*Vincent Vandenberghe**

Differentiating retirement age to compensate for health differences

Abstract

Population aging in Europe calls for an overall rise in the age of retirement. However, most observers agree that the latter should be differentiated to account for different individuals' heterogeneous health when they grow older. This paper explores the relevance of this idea using the European Survey of Health, Ageing and Retirement in Europe (SHARE) panel data. It first quantifies the health gradient across and within each of the European countries across sociodemographic groups (i.e., Gender × Education) at typical retirement age. It then estimates the degree of retirement age differentiation that would be needed to equalize expected health at the moment of retirement. Results point at the need for a very high degree of differentiation to equalize expected health, both across and within, European countries. But the paper also shows that systematic retirement age differentiation would fail to match a significant portion of the full distribution of health status. In a world synonymous with systematic health-based retirement age differentiation, there would still be a lot of what health economists call F-mistakes ([F]ailure of treatment, i.e., no retirement for people in poor health) and E-mistakes ([E]xcessive treatment, i.e., people in good health going for retirement).

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Corresponding author: Vincent Vandenberghe
vincent.vandenberghe@uclouvain.be

Economics Department, Economics School of Louvain (ESL), Institute of Economic and Social Research - Louvain Institute of Data Analysis and Modeling in economics and statistics (IRES-LIDAM), Université catholique de Louvain (UCLouvain), 3 place Montesquieu, B-1348, Belgium

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1 Introduction

Increase in life expectancy is arguably the most remarkable by-product of economic growth and medical progress. Since the end of the 19th century, advanced economies have been gaining roughly 2.4 years of longevity every decade (Oeppen and Vaupel, 2002). But this trend – in combination with lower fertility – translates into population aging. In addition, this has far-reaching economic and sociopolitical consequences. *Ceteris paribus,* population aging will cause declining labor forces and rising old-age dependency. This may hurt economic growth and the overall quality of life if governments need to divert public spending from, say, education or infrastructure investment to fund elderly-related obligations.

Different approaches could be adopted to combat the contraction of the working age population and the rise of old-age dependency, and these have been explored theoretically and empirically (Acemoglu and Restrepo, 2018; Acemoglu, 2010; Vandenberghe, 2011; Vandenberghe, 2017). These include a higher female participation in the labor force (at least in the countries where it remains very low), slightly longer hours of work, less unemployment, or even shorter initial education (Vandenberghe, 2020). But so far, the most common form of adjustment retained by policymakers consists of raising the age of effective retirement. Researchers at the Organisation for Economic Co-operation and Development (OECD) (Martins et al., 2005) have shown numerically that indexing retirement age on (rising) life expectancy could stabilize old-age dependency ratios around their current levels, preventing dramatic tax increases to finance pay-as-you-go pensions, or a general reduction of the level of pensions. And indeed, stricter retirement policies implemented since the mid-1990s have proved effective at increasing employment rates (Atalay and Barrett, 2015), although from a historically low level (Costa, 1998).

However, one concern often raised is whether such policies are fair, as elderly workers may differ a lot in terms of their health status[1] and remaining life expectancy.[2] This paper intends to analyze that question by focusing on the health gradient across different countries and, within these countries, across different sociodemographic groups around the age at which retirement typically takes place. It also aims to examine the relevance of an automatically differentiated retirement age policy[3] that would aim at equalizing the expected health at the moment of retirement. If aging is a key determinant of ill-health, and if different groups' health differs significantly, health-informed retirement age differentiation could represent a relatively straightforward way of making retirement policy more equitable.

The question we ask more specifically in this paper is as follows: what would it take in terms of lowering(raising) the retirement age to ensure that all sociodemographic groups can *expect* to retire in similar (ill)-health? The normative foundations for such an objective are known in social choice theory as ex ante egalitarianism (Diamond, 1967; Fleurbaey et al., 2016).

1 A related but quite different question is how many individuals still have the capacity to work beyond a certain age. For an illustration of how SHARE data can be used to quantify that capacity at different ages and in different countries, refer to Vandenberghe (2021).

2 There is strong evidence that ill-health at 50 years of age is correlated with a shorter life span/early death. De Nardi et al. (2016) shows that the life span is 3.3 years shorter for those with bad health than for those with good health, while Pijoan and Rios-Rull (2014) shows that the equivalent numbers are 5.6 years for men and 4.7 years for women at the age of 50 years.

3 By "automatically", we mean that the right to retire at a certain age would be granted just on the condition of belonging to a certain category. There would be no need to undergo screening and be subjected to individualized checks, as is the case to get disability benefits.

Furthermore, some of our results presented at the end of the paper – related to people's *accomplished* health at the moment of their retirement – illustrate the important difference that may exist between ex post and ex ante egalitarianism (Fleurbaey et al., 2016; Ponthiere, 2020).

Another important point is that the whole retirement age differentiation exercise presented here assumes that any impact of work/retirement on health is limited. Lowering or raising the retirement age (and thus varying the duration of the career) is supposed to have no significant impact on health, which means that the latter is primarily driven by age (our variable of differentiation/equalization) and other factors (genetic background, childhood health, circumstances, and so on).[4] This may seem to be a strong assumption, but it is backed by a relatively abundant economic literature. Bassanini and Caroli (2015) reviews the many papers that have studied the impact of work on health and find mixed evidence. Some authors point to work, in particular – long hours or night shifts, accelerating a decline in health, while others suggest exactly the opposite. There is also an abundant literature asking whether retirement is good or bad for health. And again, the results are not clear cut. Many works conclude a significant negative effect of retirement on cognitive functioning and mental health (Mazzonna and Peracchi, 2012; Bonsang et al., 2012), while others conclude that postponing retirement is detrimental to self-reported health (Rose, 2020). And even for disability insurance (DI), the results are contrasting. Börsch-Supan et al. (2017) finds a positive impact on mental health but not on objective health.

The first result of this paper is that the degree of retirement age differentiation required to, equalize expected health – i.e., achieve ex ante equality – is important, ranging from 52 years in Poland (POL) to 79 years in Switzerland (CHE). It is also very important across socioeconomic groups within countries. On average, across the European Union, women should be allowed to retire 2.9 years earlier than men.[5] And very often, tertiary-educated individuals should retire more than 10.6 years later than those with less than an upper-secondary education attainment. But the paper also shows that, more from an ex post point of view, systematic retirement age differentiation based on expected health differences across groups would fail to match a significant portion of the full distribution of achieved health status. In a world synonymous with systematic health-based retirement age differentiation, there would still be an ex post inequality, leading to what health economists call F-mistakes ([F]ailure of treatment, i.e., no retirement for people in poor health) and E-mistakes ([E]xcessive treatment, i.e., people in good health going for retirement).

The remainder of this paper is organized as follows. Section 2 reviews the existing literature on retirement age differentiation and shows our contribution to that literature. In Section 3, we present the Survey of Health, Ageing and Retirement in Europe (SHARE) data on (ill-) health used in this empirical paper. Section 4 depicts how we compute the differentiated retirement ages. Section 5 presents the main results, while Section 6 concludes the paper.

2 Literature review

This paper contributes to the literature on aging and retirement, and more precisely – on the importance of health (and indirectly, longevity) heterogeneity across countries, across sociode-

4 And also, when considering differences across countries, macroeconomic variables such as gross domestic product/head or capital intensity.

5 The result that women should be allowed to retire earlier based on their health is somewhat surprising as women have a higher life expectancy. But our result accords a recurrent result of the morbidity/mortality literature (Case and Paxson, 2005). Women have worse self-rated health and more hospitalization episodes than men from early adolescence to old age but are less likely to die at each age.

mographic groups within each country, and also among individuals within these groups. It explores empirically whether (and to which extent) policymakers should/can take that heterogeneity into account when designing pension systems, in particular, when deciding on legal retirement ages. This paper relates to the literature on health and retirement/labor supply, but with the important nuance that the focus is more on how age of eligibility should vary to account for the existence of a health gradient than on how the latter influences individuals' timing of retirement (for a review of the latter question, see French and Jones [2017]). This shift of focus partially reflects the European context underpinning this paper, whereby retirement is still largely driven by State-edicted rules and decided paternalistically by the authorities. Along those lines, this paper relates to the literature on demanding occupations and (early)retirement provision (Pestieau and Racionero, 2016; Vermeer et al., 2016). Moreover, it presents empirical evidence about the difficulty of properly targeting (or "tagging", using the term coined by Ackerlof (1978)) individuals suffering with ill-health. The tagging problem was discussed theoretically in the context of pension/disability benefit design (Cremer et al., 2007), wherein individuals self-report their health status using imperfect information, creating adverse selection. The problem documented in the final section of this paper is not so much about imperfect information causing adverse selection. It has more to do with the relevance of using group average differences, when what truly matters is addressing each individual's specific situation. A focus on group differences, with significant dispersion within each group, leads to what Cornia (1993) calls F-mistakes (failure of treatment) and E-mistakes (excessive treatment). Finally, this paper also relates to normative economics and social choice theory, in particular, the distinction between ex ante and ex post egalitarianism (Fleurbaey et al., 2016; Diamond, 1967). The equalization of expected health, which underpins most of this paper, is a typical application of ex ante egalitarian social criteria to the context of retirement; whereas our focus in the final part of the paper on residual/unaccounted health differences, and the importance for each individual of his/her "realized" health, undoubtedly points at ex post egalitarianism.

3 **Data**

This paper uses Waves 1–2 and 4–7 (2004–2017) of the SHARE survey, i.e., a total of 238,363 Individuals × Waves (Table A1 in Appendix). All individuals in SHARE were 50 years or older of age when interviewed for the first time. Data limitations of different sorts (missing values or variables, absence of repeated observations as the country participated only in one wave) imply that, in the analysis, we retain only 20 out of the 29 participating countries Austria (AUT), Belgium (BEL), Switzerland (CHE), Czech Republic (CZE), Germany (DEU), Denmark (DNK), Spain (ESP), Estonia (EST), France (FRA), Greece (GRC), Croatia (HRV), Hungary (HUNG), Israel (ISR), Italy (ITA), Luxemburg (LUX), the Netherlands (NLD), Poland (POL), Portugal (PRT), Slovenia (SVN), Sweden (SWE).

SHARE contains a rich set of items describing people's physical health status, which we use extensively here. SHARE also contains information about people's mental and cognitive health, but we do not utilize this information in this paper. Most health items are self-reported, and many are subjective in the sense that they correspond to how people perceive and self-assess their overall health status (Table 1). But SHARE questionnaires also explicitly refer to many specific health conditions diagnosed by health professionals (heart attack, hypertension, cholesterol,

stroke, diabetes, lung disease, cancer, etc.; see Table 2). SHARE interviewers also conduct measurements such as the maximum grip strength of respondents (last column of Table 2).

In the following sections, we make extensive use of physical ill-health indices. These are computed as the first principal component[6] of the items listed in Tables 1 and 2. The relationship of these health indices with age, in each of the 20 countries, is on display in Figure A1 in Appendix. Quite logically, we see that the incidence of ill-health goes up with age. However, there are important differences across countries. For instance, at the age of 67 years, the ill-health index in Switzerland (CHE) at –0.476 is much lower than in Estonia (EST), where is reaches 0.36 (Figure A1 in Appendix – long dashed lines). There are also differences in terms of the intensity of the ill-health/age gradient. In other words, both the level and the slope of the solid curve vary internationally.

Table 1 Subjective health evaluation of respondents aged 50–79 years

	Poor health[a]	Self-perceived bad health[b]	Long-term illness[c]	Limits[d]	Limits[e]	Limits[f]
AUT	2.90	2.90	0.46	2.44	0.11	0.22
BEL	2.92	2.92	0.45	2.44	0.17	0.25
CHE	2.62	2.62	0.34	2.64	0.06	0.10
CZE	3.26	3.26	0.52	2.35	0.14	0.24
DEU	3.17	3.17	0.59	2.37	0.13	0.18
DNK	2.47	2.47	0.49	2.58	0.10	0.17
ESP	3.18	3.18	0.45	2.66	0.12	0.23
EST	3.75	3.75	0.70	2.23	0.22	0.33
FRA	3.08	3.08	0.43	2.51	0.12	0.17
GRC	2.83	2.83	0.31	2.75	0.06	0.18
HRV	3.24	3.24	0.58	2.37	0.15	0.24
HUN	3.59	3.59	0.66	2.32	0.17	0.40
ISR	2.95	2.95	0.49	2.57	0.17	0.40
ITA	3.11	3.11	0.36	2.58	0.10	0.17
LUX	2.97	2.97	0.46	2.45	0.11	0.18
NLD	2.85	2.85	0.46	2.35	0.07	0.16
POL	3.59	3.59	0.64	2.28	0.23	0.31
PRT	3.66	3.66	0.52	2.34	0.27	0.33
SVN	3.22	3.22	0.47	2.42	0.15	0.21
SWE	2.65	2.65	0.52	2.50	0.10	0.15

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

[a]1–5 European scale.

[b]1–5 US scale

[c]Yes (1) and no (0).

[d]Limited in activities because of health (on a 3–1 scale).

[e]Number of limitations with activities of daily living.

[f]Limitations with instrumental activities of daily living.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

6 The values reported have been standardized internationally. This means that a one-unit change of the index corresponds to one standard deviation of the international distribution of the health index

Table 2 Health items: incidence of objective conditions (+ grip strength) in respondents aged 50–79 years

Countries	Heart attack	Hypertension	Cholesterol	Stroke	Diabetes	Lung disease	Cancer	Ulcer	Parkinson	Cataract	Hip fracture	Mobility[a]	Grip[b]
AUT	0.10	0.39	0.22	0.04	0.12	0.06	0.04	0.04	0.01	0.07	0.01	1.24	35.15
BEL	0.09	0.33	0.31	0.03	0.10	0.06	0.05	0.06	0.01	0.05	0.02	1.28	35.88
CHE	0.06	0.28	0.15	0.02	0.07	0.04	0.04	0.02	–	0.06	0.01	0.64	35.72
CZE	0.12	0.49	0.25	0.04	0.17	0.07	0.05	0.05	0.01	0.08	0.02	1.38	34.91
DEU	0.10	0.41	0.19	0.03	0.13	0.07	0.07	0.03	0.01	0.07	0.01	1.19	36.78
DNK	0.08	0.32	0.23	0.03	0.07	0.07	0.05	0.03	0.01	0.06	0.01	0.82	37.78
ESP	0.08	0.36	0.28	0.02	0.15	0.05	0.04	0.03	0.01	0.07	0.01	1.30	30.51
EST	0.16	0.47	0.20	0.04	0.12	0.06	0.05	0.08	0.01	0.08	0.01	1.73	34.42
FRA	0.10	0.31	0.24	0.02	0.11	0.05	0.05	0.03	0.01	0.05	0.01	1.15	34.24
GRC	0.09	0.38	0.28	0.02	0.11	0.04	0.02	0.07	–	0.05	0.02	1.38	33.32
HRV	0.12	0.46	0.21	0.04	0.13	0.04	0.06	0.05	0.01	0.05	0.01	1.81	35.19
HUN	0.18	0.55	0.21	0.06	0.17	0.06	0.05	0.08	0.01	0.04	0.03	2.00	32.83
ISR	0.13	0.40	0.36	0.03	0.22	0.04	0.05	0.05	0.01	0.09	0.01	1.29	30.26
ITA	0.08	0.39	0.23	0.02	0.11	0.05	0.03	0.03	–	0.05	0.01	1.22	33.11
LUX	0.09	0.33	0.33	0.02	0.11	0.07	0.07	0.06	0.01	0.07	0.02	1.21	35.26
NLD	0.09	0.27	0.18	0.03	0.09	0.07	0.05	0.02	–	0.05	0.01	0.89	36.68
POL	0.16	0.44	0.23	0.04	0.14	0.05	0.04	0.06	0.01	0.06	0.01	1.90	34.24
PRT	0.10	0.46	0.41	0.04	0.19	0.06	0.06	0.08	–	0.08	0.02	1.94	30.34
SVN	0.10	0.44	0.26	0.03	0.13	0.05	0.05	0.06	–	0.06	0.02	1.53	35.36
SWE	0.10	0.36	0.17	0.03	0.10	0.04	0.06	0.02	0.01	0.08	0.02	0.88	36.25

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

[a]Arm function and fine motor limitations

[b]Maximum grip strength measure.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

4 Analytical framework

We deploy a two-stage estimation using the SHARE data. Stage 1 aims at identifying, for each country *j*, the degree of retirement age differentiation around the age of 67 years,[7] which would ensure that its people retire with a level of (expected) ill-health equal to the international average. Formally, if Y_j^{67} represents the average ill-health index of respondents aged 67 years in country *j* and Y^{67} is the international average, there is potentially an ill-health index gap in that country equal to the difference between these two terms. If β_j^{67} represents the marginal effect of a year of age on the ill-health index,[8] then one can estimate the age of retirement ensuring equalization of the expected ill-health as follows:

$$\begin{aligned} a_j &= 67 - \frac{|Y_j^{67} - Y^{67}|}{\beta_j^{67}} \; if \; Y_j^{67} > Y^{67} \\ a_j &= 67 + \frac{|Y_j^{67} - Y^{67}|}{\beta_j^{67}} \; if \; Y_j^{67} < Y^{67} \end{aligned} \tag{1}$$

Stage 2 proceeds along the same lines as Stage 1, but within each country *j* and for each sociodemographic group *k*. The retirement age differentiation is computed around the Stage 1-estimated and country-specific retirement age a_j, using the ill-health gap applicable to group *k* and of the marginal impact of a year of age on the ill-health index $\beta_{j,k}^{a_j}$ of that group around age a_j.

$$\begin{aligned} a_{j,k} &= a_j - \frac{|Y_{j,k}^{a_j} - Y^{a_j}|}{\beta_{j,k}^{a_j}} \; if \; Y_{j,k}^{a_j} > Y^{a_j} \\ a_{j,k} &= a_j + \frac{|Y_j^{a_j} - Y^{a_j}|}{\beta_{j,k}^{a_j}} \; if \; Y_{j,k}^{a_j} < Y^{a_j} \end{aligned} \tag{2}$$

Important in such a setting are estimates of the ill-health index gaps and of the βs. As to the latter, we resort to fixed-effect (FE) estimation, which exploits the panel dimension of SHARE data (remember that SHARE consists of up to seven waves, measuring individuals' ill-health every 2–3 years). In other words, the estimated βs only reflect the within-respondent deterioration of health over time. This eliminates many of the biases that may contaminate estimates based on cross-sectional data.

5 Results

5.1 Health-equalizing differentiated retirement ages

The main results appear on Figure 1 and Table 3. They display the rather-important degree of retirement age differentiation that would be required to equalize ill-health at the moment of retirement. Focusing on cross-country differences, we see that the age of retirement would have to be the lowest (52.39 years) in Poland (POL). By contrast, the age of retirement would have to be as high as 79.45 years in Switzerland (CHE). By construction, these retirement age differences mostly reflect ill-health gaps among elderly people. And it is quite interesting to visualize how much the retirement age differences — and presumably also the ill-health gaps — parallel

7 Internationally, the age of 67 years is gradually becoming the new reference (OCDE, 2019). Not so long ago, the statutory retirement age was rather 65 years, at least for men. This said, we lower that age to 61, 63, and 65 when doing robustness analysis (Section 5.2).

8 Note the presence of subscript *j*, indicating that the marginal effect can vary from country to country, and the superscript 67, indicating that it is calculated around the age of 67 years.

differences in gross domestic product (GDP) per capita (Figure 2). This result is confirmed by a regression analysis of the differentiated retirement ages (Table A2 in Appendix). The higher the GDP per head and the capital intensity (i.e., a proxy of the structure of the economy), the higher is the health-equalizing retirement age.

Moreover, within each country, additional differentiation of the age of retirement would be needed to account for the significant variations of health across sociodemographic groups. In Poland (POL), for instance, the retirement age should range between 43.97 and 60.67 years. And in Switzerland (CHE), our estimates are that it should vary between 73.42 and 82.61 years. The combination of across- and within-country ill-health differences among elderly individuals results in ill-health-equalizing retirement ages ranging from 40 years (Hungary [HUN], less-educated females) to 82.72 years (the Netherlands [NLD], highly educated males).

Table A3 in Appendix reports our estimates of the across-country ill-health gaps (second column), as well as their degree of significance (fourth column). The last two columns report the FE-estimated marginal impact of 1 extra year of age on the ill-health index (β). The ratio of the ill-health gap by these βs is what drives the results presented in the first two columns of Table 3. The health gaps and βs underpinning the within-country-across-sociodemographic-group retirement age differentiation are reported in Tables A4 and A5 in Appendix, respectively.

5.2 **Robustness analysis**

Given that the health–age relationship is usually nonlinear, one may expect the above results to vary with the level of reference retirement age result chosen. We have fixed it at 67 years, which might be perceived as quite high, especially since, in some countries, the legal retirement age is still 60 or 62 years. It is thus useful to examine the robustness of our results to a range of (lower) reference retirement ages. To that end, we replicate the above analysis using ages ranging from

Figure 1 Differentiated retirement ages equalizing (expected) ill-health, across and within countries.

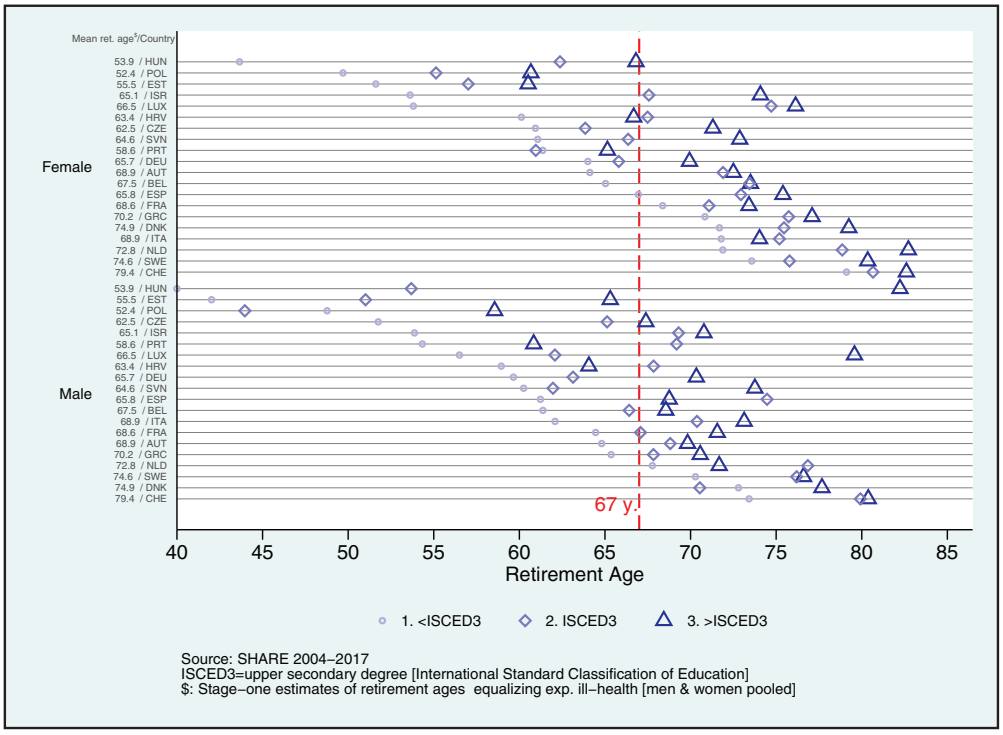


Table 3 Differentiated retirement age equalizing ill-health: between- and within-country differentiation

Countries	Differentiated retirement age, years	Gap with international reference (67 years), years	Differentiated retirement age, years, females	Differentiated retirement age, years, males	Male (M)			Female (F)			F–M gap	ISCED gap			
					<ISCED3	ISCED3[a]	>ISCED3	<ISCED3	ISCED3	>ISCED3			Retirement age, years, maximum	Retirement age, years, minimum	Maximum–minimum, years
AUT	68.92	1.92	67.82	69.50	64.11	71.90	72.50	64.81	68.81	69.83	–1.69	–6.70	72.50	64.11	8.38
BEL	67.49	0.49	65.45	70.66	65.03	73.44	73.50	61.38	66.41	68.55	–5.21	–7.82	73.50	61.38	12.12
CHE	79.45	12.45	77.91	80.79	79.11	80.66	82.61	73.42	79.92	80.38	–2.89	–5.23	82.61	73.42	9.19
CZE	62.50	–4.50	61.42	65.36	60.94	63.85	71.30	51.75	65.12	67.39	–3.94	–13.00	71.30	51.75	19.55
DEU	65.71	–1.29	64.38	66.58	64.00	65.81	69.94	59.65	63.13	70.34	–2.21	–8.31	70.34	59.65	10.69
DNK	74.87	7.87	73.67	75.46	71.69	75.46	79.24	72.80	70.54	77.68	–1.79	–6.22	79.24	70.54	8.70
ESP	65.78	–1.22	68.15	71.76	66.95	72.94	75.40	61.23	74.47	68.75	–3.61	–7.98	75.40	61.23	14.16
EST	55.52	–11.48	52.78	56.38	51.62	57.01	60.51	42.02	51.02	65.31	–3.60	–16.09	65.31	42.02	23.29
FRA	68.57	1.57	67.70	70.95	68.37	71.08	73.41	64.46	67.08	71.56	–3.26	–6.07	73.41	64.46	8.96
GRC	70.22	3.22	67.92	74.56	70.84	75.73	77.10	65.36	67.83	70.56	–6.64	–5.73	77.10	65.36	11.74
HRV	63.42	–3.58	63.61	64.76	60.12	67.49	66.68	58.94	67.84	64.06	–1.15	–5.84	67.84	58.94	8.90
HUN	53.93	–13.07	58.64	57.61	43.66	62.37	66.81	40	53.69	82.23	1.03	–32.69	82.23	40	42.23
ISR	65.11	–1.89	64.65	65.09	53.61	67.57	74.08	53.87	69.30	70.78	–0.44	–18.69	74.08	53.61	20.47
ITA	68.89	1.89	68.53	73.67	71.79	75.19	74.03	62.08	70.37	73.13	–5.14	–6.64	75.19	62.08	13.10
LUX	66.46	–0.54	66.05	68.22	53.81	74.71	76.13	56.50	62.08	79.57	–2.17	–22.70	79.57	53.81	25.76
NLD	72.79	5.79	72.10	77.82	71.89	78.86	82.72	67.77	76.85	71.67	–5.73	–7.37	82.72	67.77	14.96
POL	52.39	–14.61	50.43	55.17	49.70	55.13	60.67	48.77	43.97	58.56	–4.74	–10.38	60.67	43.97	16.71
PRT	58.62	–8.38	61.45	62.49	61.37	60.96	65.14	54.33	69.18	60.84	–1.04	–5.14	69.18	54.33	14.85
SVN	64.57	–2.43	65.32	66.77	61.07	66.36	72.87	60.25	61.96	73.76	–1.44	–12.65	73.76	60.25	13.51
SWE	74.62	7.62	74.36	76.57	73.58	75.78	80.35	70.29	76.20	76.60	–2.21	–6.54	80.35	70.29	10.06
Internal reference	67														

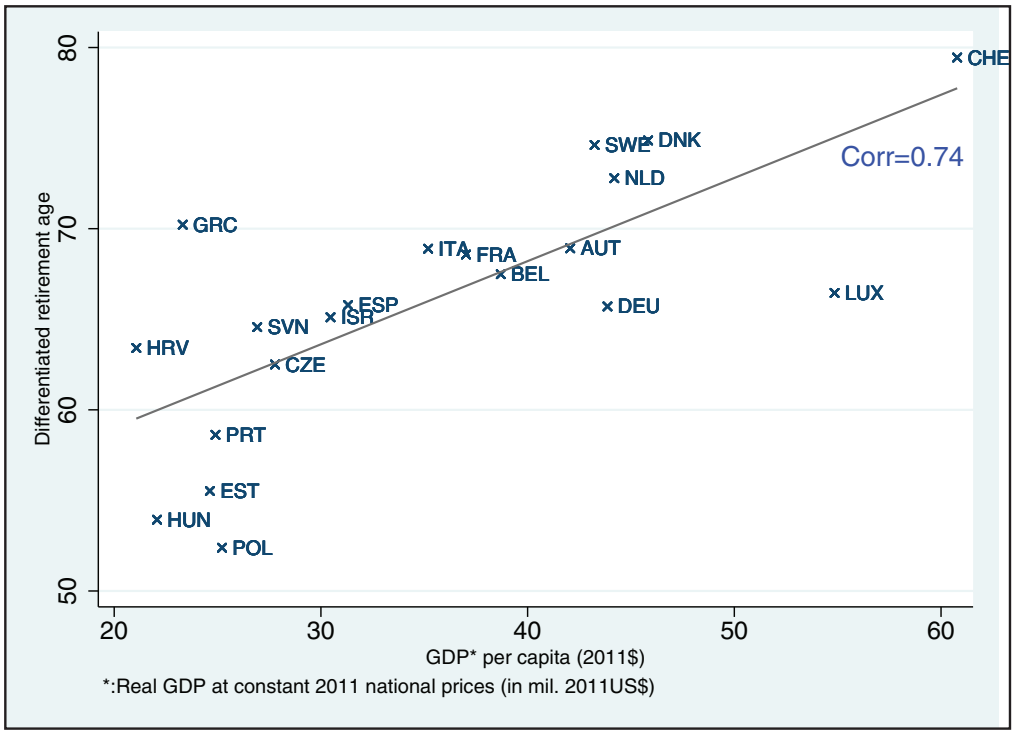
Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]ISCED3 = upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure 2 Differentiated retirement ages equalizing (expected) ill-health across countries: correlation with gross domestic product per head.



Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

61 to 67 years in steps of 2 years. The synthetic results are reported in the four first columns of Table 4, with the last of the four corresponding to the age of 67 years used so far.[9]

Another type of robustness test consists of considering alternative definitions of health. This is possible with SHARE as it informs on not only physical health but also mental health.[10] Moreover, SHARE distinguishes two dimensions of physical health, which we have so far aggregated: subjective physical health (Table 1) and objective physical health (Table 2), i.e., a series of doctor-diagnosed conditions or surveyor measurements (grip strength, mobility, etc.). The synthetic robustness results for subjective physical health only, objective health only, and overall health (combining physical and mental health) are reported in the last four columns of Table 4, with the last of the four columns corresponding to the definition of health used herein.[11]

With both robustness extensions, the take-home message is that the results are qualitatively very similar to those obtained so far, with the possible nuance that the inclusion of mental health increases the required degree of retirement differentiation to achieve (expected) health equality and also leads to small differences regarding estimation of the retirement gender gap.

9 Full results are found Figures A2–A4 and Tables A6–A8 in Appendix.

10 In SHARE, mental ill-health essentially means depression. The detailed list of items used to assess mental health in SHARE is reported in Table A9 in Appendix. They logically cover several dimensions of respondents' mood or feelings: melancholy, diminished interest, sleep disorders, or suicidal thoughts. They represent depressive symptoms that, once taken together, give a fair idea of people's mental health. The 12 items are those used to build the EURO-D scale, which has been validated in earlier cross-European studies of depression prevalence (Prince et al., 1999).

11 And again, a more detailed characterization of the differentiated retirement ages can be found in Figures A5–A7 and Tables A10–A12 in Appendix.

Table 4 Robustness analysis: sensitivity of results to different definitions of the reference age of retirement and health – regression analysis

	Reference age (physical health), years				Health (reference age =67 years)			
	61	**63**	**65**	**67**	**Physical and mental**	**Objective physical**	**Subjective physical**	**Physical**
Female (reference: male)	−2.82 ^***	−3.04 ^***	−3.36 ^***	−2.89 ^***	−6.46 ^***	−6.44 ^***	0.09	−2.89 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.883)	(0.001)
ISCED3 (reference <ISCED3)	5.85 ^***	6.43 ^***	5.74 ^***	6.63 ^***	6.89 ^***	4.28 ^***	5.61 ^***	6.63 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
>ISCED3	11.48 ^***	11.28 ^***	11.06 ^***	10.59 ^***	11.29 ^***	7.92 ^***	9.64 ^***	10.59 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BEL (reference AUT)	−2.04	−1.79	−1.34	−0.61	−2.11	−1.84	0.24	−0.61
	(0.357)	(0.425)	(0.581)	(0.809)	(0.384)	(0.451)	(0.903)	(0.802)
CHE	9.19 ^***	8.82 ^***	11.72 ^***	10.69 ^***	11.47 ^***	9.73 ^***	12.10 ^***	10.69 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CZE	−4.87 ^*	−4.54 ^*	−4.45	−5.27 ^*	−5.26 ^*	−3.29	−6.06 ^**	−5.27 ^*
	(0.030)	(0.045)	(0.069)	(0.038)	(0.032)	(0.178)	(0.003)	(0.032)
DEU	−6.15 ^**	−5.25 ^*	−3.47	−3.18	−2.90	−0.37	−4.83 ^*	−3.18
	(0.006)	(0.021)	(0.155)	(0.207)	(0.233)	(0.878)	(0.015)	(0.191)
DNK	4.45 ^*	4.65 ^*	5.81 ^*	5.91 ^*	9.05 ^***	3.14	7.74 ^***	5.91 ^*
	(0.046)	(0.040)	(0.018)	(0.020)	(0.000)	(0.199)	(0.000)	(0.016)
ESP	1.55	1.67	1.22	1.30	0.49	−1.39	2.54	1.30
	(0.483)	(0.457)	(0.614)	(0.606)	(0.839)	(0.567)	(0.197)	(0.593)
EST	−14.54 ^***	−15.35 ^***	−14.81 ^***	−14.08 ^***	−21.12 ^***	−6.44 ^*	−14.46 ^***	−14.08 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)	(0.000)	(0.000)
FRA	0.10	−0.11	−0.80	0.67	−2.59	1.01	0.79	0.67
	(0.964)	(0.962)	(0.742)	(0.791)	(0.286)	(0.677)	(0.687)	(0.783)
GRC	4.55 ^*	3.75	3.07	2.58	1.20	−1.85	9.08 ^***	2.58
	(0.042)	(0.097)	(0.207)	(0.306)	(0.620)	(0.448)	(0.000)	(0.289)
HRV	−3.99	−4.20	−5.12 ^*	−4.47	−5.95 ^*	−2.93	−6.04 ^**	−4.47
	(0.073)	(0.064)	(0.037)	(0.078)	(0.021)	(0.229)	(0.003)	(0.067)
HUN	−10.79 ^***	−10.68 ^***	−10.88 ^***	−10.53 ^***	−1.96	−4.74	−4.90 ^*	−8.28 ^**

(*continued*)

Table 4 (Continued)

	Reference age (physical health), years				Health (reference age =67 years)			
	61	**63**	**65**	**67**	**Physical and mental**	**Objective physical**	**Subjective physical**	**Physical**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.420)	(0.085)	(0.028)	(0.002)
ISR	0.64	−0.72	−2.39	−3.79	−4.33	−11.15 ^***	−3.51	−3.79
	(0.773)	(0.750)	(0.326)	(0.134)	(0.077)	(0.000)	(0.075)	(0.120)
ITA	4.65 ^*	4.65 ^*	5.15 ^*	2.44	7.13 ^**	3.12	2.31	2.44
	(0.038)	(0.040)	(0.036)	(0.333)	(0.004)	(0.201)	(0.239)	(0.315)
LUX	−2.84	−4.37	−2.11	−1.53	−20.65 ^***	−1.14	−2.36	−1.53
	(0.200)	(0.054)	(0.385)	(0.544)	(0.000)	(0.640)	(0.230)	(0.529)
NLD	1.96	2.11	2.93	6.30 ^*	−6.50 ^**	9.99 ^***	3.31	6.30 ^*
	(0.376)	(0.348)	(0.229)	(0.014)	(0.009)	(0.000)	(0.093)	(0.011)
POL	−13.10 ^***	−14.16 ^***	−15.55 ^***	−15.86 ^***	−2.74	−8.45 ^***	−19.30 ^***	−15.86 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.261)	(0.001)	(0.000)	(0.000)
PRT	−6.02 ^**	−5.48 ^*	−6.48 ^**	−6.69 ^**	7.39 ^**	−6.50 ^**	−7.32 ^***	−6.69 ^**
	(0.007)	(0.016)	(0.009)	(0.009)	(0.003)	(0.009)	(0.000)	(0.007)
SVN	−0.66	−0.76	−0.88	−2.61		−2.59	−1.48	−2.61
	(0.764)	(0.736)	(0.716)	(0.299)		(0.288)	(0.451)	(0.282)
SWE	3.81	4.20	5.48 ^*	6.80 ^**		8.05 ^**	6.39 ^**	6.80 ^**
	(0.087)	(0.064)	(0.026)	(0.008)		(0.001)	(0.001)	(0.006)
Constant	58.65 ^***	60.73 ^***	62.84 ^***	64.37 ^***	66.87 ^***	67.46 ^***	63.89 ^***	64.37 ^***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	120	120	120	120	108	120	120	120

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

Notes: The (health-equalizing) differentiated retirement ages are computed using i) (first four columns) different international reference ages for retirement, i.e., 61, 63, 65, and 67 years used above; or ii) (last four columns) different definitions of health: overall health (combining physical and mental health), subjective physical health, objective health, and physical health (combining subjective and objective items), which we have used so far. They are then regressed on gender, education, and country dummies. The stability of the coefficients suggests that the results are robust to changes in international reference retirement age or the definition of health.

p-values are in parentheses: ^*: $p < 0.05$; ^**: $p < 0.01$; ^***: $p < 0.001$.

ISCED, International Standard Classification of Education.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

5.3 The limit to retirement age differentiation based on ex ante equalization

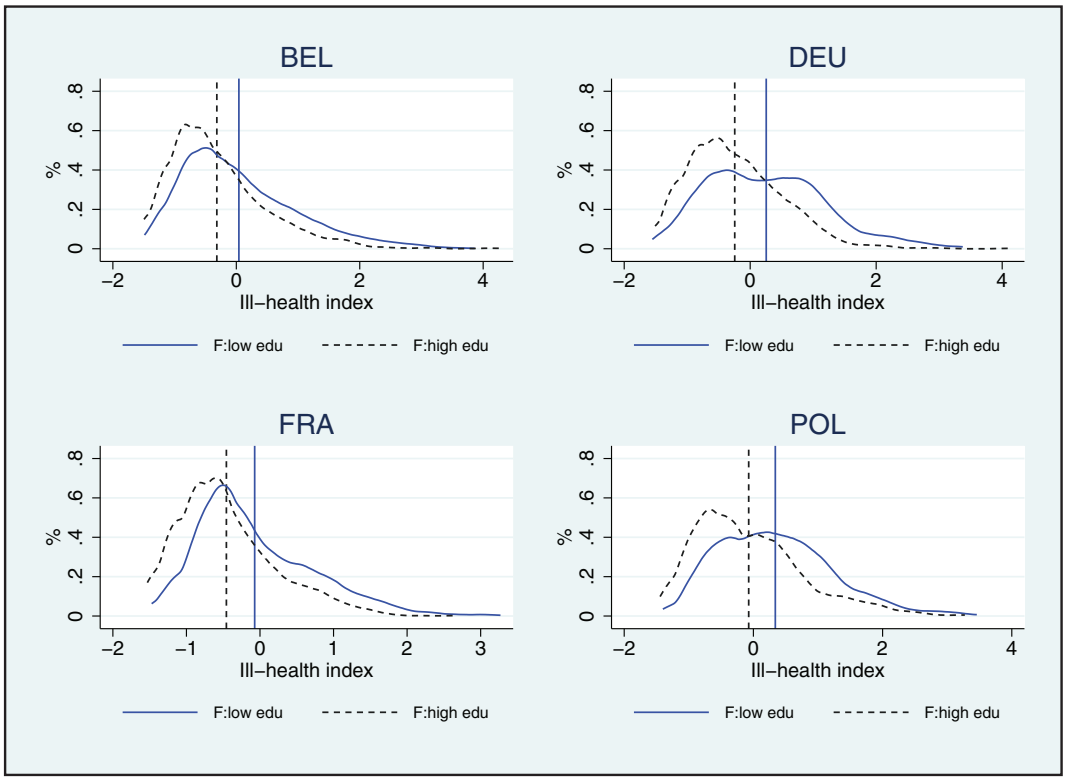
In this section, we focus on what happens within each country; we examine and discuss the importance of what econometricians call the variance "within" sociodemographic groups. So far, within each country, we have essentially looked at the "between"-group variance in an attempt to differentiate retirement age (i.e., introduce a certain dose of tagging [24]). We have shown that (ill-)health varies significantly (in the statistical sense) among groups at any given age beyond 50 years (Table A4 in Appendix). And we have used these differences (in combination with group-specific age/ill-health gradients) to compute the differentiated retirement ages that ensure equalization of expected ill-health across groups (Table 3), contributing thus to the achievement of ex ante equality across pensioners (Diamond, 1967).

But this amounts to focusing on the average characteristics of the different sociodemographic groups, ignoring the potentially huge dispersion within each of them in terms of accomplished health and, thus, the full magnitude of the ex post distribution of conditions. From an ethical perspective, both ex ante and ex post egalitarianism are attractive (Fleurbaey et al., 2016), and it is beyond the reach of this paper to rank them. But we would posit that ex post egalitarians should be concerned to observe that the systematic retirement age differentiation as modeled above is still synonymous with what Cornia (1993) calls F-mistake and E-mistake errors. The first type of errors, synonymous with "failure of treatment", corresponds to individuals suffering from ill-health but who belong to the socioeconomic group that — on average — fares relatively well and got assigned a high retirement age. The second type of errors — synonymous with "excessive" treatment, is just the symmetric case, i.e., individuals whose health is expected to be relatively bad given the socioeconomic group they belong to and thus are allowed to retire early, but who *de facto* are in good shape. Note that type-E and type-F errors could easily be related to the concept of statistical discrimination. Arrow (1971) and Phelps (1972) explain in their seminal works that a decision maker could base his/her decision on average characteristics and, by doing so, some high-performing members belonging to an underperforming group are discriminated against. The same could arise in the context of differentiated retirement. In particular, frail "rich" individuals risk being penalized because the social planner only considers the average health status of the rich as a group.

Figure 3 illustrates, for some of the countries forming our data set, how difficult it is to avoid Type-F and Type-E errors and achieve ex post equalization. Both errors remain very frequent whatever the age band considered. There is no doubt that highly educated females are, on average, in better health than their less-educated peers. The dotted line in gray is clearly located to the left of the solid line. But it is also clear that distributions overlap. There are highly educated females with a high ill-health index (higher than the average for less-educated females). These would be denied early retirement in spite of their ill-health. Similarly, there are many less-educated women with a low ill-health index (lower than the average for highly educated women). This hints at the possibility of many less-educated women in relatively good condition who would (illegitimately) be granted the right to retire early due to inaccurate tagging.

One way to go beyond visual evidence is to resort to variance decomposition techniques commonly used in microeconometrics. Table 5 contains the share of total country-level

Figure 3 The difficulty to tag (importance of Type-E and Type-F errors). The case of less- vs. highly educated females aged 55–65 years in Germany (DEU), France (FRA), Belgium (BEL), and Poland (POL).



ill-health variance explained by the sociodemographic categories (Gender×Education) used above. As the last column suggests, this share is small, often <5%, and never >9%.

6 Concluding remarks

This paper has explored the idea of a differentiated retirement age policy aimed at accounting for people's health inequality when they grow older. Using European SHARE data on health and how the latter varies across countries and within countries across sociodemographic groups, we compute the degree of retirement age differentiation that would be required to equalize (ill)-health at the moment of retirement. Such a policy would be a way to systematize earlier suggestions that pensions reforms (in particular, those aimed at raising the retirement age) should make an exception for workers with demanding occupations, since health considerations may make it unreasonable to expect them to work longer. They also echo recent work on the fairness of retirement systems under unequal lifetime (Ponthiere, 2020); health and residual life expectancy are indeed highly correlated.

The results of this paper are essentially fourfold.

First, European elderly populations vary significantly in terms of their health around the typical retirement ages. This is true across countries (with tentative evidence that higher GDP per capita translates into better health), but also between sociodemographic groups within countries, with less-educated elderly individuals being systematically less healthy than their more-educated peers (something that might also be related to income differences).

Table 5 Share of variance of ill-health within countries explained by sociodemographic categories

Countries	Ill-health index	Variance in ill-health	Share explained[a]
AUT	−0.24	0.75	0.02
BEL	−0.17	0.76	0.03
CHE	−0.54	0.61	0.02
CZE	0.03	0.76	0.09
DEU	−0.02	0.69	0.06
DNK	−0.47	0.88	0.03
ESP	−0.10	0.69	0.02
EST	0.41	0.69	0.09
FRA	−0.18	0.65	0.02
GRC	−0.37	0.69	0.05
ITA	−0.13	0.69	0.02
LUX	−0.09	0.80	0.08
NLS	−0.24	0.67	0.02
POL	0.33	0.76	0.06
PRT	0.32	0.64	0.05
SVN	−0.04	0.69	0.09
SWE	−0.40	0.78	0.03

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]Using six sociodemographic groups (i.e., gender × education, where education consists of three levels: <ISCED3, ISCED3=upper secondary degree, >ISCED3).

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Second, unsurprisingly, aging causes a decline of health. This is true in every European country considered here and across every sociodemographic group we examined. But this almost trivial result also means that advancing (or postponing) the age of retirement is a way to equalize the (expected) health at the moment of retirement.

Third, equalization can be achieved both across countries and within each country, but it requires extensive retirement age differentiation. To equalize the expected health for the different sociodemographic groups forming their populations, most European countries would have to admit >10 years of difference between those with the worst versus those with the best health status.

Fourth, there are limitations as to what can be achieved via health-based retirement age differentiation and the underlying principle of ex ante equalization of health. SHARE data clearly show that such a policy would still be prone to ex post inequalities, which consist of

extensive F-mistake errors (failure of treatment, i.e., retirement rights not granted to people in poor health) and E-mistake errors (excessive treatment, i.e., retirement rights granted to people in good health). The importance to be given to these errors is a matter of ethical perspective. People who only care about ex ante equalization would probably consider that not much should be done about the residual/within-group differences and these F- and E-mistakes. The ex post residual inequalities are reflected in what econometricians call "within"-socioeconomic-group variation of the health status. Retirement age differentiation would, by construction, be based on "between"-group statistical (thus, ex ante estimated) differences. In Section 5.3, we show that allowing retirement age to differ across six groups (three Educational attainment levels × Gender) would account for (at the most) 9% of country-level health variance. If what matters socially is the equalization of each individual's health upon retirement – i.e., ex post equalization – then, the gains obtained from abandoning a uniform retirement age policy are probably limited.

Of course, policies other than differentiated retirement can be implemented. And some of our results are supportive of this option. For instance, the sheer magnitude of the achieved/ex post health status differences across individuals highlighted here legitimizes upstream public health policies, or other social policies aimed at combating health inequality, already in the early stages of life. Furthermore, the importance of the unaccounted interindividual health inequalities within our retirement groups probably calls for a less-statistical/ex ante approach and a more-individualized/ex post treatment of health differences. Would it be feasible? Probably not as part of a retirement policy, but maybe via disability insurance, or more precisely, the screening procedure that determines the eligibility of individuals to disability benefits. Contrary to statisticians telling retirement policymakers what could be done exploiting expected/ex ante health differences across sociodemographic groups, the doctors in charge of the screening are (at least potentially) assessing each individual's realized health. And this probably puts them in a position to achieve what theorists call ex post equality. In many countries, disability benefits are closely linked to old-age pension systems. And their role is to provide, on a case-by-case basis, "retirement" opportunities (i.e., replacement earning) to people who suffer from ill-health but are not yet eligible for proper retirement/pension money.[12] In addition, it is also common that workers who receive disability benefits subsequently shift to the old-age pension system once they reach the official retirement age. This raises the question of which policy is best suited to account for health inequalities. (i) Should policymakers go for socioeconomic group-based differentiated retirement ages, as we simulate in this paper? (ii) Or should they stick to what has been the historical norm; i.e., a unique/uniform retirement age, supplemented by disability benefits conditional on individualized – but time-consuming and also error-prone (Cremer et al., 2007) – assessment of health status?

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12 There is evidence (Banks et al., 2012) that with higher official retirement age, fewer early-retirement schemes, and also stricter unemployment benefits, disability benefits have, over time, come to represent an important pathway to retirement.

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Appendix

Table A1 Number of respondents by wave

Wave	AUT	BEL	CHE	CZE	DEU	DNK	ESP	EST	FRA	GRC	HRV	HUN	ISR	ITA	LUX	NLD	POL	PRT	SVN	SWE	Total
	607	1,653	409	-	1,239	704	946	-	1,179	1,097	-	-	910	1,055	-	1,261	-	-	-	1,266	12,326
	916	2,647	1,243	2,303	2,173	2,189	1,794	-	2,215	2,650	-	-	1,809	2,331	-	2,285	2,046	-	-	2,268	28,869
	4,006	4,304	3,172	4,491	1,318	1,906	2,792	5,357	4,390	-	-	2,576	-	2,754	-	2,342	1,410	1,633	2,178	1,574	46,203
	3,315	4,528	2,518	4,536	4,825	3,520	4,792	4,206	3,526	-	-	-	1,680	3,583	1,330	3,499	-	-	2,339	3,786	51,983
	2,523	4,639	2,292	3,914	3,704	3,177	3,864	4,098	3,043	3,824	2,068	-	1,340	4,072	1,296	-	1,457	1,270	3,348	3,078	53,007
	2,338	3,759	1,835	3,163	2,996	2,711	3,134	3,350	2,482	2,259	1,969	1,206	1,346	3,238	924	-	3,808	323	2,731	2,403	45,975
Total	13,705	21,530	11,469	18,407	16,255	14,207	17,322	17,011	16,835	9,830	4,037	3,782	7,085	17,033	3,550	9,387	8,721	3,226	10,596	14,375	238,363
N	238,363																				

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A2 Regression analysis of the macroeconomic determinants of the differentiated retirement ages

	Model 1	**Model 2**
Female (reference: male)	–2.89 ^***	–2.89 ^**
	(0.000)	(0.006)
ISCED3 (reference<ISCED3	6.63 ^***	6.63 ^***
	(0.000)	(0.000)
>ISCED3	10.59 ^***	10.59 ^***
	(0.000)	(0.000)
GDP per capita		0.52 ^***
		(0.000)
Annual working hours		0.00
		(0.609)
Employment rate		–0.65 ^***
		(0.000)
Human capital index		2.00
		(0.421)
Capital per head		0.06 ^**
		(0.008)
Share of government consumption		0.38
		(0.985)
Constant	64.37 ^***	53.78 ^***
	(0.000)	(0.000)
Controls	Country FE	
Observations	120	120

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004-2017, Penn World Table version 9.1.

Notes: *p*-values are in parentheses.

^*: $p < 0.05$; ^**: $p < 0.01$; ^***: $p < -1$.

ISCED, International Standard Classification of Education; GDP, gross domestic product; FE, fixed effects.

Table A3 Ill-health cross-country differences around the age of 67 years

	[b]	[b] – [a]	H0	β^b	H0
	Ill-health	**Ill-health gap**	**[b] – [a]=0**	**Marginal impact**	**β=0**
	index[a]	**(reference: internal average)**	**(*p*-value)**	**of 1 year of age**	**(*p*-value)**
Internal reference [a]	−0.064				
AUT	−0.167	−0.10	0.0000	0.0534	0.0000
BEL	−0.083	−0.02	0.3132	0.0386	0.0000
CHE	−0.476	−0.41	0.0000	0.0331	0.0000
CZE	0.092	0.16	0.0000	0.0347	0.0000
DEU	−0.007	0.06	0.0030	0.0443	0.0000
DNK	−0.366	−0.30	0.0000	0.0383	0.0000
ESP	−0.021	0.04	0.0236	0.0354	0.0000
EST	0.354	0.42	0.0000	0.0364	0.0000
FRA	−0.127	−0.06	0.0009	0.0399	0.0000
GRC	−0.210	−0.15	0.0000	0.0451	0.0000
HRV	0.140	0.20	0.0000	0.0571	0.0000
HUN	0.292	0.36	0.0000	0.0273	0.2257
ISR	−0.013	0.05	0.1316	0.0273	0.0000
ITA	−0.124	−0.06	0.0012	0.0317	0.0000
LUX	−0.047	0.02	0.6923	0.0324	0.0000
NLD	−0.263	−0.20	0.0000	0.0344	0.0000
POL	0.367	0.43	0.0000	0.0295	0.0000
PRT	0.427	0.49	0.0000	0.0586	0.0000
SVN	0.027	0.09	0.0002	0.0377	0.0000
SWE	−0.338	−0.27	0.0000	0.0358	0.0000

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

[a]A higher value indicates a poorer health.

[b]Estimated using "within"-respondent variation of ill-health across waves (i.e., fixed-effect estimation).

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A4 Ill-health within-country differences: gaps by gender (Male, Female) and educational attainment (ISCED)

	Ill-health index[a]	Index for males			Index for females			Male, H0: gap =0			Female, H0: gap =0		
		<ISCED3	ISCED3b	>ISCED3	<iISCED3	ISCED3	>ISCED3	<ISCED3	ISCED3	>ISCED3	<ISCED3	ISCED3	>ISCED3
Countries								*p*-value	*p*-value	*p*-value	*p*-value	*p*-value	*p*-value
AUT	−0.167	0.31	−0.15	−0.17	0.29	0.01	0.01	0.0048	0.0017	0.0010	0.0000	0.9031	0.4705
BEL	−0.083	0.11	−0.22	−0.25	0.25	0.04	0.04	0.0278	0.0000	0.0000	0.0000	0.4400	0.4432
CHE	−0.476	0.01	−0.05	−0.11	0.14	−0.01	−0.01	0.9210	0.3049	0.2173	0.0256	0.8148	0.8736
CZE	0.092	0.06	−0.07	−0.33	0.26	−0.09	−0.09	0.2206	0.1087	0.0000	0.0000	0.0041	0.0033
DEU	−0.007	0.09	−0.00	−0.20	0.34	0.10	0.10	0.5071	0.9026	0.0000	0.0000	0.0018	0.0023
DNK	−0.366	0.13	−0.03	−0.18	0.10	0.14	0.14	0.2148	0.6828	0.0124	0.1520	0.0782	0.2462
ESP	−0.021	−0.05	−0.19	−0.32	0.16	−0.24	−0.24	0.1479	0.0032	0.0000	0.0000	0.0003	0.1736
EST	0.354	0.17	−0.06	−0.27	0.46	0.14	0.14	0.0664	0.1797	0.0000	0.0000	0.0002	0.0000
FRA	−0.127	0.01	−0.10	−0.22	0.17	0.04	0.04	0.8229	0.0412	0.0012	0.0000	0.3356	0.0635
GRC	−0.210	−0.03	−0.27	−0.33	0.20	0.10	0.10	0.5732	0.0000	0.0000	0.0000	0.1973	0.8908
HRV	0.140	0.14	−0.27	−0.56	0.15	−0.13	−0.13	0.0912	0.0748	0.0001	0.0211	0.2761	0.4814
HUN	0.292	0.28	−0.23	−0.51	0.81	0.01	0.01	0.3134	0.0275	0.0067	0.0000	0.9435	0.0000
ISR	−0.013	0.39	−0.07	−0.24	0.24	−0.11	−0.11	0.0003	0.4313	0.0010	0.0063	0.0926	0.0203
ITA	−0.124	−0.11	−0.23	−0.26	0.20	−0.03	−0.03	0.0015	0.0000	0.0027	0.0000	0.6553	0.1768
LUX	−0.047	0.34	−0.29	−0.44	0.30	0.21	0.21	0.0088	0.0007	0.0000	0.0015	0.0391	0.0480
NLD	−0.263	0.03	−0.22	−0.28	0.18	−0.14	−0.14	0.6165	0.0115	0.0006	0.0015	0.1581	0.7615
POL	0.367	0.09	−0.11	−0.31	0.09	0.14	0.14	0.5578	0.0432	0.0405	0.2669	0.0054	0.0006
PRT	0.427	−0.15	−0.27	−0.33	0.26	−0.35	−0.35	0.0295	0.2068	0.0219	0.0001	0.0117	0.4777
SVN	0.027	0.26	−0.07	−0.33	0.17	0.06	0.06	0.0058	0.0851	0.0000	0.0010	0.1869	0.0000
SWE	−0.338	0.05	−0.04	−0.22	0.15	−0.04	−0.04	0.3398	0.5381	0.0008	0.0019	0.4079	0.2903

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]A higher value indicates a poorer health.

[b]ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A5 Marginal impact of 1 year of age on ill-health (*b*): breakdown by gender (Male, Female) and educational attainment (ISCED)

	β	β values, Male[a]			β values, Female[a]			Male, H0:β=0			Female, H0:β=0		
Countries	**Country level[a]**	**<ISCED3**	**ISCED3b**	**>ISCED3**	**<ISCED3**	**ISCED3**	**>ISCED3**	**<ISCED3**	**ISCED3**	**>ISCED3**	**<ISCED3**	**ISCED3**	**>ISCED3**
								***p*-value**	***p*-value**	***p*-value**	***p*-value**	***p*-value**	***p*-value**
AUT	0.05	0.06	0.05	0.05	0.07	0.05	0.05	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
BEL	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CHE	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CZE	0.03	0.04	0.05	0.04	0.02	0.03	0.04	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DEU	0.04	0.05	0.05	0.05	0.06	0.04	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DNK	0.04	0.04	0.04	0.04	0.05	0.03	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
ESP	0.04	0.04	0.03	0.03	0.04	0.03	0.03	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
EST	0.04	0.04	0.04	0.05	0.03	0.03	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FRA	0.04	0.05	0.04	0.04	0.04	0.03	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GRC	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
HRV	0.06	0.04	0.07	0.17	0.03	0.03	0.13	0.0168	0.0195	0.0000	0.0334	0.2397	0.0000
HUN	0.03	0.03	0.03	0.04	0.03	0.03	0.02	0.5579	0.8046	0.0098	0.0011	0.1258	0.1036
ISR	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.0000	0.0154	0.0594	0.0001	0.3185	0.0845
ITA	0.03	0.04	0.04	0.05	0.03	0.02	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LUX	0.03	0.03	0.04	0.05	0.03	0.05	0.02	0.5488	0.0033	0.0010	0.0071	0.0001	0.1954
NLD	0.03	0.04	0.04	0.03	0.04	0.04	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
POL	0.03	0.03	0.04	0.04	0.03	0.02	0.04	0.0000	0.0000	0.0001	0.0000	0.0000	0.0002
PRT	0.06	0.05	0.12	0.05	0.06	0.03	0.06	0.0000	0.0000	0.0069	0.0000	0.1230	0.0011
SVN	0.04	0.07	0.04	0.04	0.04	0.02	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SWE	0.04	0.05	0.04	0.04	0.03	0.03	0.03	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]Estimated using "within"-respondent variation of ill-health across waves (i.e., fixed effect estimation) around the country-specific retirement age.

[b]ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A6 Differentiated retirement age equalizing ill-health: between- and within-country differentiation (**reference age: 61 years)**

Countries	Differentiated retirement	Gap to internal reference (61 years)	Differentiated retirement, Females	Differentiated retirement, Males	Education			F–M gap	ISCED gap		Retirement minimum	Maximum – minimum
					>ISCED3	<ISCED3	ISCED3					
AUT	63.29	2.29	63.00	63.03	59.21	63.95	65.88	−0.03	−6.67	66.45	59.02	7.43
BEL	60.79	−0.21	58.84	63.11	56.29	61.51	65.13	−4.27	−8.84	66.52	53.73	12.79
CHE	72.02	11.02	70.35	74.05	67.99	71.29	77.33	−3.70	−9.34	78.37	65.84	12.53
CZE	56.76	−4.24	56.79	59.50	49.03	58.48	66.93	−2.72	−17.89	68.37	44.88	23.49
DEU	57.89	−3.11	56.50	57.23	51.20	56.47	62.93	−0.73	−11.72	63.88	50.80	13.07
DNK	68.41	7.41	66.06	68.87	63.56	67.27	71.57	−2.81	−8.02	72.92	62.23	10.68
ESP	61.11	0.11	62.53	66.60	58.73	67.98	66.98	−4.07	−8.25	69.79	56.44	13.35
EST	49.48	−11.52	47.94	49.01	42.50	48.55	54.38	−1.07	−11.89	55.17	42.33	12.84
FRA	62.52	1.52	62.02	64.20	59.54	62.18	67.62	−2.18	−8.08	68.46	58.11	10.34
GRC	66.62	5.62	64.67	70.45	64.25	68.42	72.52	−5.78	−5.75	72.52	61.85	10.67
HRV	58.71	−2.29	56.75	61.30	54.29	61.90	60.89	−4.54	−6.60	63.70	49.52	14.18
HUN	44.96	−16.04	54.13	50.32	40.00	46.58	70.09	3.81	−30.09	75.62	40.00	35.62
ISR	63.56	2.56	63.00	64.30	50.80	67.77	72.39	−1.29	−21.59	73.64	48.94	24.70
ITA	65.49	4.49	65.98	69.34	63.04	70.55	69.39	−3.35	−6.35	70.56	58.39	12.17
LUX	59.02	−1.98	59.24	61.10	52.68	59.94	67.88	−1.86	−15.20	67.89	50.74	17.15
NLD	63.89	2.89	61.63	68.31	60.26	65.13	69.53	−6.68	−9.27	73.06	59.41	13.66
POL	48.73	−12.27	47.13	52.68	45.20	46.59	57.94	−5.55	−12.75	60.37	42.73	17.64
PRT	53.40	−7.60	53.93	60.06	52.90	56.23	61.85	−6.13	−8.95	66.29	49.76	16.53
SVN	60.47	−0.53	62.61	62.09	55.59	61.17	70.28	0.53	−14.69	74.62	52.76	21.86
SWE	66.80	5.80	64.80	68.84	63.54	65.69	71.24	−4.04	−7.70	71.87	60.76	11.11
Internal reference	61											

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A7 Differentiated retirement age equalizing ill-health: between- and within-country differentiation (**reference age: 63 years)**

Countries	Differentiated retirement	Gap to internal reference (63 years)	Differentiated retirement, Females	Differentiated retirement, Males	Education			F–M gap	ISCED gap	Retirement maximum	Retirement minimum	Maximum – minimum
					>ISCED3	<ISCED3	ISCED3					
AUT	65.21	2.21	64.20	66.02	61.72	66.10	67.52	–1.82	–5.80	68.80	61.15	7.64
BEL	63.07	0.07	61.43	65.20	58.73	63.82	67.40	–3.77	–8.68	68.16	55.92	12.24
CHE	73.96	10.96	72.69	75.18	70.84	73.51	77.46	–2.49	–6.62	77.84	70.22	7.62
CZE	59.00	–4.00	59.79	61.36	51.44	60.94	69.34	–1.57	–17.90	70.30	48.75	21.55
DEU	60.72	–2.28	59.28	60.44	55.50	59.74	64.34	–1.16	–8.84	65.40	54.05	11.35
DNK	70.41	7.41	68.94	70.58	65.25	68.87	75.16	–1.65	–9.92	75.19	64.31	10.88
ESP	63.15	0.15	64.12	69.45	61.08	69.53	69.74	–5.33	–8.65	72.28	58.06	14.22
EST	50.76	–12.24	49.23	50.29	43.78	49.83	55.67	–1.07	–11.89	56.45	43.61	12.84
FRA	64.44	1.44	64.14	65.87	60.93	65.52	68.57	–1.73	–7.63	69.27	60.26	9.01
GRC	68.09	5.09	65.58	72.13	66.09	70.08	70.40	–6.55	–4.31	74.10	63.33	10.77
HRV	60.69	–2.31	58.42	63.41	56.64	62.96	63.13	–4.99	–6.49	65.50	52.83	12.67
HUN	48.27	–14.73	56.33	52.52	40.00	49.89	73.39	3.81	–33.39	78.92	40.00	38.92
ISR	64.30	1.30	63.75	65.04	51.54	68.51	73.13	–1.29	–21.59	74.39	49.69	24.70
ITA	66.74	3.74	67.86	71.67	64.08	72.43	72.77	–3.81	–8.69	72.96	58.66	14.30
LUX	60.64	–2.36	58.23	63.24	53.01	63.01	66.19	–5.01	–13.19	70.82	51.85	18.97
NLD	66.16	3.16	64.43	70.02	62.74	69.11	69.83	–5.59	–7.09	73.35	61.01	12.33
POL	49.77	–13.23	48.17	53.72	46.23	47.62	58.98	–5.55	–12.75	61.41	43.77	17.64
PRT	54.95	–8.05	57.44	61.82	53.54	61.81	63.54	–4.38	–1–	67.03	49.93	17.11
SVN	62.71	–0.29	63.53	65.18	58.68	62.62	71.76	–1.64	–13.08	72.75	57.73	15.02
SWE	69.07	6.07	66.73	71.89	64.76	69.36	73.81	–5.16	–9.05	74.49	61.33	13.15
Internal reference	63 years											

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A8 Differentiated retirement age equalizing ill-health: between- and within-country differentiation (**reference age: 63 years)**

Countries	Differentiated retirement	Gap to internal reference (65 years)	Differentiated retirement, Females	Differentiated retirement, Males	Education			F–M gap	ISCED gap	Retirement maximum	Retirement minimum	Maximum – minimum
					>ISCED3	<ISCED3	ISCED3					
AUT	67.01	2.01	66.40	67.11	63.93	68.21	68.13	−0.71	−4.20	68.62	63.59	5.02
BEL	65.02	0.02	62.77	68.06	60.92	67.03	68.31	−5.29	−7.39	70.29	57.33	12.96
CHE	77.45	12.45	77.81	79.15	73.95	77.33	84.16	−1.35	−10.21	85.00	71.69	13.31
CZE	61.01	−3.99	61.10	63.51	53.53	63.28	70.11	−2.41	−16.58	71.69	49.97	21.72
DEU	63.73	−1.27	62.15	64.42	59.70	62.51	67.66	−2.27	−7.95	69.03	57.44	11.60
DNK	72.68	7.68	70.86	74.27	70.15	69.86	77.69	−3.41	−7.54	78.15	67.16	10.99
ESP	64.12	−0.88	65.38	70.58	62.18	71.17	70.59	−5.19	−8.41	74.34	59.99	14.35
EST	53.30	−11.70	49.77	54.12	45.13	51.84	58.87	−4.35	−13.74	59.69	41.52	18.17
FRA	65.45	0.45	64.74	67.17	62.92	65.72	69.23	−2.43	−6.31	70.17	61.44	8.74
GRC	68.99	3.99	66.68	72.98	67.07	70.27	72.14	−6.29	−5.07	74.90	64.42	10.48
HRV	61.41	−3.59	59.14	64.13	57.37	63.68	63.86	−4.99	−6.49	66.22	53.55	12.67
HUN	50.44	−14.56	57.78	53.97	40.00	52.06	75.57	3.81	−35.57	81.10	40.00	41.10
ISR	64.61	−0.39	64.15	64.59	53.24	67.93	71.93	−0.44	−18.69	73.58	53.11	20.47
ITA	68.42	3.42	70.05	73.76	65.77	74.46	75.50	−3.71	−9.73	76.06	60.61	15.45
LUX	63.25	−1.75	63.31	65.98	55.38	66.65	71.91	−2.66	−16.52	74.78	50.83	23.95
NLD	69.14	4.14	65.98	73.38	67.57	69.12	72.35	−7.40	−4.78	79.13	65.58	13.55
POL	50.03	−14.97	48.44	53.99	46.50	47.89	59.25	−5.55	−12.75	61.67	44.03	17.64
PRT	56.90	−8.10	58.34	62.22	55.35	60.58	64.89	−3.88	−9.54	67.78	52.69	15.09
SVN	64.31	−0.69	65.52	66.22	60.69	63.94	72.99	−0.70	−12.30	74.53	60.07	14.46
SWE	71.98	6.98	68.23	76.25	68.89	71.44	76.40	−8.02	−7.52	80.18	65.73	14.45
Internal reference	65 years											

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A9 Mental health: individuals aged 50–59 years (country averages)

Countries	Depression[a]	Pessimism[a]	Suicidality[a]	Guilt[a]	Sleep[a]	Interest[a]	Irritability[a]	Appetite[a]	Fatigue[a]	Concentration[a]	Enjoyment[a]	Tearfulness[a]	Mental ill-health index[b]
					(lack of)	(lack of)		(lack of)		(lack of)	(lack of)		
AUT	0.34	0.08	0.04	0.06	0.30	0.04	0.21	0.06	0.24	0.11	0.15	0.21	−0.26
BEL	0.39	0.12	0.09	0.09	0.35	0.07	0.28	0.09	0.34	0.19	0.08	0.31	−0.01
CHE	0.39	0.07	0.04	0.05	0.29	0.04	0.27	0.05	0.27	0.11	0.05	0.21	−0.26
CZE	0.38	0.16	0.08	0.07	0.35	0.06	0.24	0.07	0.31	0.12	0.05	0.20	−0.15
DEU	0.43	0.06	0.05	0.05	0.36	0.05	0.28	0.05	0.29	0.13	0.10	0.22	−0.16
DNK	0.30	0.04	0.03	0.10	0.30	0.05	0.22	0.05	0.31	0.10	0.06	0.16	−0.31
ESP	0.34	0.21	0.07	0.05	0.30	0.13	0.23	0.08	0.36	0.19	0.11	0.26	−0.04
EST	0.48	0.25	0.06	0.15	0.46	0.09	0.39	0.07	0.50	0.11	0.12	0.22	0.17
FRA	0.46	0.19	0.12	0.11	0.38	0.07	0.35	0.08	0.36	0.20	0.10	0.25	0.11
GRC	0.29	0.18	0.04	0.06	0.21	0.13	0.22	0.08	0.26	0.18	0.14	0.24	−0.17
HRV	0.41	0.18	0.07	0.06	0.34	0.09	0.34	0.08	0.39	0.16	0.09	0.25	–
HUN	0.40	0.23	0.12	0.13	0.38	0.11	0.36	0.11	0.47	0.19	0.15	0.30	0.23
ISR	0.31	0.15	0.05	0.09	0.32	0.11	0.29	0.09	0.28	0.18	0.11	0.25	−0.08
ITA	0.37	0.16	0.04	0.09	0.29	0.12	0.42	0.08	0.33	0.24	0.19	0.23	0.05
LUX	0.44	0.10	0.07	0.11	0.35	0.06	0.33	0.08	0.32	0.16	0.11	0.24	−0.03
NLD	0.30	0.06	0.04	0.08	0.26	0.06	0.15	0.05	0.27	0.18	0.09	0.28	−0.26
POL	0.53	0.35	0.10	0.11	0.44	0.11	0.41	0.10	0.41	0.19	0.25	0.23	0.32
PRT	0.52	0.45	0.10	0.07	0.43	0.11	0.34	0.12	0.31	0.27	0.22	0.36	0.35
SVN	0.37	0.26	0.05	0.08	0.36	0.06	0.29	0.06	0.28	0.11	0.08	0.17	−0.13
SWE	0.31	0.05	0.03	0.07	0.30	0.06	0.20	0.06	0.32	0.12	0.11	0.22	−0.25

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

[a]No (0), and yes (1).

[b]First principal component of all items (the higher the value, the worse is people' s health). Principal component analysis was carried with all countries pooled. The displayed values correspond to the predicted score values divided by the standard deviation.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A10 Differentiated retirement age equalizing ill-health: between- and within-country differentiation (**objective physical health)**

Countries	Differentiated retirement	Gap to internal reference (67 years)	Differentiated retirement, Females	Differentiated retirement, Males	Education			F–M gap	ISCED gap	Retirement maximum	Retirement minimum	Maximum – minimum
					>ISCED3	<ISCED3	ISCED3					
AUT	68.30	1.30	66.54	70.09	66.29	69.48	69.17	−3.54	−2.88	71.37	64.46	6.91
BEL	66.02	−0.98	61.41	71.54	62.72	68.58	68.13	−10.13	−5.41	74.36	56.72	17.64
CHE	78.95	11.95	74.99	81.09	78.00	79.60	76.52	−6.10	1.48	82.20	73.49	8.71
CZE	63.43	−3.57	61.80	68.24	59.90	65.41	69.76	−6.44	−9.86	73.91	55.61	18.30
DEU	68.29	1.29	65.49	70.40	64.16	66.44	73.23	−4.91	−9.07	75.23	61.05	14.18
DNK	71.83	4.83	68.05	74.86	67.27	69.86	77.22	−6.81	−9.95	79.58	62.33	17.26
ESP	64.41	−2.59	62.86	70.99	62.67	70.51	67.60	−8.13	−4.93	74.20	59.01	15.20
EST	60.38	−6.62	51.21	67.68	51.04	56.26	71.03	−16.47	−19.99	73.31	40.00	33.31
FRA	68.49	1.49	66.57	72.09	65.55	69.39	73.05	−5.52	−7.49	74.71	63.30	11.41
GRC	66.06	−0.94	63.22	69.72	64.82	66.57	68.01	−6.50	−3.19	71.19	61.35	9.84
HRV	64.61	−2.39	63.70	67.07	62.22	66.04	67.89	−3.37	−5.66	69.03	60.11	8.92
HUN	57.01	−9.99	52.08	62.07	40.00	60.09	71.13	−9.99	−31.13	73.87	40.00	33.87
ISR	56.69	−10.31	55.47	58.86	50.93	60.17	60.39	−3.39	−9.46	61.77	46.86	14.90
ITA	68.32	1.32	69.05	73.82	66.20	73.77	74.35	−4.77	−8.15	75.52	60.38	15.14
LUX	65.00	−2.00	64.64	69.71	56.29	67.02	78.22	−5.07	−21.93	82.76	51.95	30.81
NLD	76.79	9.79	73.41	83.20	74.70	76.89	83.32	−9.80	−8.62	85.00	68.79	16.21
POL	59.78	−7.22	56.52	63.22	57.55	58.24	63.81	−6.71	−6.26	66.66	51.92	14.74
PRT	58.53	−8.47	60.95	62.67	57.72	67.29	60.43	−1.72	−2.71	70.92	52.70	18.22
SVN	65.06	−1.94	62.95	68.50	60.47	65.27	71.44	−5.55	−10.97	72.64	58.03	14.60
SWE	74.98	7.98	73.10	79.62	71.97	76.03	81.08	−6.52	−9.10	84.94	68.04	16.89
Internal reference	67 years											

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A11 Differentiated retirement age equalizing ill-health: between- and within-country differentiation (**subjective physical health)**

Countries	Differentiated retirement	Gap to internal reference (67 years)	Differentiated retirement, Females	Differentiated retirement, Males	Education			F–M gap	ISCED gap	Retirement maximum	Retirement minimum	Maximum – minimum
					>ISCED3	<ISCED3	ISCED3					
AUT	69.28	2.28	69.41	68.63	65.29	70.80	70.96	0.79	−5.67	71.22	64.32	6.90
BEL	68.58	1.58	68.17	70.34	65.11	70.13	72.53	−2.17	−7.42	74.22	64.90	9.32
CHE	80.95	13.95	80.77	81.47	76.37	81.99	85.00	−0.70	−8.63	85.00	74.38	10.62
CZE	62.02	−4.98	63.82	62.10	54.29	64.84	69.76	1.73	−15.47	70.56	53.81	16.76
DEU	64.75	−2.25	64.66	63.72	60.26	63.88	68.42	0.94	−8.16	69.59	59.77	9.82
DNK	76.37	9.37	76.93	76.60	74.12	75.22	80.95	0.33	−6.82	81.08	73.67	7.40
ESP	66.74	−0.26	71.34	71.77	65.47	76.23	72.98	−0.43	−7.51	78.75	63.75	15.00
EST	55.32	−11.68	54.33	54.80	48.56	54.21	60.92	−0.47	−12.36	62.02	47.79	14.23
FRA	68.88	1.88	69.70	69.92	66.88	69.84	72.72	−0.21	−5.84	73.03	65.84	7.19
GRC	74.96	7.96	76.11	80.09	73.38	80.84	80.09	−3.98	−6.71	83.10	69.52	13.58
HRV	62.89	−4.11	63.63	62.33	57.49	66.37	65.08	1.30	−7.59	66.63	54.77	11.86
HUN	55.15	−11.85	58.63	56.91	40.00	57.86	75.46	1.72	−35.46	81.12	40.00	41.12
ISR	64.83	−2.17	66.88	64.13	55.79	66.98	73.75	2.76	−17.96	75.51	54.52	20.98
ITA	67.53	0.53	71.76	70.90	65.68	73.74	74.58	0.86	−8.90	76.99	63.41	13.57
LUX	66.59	−0.41	66.45	66.87	60.37	67.18	72.42	−0.43	−12.05	73.17	58.34	14.83
NLD	70.82	3.82	70.95	73.71	68.39	72.51	76.10	−2.76	−7.71	79.48	68.22	11.26
POL	48.53	−18.47	49.12	50.31	42.51	47.37	59.27	−1.19	−16.76	60.68	42.01	18.67
PRT	59.81	−7.19	62.12	61.27	59.29	64.19	61.61	0.85	−2.31	68.83	57.86	10.97
SVN	65.34	−1.66	68.93	66.16	62.45	65.29	74.88	2.77	−12.43	77.48	61.45	16.03
SWE	74.57	7.57	75.46	75.36	72.22	75.74	78.26	0.09	−6.04	78.95	71.70	7.25
Internal reference	67											

Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a] ISCED3=upper secondary degree.

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Table A12 Differentiated retirement age equalizing ill-health: between- and within-country differentiation (**physical** + **mental health)**

Countries	Differentiated retirement	Gap to internal reference (67 years)	Differentiated retirement, Females	Differentiated retirement, Males	Education			F–M gap	ISCED gap	Retirement maximum	Retirement minimum	Maximum – minimum
					>ISCED3	<ISCED3	ISCED3					
AUT	69.62	2.62	68.27	71.13	65.95	71.39	71.75	−2.86	−5.80	73.74	65.72	8.02
BEL	66.65	−0.35	62.58	72.59	62.24	69.54	70.98	−10	−8.74	75.82	58.28	17.54
CHE	83.22	16.22	77.77	84.56	77.36	83.44	82.69	−6.79	−5.34	85.00	71.03	13.97
CZE	63.60	−3.40	60.87	68.01	58.01	65.54	69.76	−7.14	−11.75	72.52	51.53	20.99
DEU	66.84	−0.16	64.93	68.66	63.15	64.80	72.44	−3.73	−9.29	72.72	60.98	11.74
DNK	77.73	10.73	76.82	80.68	72.83	78.42	85.00	−3.86	−12.17	85.00	69.14	15.86
ESP	63.97	−3.03	67.23	73.15	61.80	71.93	76.83	−5.91	−15.03	79.63	57.52	22.11
EST	48.27	−18.73	46.05	51.35	43.26	46.77	56.07	−5.30	−12.81	57.04	40.00	17.04
FRA	66.34	−0.66	63.64	70.57	62.87	66.66	71.79	−6.93	−8.92	75.45	60.16	15.28
GRC	69.53	2.53	66.46	75.34	67.20	71.27	74.23	−8.88	−7.03	78.83	63.19	15.63
ISR	60.96	−6.04	55.23	67.45	48.26	64.52	71.24	−12.22	−22.98	76.39	40.00	36.39
ITA	65.48	−1.52	64.32	71.16	62.78	69.98	70.46	−6.84	−7.68	72.33	56.70	15.63
LUX	64.97	−2.03	59.58	71.16	48.55	70.47	77.08	−11.58	−28.52	80.11	40.98	39.13
NLD	74.80	7.80	72.34	81.32	71.40	82.53	76.56	−8.98	−5.16	85.00	67.69	17.31
POL	40.84	−26.16	46.82	49.13	40.89	44.23	58.81	−2.31	−17.92	60.47	40.00	20.47
PRT	59.20	−7.80	60.12	66.28	59.21	64.25	66.14	−6.16	−6.93	69.88	54.69	15.19
SVN	64.49	−2.51	64.33	69.59	59.99	64.02	76.88	−5.26	−16.89	77.59	57.99	19.59
SWE	76.26	9.26	72.97	81.21	73.65	77.05	80.57	−8.24	−6.92	84.01	70.60	13.40
Internal reference	67											

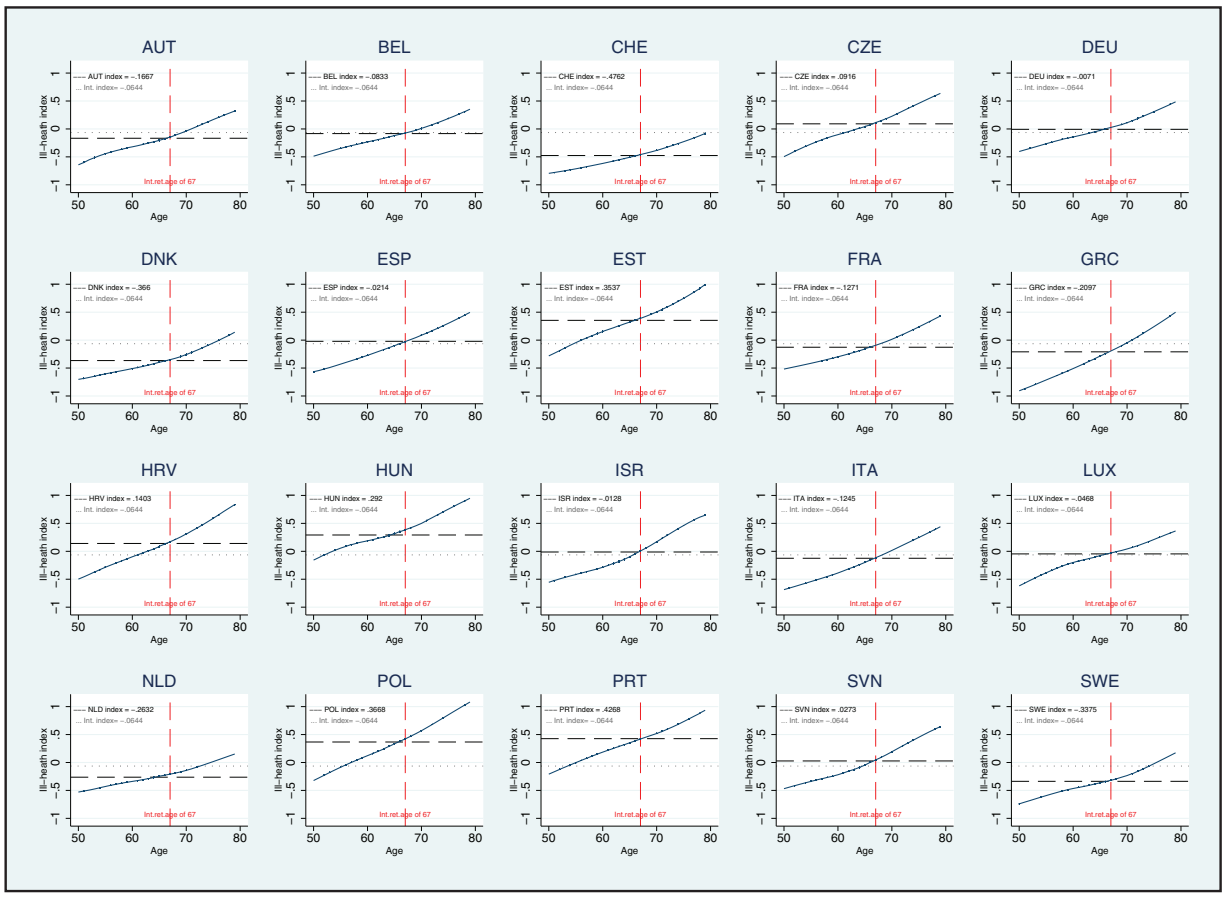
Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

ISCED, International Standard Classification of Education.

[a]ISCED3=upper secondary degree.\

AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

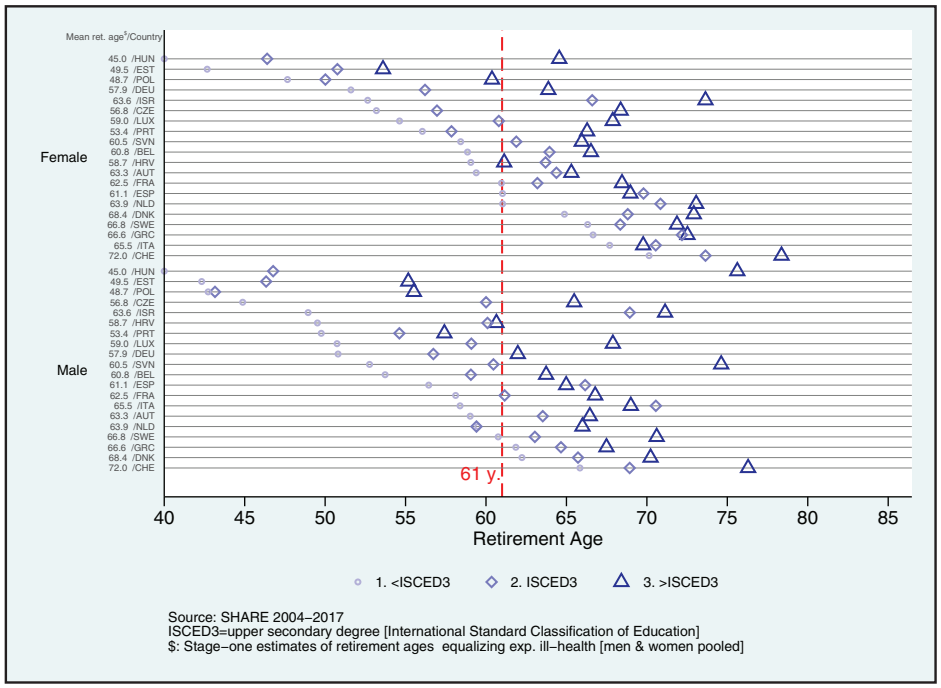
Figure A1 Ill-health index systematically rises with age, but intercept and slope vary across countries.



Source: Survey of Health, Ageing and Retirement in Europe (SHARE) 2004–2017.

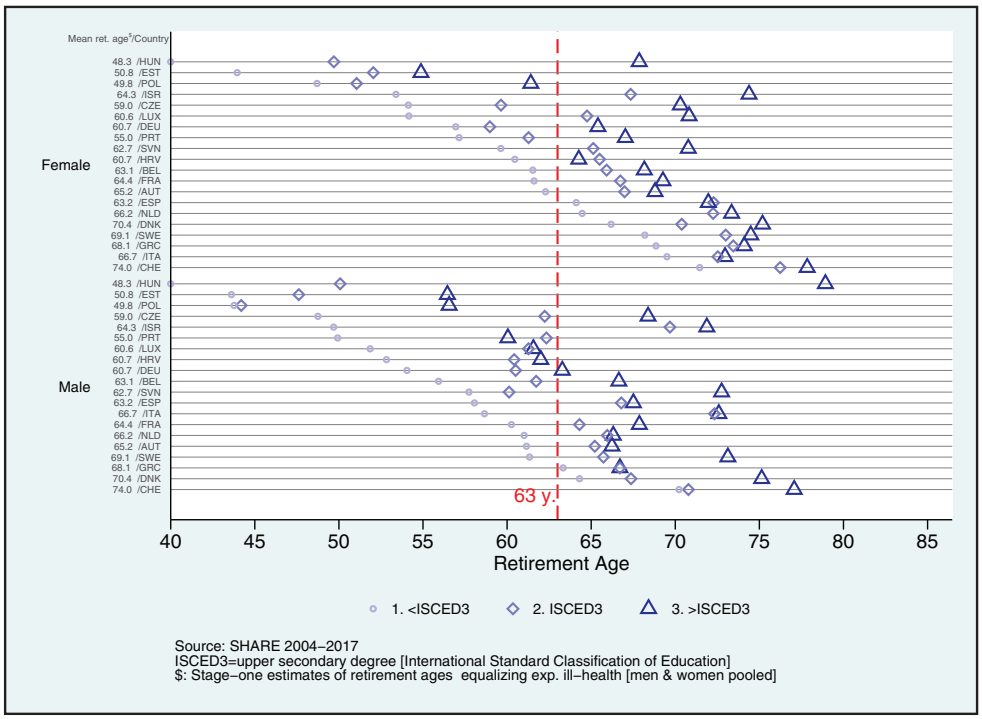
Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure A2 Differentiated retirement ages equalizing (expected) ill-health, across and within countries (**reference age: 61 years**).



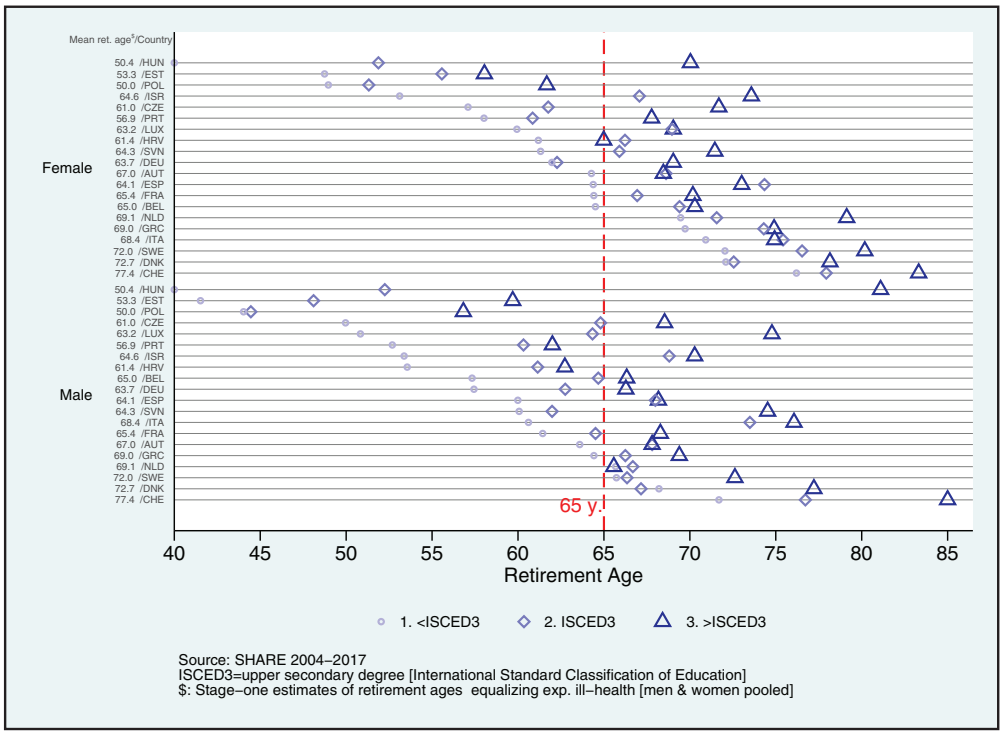
Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure A3 Differentiated retirement ages equalizing (expected) ill-health, across and within countries (**reference age: 63 years).**



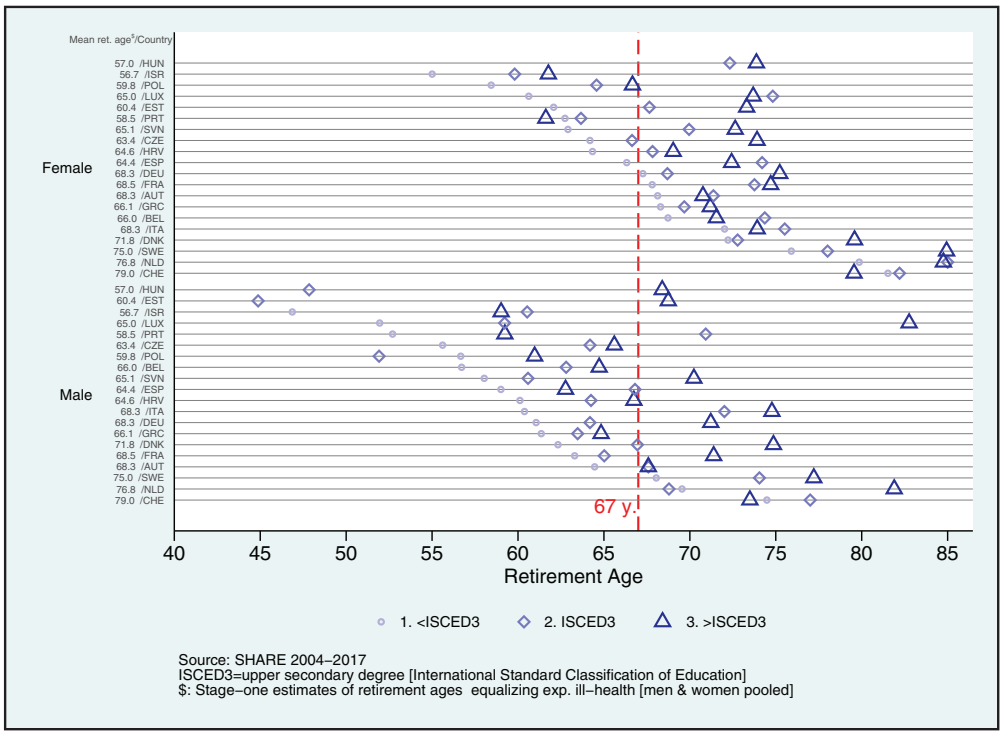
Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure A4 Differentiated retirement ages equalizing (expected) ill-health, across and within countries (**reference age: 65 years**).



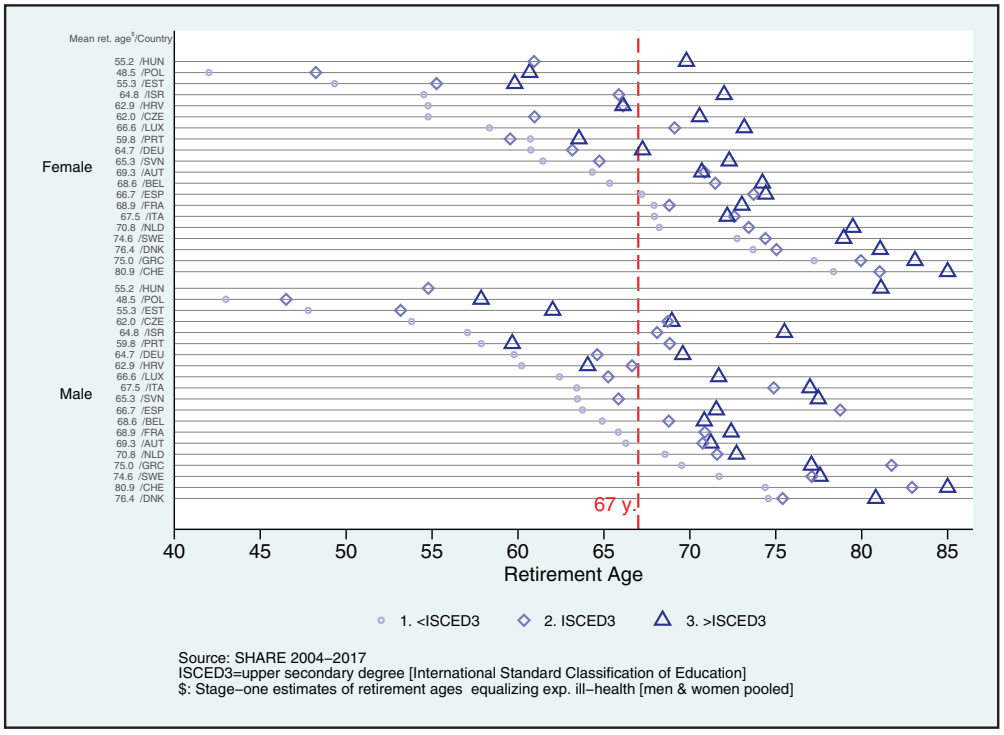
Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure A5 Differentiated retirement age equalizing (expected) ill-health, across and within countries (**objective physical health**).



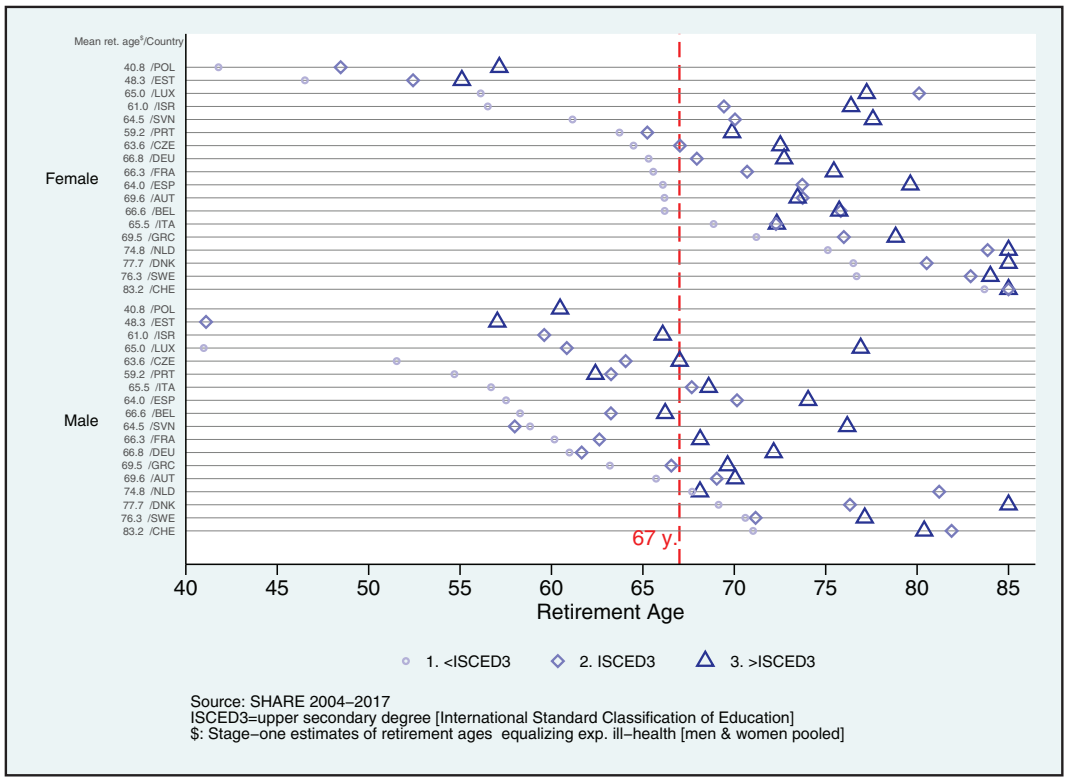
Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure A6 Differentiated retirement age equalizing (expected) ill-health, across and within countries (**subjective physical health**).



Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.

Figure A7 Differentiated retirement age equalizing (expected) ill-health, across and within countries (**physical** + **mental health)**.



Notes: AUT, Austria; BEL, Belgium; CHE, Switzerland; CZE, Czech Republic; DEU, Germany; DNK, Denmark; ESP, Spain; EST, Estonia; FRA, France; GRC, Greece; HRV, Croatia; HUNG, Hungary; ISR, Israel; ITA, Italy; LUX, Luxemburg; NLD, the Netherlands; POL, Poland; PRT, Portugal; SVN, Slovenia; SWE, Sweden.