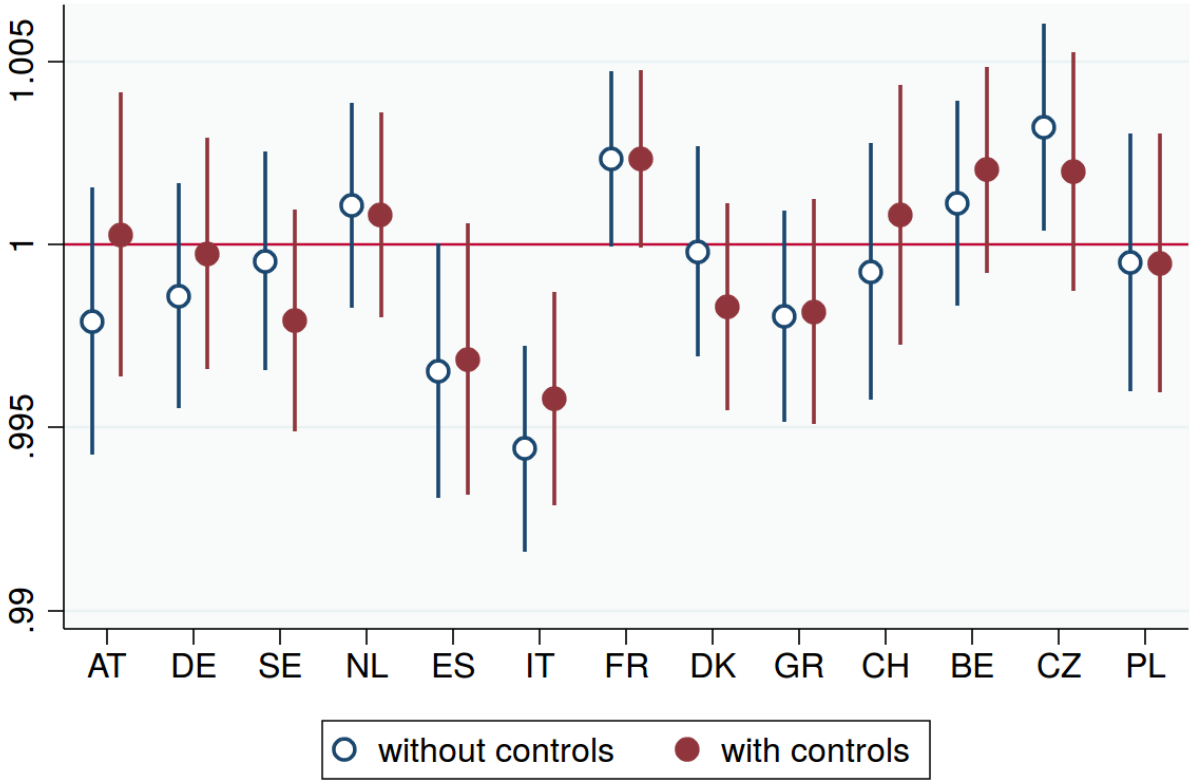

Figure 7.

The proportional shift of the retirement hazard corresponding to one percent more years spent with a spouse or partner

6 Fertility History

We condensed fertility history into two variables: the number of children ever born to the individual and the age of the youngest child when the individual was

50 years old. Tables 10 and 11 show the results for the 13 countries combined, and Figures 8 and 9 show the country-by-country estimates.

The results show that people with more children retire somewhat later on average in the 13 countries. The retirement hazard is about 3 percent lower for each additional child, showing a modest association. The association is robust to controlling for the statutory retirement age and birth year. Figure 8 reveals that the average modest association is the result of small and statistically insignificant association in most countries, a positive association in the Czech republic, and a strong negative association in Italy.

Table 10. Hazard of retirement by the number of children

	(1)	(2)	(3)	(4)
number of children	-0.021**	-0.013	-0.029**	-0.028**
	(0.0074)	(0.0074)	(0.0074)	(0.0074)
retirement age		-0.132**	-0.113**	-0.112**
		(0.0049)	(0.0065)	(0.0066)
early retirement age		-0.025**	-0.022**	-0.028**
		(0.0055)	(0.0068)	(0.0069)
early retirement possible		1.544**	1.536**	1.880**
		(0.32)	(0.40)	(0.41)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12785	12479	12479	12479

Standard errors in parentheses. * p<0.05, ** p<0.01

Results from Cox proportional hazard models. Coefficients show log differences hazard rates

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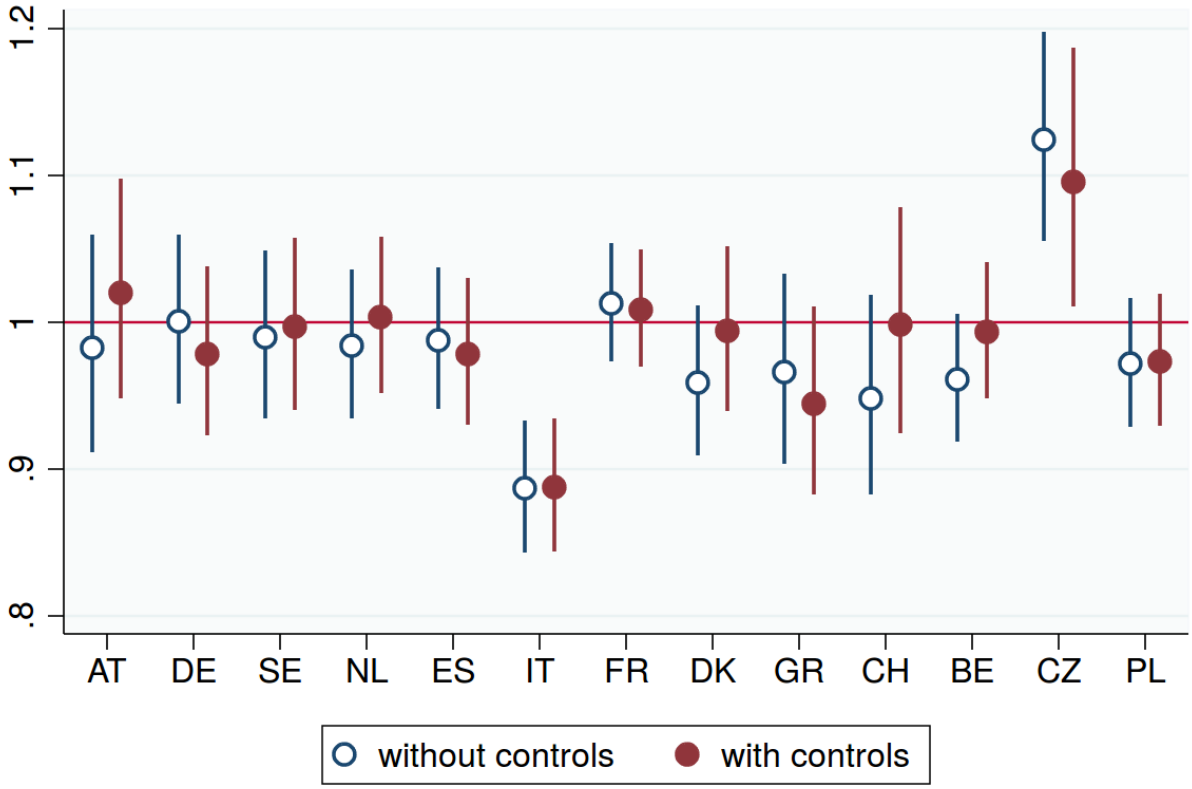

Figure 8.

The proportional shift of the retirement hazard corresponding to the number of children

Table 11 shows that the age of the youngest child is positively related to the retirement hazard, implying somewhat earlier retirement of people with younger children. The association is cut by two thirds when the statutory age is controlled for. The country-level results reveal stronger and statistically significant positive associations with the retirement hazard in Germany, Sweden and Denmark.

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Table 11. Hazard of retirement by the age of the youngest child

	(1)	(2)	(3)	(4)
age of youngest child	0.018**	0.008**	0.008**	0.008**
	(0.0018)	(0.0018)	(0.0019)	(0.0019)
retirement age		-0.130**	-0.106**	-0.105**
		(0.0052)	(0.0070)	(0.0071)
early retirement age		-0.025**	-0.023**	-0.028**
		(0.0059)	(0.0074)	(0.0075)
early retirement possible		1.519**	1.595**	1.899**
		(0.35)	(0.44)	(0.44)
Year of birth dummies	No	No	No	Yes
Country dummies	No	No	Yes	Yes
N	12785	12479	12479	12479

Standard errors in parentheses. * p<0.05, ** p<0.01
Results from Cox proportional hazard models. Coefficients show log differences hazard rates

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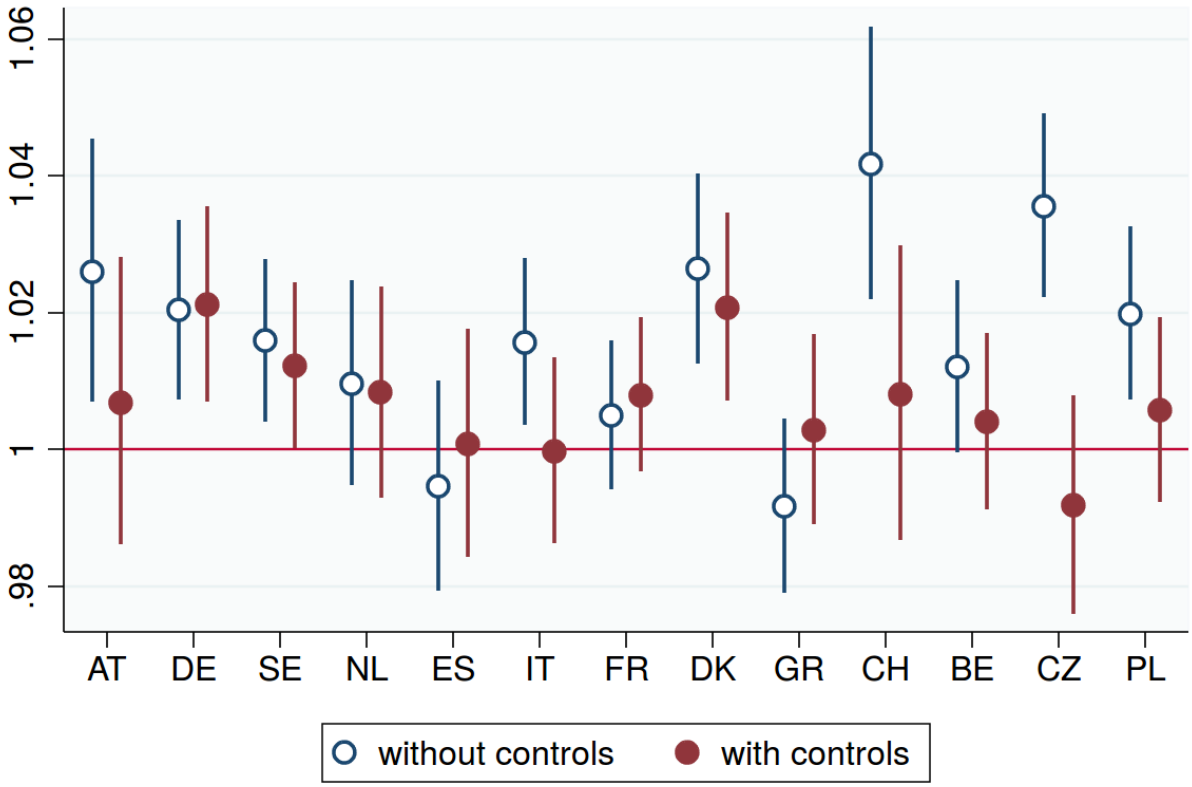

Figure 9.

The proportional shift of the retirement hazard corresponding to the age of the youngest child

7 Robustness Checks

We carried out several robustness checks. First, we entered all the right hand side variables used in our analysis together in the hazard model. Second, we also re-estimated the model separately for the pre-crisis year. Table 11 shows the results. Third, we estimated all models separately for men and women. The corresponding country-specific estimates are in the Appendix, Figures A1 through A7.

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Table 12. Hazard model with all covariates (incl. birth cohort and country). N=12783

	All years	Pre-recession years
female	0.028	-0.122**
	(0.029)	(0.029)
retirement age	-0.132**	-0.155**
	(0.0081)	(0.0081)
early retirement age	-0.025**	-0.031**
	(0.0076)	(0.0075)
early retirement possible	1.482**	1.995**
	(0.45)	(0.44)
education 9-12 years	0.124**	0.209**
	(0.033)	(0.033)
education 13+ years	0.005	0.057
	(0.033)	(0.032)
percent of years working	0.004*	0.012**
	(0.0018)	(0.00087)
percent of years unemployed	0.019**	0.003
	(0.00088)	(0.0018)
immigrant	-0.097	-0.080
	(0.050)	(0.045)
non-EU immigrant	-0.160	-0.175
	(0.10)	(0.135)
percent of years with spouse	-0.002**	-0.001*
	(0.00059)	(0.00047)
number of children	-0.002	-0.017
	(0.010)	(0.0085)
age of youngest child	0.011**	0.009*
	(0.0022)	(0.004)

Most results are robust to controlling for the other right hand side variables, The pre-crisis retirement behavior is also similar to the mid-crisis retirement behavior in most respects. Gender differences in retirement age disappear in the mid-crisis years among people who face not only the same statutory retirement age but also have the same immigrant status, education, labor market history, family history, and number of children. Immigrants, especially non-EU immigrants retire later, but statistical power is lost to detect significant relationships. Secondary educated people retire substantially earlier than low-educated people of the same gender, birth cohort, country, labor market history,

family history and number of children. When compared without conditioning on the other variables, high educated people were predicted to retire almost as early as secondary educated people. Conditional on the other variables, though, their retirement age is more similar to that of low-educated people.

The positive association of the retirement hazard with the percent of years employed is robust to the inclusion of other covariates in pre-crisis years, and the association remains the same if the crisis years are also included, but the magnitude gets smaller. The associations with unemployment history are more sensitive to the inclusion of the other covariates, especially employment history. The association with marital history and the age of the youngest child remain similar, but the association with the number of children is weaker and not statistically significant here.

The only marked difference between the results with and without the crisis years is with respect to unemployment history. The results suggest that unemployment history started to matter in crisis years: people with longer unemployment histories started to retire later in crisis years. Note that the interpretation of this association is different when employment history is controlled for as here it is identified from the unemployment versus non-participation margin.

We also find some interesting gender differences in the associations. The retirement age difference for immigrants is present among men but not women. It is driven exclusively by the higher retirement age among French immigrant men (Figure A1). The differences with respect to education, employment history and marital history are similar across genders. Looking at the results for the pooled data across countries, it appears as if the negative association between the retirement hazard and the number of children were driven by differences among men. It turns out, however, that the zero average association among women is the result of an outlier country in the opposite direction. Both men and women retire later if they have more children in Italy; men retire later if they have more children in Spain and perhaps in Poland; but women retire later if they have more children in the Netherlands, Belgium, and, perhaps, Greece and

Switzerland. The outlier is the Czech Republic where women retire substantially earlier if they have more children, due to specific provisions in the retirement eligibility rules.

8 Conclusion

This study established associations between the age of retirement and long-term life course factors in 13 European countries. It also examined differences between immigrants and non-immigrants. The study established some new and relatively robust findings. We found that people who were employed for a higher fraction of their active career retire earlier, on average. This relationship is robust to controlling for many important factors, including the statutory retirement age or demographic differences. Another robust associations established by the analysis shows that in most European countries secondary educated people retire significantly earlier than lower or higher educated people of similar gender, labor market history and other characteristics.

Some of the other findings can also generate further research. These include the later retirement of immigrants in France; cross-country differences in the role of unemployment history and in years of the economic crisis; the role of marriage history and the number of children in Mediterranean countries, and, in particular, Italy.

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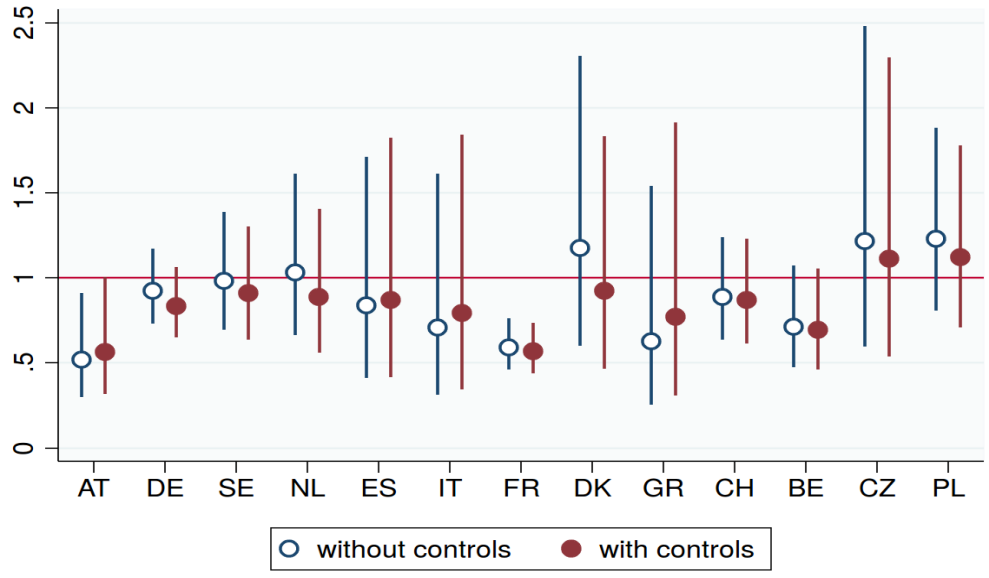
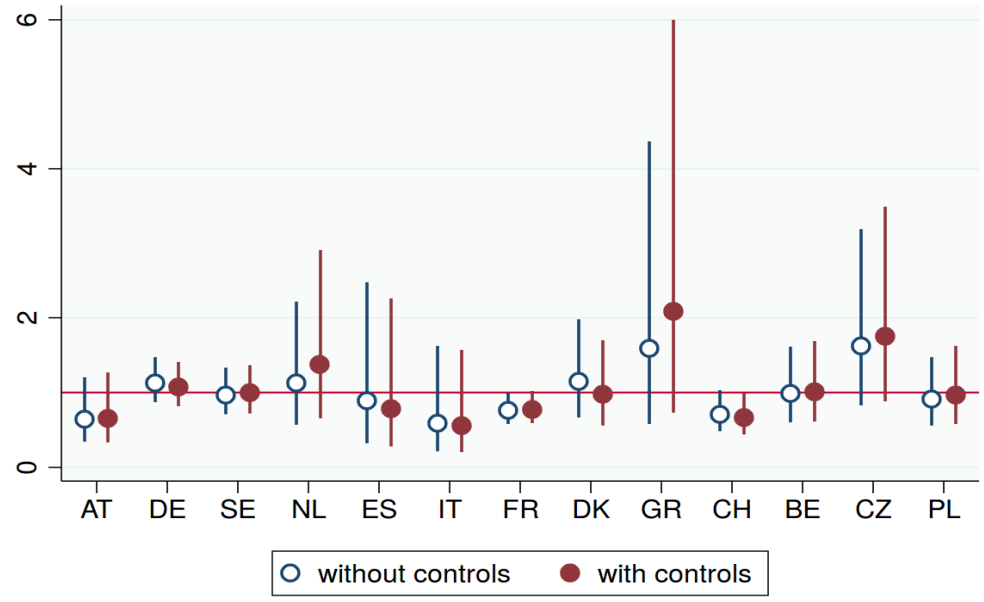
Appendix A. Country-specific hazard rate estimates by gender



Men



Women

Figure A1.
The retirement hazard of immigrants as the proportion of non-immigrants. Men and women separately

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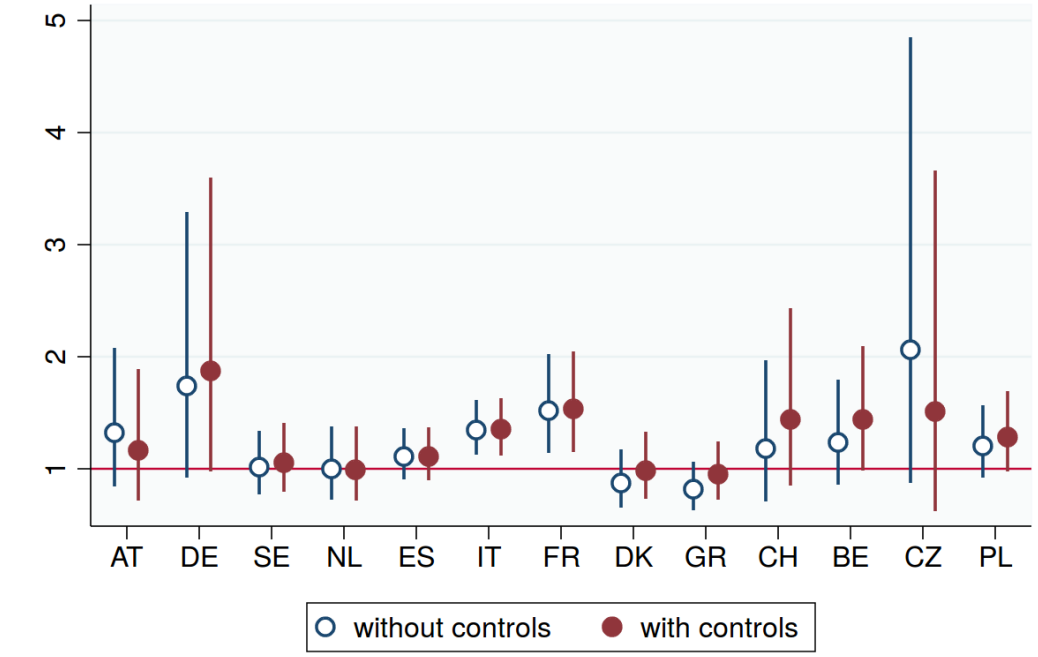
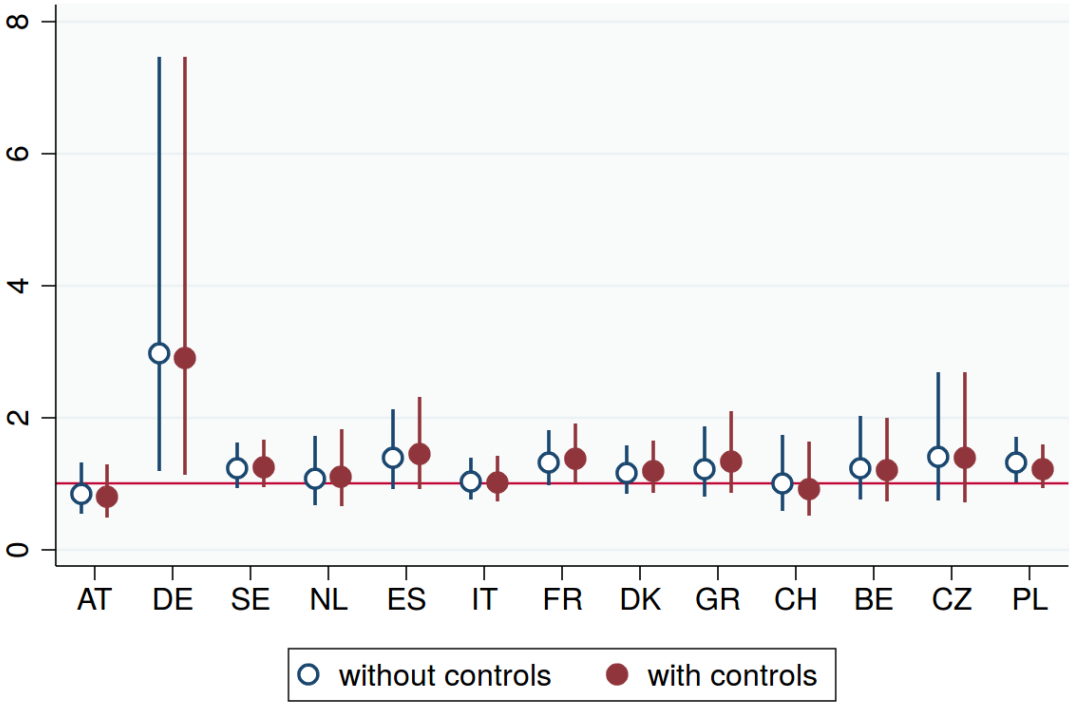


Men



Women

Figure A2.
The retirement hazard of 9-12 years of education as the proportion of 0-8 years. Men and women separately

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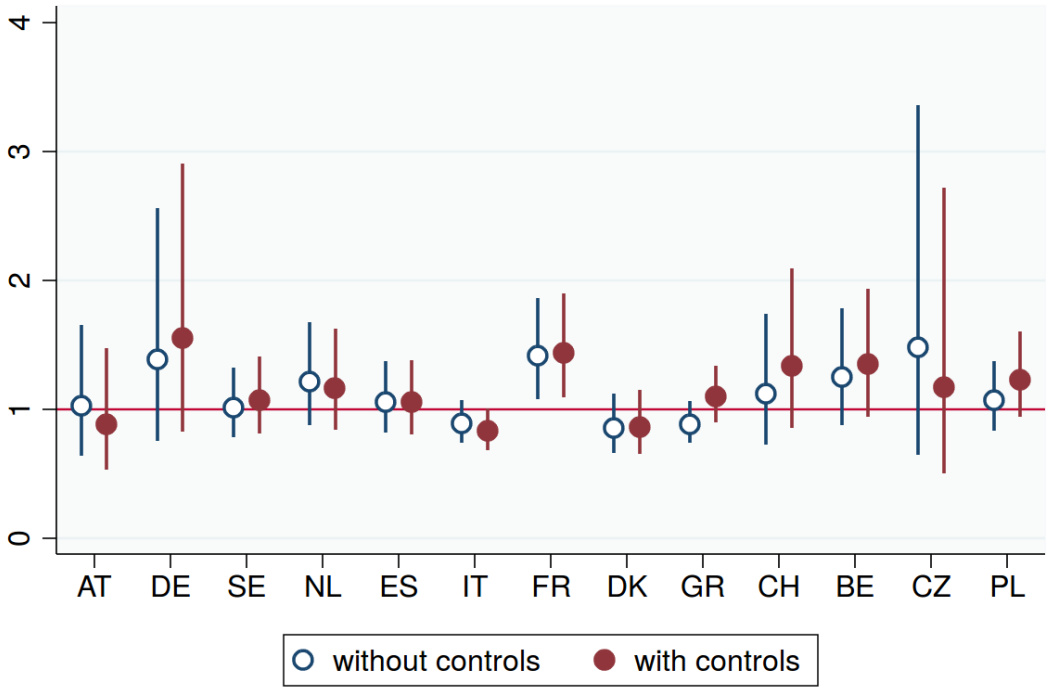
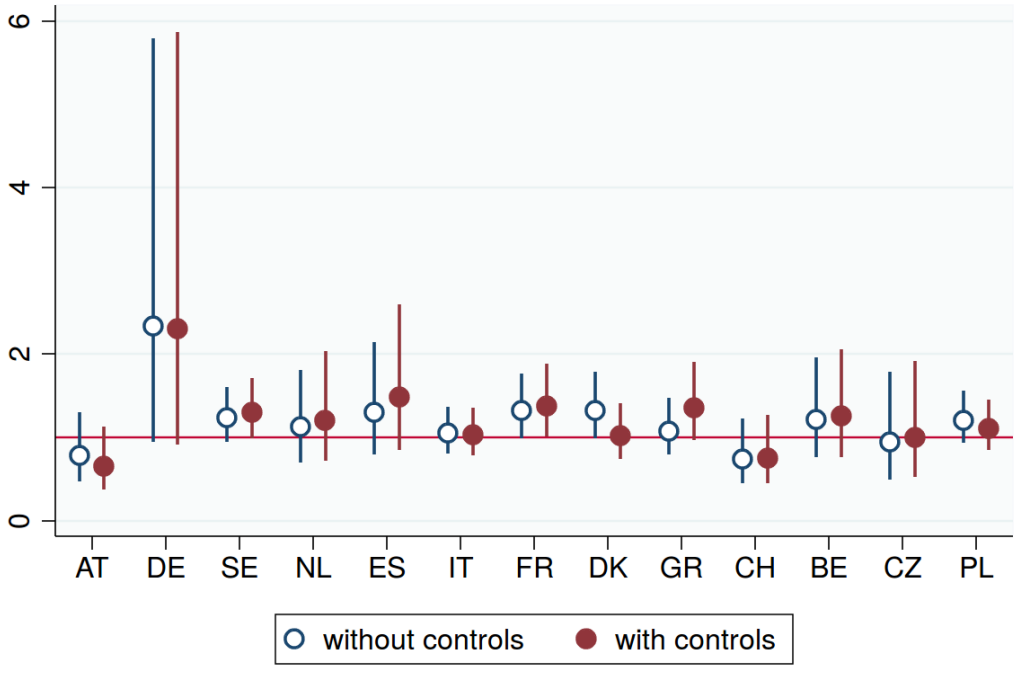


Men



Women

Figure A3.
The retirement hazard of 13+ years of education as the proportion of 0-8 years. Men and women separately

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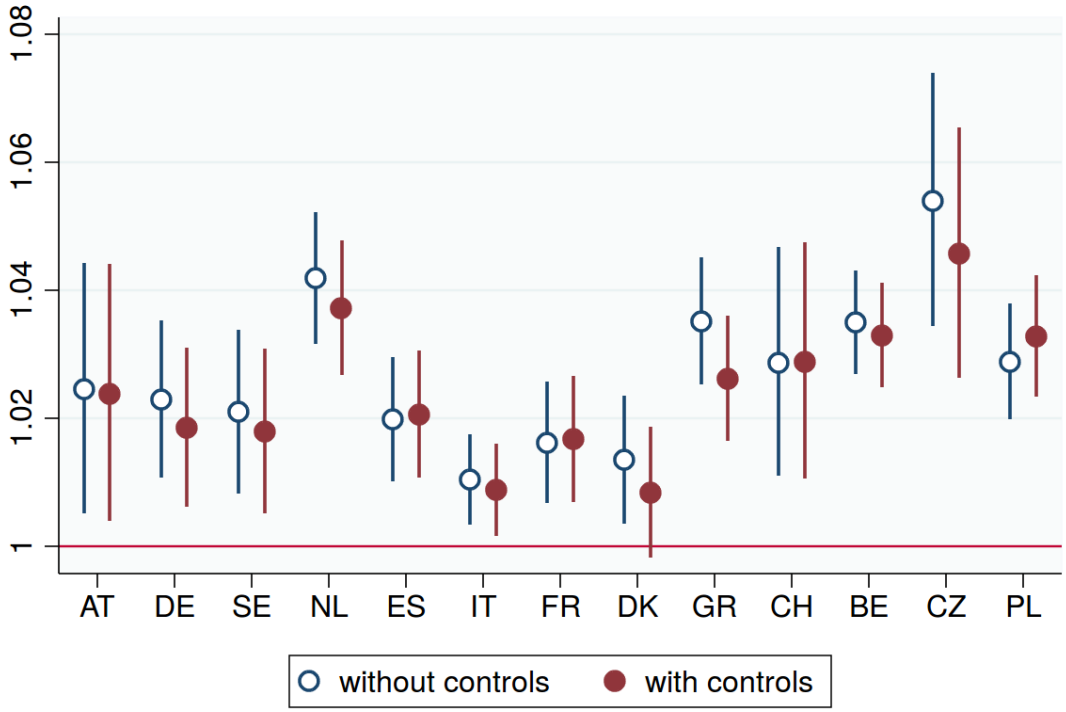
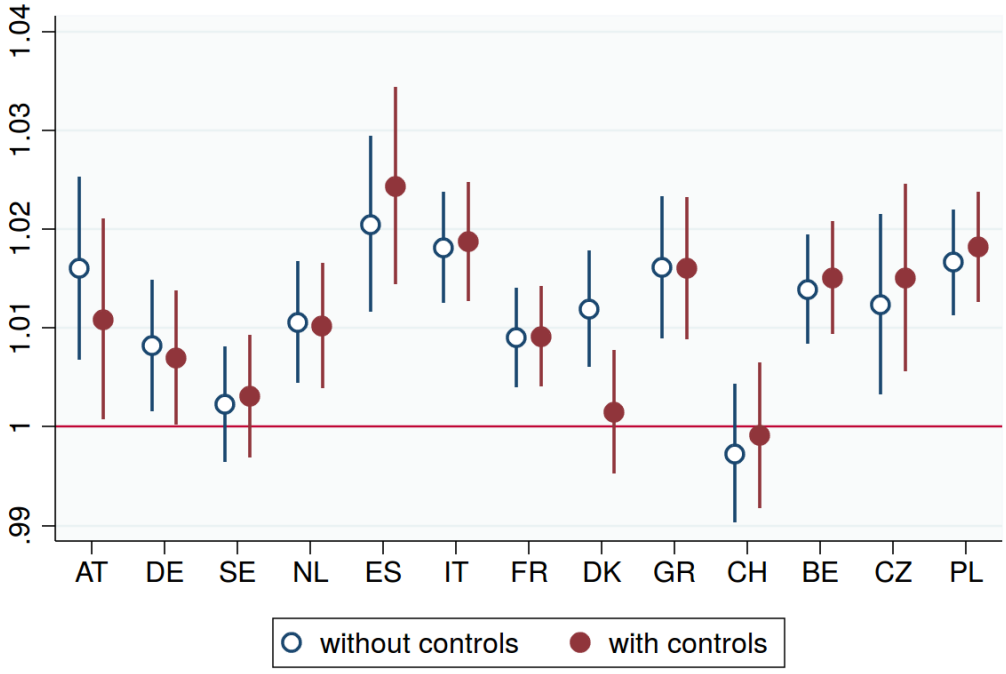


Men



Women

Figure A4.
The proportional shift of the retirement hazard corresponding to one percent more years spent employed. Men and women separately

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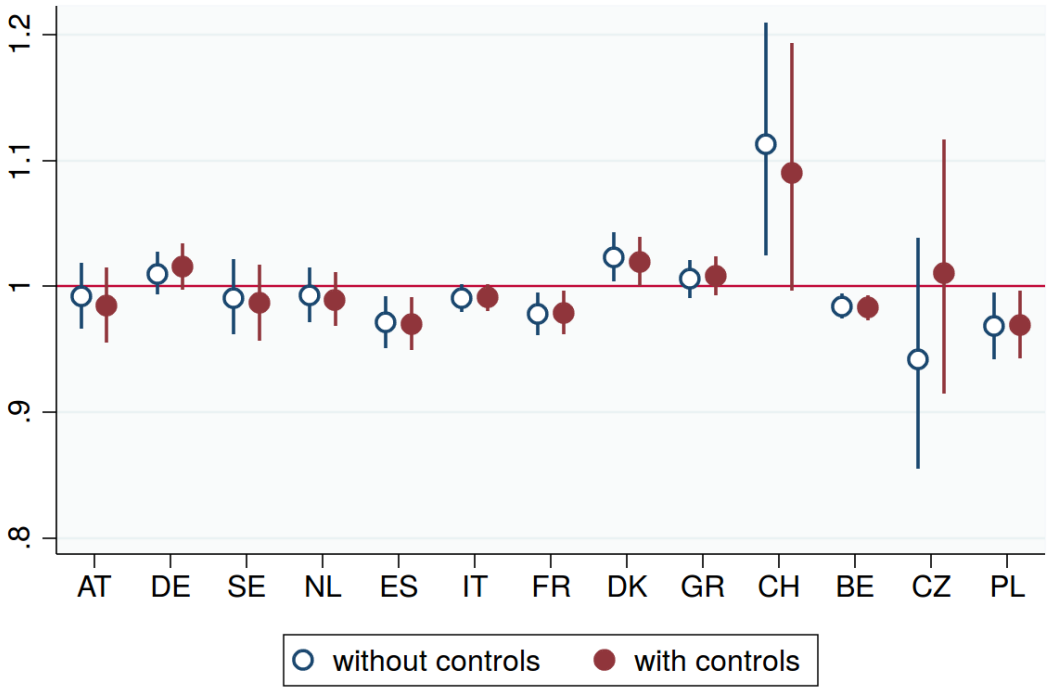

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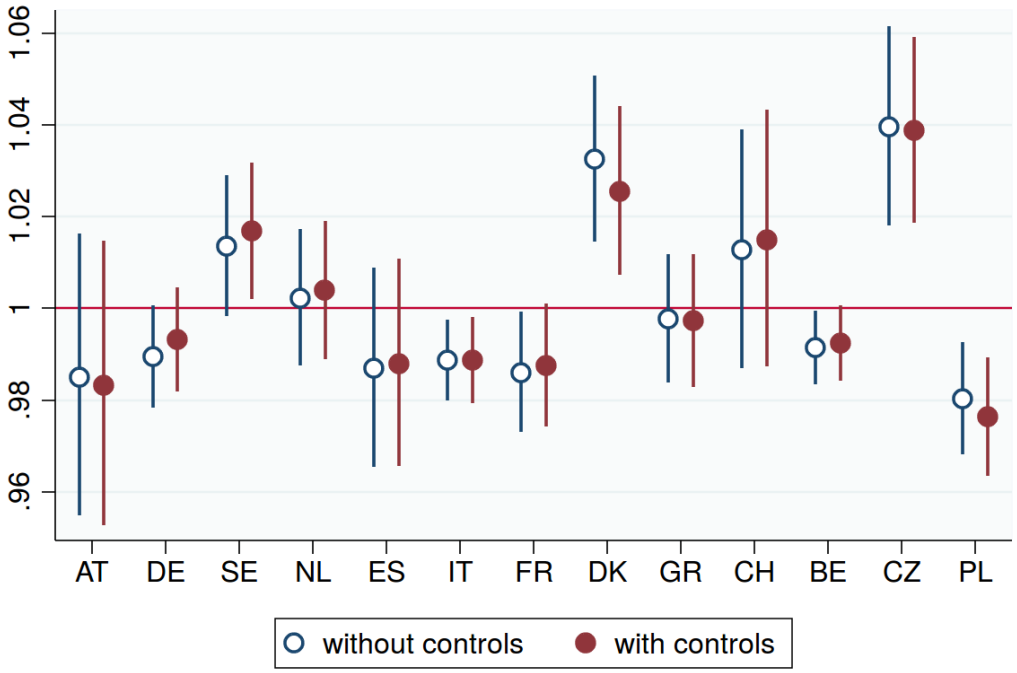

Women

Figure A5.
The proportional shift of the retirement hazard corresponding to one percent more years spent unemployed. Men and women separately

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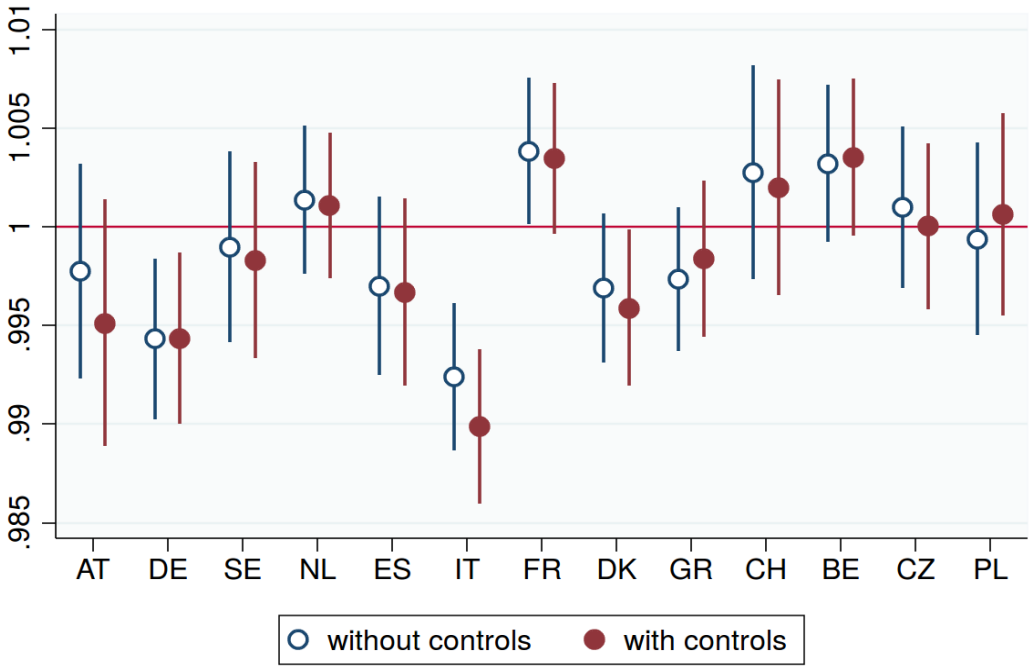
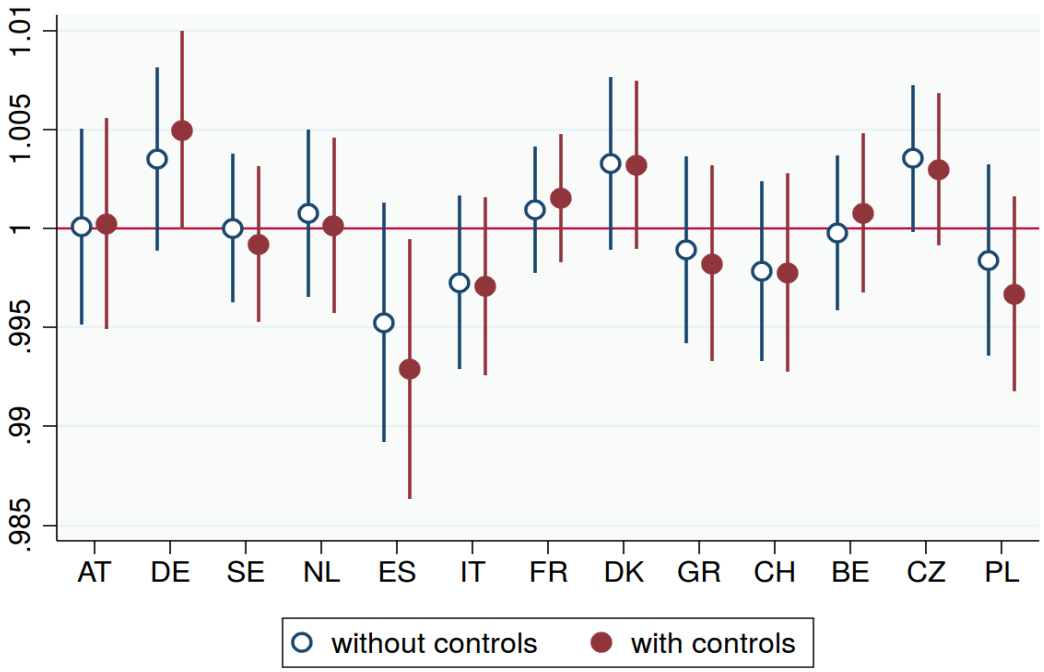


Men



Women

Figure A6.
The proportional shift of the retirement hazard corresponding to one percent more years spent with a spouse or partner. Men and women separately

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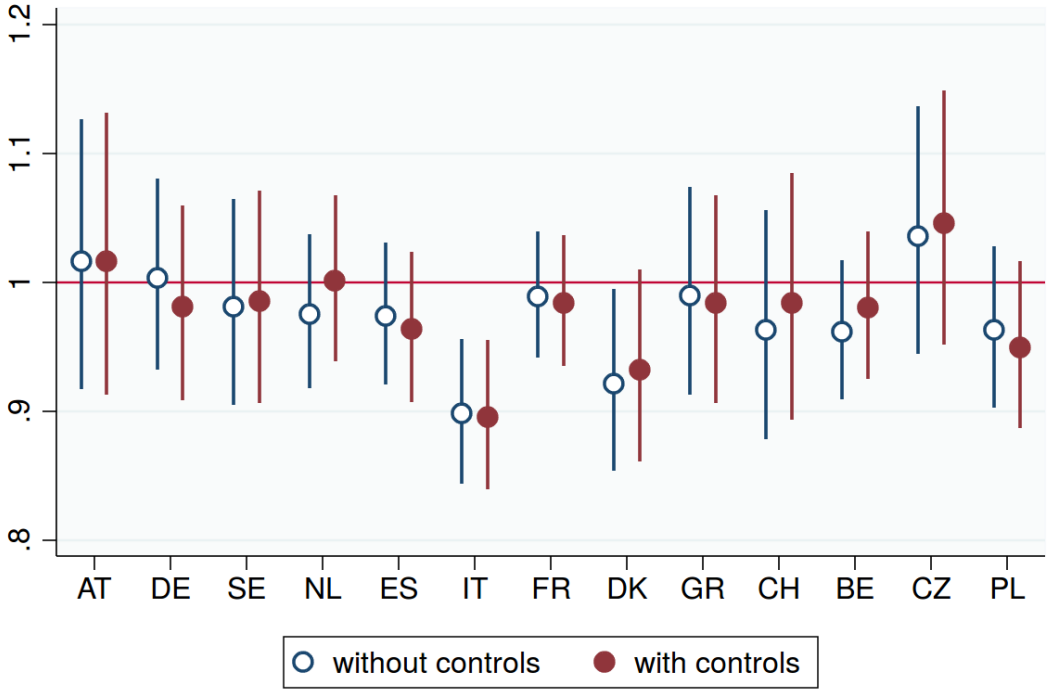

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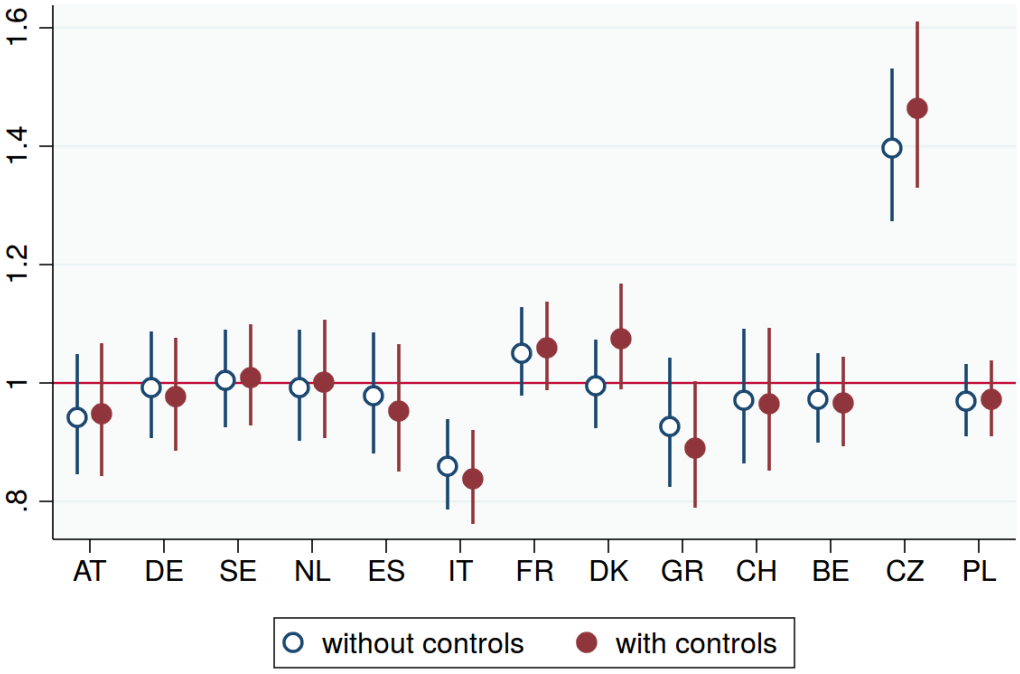

Women

Figure A7.
The proportional shift of the retirement hazard corresponding to the number of children. Men and women separately

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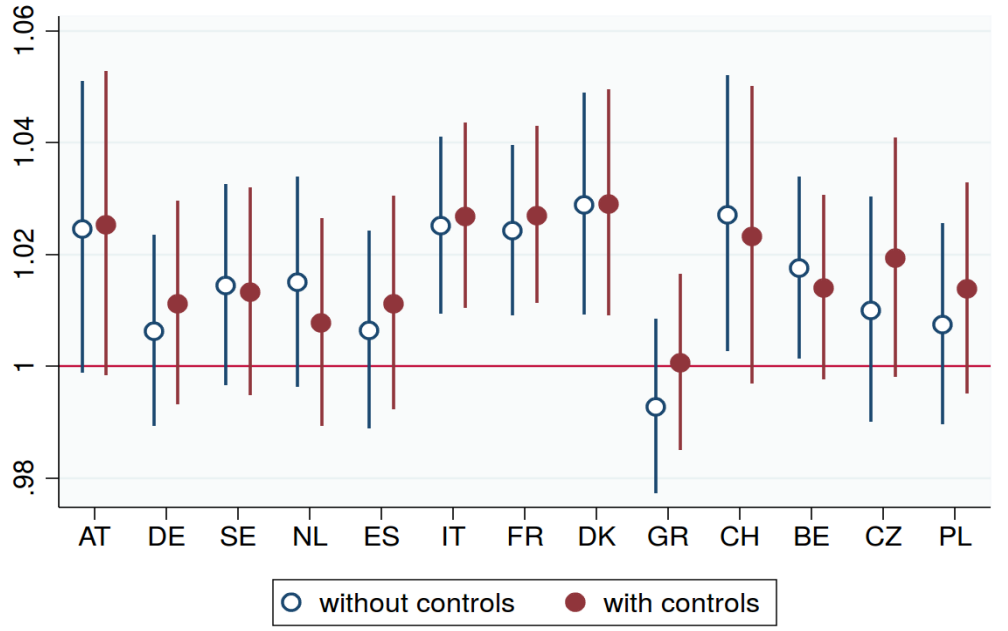
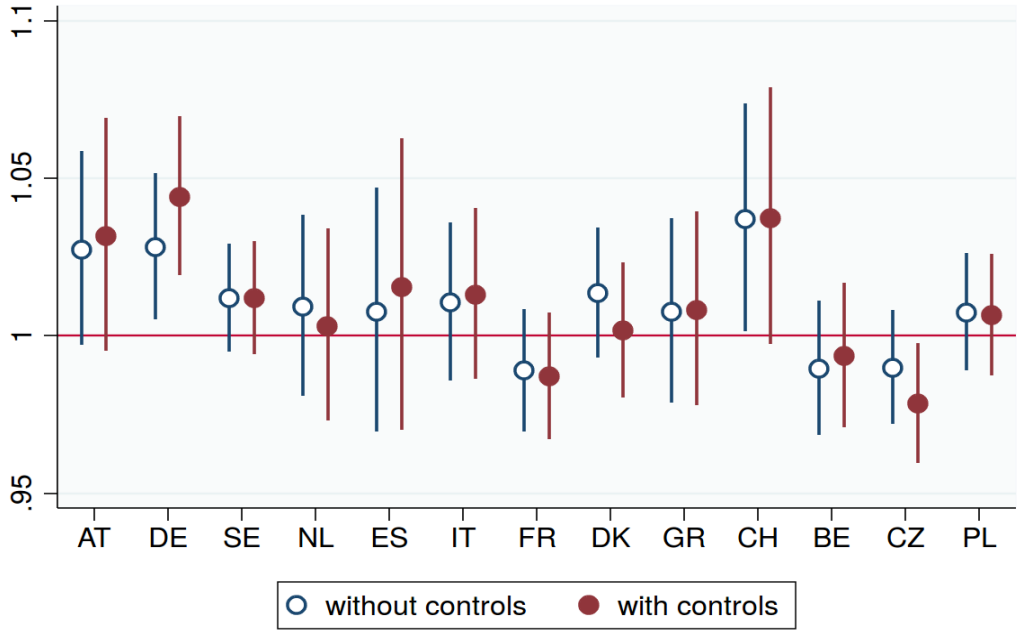


Men



Women

Figure A8.
The proportional shift of the retirement hazard corresponding to the age of the youngest children. Men and women separately

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