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Abstract

We use harmonized household panel data from 10 European countries (SHARE) plus US (HRS) and England (ELSA) to provide novel and comparable measurements of education and gender differences in life expectancy and disability-free life expectancy, as well as in the underlying multi-state life tables. Common across countries we find significant interactions between socio-economic status and gender: (a) the education advantage in life expectancy is larger for males, (b) the female advantage in life expectancy is larger among the low educated, (c) education reduces disability years and this added advantage is larger for females, and (d) females suffer more disability years but this disadvantage is hardly present for the high educated. Common across countries we also find that the education advantage in disability years is due to better health transitions by the highly-educated, and that the female disadvantage in disability years is due to better survival in ill-health by females. Looking at the differences across countries, we find that inequalities are largest in Eastern Europe, lowest in Scandinavia, and that the education gradient in life expectancy for males correlates positively with income inequality and negatively with public health spending across countries.

JEL Codes: I14, I24, J14, J16.

Keywords: Life expectancy, healthy life expectancy, education gradient, gender gap.

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1 Introduction

The study of economic inequality has attracted a great deal of attention in the last decades. New data and methods have been developed and thanks to them we have today a fairly good picture of the differences in income and wealth inequality across countries, see for instance the recent survey report by Alvaredo et al. (2018). However, less is known about the range of inequality in health outcomes and mortality across countries. This is unfortunate as health inequality might be more important in terms of welfare, it is likely to become more relevant in the coming years with the aging of population, and it certainly has first order implications for public policy. Furthermore, efforts to understand the origins of health inequality can benefit from both the differences and the similarities to be found across countries.

This paper aims to fill this gap by comparing the inequality in life expectancy and healthy life expectancy between education and gender groups across 10 European countries, the US and England. To do so, we put together harmonized and comparable household panel data from the Survey of Health, Ageing and Retirement (SHARE) for Continental Europe, the Health and Retirement Study (HRS) for the US, and the English Longitudinal Study of Ageing (ELSA) for England to compute multi-state life tables by gender and education starting at age 50 and comprising the period from 2002 to 2015. This delivers the associated gender and education differences in age-50 life expectancy and healthy life expectancy across countries, as well as other statistics of interest. We focus on education as a measure of socio-economic status because it is a good approximation to lifetime income and because of its small measurement error. We focus on gender because it is an important dimension of inequality across individuals that has been somewhat overlooked by the literature on health inequalities. In addition, because neither education nor gender change over the life cycle, these choices simplify the methods used to obtain the multi-state life tables and minimize issues related to reverse causality. We focus on age 50 because most health differences emerge after that age. Our measure of health is the absence of conditions limiting the activities of daily living (ADL), and hence we use the terms healthy life expectancy and disability-free life expectancy interchangeably. This definition of health is of high economic relevance because it is related both to the ability to work and to the need of long-term care.

We uncover three important common patterns across countries. First, we find that there is an important interaction between socio-economic status and gender in terms of life expectancies. In particular, the education gradient in life expectancy (the difference in life expectancy between college and non-college individuals) tends to be larger for males

than for females, while the gender gap in life expectancy (the difference in life expectancy between females and males) tends to be larger among the low educated than among the high educated. More precisely: in our sample of 12 countries the average education gradient is 3.4 years for males and 2.3 year for females, while the average gender gap is 3.9 years among the low-educated and 2.7 years among the high-educated.

Second, in almost all countries the education gradients are substantially larger in disability-free life expectancy than in life expectancy, and this is especially so among females. Given the identity linking life expectancy, disability-free life expectancy and disability-years, this implies that more educated individuals spend less time in disability, despite living longer. In particular, high-educated males spend on average 0.6 fewer years in disability than low-educated ones, while this difference is 1.7 years for females. This result connects with the literature on the compression of morbidity, which conjectures that as life expectancy increases over time there is a parallel decline in morbidity, see Fries (1980). Our cross-sectional variation implies that an extra year of life for males (females) is associated with almost 2 (almost 6) fewer months in disability. We also find that this compression of morbidity arises because education is health-protecting after age 50, not because of differences in mortality conditional on health across education groups. Indeed, if the only difference between education groups was in the mortality rates conditional on health, the more educated would suffer more years in disability due to their higher survival. Finally, a consequence of the education gradient in disability years being larger for females than for males is that the larger socio-economic inequality among males than among females in terms of life expectancy gets reduced or reverted when looking at disability-free life expectancy.

And third, we see that in every country the gender gap in healthy life expectancy is smaller than in life expectancy, or in other words, women spend more years in disability. This pattern had been observed before and was described as "women get sicker but men die quicker" and it represents a "failure of compression" of sorts. Our novel result is that this puzzle applies primarily to the low educated individuals. In particular, low educated females (high educated) spend on average 1.4 (0.3) more years in disability than low-educated (high educated) males. This implies that, among the low-educated (high-educated) every extra year of life expectancy enjoyed by females relative to males is associated with 4 (1.5) extra months in disability. Our decomposition results show that this pattern happens because women experience higher survival rates than men once in disability combined with health transitions that are no better than those of males, or only slightly better.

In addition to the common characteristics across countries discussed above, we also find

that our cross-country data displays a large amount of heterogeneity. We can summarize our findings as follows. First, the education gradients in life expectancy in several Eastern and Western European countries are similar to or larger than the ones in the US. For instance, the education gradient in life expectancy for males is 3.6 years in the US, 5.4 years in Poland, 4.6 in Estonia, 3.9 in France and 3.8 in Austria, while the gradient in life expectancy for females is 3.2 years in the US, 5.9 in Czechia, and 3.0 in Slovenia. In contrast, the gradients tend to be smaller than in the US (but still important) in the Mediterranean and Scandinavian countries. Looking at how these gradients relate with other country variables, we find that the education gradients for males are positively related to income inequality and negatively related to the share of GDP spent in health by the government. However, the correlations for females are less clear. These results relate to the literature on the determinants of the educational gradient of health outcomes, and to the question whether the gradient is the result of the income channel (the fact that more educated individuals are richer). Our cross-country evidence is at odds with the income channel when taking together results for males and females. Regarding the gender gaps in life expectancy, we find that they are largest in Eastern Europe (around 5.5 years for both low educated and high educated individuals) and lowest in Scandinavia (less than 2 years for both low educated and high educated individuals), especially in Denmark. The rest of countries and regions display intermediate values of the gender gradient among low educated, and England, Western Europe and the Mediterranean display gender gaps for the high educated as low as or lower than the ones in the Scandinavian countries. The female disadvantage in disability years ("women get sicker but men die quicker") is largest in the Mediterranean and smallest in Scandinavia. All in all, inequalities are largest in Eastern Europe and smallest in Scandinavia.

Second, the interaction between gender and socio-economic status also varies across countries. For instance, the difference in the educational gradient of life expectancy between males and females is largest in the Mediterranean (2.3 years) and Western Europe (2.2 years) and virtually nonexistent in Scandinavia, with Eastern Europe containing a lot of heterogeneity. The difference in the gender gap of life expectancy between low and high educated individuals is largest in Poland and in Spain (where the female advantage is 4 and 3.5 years larger among the low-educated) and virtually non-existence in Scandinavia, the US, Italy, Slovenia and Czechia.

And third, the US stands out relative to Europe in two ways. The first one is the larger contribution of the education differences in health transitions (as opposed to education differences in mortality) in accounting for the gradients in life expectancy, health-life expectancy, and disability-years. The second one is that the US has the largest educational

difference in disability years for males, and one of the largest for females. That is to say, the detrimental effect of low education for the life expectancy is actually amplified more in the US than anywhere else when we consider its "disability-free" and "in-disability" components.

Methodologically, we face the challenge that the SHARE data is not straightforward to use for survival analysis because, for several reasons, it is quite an irregular panel. In this sense, our contribution is to write a three-state continuous time duration model tailored to match micro data obtained in discrete time at irregular intervals. We estimate the model with Bayesian techniques and produce the multi-state life tables that are the basis for the life expectancy calculations and decompositions. We validate the use of SHARE data for survival analysis by comparing our estimated life tables by gender to the ones from population data. We show that the SHARE tables match the population tables reasonably well in many countries and we select for our analysis the 10 best-fitting countries (out of 16). The value of this methodology goes beyond this paper as it can be easily applied to other surveys of similar design and it represents an alternative to the so-called Sullivan method. The Sullivan method is less demanding in terms of data because it only requires population survival rates and cross-sectional data on the health distribution.[1] However, it has a few drawbacks. First, because it does not provide transitions, its scope is more limited. For instance, it cannot be used to analyze the persistence of health states or to decompose the observed gradients into differences in mortality versus differences in transitions. Second, in order to compute education gradients in life expectancies and healthy life expectancies the Sullivan method requires population life-tables by education, and these are not available for all countries. And third, it is based on somewhat more restrictive assumptions, namely that mortality rates be independent from the health state and that the expected number of good-to-bad health transitions equals the expected number of bad-to-good health transitions. Our panel data show these assumptions to be strongly violated.[2]

[1] The Sullivan method was developed in the 60's, see Sanders (1964), Sullivan (1966), and Sullivan (1971). See discussion in Laditka and Hayward (2003).

[2] In practice, however, the biases caused by these erroneous assumptions on the calculation of healthy life expectancies and their gradients are relatively small, which is why the Sullivan method is so widely used. Furthermore, note that the standard interpretation of life expectancies is based on the assumption that the environment is stationary so that age-specific health transitions and survival rates are constant across birth cohorts. In this situation, Sullivan and multi-state life table methods coincide up to a second order term.

1.1 Related literature

The size of the education gradients of life expectancy and healthy life expectancy —and the shape of the underlying multi-state life tables— are consequential for many economic questions. First, because gradients are big, forecasts of future gains in life expectancy and healthy life expectancy need to keep track of the changes in education attainment of the underlying population. For instance, according to Case and Deaton (2017), the growth in college attainment explains approximately 48 percent of the reduction in age-adjusted mortality in the US between 1910 and 2000. Second, the redistributive power of retirement pensions may be partly eroded by the longer life expectancies of richer individuals, see for instance Brown (2002) or Fuster et al. (2003). Third, the increase in the dependency ratio has led many countries to delay retirement age in order to balance their pay-as-you-go retirement systems. Many papers show that health is an important determinant of labor supply at old age, see Blundell et al. (2016) for a recent survey. In this context, the gradient in healthy life expectancy is important for both the effectiveness and the welfare impact of such policies, see for instance Wen (2017). And fourth, the unhealthy life expectancy (the difference between life expectancy and healthy life expectancy) is critical to predict expenses in long-term care needs and medical assistance. Hence, its gradient matters to understand the redistributive power of public policies that finance these programs, see for instance De Nardi et al. (2016) or Bueren (2017).

There are relatively good measures of the education gradient in life expectancy in the US using both data from death registers —see for instance Meara et al. (2008)— and data from household surveys —see Pijoan-Mas and Ríos-Rull (2014). However, this is not so in Europe. First, death registers are less useful in Europe because they do not record data on education. Some recent papers, however, have linked the death registers with census data to obtain education and sex-specific death rates of individuals up to 79 years of age. A limitation is that country samples are not always nationally representative and the resulting data are not homogenized across countries, which makes cross-country comparisons problematic.[3] And second, regarding survey data only the European Community Household Panel (ECHP) –which covers the period between 1994 and 2000– has been used, see Majer et al. (2010). A limitation of the ECHP is that the survey design is far from ideal for survival analysis because of the small number of old individuals and because of the lack of exit interviews to distinguish attrition from death events. In addition, the range of countries available in the ECHP is also limited as it does not include

[3]This register-based mortality data set is managed by the Demetriq project (`http://www.demetriq.eu`). See for instance Avendano et al. (2011), Mackenbach et al. (2008) for results on socioeconomic inequalities in mortality across European countries.

countries of the former communist bloc. Our paper is the first one to use SHARE data for this purpose, for which in principle it is very well suited. Furthermore, due to the similar sample design and questionnaires of SHARE, ELSA, and HRS, we can provide clean comparisons of Continental European countries with England and the US.[4] Regarding healthy life expectancy, there is even less available information. For Europe there are only two studies: Maki et al. (2013) applying the Sullivan method to census-linked mortality data and Majer et al. (2010) estimating multistate life tables with the ECHP survey data.

Finally, a recent literature has provided important findings about the widening gap of the education gradients of life expectancy in the US, see for instance Meara et al. (2008) or Montez et al. (2011), and about the increase in mortality rates of low-educated white males, see Case and Deaton (2017). The increase in the educational gradient of mortality has been also documented in several European countries, see for instance Mackenbach et al. (2015b) or de Gelder et al. (2017). Our work does not have much to say about this phenomenon as the time span of our underlying data is relatively short. However, our methods can be used to look at time changes when these surveys become larger (and can be already applied to the long HRS panel in the US).

The remainder of the paper is organized as follows. In Section 2 we explain the methodological problems in using SHARE for survival analysis. In Section 3 we explain the duration model we use to estimate multi-state life tables and how we build our measures of life expectancy from them. In Section 4 we describe the data choices we make and in Section 5 we present the main results. Finally, Section 6 looks at the results with more detail by presenting some cross-country regressions, and Section 7 concludes. The online Appendix provides a detailed comparison of country life tables by gender obtained with our SHARE data and the ones coming from population data.

2 Survival analysis with SHARE data

The Survey of Health, Ageing and Retirement in Europe (SHARE) is an important source of data that has been so far underutilized for survival analysis. SHARE is particularly useful for three reasons. First, it is based on nationally representative country samples of the non-institutionalized civilian population aged 50 and older, and individuals are kept in the survey if they move into a nursing home. This allows to compare gradients across countries using a harmonized dataset. Furthermore, the survey design and questionnaires

[4]Delavande and Rohwedder (2011) also use data from HRS, ELSA, and SHARE to compare socio-economic gradients of mortality. However, their approach is very different as they use a single cross-section for each country and exploit data on subjective survival probabilities.

are based on the ones used by the Health and Retirement Study (HRS) in the US, which in turn is the model for the English Longitudinal Study of Ageing (ELSA) in England, and similar surveys in many other countries.[5] This increases the scope of comparability of results. Second, it explicitly attempts to obtain end-of-life interviews so it is arguably less likely to under-report deaths than other survey data. And third, its longitudinal dimension allows us to use a multistate model to improve on the Sullivan method to compute healthy life expectancies.

At the same time, there is a number of potential problems with the use of SHARE data for survival analysis. First, there is the possibility of biases in sample design, response rates at baseline, or sample retention inherent in survey data. The sample retention problem is important for survival analysis if attrition is larger for deceased individuals. However, in the online Appendix we argue that this potential problem should not prevent the use of SHARE for survival analysis, at least for many of its country samples. In particular, we show that for several countries the survival functions compare well to the corresponding population life tables. In addition, we show that the probability of attrition is unrelated to variables that predict survival.

Second, in practical terms, the SHARE panel is not straightforward to use for longitudinal analysis because it is not a perfectly regular panel. First, the time between surveys differs substantially across waves and across countries; second, wave 3 only contains retrospective data, so no information on health states or any time-changing socio-economic information is available; third, a few countries could not guarantee funding for all years and do not provide data for all waves; and fourth, a fraction of individuals in each country were lost for one or two waves and recovered afterwards. To bypass these problems we use a multi-state continuous time survival model with health as a dynamic latent variable. The model allows for flexible interactions of duration and regressors in a tractable way and is estimated with data on the particular observation windows for each individual. Then, we use the estimated model to compute multi-state life tables at annual frequency for each country-gender-education sample, which in turn are used to obtain life expectancies and healthy life expectancies.

And the third problem with SHARE is the small sample sizes for every country. This problem becomes more severe as one breaks down the data by gender, age, education, and health, and is hence of first order importance for the study of socio-economic gradients of

[5]The other countries using the HRS design and questionnaires to collect data on ageing are Brazil, Canada, China, Costa Rica, India, Indonesia, Ireland, Japan, Mexico, New Zealand, North Ireland, Scotland, South Korea, and South Africa. See `https://g2aging.org/` for details. As of now, surveys for these countries still have few waves, if any at all.

health outcomes. To deal with this problem we do three things. First, we pool together individuals of different cohorts to estimate our duration model. In practice, this means that we ignore possible time changes in survival rates and health transitions, but given the relatively short time span of the data we expect this not to be major problem. Second, we use Bayesian techniques to estimate our statistical model of survival and impose a set of "regularity" priors that constrain the model parameters to preserve the age decline of health and survival. This set of priors changes neither point estimates nor their precision for most countries but helps narrowing the posterior distribution of the parameters on those country samples with fewer data. And third, we provide complementary estimates pooling together individuals of similar countries, which allows to reduce the standard errors of our life expectancies without changing the main results.

Perhaps because of these problems, previous work with SHARE for survival analysis is scarce: the only papers we are aware of are Boháček et al. (2015), Nakajima and Telyukova (2015), and Solé-Auró et al. (2015). Boháček et al. (2015), which reports on the first stages of this project, computes non-parametric survival functions for high and low educated individuals for several countries by use of the Kaplan-Meier estimator, which naturally deals with the irregularity of the panel. Nakajima and Telyukova (2015) estimate multi-state health and survival age-dependent markovian matrices between waves 1 and 2 for Sweden only, so they do not need to deal with the irregularity of the panel. Solé-Auró et al. (2015) estimates survival models for several deseases in order to compare prevalence, incidence, and mortality in Europe and the US. These authors deal with the irregularity of the panel and the small country samples by pooling the data of 5 SHARE countries together and by estimating proportional hazard models of mortality and of the onset of disease between waves 1 and 2.

3 Methodology

As discussed in Section 2, the time span between the two consecutive observations that form an individual transition differs across countries, waves, and individuals. This makes unfeasible to simply estimate wave to wave transitions and survival rates as it is typically done with HRS data. For this reason, in Section 3.1 we set up a duration model with three states which is tailored to match microdata obtained in discrete time at irregular intervals; in Section 3.2 we discuss the estimation methods, and in Section 3.3 we discuss how we build the life expectancy measures from the estimated parameters.

3.1 Statistical model

We define 3 states: 0 (dead), 1 (alive-unhealthy), 2 (alive-healthy). A typical measurement at wave w is (a_w, h_w, x_w) where a_w is age, h_w is health state, and x_w are socio-economic variables. Every individual in our sample is observed in at least two (not necessarily consecutive) waves, so our empirical model is based on the transition probabilities $P(h_{w+1}|a_{w+1}, a_w, h_w, x_w)$, where $w+1$ is the next wave of observation for each individual, which is at an arbitrary distance $a_{w+1} - a_w$ from wave w.

We interpret the transitions between states as the outcome of independent competing risks in continuous time, but we assume that the underlying hazard rates are constant between birthdays and that at most one transition occurs between any 2 birthdays and between an observation (wave) and the nearest birthday. This leads to fairly simple expressions. To obtain the likelihood contribution for $P(h_{w+1}|a_{w+1}, a_w, h_w, x_w)$, we need to combine probability contributions for: (i) complete 1-year intervals between birthdays, (ii) incomplete intervals between $\left[a_w, \text{int}(a_w) + 1\right]$ and $\left[\text{int}(a_{w+1}), a_{w+1}\right]$, where $\text{int}(a)$ is a function that returns the integer part of any age a. For instance, an individual who is observed in two waves separated by two and a half years will provide one or two contributions of type (i) and two contributions of type (ii). Furthermore, we need to integrate over all possible trajectories between (a_w, h_w) and (a_{w+1}, h_{w+1}) because health is allowed to change every year but it is unobserved between interviews.

For contributions of type (i) we specify two multinomial logits for the transition probabilities from each state $i = 1, 2$ at birthday a to state $j = 0, 1, 2$ at birthday $a + 1$. The covariates are age a itself and potentially variables for socio-economic status x. To ease notation, let's abstract from x. Define $a \in \{50, 51, ..., \bar{a}\}$, where $\bar{a}$ is the maximum age. Define $f_{ij}(a) = \beta_{ij0} + \beta_{ij1}a + \beta_{ij2}a^2$. The probability $p_{ij}(a)$ that an individual with health $i \in \{1, 2\}$ at birthday a transits into health $j \in \{0, 1, 2\}$ within a year is given by:

$$\begin{aligned} p_{ii}(a) &= \frac{1}{1 + e^{f_{ik}(a)} + e^{f_{i0}(a)}} \\ p_{ik}(a) &= \frac{e^{f_{ik}(a)}}{1 + e^{f_{ik}(a)} + e^{f_{i0}(a)}} \\ p_{i0}(a) &= \frac{e^{f_{i0}(a)}}{1 + e^{f_{ik}(a)} + e^{f_{i0}(a)}} \end{aligned}$$

where $k \neq i, 0$.

For contributions of type (ii) define $\tilde{p}_{ij}(a, d)$ as the probability that and individual with health $i \in \{1, 2\}$ and age a transits into health $j \in \{0, 1, 2\}$ within a fraction d of a year (before reaching birthday $a + 1$). Computing $\tilde{p}_{ij}(a, d)$ involves two steps.

1. Recovering the hazard rates $\lambda_{ij}(a)$,

$$\begin{aligned} 1 - p_{ik}(a) - p_{i0}(a) &= e^{-(\lambda_{ik}(a)+\lambda_{i0}(a))} \\ p_{ik}(a) &= \frac{\lambda_{ik}(a)}{\lambda_{ik}(a)+\lambda_{i0}(a)}[1 - e^{-(\lambda_{ik}(a)+\lambda_{i0}(a))}] \end{aligned}$$

2. Computing the probabilities as

$$\begin{aligned} \tilde{p}_{ii}(a,d) &= e^{-(\lambda_{ik}(a)+\lambda_{i0}(a))d} \\ \tilde{p}_{ik}(a,d) &= \frac{\lambda_{ik}(a)}{\lambda_{ik}(a)+\lambda_{i0}(a)}\left[1 - e^{-(\lambda_{ik}(a)+\lambda_{i0}(a))d}\right] \\ \tilde{p}_{i0}(a,d) &= \frac{\lambda_{i0}(a)}{\lambda_{ik}(a)+\lambda_{i0}(a)}\left[1 - e^{-(\lambda_{ik}(a)+\lambda_{i0}(a))d}\right] \end{aligned}$$

where $k \neq i, 0$.

Given the objects $p_{ij}(a)$ and $\tilde{p}_{ij}(a,d)$ just defined, we can write the likelihood $P(h_{w+1}|a_{w+1}, a_w, h_w)$ of any given individual transition as,

$$\begin{aligned} P(h_{w+1}|a_{w+1}, a_w, h_w) &= \begin{bmatrix} \mathbb{1}_{h_w=1} & \mathbb{1}_{h_w=2} \end{bmatrix} \begin{bmatrix} \tilde{p}_{11}(int(a_w), d_1) & \tilde{p}_{12}(int(a_w), d_1) \\ \tilde{p}_{21}(int(a_w), d_1) & \tilde{p}_{22}(int(a_w), d_1) \end{bmatrix} \\ &\quad \prod_{a=int(a_w)+1}^{int(a_{w+1})} \begin{bmatrix} p_{11}(a) & p_{12}(a) \\ p_{21}(a) & p_{22}(a) \end{bmatrix} \\ &\quad \begin{bmatrix} \tilde{p}_{11}(int(a_{w+1}), d_2) & \tilde{p}_{12}(int(a_{w+1}), d_2) & \tilde{p}_{10}(int(a_{w+1}), d_2) \\ \tilde{p}_{21}(int(a_{w+1}), d_2) & \tilde{p}_{22}(int(a_{w+1}), d_2) & \tilde{p}_{20}(int(a_{w+1}), d_2) \end{bmatrix} \begin{bmatrix} \mathbb{1}_{h_{w+1}=1} \\ \mathbb{1}_{h_{w+1}=2} \\ \mathbb{1}_{h_{w+1}=0} \end{bmatrix} \end{aligned}$$

where $\mathbb{1}$ is an indicator function and

$$\begin{aligned} d_1 &= int(a_w) + 1 - a_w \\ d_2 &= a_{w+1} - int(a_{w+1}) \end{aligned}$$

Similar expressions for the likelihood contribution of a given individual transition can be derived when the information on health h_w or/and h_{w+1} is incomplete (the survival status is known but not whether the individual is healthy or unhealthy).

Finally, in the data we observe N of such individual transitions. Because, we consider

those N transitions independent, the full likelihood is given by:

$$p(H|\boldsymbol{\beta}) = \prod_{n=1}^{N} P(h_{w+1}^n | a_{w+1}^n, a_w^n, h_w^n), \tag{1}$$

where H represents all the health transitions in the sample and $\boldsymbol{\beta}$ is the vector of β_{ijl} parameters.

3.2 Estimation

Given the weak tractability of non-linear equation solvers, we rely on Markov Chain Monte-Carlo (MCMC) techniques to sample from the posterior distribution of $\boldsymbol{\beta}$. Because of the large sample equivalence of Bayesian and classical methods, both interpretations of the results are supported. In order to reduce the uncertainty of estimated parameters from our small country samples, we constrain the space of possible $\boldsymbol{\beta}$ to satisfy a set of five regularity conditions $r_1(\boldsymbol{\beta}|a)$ to $r_5(\boldsymbol{\beta}|a)$ that we re-write as a prior for $\boldsymbol{\beta}$ with pdf:

$$p(\beta) = \prod_{a=50}^{\bar{a}} r_1(\boldsymbol{\beta}|a) \cdot r_2(\boldsymbol{\beta}|a) \cdot r_3(\boldsymbol{\beta}|a) \cdot r_4(\boldsymbol{\beta}|a) \cdot r_5(\boldsymbol{\beta}|a) \tag{2}$$

These five regularity conditions are:

$$r_1(\boldsymbol{\beta}|a) = \begin{cases} 1 & \text{if } \dfrac{p_{22}(a)}{1-p_{20}(a)} \geq \dfrac{p_{22}(a+1)}{1-p_{20}(a+1)}, \\ 0 & \text{otherwise} \end{cases} \tag{3}$$

$$r_2(\boldsymbol{\beta}|a) = \begin{cases} 1 & \text{if } \dfrac{p_{12}(a)}{1-p_{10}(a)} \geq \dfrac{p_{12}(a+1)}{1-p_{10}(a+1)}, \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

$$r_3(\boldsymbol{\beta}|a) = \begin{cases} 1 & \text{if } p_{20}(a+1) \geq p_{20}(a), \\ 0 & \text{otherwise} \end{cases} \tag{5}$$

$$r_4(\boldsymbol{\beta}|a) = \begin{cases} 1 & \text{if } p_{10}(a+1) \geq p_{10}(a), \\ 0 & \text{otherwise} \end{cases} \tag{6}$$

$$r_5(\boldsymbol{\beta}|a) = \begin{cases} 1 & \text{if } p_{10}(a) \geq p_{20}(a), \\ 0 & \text{otherwise} \end{cases} \tag{7}$$

and allow us to restrict the parameter space such that: conditional on surviving, the probability of remaining in good health decreases with age, equation (3); conditional on surviving, the probability of moving from bad to good health decreases with age, equation (4); the probability of surviving (conditional on both good and bad health) decreases with age, equations (5) and (6); and the probability of dying is larger when in bad health than in good health, equation (7).

The posterior distribution of $\boldsymbol{\beta}$ is given by:

$$p(\boldsymbol{\beta}|H) \propto p(H|\boldsymbol{\beta}) \cdot p(\boldsymbol{\beta}), \tag{8}$$

In order to sample from the posterior distribution, we use a standard Metropolis algorithm:

1. Initialize at $\boldsymbol{\beta}^{t=0}$
2. Propose candidate $\boldsymbol{\beta}^c = \boldsymbol{\beta}^t + \epsilon$, where $\epsilon \sim N(0, \sigma_\epsilon^2)$
3. Accept $\boldsymbol{\beta}^c$ with probability:

$$\alpha(\boldsymbol{\beta}^c|\boldsymbol{\beta}^t) = \min\left\{1, \frac{p(\boldsymbol{\beta}^c|H)}{p(\boldsymbol{\beta}^t|H)}\right\}$$

4. If candidate is accepted $\boldsymbol{\beta}^{t+1} = \boldsymbol{\beta}^c$, otherwise $\boldsymbol{\beta}^{t+1} = \boldsymbol{\beta}^t$.
5. Set t=t+1 and go back to 2 until convergence in the posterior distribution.

The empirical results in the next sections are based on 500,000 draws for each sample. The first 40,000 draws are disregarded as burn-in and the remaining 460,000 provide a posterior distribution of the vector of parameters $\boldsymbol{\beta}$ for each country-gender-education sample. We adjust the variance σ_ε^2 of the proposal for every country-gender-education sample to ensure acceptance rates are around 30%.

3.3 Computing life expectancies

We use the posterior distribution of parameter estimates to obtain a distribution of transition probabilities or multi-state life tables $p_{ij}(a)$ for each country-gender-education sample, which in turn we use to compute a distribution of life expectancies (LE), healthy life

expectancies (HLE), and unhealthy life expectancies (ULE) using standard formulas (see Appendix A). LE is understood as the average number of years that a 50-year old person will live if the health transitions $p_{ij}(a)$ were to remain constant at the estimated values. Likewise, healthy (unhealthy) life expectancy HLE (ULE) is understood as the average number of years that a 50-year old person will spend in the good (bad) health state if the health transitions $p_{ij}(a)$ were to remain constant at the estimated values. Note that it has to be the case that LE=HLE+ULE.

4 Data

We use all available waves of SHARE data plus waves 6 to 11 of HRS and 1 to 6 of ELSA in order to have data for the US and England for a comparable time frame.[6,7]

We create a sample where every individual-wave observation refers to a transition between the given wave and the next available (not necessarily consecutive) one. This observation keeps track of the date of interview and health in the next available wave or the date of death if the individual did not survive, as well as gender, education, age and health of the current wave. After recording this information, the last wave of every individual is dropped because it cannot provide any further transition. Of course, we drop individuals with only one observation because they cannot provide any transition. We keep those individuals with age at their first interview above 49 and below 91. Individuals with missing information on health but known survival status are kept as they also provide valuable likelihood contributions (this is the case for instance for all individuals in Wave 3 of SHARE). Except in ELSA, the age variable is continuous because we use year and month of birth and year and month of interview.

[6]We use data from SHARE Waves 1, 2, 3 (SHARELIFE), 4, 5 and 6 (DOIs: 10.6103/SHARE.w1.610, 10.6103/SHARE.w2.610, 10.6103/SHARE.w3.610, 10.6103/SHARE.w4.610, 10.6103/SHARE.w5.610, 10.6103/SHARE.w6.610), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N211909, SHARE-LEAP: N227822, SHARE M4: N261982). Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

[7]ELSA data were made available through the UK Data Archive. ELSA was developed by a team of researchers based at the NatCen Social Research, University College London and the Institute for Fiscal Studies. The data were collected by NatCen Social Research. The funding is provided by the National Institute of Aging in the United States, and a consortium of UK government departments co-ordinated by the Office for National Statistics.

TABLE 1: Sample statistics

	Waves	First year	Last year	Individuals
Austria*	6	2004	2015	5139
Belgium	6	2004	2015	6557
Czechia*	5	2006	2015	6441
Denmark*	6	2004	2015	4453
Estonia*	3	2010	2015	6322
France*	6	2004	2015	5964
Germany	6	2004	2015	5723
Greece	4	2004	2015	3394
Israel	4	2005	2015	3041
Italy*	6	2004	2015	5248
Netherlands	5	2004	2013	3474
Poland*	4	2006	2015	2175
Slovenia*	3	2011	2015	3035
Spain*	6	2004	2015	6927
Sweden*	6	2004	2015	5242
Switzerland	6	2004	2015	3557
England*	6	2002	2013	14242
US*	6	2002	2013	27198

Notes: "First year" and "Last year" refer to year of interview or death in our sample. An * mark indicates that the country sample has been selected for the main exercises of the paper, see the Online Appendix for details.

High education is defined in all countries as completing a degree at a tertiary educational institution (college or university) corresponding to ISCED 1997 codes 5 and 6, whereas low education correspond to all the remaining categories, that is ISCED 1997 codes 0, 1, 2, 3, or 4.[8]

A person in a healthy state is defined as having no limitations with activities of daily living (ADL). That is, he or she has no limitations with any of the following six activities: dressing (including putting on shoes and socks), walking across a room, bathing or showering, eating, getting in and out of bed, and using the toilet.[9] There is a well-known educational gradient in the incidence of difficulties in ADLs, see Cutler and Lleras-Muney (2010).

In Table 1 we report for every country the number of waves for which the survey was

[8]See Table B.1 in Appendix B for a comparison of the education distribution in our country samples with the one from the population from Eurostat and OECD for the relevant age groups.

[9]Counts of ADL were first proposed by Katz et al. (1963) to measure the degree of independence of old people. Limitations in ADL have been widely used as health variables to understand economic decisions of the old like labor supply (e.g. Dwyera and Mitchell, 1999), savings (e.g. Ameriks et al., 2015), or the purchase of long-term care insurance (e.g. Braun et al., 2017). In terms of international comparability, Chan et al. (2012) find good equivalence for the ADL items between the HRS and SHARE, but less so with ELSA.

run, the interval of years for which the survey was conducted, and the number of individuals. Clearly, the HRS and ELSA samples, with around 30,000 and 15,000 individuals are much larger than any country sample in SHARE, which range between very small samples in Greece, Israel, Netherlands, Poland, Slovenia, and Switzerland (all below 3,500 individuals) and larger ones in Belgium, Czech Republic, France, Estonia, and Spain (all over 6,000). Countries also differ in the number of waves. A higher number of waves allows to extract more transitions from the same number of individuals. HRS and ELSA provide 6 waves each, and then most SHARE countries provide 6 but Netherlands, Greece, Israel, Czech Republic, Poland, Slovenia, and Estonia provide fewer than 5 waves either because they dropped from SHARE or because they entered later than other countries.

Finally, as discussed in Section 2 there are potential problems in the use of SHARE data for survival analysis. For this reason, in the Online Appendix we perform a validation exercise by comparing the survival functions computed with our survey data for each country to the ones in the population life tables for the same range of years. Our results indicate that most SHARE samples, plus the ELSA and HRS samples, aggregate reasonably well to the population life tables, and that attrition from the sample is not related to variables that predict survival. However, a few SHARE countries do not do as well. Hence, we choose to keep the data only for those countries for which the validation exercise is best; these countries are indicated with an asterisk symbol in Table 1.

5 Results

In this Section we present for our 12 countries our results on life expectancy (LE), healthy life expectancy (HLE), and unhealthy life expectancy (ULE) for four demographic groups: males and females with and without college education.[10] In order to organize the information and obtain more precise estimates with larger samples, we also group the 10 Continental European countries into 4 regions and estimate again our duration model with the pooled data of each region in order to compute the region *average* multi-state life tables and associated LE, HLE, and ULE. The four regions we consider are Western Europe (Austria and France), Eastern Europe (Czechia, Estonia, Poland and Slovenia), Mediterranean (Italy and Spain), and Scandinavia (Denmark and Sweden). Our results focus on the life expectancy differences between gender and education groups. The actual levels of the life expectancy for each of the four demographic groups in each country are reported in Table B.2 and B.3 of Appendix B, while the ones for males and females

[10]The corresponding life tables for each group and country are available online at the authors' web pages.

without distinguishing education level are reported in Table B.4.

5.1 Education gradients in life expectancy

We start by examining our findings for education. In Table 2 we report the gradients in LE separately for men (Panel A, column 1) and women (Panel B, column 1), as well as for the difference among the two genders (Panel C, column 1). As it is well-known, more educated individuals have larger LE in all countries for both males and females. More importantly, we find that inequality tends to be larger among males than among females: the average of the education gradient across the 12 countries is 3.4 years for males and 2.3 years for females. Our results, however, show a large amount of heterogeneity across countries. First, looking at males, the gradient is largest in Eastern and Western Europe (around 4 years), while it is lowest but still important in Scandinavia (2.1). The Mediterranean (3) stands in the middle. In Eastern and Western Europe the gradients are indeed larger than in England (3.4) and the US (3.6). There is substantial heterogeneity within Eastern Europe: while the largest gradient across all countries is in Poland (5.4), Slovenia (2.5) presents a gradient among the smallest of our sample. Second, the pattern for females is different. The gradient is still largest in Eastern Europe (3.9) but it is smallest in the Mediterranean (0.7), with Scandinavia (2.3) and Western Europe (1.7) in the middle. For females, only Eastern Europe shows a gradient larger than the US (3.2). And third, the interaction between education and gender also varies across countries. In particular, there is virtually no gender difference in the education gradient of LE in Scandinavia, Italy, or Slovenia. Instead, Poland (with 4.4 years of difference in the gradient between males and females), Spain (3.5), and Austria, France, and England (2.2) show large gender differences in the education gradient. Czechia (with -2.3 years) is the only country where there is significantly more inequality among females.

Our international comparison of life expectancy gradients of education are qualitatively in line with findings in mortality gradients of other studies, although there are some important differences. In particular, using census-based mortality studies, papers like Mackenbach et al. (2008), Mackenbach et al. (2015a) and Avendano et al. (2011) document that mortality differences among 30-79 year-olds are largest in Eastern Europe (but less so in Slovenia), intermediate in Nordic countries, and smallest in Mediterranean. Mackenbach (2017), refers to these results as the "Eastern Disaster", the "Nordic Paradox", and the "Southern Miracle". The term "Nordic Paradox" highlights that one would expect the lowest inequality in mortality to arise in countries with low income inequality and strong welfare states, while the term "Southern Miracle" underscores the low inequal-

TABLE 2: Education gradients

	A. Males			B. Females			C. Difference		
	LE	HLE	ULE	LE	HLE	ULE	LE	HLE	ULE
Western Europe	3.9	4.6	-0.8	1.7	3.0	-1.3	2.2	1.6	0.6
	(0.7)	(0.7)	(0.4)	(0.6)	(0.7)	(0.4)	(1.0)	(1.0)	(0.6)
Austria	3.8	4.1	-0.3	1.7	2.7	-1.0	2.2	1.4	0.8
	(1.1)	(1.0)	(0.5)	(1.1)	(1.0)	(0.5)	(1.5)	(1.4)	(0.7)
France	3.9	5.0	-1.1	1.8	3.2	-1.5	2.2	1.8	0.4
	(1.0)	(1.0)	(0.5)	(0.8)	(0.9)	(0.7)	(1.3)	(1.4)	(0.9)
Eastern Europe	4.0	4.3	-0.3	3.9	5.1	-1.2	0.1	-0.8	0.9
	(0.8)	(0.7)	(0.3)	(0.6)	(0.6)	(0.4)	(1.0)	(0.9)	(0.5)
Czechia	3.5	4.0	-0.5	5.9	5.7	0.1	-2.3	-1.6	-0.7
	(1.3)	(1.2)	(0.5)	(1.0)	(1.1)	(0.8)	(1.7)	(1.7)	(0.9)
Estonia	4.6	4.6	-0.0	2.5	4.5	-2.0	2.1	0.1	2.0
	(1.3)	(1.2)	(0.5)	(0.8)	(0.8)	(0.5)	(1.5)	(1.4)	(0.7)
Poland	5.4	4.5	0.8	1.0	1.3	-0.6	4.4	3.2	1.3
	(2.0)	(1.9)	(1.1)	(2.6)	(2.6)	(1.7)	(3.2)	(3.2)	(2.0)
Slovenia	2.5	3.7	-1.3	3.0	5.3	-2.5	-0.5	-1.6	1.2
	(1.7)	(1.6)	(0.8)	(1.5)	(1.7)	(1.0)	(2.3)	(2.4)	(1.2)
Mediterranean	3.0	3.4	-0.4	0.7	4.1	-3.5	2.3	-0.7	3.1
	(1.0)	(1.0)	(0.5)	(1.1)	(1.1)	(0.4)	(1.5)	(1.5)	(0.7)
Italy	2.5	2.1	0.3	2.5	5.9	-3.6	0.1	-3.8	3.9
	(1.3)	(1.4)	(0.8)	(1.6)	(1.8)	(0.8)	(2.1)	(2.3)	(1.2)
Spain	3.4	4.3	-0.9	-0.0	3.0	-3.1	3.5	1.3	2.2
	(1.4)	(1.4)	(0.5)	(1.4)	(1.5)	(0.6)	(2.0)	(2.0)	(0.8)
Scandinavia	2.1	2.9	-0.8	2.3	3.7	-1.4	-0.1	-0.8	0.7
	(0.7)	(0.7)	(0.3)	(0.6)	(0.6)	(0.3)	(0.9)	(0.9)	(0.4)
Denmark	2.0	3.0	-1.0	2.1	4.0	-1.9	-0.1	-1.0	0.9
	(1.0)	(1.0)	(0.4)	(1.0)	(1.0)	(0.4)	(1.4)	(1.4)	(0.6)
Sweden	2.5	2.9	-0.5	2.8	3.6	-0.8	-0.3	-0.7	0.3
	(0.8)	(0.9)	(0.5)	(0.8)	(0.8)	(0.5)	(1.1)	(1.2)	(0.7)
England	3.4	4.7	-1.3	1.2	3.0	-1.8	2.2	1.7	0.5
	(0.6)	(0.6)	(0.3)	(0.6)	(0.6)	(0.4)	(0.8)	(0.8)	(0.5)
US	3.6	5.3	-1.7	3.2	5.1	-2.0	0.4	0.1	0.3
	(0.4)	(0.4)	(0.2)	(0.4)	(0.4)	(0.2)	(0.6)	(0.6)	(0.3)
Average	3.4	4.0	-0.6	2.3	3.9	-1.7	1.1	0.1	1.1
	(0.4)	(0.3)	(0.2)	(0.4)	(0.4)	(0.2)	(0.5)	(0.5)	(0.3)

Notes: LE stands for life expectancy, HLE for healthy life expectancy, and ULE for unhealthy life expectancy, all at age 50. The educational gradient is the difference in the corresponding life expectancy between college and non-college individuals. Panel A refers to males, Panel B to females, and Panel C is the difference between the male and female gradients. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

ity in mortality in countries where the welfare state is not so strong. Our results confirm the "Eastern Disaster" —as inequalities are large in former communist countries— but not the "Nordic Paradox" —as inequalities in Denmark and Sweden are indeed among the lowest in our sample— nor the "Southern Miracle" —as inequalities in Italy and Spain are not the smallest in our sample. There are several possible reasons for the discrepancy of our results with the ones just quoted. First, the age range and sampling methods of the underlying populations in SHARE, HRS, and ELSA differs from the ones in these studies. Second, in these studies Italy is represented only by Turin and Spain by Barcelona, Madrid and the Basque Country. And third, in these studies, Finland and Norway are the Scandinavian countries that create the "Nordic Paradox", while Denmark and Sweden have inequalities among the lowest, as it happens in our sample.

5.2 Education gradients in healthy and unhealthy life expectancy

In Table 2 we also report the education gradients in HLE (second column in each panel) and ULE (third column in each panel). We find that the gradient in HLE is typically larger than the gradient in LE, and more so among females. In particular, the average education gradients of HLE and LE over the 12 countries are 4.0 and 3.4 years for males and 3.9 and 2.3 years for females. There are two comments to make regarding these results. First, the gradient of ULE is negative —more educated individuals spend fewer years in disability despite enjoying longer lives— and larger for females (-1.7) than for males (-0.6). Second, the higher inequality among males measured in the education gradient of LE (3.4 years for males, 2.3 for females) disappears when looking at the education gradient of HLE (4.0 years for males, 3.9 for females).

Looking at the numbers for males by regions, we see that the gradient in ULE —the difference between the gradients in LE and the HLE— is largest in the US (-1.7) and England (-1.3) and it is smallest in Eastern Europe (-0.3) and the Mediterranean (-0.3), see the third column in Panel A. Country by country, however, there are a few exceptions to this pattern: in Italy and Poland it is the more educated who spend more time in disability, although the differences are small and not significant. Looking at the numbers for females we see that the gradient in ULE is largest in the Mediterranean (-3.5) and smallest in Eastern Europe (-1.2), Western Europe (-1.3) and Scandinavia (-1.4), see the third column in Panel B. England (-1.8) and the US (-2.0) are in between these two blocks. In terms of country data, we find that Czechia is an exception as high educated females spend more time in disability than the low educated ones although again the number is very small (0.1). Finally, looking together at the results for males and females, it is

clear that the difference in the ULE gradient between females and males is particularly large in the Mediterranean. In this region, high educated females spend 3.5 fewer years in disability than less educated ones while high educated males only spend 0.4 years less in disability, so that the gender difference in the ULE gradient is 3.1 years. For the rest of regions, the US, and England this difference is positive but small, less than 1 year.

Our results are qualitatively in line with some previous findings. Crimmins and Cambois (2003), in a review of single-country studies, document that the socio-economic gradient tends to be larger in HLE than in LE for several definitions of health and socio-economic status. Majer et al. (2010), using survey data from the ECHP for several European countries, also find that gradients in HLE are larger than in LE and that the gradient is larger among men than among women for LE, but less so in HLE. However, they do not have data on Eastern Europe nor on England and US. Maki et al. (2013) apply the Sullivan method to census-linked mortality data and calculate gender-specific educational differences in disability-free life expectancy between the ages of 30 and 79 years. They find that the educational differences are much greater in HLE than in LE in all countries. The smallest differences in HLE among men appear to be in the Mediterranean (4 years in Turin-Tuscany, 4.6 in Madrid-Barcelona), while the largest ones are in Lithuania (10.2) and Austria (7.8).

5.3 Decomposition of education gradients

The estimation of multi-state life tables by education and gender allows us to measure to which extent the observed education gradients arise because of differences across education groups in health already present at age 50, differences across education groups in health transitions after age 50, and differences across education groups in mortality. In particular, following Pijoan-Mas and Ríos-Rull (2014) we compute the counterfactual LE, HLE, and ULE in which education types only differ in (a) their health distribution at age 50, (b) their health transitions conditional on survival, and (c) their mortality conditional on health.[11] Tables 3, 4, and 5 report the decomposition for the LE, HLE, and ULE gradients respectively.[12]

First of all we find that differences in health across education groups at age 50 are irrelevant for the gradients. For instance, in the case of LE the counterfactual gradient

[11] This decomposition is also similar to what Solé-Auró et al. (2015) do in order to assess whether the larger prevalence of desease among old Americans (as compared to Europeans) is due to larger prevalence at age 50, larger incidence after age 50, or higher survival.

[12] To compute these counterfactual LE, HLE, and ULE we combine the initial health distribution and multi-state life tables for the whole population (without distinguish between education groups) with the education-specific ones used in Section 5.1 and 5.2.

TABLE 3: Decomposition of LE education gradients

	A. Males				B. Females			
	LE	LE_a	LE_b	LE_c	LE	LE_a	LE_b	LE_c
Western Europe	3.9	0.0	0.8	3.2	1.7	0.0	0.6	1.1
	(0.7)	(0.0)	(0.2)	(0.7)	(0.6)	(0.0)	(0.2)	(0.7)
Austria	3.8	0.1	0.8	3.3	1.7	0.0	0.5	1.2
	(1.1)	(0.0)	(0.3)	(1.1)	(1.1)	(0.0)	(0.2)	(1.1)
France	3.9	0.0	0.9	3.0	1.8	0.0	0.7	1.1
	(1.0)	(0.0)	(0.3)	(1.0)	(0.8)	(0.0)	(0.2)	(0.9)
Eastern Europe	4.0	0.1	0.7	3.3	3.9	0.0	0.8	3.0
	(0.8)	(0.0)	(0.2)	(0.8)	(0.6)	(0.0)	(0.2)	(0.6)
Czechia	3.5	0.1	1.2	2.6	5.9	0.0	1.0	5.0
	(1.3)	(0.0)	(0.4)	(1.4)	(1.0)	(0.0)	(0.4)	(1.2)
Estonia	4.6	0.0	0.4	4.1	2.5	0.0	0.7	1.6
	(1.3)	(0.0)	(0.2)	(1.3)	(0.8)	(0.0)	(0.2)	(0.8)
Poland	5.4	0.1	0.1	5.2	1.0	0.0	0.1	0.9
	(2.0)	(0.1)	(0.4)	(2.0)	(2.6)	(0.0)	(0.5)	(2.4)
Slovenia	2.5	0.0	0.8	1.2	3.0	0.1	0.8	1.7
	(1.7)	(0.0)	(0.5)	(1.9)	(1.5)	(0.0)	(0.4)	(1.9)
Mediterranean	3.0	0.0	0.7	2.6	0.7	0.0	1.4	-1.6
	(1.0)	(0.0)	(0.3)	(1.0)	(1.1)	(0.0)	(0.3)	(1.2)
Italy	2.5	0.0	0.1	2.4	2.6	0.0	1.8	0.1
	(1.3)	(0.0)	(0.4)	(1.3)	(1.6)	(0.0)	(0.5)	(2.1)
Spain	3.4	0.0	1.2	2.5	-0.0	0.0	1.0	-2.1
	(1.4)	(0.0)	(0.4)	(1.4)	(1.4)	(0.0)	(0.3)	(1.4)
Scandinavia	2.1	0.0	0.7	1.6	2.3	0.0	0.8	1.5
	(0.7)	(0.0)	(0.2)	(0.7)	(0.6)	(0.0)	(0.2)	(0.7)
Denmark	2.0	0.0	0.7	1.3	2.1	0.1	1.0	0.8
	(1.0)	(0.0)	(0.2)	(1.0)	(1.0)	(0.0)	(0.3)	(1.0)
Sweden	2.5	0.0	0.6	2.1	2.8	0.0	0.5	2.3
	(0.8)	(0.0)	(0.3)	(0.9)	(0.8)	(0.0)	(0.2)	(0.8)
England	3.4	0.1	1.1	2.5	1.2	0.0	0.5	0.6
	(0.6)	(0.0)	(0.2)	(0.6)	(0.6)	(0.0)	(0.1)	(0.6)
US	3.6	0.1	1.4	1.9	3.2	0.1	1.3	2.0
	(0.4)	(0.0)	(0.1)	(0.5)	(0.4)	(0.0)	(0.1)	(0.4)
Average	3.4	0.1	0.8	2.7	3.2	0.0	0.8	1.3
	(0.4)	(0.0)	(0.1)	(0.4)	(0.4)	(0.0)	(0.1)	(0.4)

Notes: LE stands for the educational gradient in life expectancy at age 50. LE_a, LE_b, and LE_c correspond to the counterfactual educational gradient in life expectancies when education types differ only in the health distribution at age 50, only in the health transition conditional on survival, and only in probability of survival respectively. Panel A refers to males, Panel B to females. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE 4: Decomposition of HLE education gradients

	A. Males				B. Females			
	HLE	HLE_a	HLE_b	HLE_c	HLE	HLE_a	HLE_b	HLE_c
Western Europe	4.6	0.1	2.1	2.5	3.0	0.1	2.2	0.7
	(0.7)	(0.0)	(0.5)	(0.6)	(0.7)	(0.0)	(0.5)	(0.5)
Austria	4.1	0.1	1.6	2.6	2.7	0.1	1.7	0.8
	(1.0)	(0.0)	(0.7)	(0.8)	(1.0)	(0.0)	(0.6)	(0.8)
France	5.0	0.1	2.4	2.4	3.3	0.1	2.5	0.7
	(1.0)	(0.0)	(0.7)	(0.7)	(0.9)	(0.0)	(0.8)	(0.6)
Eastern Europe	4.3	0.2	1.7	2.5	5.1	0.1	2.7	2.1
	(0.7)	(0.0)	(0.4)	(0.6)	(0.6)	(0.0)	(0.4)	(0.4)
Czechia	4.0	0.1	2.4	1.8	5.7	0.0	2.5	3.0
	(1.2)	(0.0)	(0.6)	(1.0)	(1.1)	(0.0)	(0.8)	(0.7)
Estonia	4.6	0.1	1.2	3.2	4.5	0.1	2.8	1.3
	(1.2)	(0.0)	(0.6)	(1.0)	(0.8)	(0.0)	(0.6)	(0.6)
Poland	4.5	0.3	0.3	3.9	1.3	0.2	0.5	1.2
	(1.9)	(0.1)	(1.1)	(1.4)	(2.5)	(0.0)	(1.8)	(1.4)
Slovenia	3.7	0.1	2.0	1.2	5.4	0.2	3.4	1.3
	(1.6)	(0.0)	(1.0)	(1.4)	(1.7)	(0.0)	(1.1)	(1.3)
Mediterranean	3.4	0.0	1.6	1.8	4.1	0.0	4.6	-0.7
	(1.0)	(0.0)	(0.6)	(0.7)	(1.1)	(0.0)	(0.7)	(0.7)
Italy	2.1	-0.0	0.4	1.8	6.0	0.0	5.4	0.2
	(1.4)	(0.0)	(1.0)	(1.0)	(1.8)	(0.0)	(1.1)	(1.1)
Spain	4.3	0.1	2.5	1.8	3.0	0.0	3.6	-0.9
	(1.4)	(0.0)	(0.7)	(1.1)	(1.4)	(0.0)	(1.1)	(1.0)
Scandinavia	2.9	0.1	1.8	1.1	3.7	0.1	2.4	1.1
	(0.7)	(0.0)	(0.4)	(0.6)	(0.7)	(0.0)	(0.4)	(0.5)
Denmark	3.0	0.1	2.0	0.9	4.0	0.2	2.9	0.8
	(1.0)	(0.0)	(0.6)	(0.8)	(1.0)	(0.0)	(0.6)	(0.8)
Sweden	2.9	0.1	1.5	1.4	3.6	0.1	1.9	1.6
	(0.9)	(0.0)	(0.6)	(0.7)	(0.8)	(0.0)	(0.6)	(0.6)
England	4.7	0.3	2.9	1.6	3.0	0.2	2.4	0.3
	(0.6)	(0.0)	(0.4)	(0.4)	(0.6)	(0.0)	(0.4)	(0.4)
US	5.3	0.3	3.2	1.5	5.1	0.4	3.5	1.3
	(0.4)	(0.0)	(0.3)	(0.4)	(0.4)	(0.0)	(0.3)	(0.3)
Average	4.0	0.2	1.9	2.0	5.1	0.1	2.8	1.0
	(0.3)	(0.0)	(0.2)	(0.3)	(0.4)	(0.0)	(0.3)	(0.2)

Notes: HLE stands for the educational gradient in healthy life expectancy at age 50. HLE_a, HLE_b, and HLE_c correspond to the counterfactual educational gradient in healthy life expectancies when education types differ only in the health distribution at age 50, only in the health transition conditional on survival, and only in probability of survival respectively. Panel A refers to males, Panel B to females. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE 5: Decomposition of ULE education gradients

	A. Males				B. Females			
	ULE	ULE_a	ULE_b	ULE_c	ULE	ULE_a	ULE_b	ULE_c
Western Europe	-0.8	-0.1	-1.3	0.7	-1.3	-0.1	-1.6	0.4
	(0.4)	(0.0)	(0.3)	(0.2)	(0.4)	(0.0)	(0.4)	(0.3)
Austria	-0.3	-0.1	-0.7	0.7	-1.0	-0.1	-1.2	0.4
	(0.5)	(0.0)	(0.4)	(0.3)	(0.5)	(0.0)	(0.4)	(0.4)
France	-1.1	-0.1	-1.5	0.6	-1.5	-0.0	-1.8	0.5
	(0.5)	(0.0)	(0.4)	(0.4)	(0.7)	(0.0)	(0.6)	(0.4)
Eastern Europe	-0.3	-0.1	-1.0	0.9	-1.2	-0.1	-1.8	0.9
	(0.3)	(0.0)	(0.2)	(0.2)	(0.4)	(0.0)	(0.3)	(0.3)
Czechia	-0.5	-0.1	-1.2	0.9	0.1	-0.0	-1.5	2.0
	(0.5)	(0.0)	(0.3)	(0.4)	(0.8)	(0.0)	(0.4)	(0.6)
Estonia	-0.0	-0.1	-0.8	0.9	-2.0	-0.1	-2.2	0.3
	(0.5)	(0.0)	(0.4)	(0.3)	(0.5)	(0.0)	(0.4)	(0.3)
Poland	0.8	-0.2	-0.2	1.2	-0.5	-0.2	-0.4	-0.3
	(1.1)	(0.0)	(0.7)	(0.7)	(1.7)	(0.0)	(1.4)	(1.2)
Slovenia	-1.2	-0.1	-1.2	0.0	-2.5	-0.1	-2.6	0.4
	(0.8)	(0.0)	(0.6)	(0.6)	(1.0)	(0.0)	(0.9)	(0.7)
Mediterranean	-0.4	-0.0	-0.9	0.7	-3.5	-0.0	-3.2	-0.9
	(0.5)	(0.0)	(0.3)	(0.3)	(0.4)	(0.0)	(0.5)	(0.5)
Italy	0.3	0.0	-0.3	0.6	-3.6	-0.0	-3.5	-0.1
	(0.8)	(0.0)	(0.6)	(0.4)	(0.8)	(0.0)	(0.8)	(1.1)
Spain	-0.9	-0.0	-1.3	0.7	-3.1	-0.0	-2.5	-1.2
	(0.5)	(0.0)	(0.4)	(0.4)	(0.6)	(0.0)	(0.7)	(0.5)
Scandinavia	-0.8	-0.1	-1.1	0.5	-1.4	-0.1	-1.6	0.4
	(0.3)	(0.0)	(0.3)	(0.2)	(0.3)	(0.0)	(0.3)	(0.2)
Denmark	-1.0	-0.1	-1.3	0.4	-1.9	-0.1	-1.8	-0.0
	(0.4)	(0.0)	(0.4)	(0.3)	(0.4)	(0.0)	(0.4)	(0.3)
Sweden	-0.5	-0.1	-0.9	0.6	-0.8	-0.1	-1.4	0.7
	(0.5)	(0.0)	(0.4)	(0.2)	(0.5)	(0.0)	(0.4)	(0.3)
England	-1.3	-0.2	-1.8	0.8	-1.8	-0.2	-1.9	0.3
	(0.3)	(0.0)	(0.3)	(0.3)	(0.4)	(0.0)	(0.3)	(0.3)
US	-1.7	-0.2	-1.8	0.4	-2.0	-0.3	-2.2	0.7
	(0.2)	(0.0)	(0.1)	(0.1)	(0.2)	(0.0)	(0.2)	(0.2)
Average	-0.6	-0.1	-1.1	0.7	-2.0	-0.1	-1.9	0.3
	(0.2)	(0.0)	(0.1)	(0.1)	(0.2)	(0.0)	(0.2)	(0.2)

Notes: ULE stands for the educational gradient in unhealthy life expectancy at age 50. ULE_a, ULE_b, and ULE_c correspond to the counterfactual educational gradient in unhealthy life expectancies when education types differ only in the health distribution at age 50, only in the health transition conditional on survival, and only in probability of survival respectively. Panel A refers to males, Panel B to females. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

LE_a is between 0 and 0.1 for all countries and genders —see the second column in Panels A and B of Table 3— which is to be expected given that most individuals in their fifties are healthy.

Second, we find that higher educated individuals tend to live longer mainly because of lower mortality rates conditional on health, not because of better health transitions. This is especially the case for males, whose mortality differentials explain around 80% of the observed gradients in LE and most of its cross-country differences. An important exception is the US where the male gradient driven exclusively by differences in health transitions, LE_b, is the greatest among all countries with 1.4 years, see the third column in Panel A of Table 3. But even for males in the US, differential mortality still explains 53% of the observed gradient in LE. Differences in mortality rates across education groups are relatively less important for females, accounting for around 65% of the gradient in LE.

Third, we find that in most countries and regions the difference between the gradients in LE of males and females is mostly driven by the difference in the mortality gradient LE_c between males and females, while the gradient LE_b due to transitions tends to be very similar across genders. For instance, in Western Europe the education gradient in LE is 3.9 years for males and 1.7 year for females. If education groups only differed in health transitions conditional on survival, the gradients would be very similar, 0.8 and 0.6 years respectively, while if education groups only differed in mortality conditional on health the gradient for males, 3.2 years, would still be much larger than the one for females, 1.1 years.

Fourth, the decomposition of the HLE gradients shows a larger importance of the educational differences in health transitions. Indeed, for females in all regions, and for males in the US, England, and Scandinavia the gradient in HLE due to educational differences in health transitions, HLE_b, is larger than the one due to educational differences in mortality, HLE_c, see third and fourth columns in each panel of Table 4. For instance, in the US the gradient in HLE_b is 3.2 years for males and 3.5 for females, while the gradient in HLE_c is 1.5 and 1.3 respectively. Instead, for males in several countries in Western and Eastern Europe and in the Mediterranean differences in mortality across education groups are more important than differences in health transitions. This is especially so among Polish and Estonian males, whose HLE_b are small, 0.3 and 1.2 respectively but whose HLE_c are very large, 3.9 and 3.2 respectively. Indeed, these two countries have exceptionally large gradients in HLE, and what this decomposition shows is that they are mainly driven by the fact that less educated males face substantially higher mortality rates conditional on health than more educated ones.

And fifth, as shown in Section 5.2, the education gradients in ULE are negative for

almost all countries and genders, reflecting the fact that more educated individuals spend on average fewer years in disability. When looking at the decomposition of this gradient in Table 5, we find that the gradient due to health transitions, ULE_b, is negative and larger in absolute value than the whole gradient in ULE, while for most countries and genders the gradient due to mortality differences, ULE_c, is positive. This tells us that the more educated spend fewer years in disability because of better health transitions. Did they experienced similar health transitions as the less educated, they would spend more years in disability thanks to their better survival rates.

5.4 Gender gaps in life expectancy

We now turn to examining our result for inequality between men and women. In particular, we define the difference between the average life expectancy of women and men as the gender gap in life exepectancy. In Table 6 we report the gender gaps in LE separately for low and high educated individuals (first column in Panels A and B respectively), as well as the difference of the gender gaps across the two education groups (first column in Panel C). As in population life tables, we find that LE is larger for females than for males. But more importantly, we also find a significant socio-economic component of the gender gap: life expectancy differences between females and males are larger among low-educated individuals. In particular, looking at the average across the 12 countries, low educated women live 3.9 more years than men while high educated women live only 2.7 more years than men.

Looking at variation across countries, the gender gap in LE among the low educated is largest in Eastern Europe (5.6 years) and lowest in Scandinavia (1.8 years), while Western Europe, the Mediterranean, England and the US present similar values (between 3.7 and 3.3 years). Among the high-educated, the gender gap is still largest in Eastern Europe (5.5 years), although the region shows large heterogeneity with gender gaps ranging from 0.9 years in Poland to 7.3 years in Czechia. Instead, Western Europe, the Mediterranean, England and Scandinavia have all small gender gradients (at values between 1.3 and 1.9). The socio-economic dimension of the gender gap is particularly clear in the Mediterranean (where the gender gap is 2.3 years larger among the low educated than among the high educated) and in Western Europe and England (2.2 years), while there is no substantial difference in the gender gap across education groups in Scandinavia and Eastern Europe, and there is a very small one in the US.

5.5 Gender gaps in healthy and unhealthy life expectancy

In Table 6 we also report the gender gaps in HLE (second column in each panel) and ULE (third column in each panel). We find that the female advantage in LE diminishes when looking at HLE, that is, the gender gradients are smaller in HLE than in LE. By construction, the flip side of this result is that the gender gap in ULE is generally positive, that is to say, females tend to spend longer time in disability than males. Indeed, it is well known that females tend to report a higher incidence of disability.[13] Our results show that (a) there is a socio-economic dimension in this pattern as the gender gap in ULE is larger among low educated than among high educated, and (b) there is also substantial variation across countries. In particular, the average gradient in ULE is 1.4 years among the low educated, while it is only 0.4 years on average and non-existent for a few countries among the high educated. Looking at data across countries, we see that in Western Europe the gender gap in ULE is 1 year among the low educated and 1/2 of a year among the high educated, a pattern which is similar in Eastern Europe or England. In the Mediterranean and in Scandinavia, while low-educated females have ULE larger than males, high-educated females tend to spend similar or less time in disability than males. Instead, for the high educated only Czechia and the US present substantial gender gaps in ULE (1.8 and 1.4 years respectively).

5.6 Decomposition of gender gaps

As we did with the education gradients in Section 5.3, we decompose the gender gaps for low and high educated individuals in LE, HLE, and ULE into (a) gender differences in the health distribution at age 50, (b) gender differences in the transition conditional on survival, and (c) gender differences in mortality conditional on health. Tables 7, 8, and 9 report the decompositions of LE, HLE, and ULE respectively for low (Panel A) and high educated (Panel B) individuals.

In all three life expectancies we find that initial differences in health at age 50 are irrelevant. When looking at the decomposition of the gender gap in LE (see Table 7), we find that virtually all the LE advantage for females comes from gender differences in survival conditional on health, captured by LE_c in the fourth column of each Panel, and that differences in health transitions across genders, captured by LE_b in the third column of each Panel, are inconsequential for LE differences. The only exception is the low educated in the Mediterranean, where health deteriorates faster for females and hence health transitions contribute to narrow down the gender gap in survival. The pattern is

[13] See for instance Crimmins et al. (2011) who also use data from HRS, SHARE and ELSA.

TABLE 6: Gender gaps

	A. Low educated			B. High educated			C. Difference		
	LE	HLE	ULE	LE	HLE	ULE	LE	HLE	ULE
Western Europe	3.7	2.6	1.0	1.5	1.0	0.5	2.2	1.6	0.6
	(0.6)	(0.5)	(0.2)	(0.8)	(0.8)	(0.5)	(1.0)	(1.0)	(0.6)
Austria	3.0	2.2	0.8	0.8	0.8	0.0	2.2	1.4	0.8
	(0.9)	(0.8)	(0.4)	(1.2)	(1.2)	(0.7)	(1.5)	(1.4)	(0.7)
France	4.2	2.9	1.3	2.0	1.1	0.9	2.2	1.8	0.4
	(0.7)	(0.6)	(0.3)	(1.1)	(1.2)	(0.8)	(1.3)	(1.4)	(0.9)
Eastern Europe	5.6	4.1	1.6	5.5	4.9	0.6	0.1	-0.8	0.9
	(0.4)	(0.4)	(0.2)	(0.9)	(0.8)	(0.4)	(1.0)	(0.9)	(0.5)
Czechia	4.9	3.8	1.1	7.3	5.5	1.8	-2.3	-1.6	-0.7
	(0.7)	(0.7)	(0.3)	(1.5)	(1.5)	(0.9)	(1.7)	(1.7)	(0.9)
Estonia	7.3	4.9	2.4	5.1	4.8	0.4	2.1	0.1	2.0
	(0.8)	(0.7)	(0.3)	(1.3)	(1.2)	(0.6)	(1.5)	(1.4)	(0.7)
Poland	5.3	3.8	1.5	0.9	0.6	0.1	4.4	3.2	1.3
	(1.0)	(0.9)	(0.5)	(3.1)	(3.0)	(2.0)	(3.2)	(3.2)	(2.0)
Slovenia	4.4	3.5	0.8	4.8	5.2	-0.4	-0.5	-1.6	1.2
	(1.2)	(1.1)	(0.5)	(2.0)	(2.1)	(1.1)	(2.3)	(2.4)	(1.2)
Mediterranean	3.7	1.4	2.3	1.3	2.1	-0.8	2.3	-0.7	3.1
	(0.4)	(0.4)	(0.2)	(1.4)	(1.5)	(0.6)	(1.5)	(1.5)	(0.7)
Italy	2.8	0.4	2.4	2.7	4.2	-1.5	0.1	-3.8	3.9
	(0.6)	(0.5)	(0.3)	(2.0)	(2.2)	(1.1)	(2.1)	(2.3)	(1.2)
Spain	4.4	2.3	2.1	0.9	1.0	-0.1	3.5	1.3	2.2
	(0.6)	(0.6)	(0.3)	(1.9)	(1.9)	(0.7)	(2.0)	(2.0)	(0.8)
Scandinavia	1.8	1.2	0.6	1.9	2.0	-0.1	-0.1	-0.8	0.7
	(0.5)	(0.5)	(0.3)	(0.7)	(0.8)	(0.4)	(0.9)	(0.9)	(0.4)
Denmark	1.3	0.9	0.4	1.4	2.0	-0.5	-0.1	-1.0	0.9
	(0.9)	(0.9)	(0.4)	(1.1)	(1.1)	(0.4)	(1.4)	(1.4)	(0.6)
Sweden	2.1	1.4	0.7	2.4	2.0	0.4	-0.3	-0.7	0.3
	(0.7)	(0.7)	(0.3)	(0.9)	(1.0)	(0.6)	(1.1)	(1.2)	(0.7)
England	3.5	2.0	1.5	1.3	0.3	0.9	2.2	1.7	0.5
	(0.3)	(0.3)	(0.2)	(0.7)	(0.7)	(0.5)	(0.8)	(0.8)	(0.5)
US	3.3	1.6	1.6	2.9	1.5	1.4	0.4	0.1	0.3
	(0.3)	(0.3)	(0.1)	(0.5)	(0.5)	(0.2)	(0.6)	(0.6)	(0.3)
Average	3.9	2.5	1.4	2.7	2.4	0.3	1.1	0.1	1.1
	(0.2)	(0.2)	(0.1)	(0.5)	(0.5)	(0.3)	(0.5)	(0.5)	(0.3)

Notes: LE stands for life expectancy, HLE for healthy life expectancy, and ULE for unhealthy life expectancy, all at age 50. The gender gap is the difference in the corresponding life expectancy between females and males. Panel A refers to individuals without college, Panel B to individuals with a college degree, and Panel C is the difference between the non-college and the college gender gaps. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

similar for the decomposition of the gradients in HLE (see Table 8).

It may seem odd that gender differences in health transitions turn out to be inconsequential for gender differences in LE given that females —especially low-educated— spend longer time in disability than males. The answer to this apparent puzzle is that the reason why females have longer ULE than males is not that they are more prone to disability but that their mortality conditional on disability is lower, which mechanically extends the duration of the disability state. This is shown in the decomposition of the gender gap in ULE (see Table 7). In particular, for the low-educated the gender gap in ULE comes entirely from the gender gap in mortality conditional on health, with the exception of the Mediterranean (where almost 1/2 comes from the worse health transitions of females) and the US (1/3).

5.7 Overall inequality

In order to complement the results on the differences of life expectancies across education and gender groups, we also compute the differences in LE, HLE, and ULE between females with a college degree and males without, which are the longest and shortest lived groups. The results are reported in Table B.5 in the Appendix. As one may expect from the results in the previous sections, these differences are large and again heterogeneous across countries. On average, the difference between high educated females and low educated males is 6.2 years for LE and 6.4 for HLE. Looking at variation across countries in terms of LE, the highest difference is in Eastern Europe where an educated female can expect to live 9.5 years more than an uneducated male. The differences are also large in all countries in the region, ranging from 6.3 years in Poland to 10.8 in Czechia. Next come the US (6.5 years), Western Europe (5.4), England (4.7), the Mediterranean (4.4) and Scandinavia (4.1). The ranking of countries is preserved when looking at differences in terms of HLE because differences in ULE tend to be small.

6 Discussion

In this Section we put together several of the results in Section 5 to discuss them in more detail.

6.1 Compression of morbidity

The results in Section 5.2 show that for both males and females the gradient in HLE tends to be larger than the gradient in LE in most countries. This means that the high

Table 7: Decomposition of LE gender gaps

	A. Low educated				B. High educated			
	LE	LE_a	LE_b	LE_c	LE	LE_a	LE_b	LE_c
Western Europe	3.7	0.0	0.0	3.7	1.5	0.0	0.0	1.5
	(0.6)	(0.0)	(0.1)	(0.6)	(0.8)	(0.0)	(0.1)	(0.8)
Austria	3.0	0.0	0.1	2.7	0.8	0.0	0.1	0.7
	(0.9)	(0.0)	(0.2)	(0.9)	(1.2)	(0.0)	(0.2)	(1.2)
France	4.2	0.0	-0.0	4.2	2.0	-0.0	-0.0	2.0
	(0.7)	(0.0)	(0.1)	(0.7)	(1.1)	(0.0)	(0.3)	(1.1)
Eastern Europe	5.6	-0.0	-0.0	5.7	5.5	-0.0	0.2	5.3
	(0.4)	(0.0)	(0.1)	(0.4)	(0.9)	(0.0)	(0.2)	(0.9)
Czechia	4.9	-0.0	0.2	4.7	7.3	-0.0	0.1	7.2
	(0.7)	(0.0)	(0.2)	(0.7)	(1.5)	(0.0)	(0.3)	(1.5)
Estonia	7.3	-0.0	-0.2	7.4	5.1	-0.0	0.3	4.8
	(0.8)	(0.0)	(0.1)	(0.8)	(1.3)	(0.0)	(0.3)	(1.3)
Poland	5.3	0.0	-0.0	5.3	0.9	-0.0	-0.1	1.1
	(1.0)	(0.0)	(0.2)	(1.0)	(3.1)	(0.0)	(1.0)	(2.9)
Slovenia	4.4	-0.0	0.2	4.1	4.8	-0.0	0.7	4.1
	(1.2)	(0.0)	(0.2)	(1.2)	(2.0)	(0.0)	(0.7)	(2.0)
Mediterranean	3.7	0.0	-0.6	4.3	1.3	0.0	0.3	1.0
	(0.4)	(0.0)	(0.1)	(0.4)	(1.4)	(0.0)	(0.3)	(1.4)
Italy	2.8	-0.0	-0.8	3.7	2.8	0.0	0.5	1.9
	(0.6)	(0.0)	(0.2)	(0.6)	(2.0)	(0.0)	(0.5)	(2.0)
Spain	4.4	0.0	-0.4	4.8	0.9	-0.0	-0.1	1.2
	(0.6)	(0.0)	(0.1)	(0.6)	(1.9)	(0.0)	(0.5)	(1.9)
Scandinavia	1.8	-0.0	-0.0	1.8	1.9	-0.0	0.1	1.8
	(0.5)	(0.0)	(0.1)	(0.5)	(0.8)	(0.0)	(0.1)	(0.7)
Denmark	1.3	-0.0	0.1	1.3	1.5	-0.0	0.3	1.2
	(0.9)	(0.0)	(0.2)	(0.9)	(1.1)	(0.0)	(0.2)	(1.1)
Sweden	2.1	0.0	-0.1	2.2	2.4	-0.0	0.0	2.4
	(0.7)	(0.0)	(0.2)	(0.7)	(0.9)	(0.0)	(0.1)	(0.9)
England	3.5	0.0	-0.0	3.5	1.3	0.0	-0.1	1.4
	(0.3)	(0.0)	(0.1)	(0.3)	(0.7)	(0.0)	(0.1)	(0.7)
US	3.3	-0.0	-0.3	3.7	2.9	-0.0	-0.3	3.2
	(0.3)	(0.0)	(0.1)	(0.3)	(0.5)	(0.0)	(0.1)	(0.5)
Average	3.9	-0.0	-0.1	4.0	2.9	-0.0	0.1	2.6
	(0.2)	(0.0)	(0.0)	(0.2)	(0.5)	(0.0)	(0.1)	(0.5)

Notes: LE stands for the gender gap in life expectancy at age 50. LE_a, LE_b, and LE_c correspond to the counterfactual gender gaps in life expectancies when genders differ only in the health distribution at age 50, only in the health transition conditional on survival, and only in probability of survival respectively. Panel A refers to non-college individuals, Panel B to individuals with a college degree. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE 8: Decomposition of HLE gender gaps

	A. Low educated				B. High educated			
	HLE	HLE_a	HLE_b	HLE_c	HLE	HLE_a	HLE_b	HLE_c
Western Europe	2.6	0.0	0.0	2.6	1.0	0.0	0.0	1.0
	(0.5)	(0.0)	(0.3)	(0.4)	(0.8)	(0.0)	(0.6)	(0.6)
Austria	2.2	0.0	0.1	2.0	0.8	0.0	0.4	0.3
	(0.8)	(0.0)	(0.5)	(0.7)	(1.2)	(0.0)	(0.7)	(0.9)
France	2.9	0.0	-0.1	3.0	1.0	-0.0	-0.3	1.3
	(0.6)	(0.0)	(0.4)	(0.5)	(1.2)	(0.0)	(1.0)	(0.8)
Eastern Europe	4.1	-0.0	0.0	4.1	4.9	-0.0	0.8	4.2
	(0.4)	(0.0)	(0.2)	(0.3)	(0.8)	(0.0)	(0.5)	(0.7)
Czechia	3.9	-0.0	0.4	3.4	5.5	-0.0	0.2	5.4
	(0.7)	(0.0)	(0.4)	(0.5)	(1.5)	(0.0)	(0.9)	(1.2)
Estonia	4.9	-0.0	-0.5	5.4	4.8	-0.0	0.9	3.9
	(0.7)	(0.0)	(0.4)	(0.6)	(1.2)	(0.0)	(0.8)	(1.0)
Poland	3.8	0.1	-0.1	3.7	0.6	-0.0	-0.2	1.1
	(0.9)	(0.0)	(0.6)	(0.8)	(3.0)	(0.0)	(2.5)	(2.0)
Slovenia	3.6	-0.1	0.7	2.9	5.2	-0.0	2.2	2.8
	(1.1)	(0.0)	(0.6)	(0.9)	(2.1)	(0.0)	(1.5)	(1.5)
Mediterranean	1.4	0.0	-1.6	3.0	2.1	0.0	0.9	1.2
	(0.4)	(0.0)	(0.2)	(0.3)	(1.5)	(0.0)	(0.9)	(1.3)
Italy	0.4	-0.0	-2.2	2.6	4.2	0.0	2.2	1.8
	(0.5)	(0.0)	(0.4)	(0.4)	(2.3)	(0.0)	(1.5)	(1.7)
Spain	2.3	0.0	-1.1	3.3	1.0	-0.0	-0.2	1.3
	(0.6)	(0.0)	(0.3)	(0.5)	(1.9)	(0.0)	(1.2)	(1.7)
Scandinavia	1.2	-0.1	-0.1	1.3	2.0	-0.0	0.4	1.6
	(0.5)	(0.0)	(0.4)	(0.4)	(0.8)	(0.0)	(0.5)	(0.6)
Denmark	1.0	-0.1	0.3	0.8	2.0	-0.0	0.8	1.1
	(0.9)	(0.0)	(0.6)	(0.7)	(1.1)	(0.0)	(0.6)	(1.0)
Sweden	1.4	0.0	-0.3	1.7	2.0	-0.0	0.2	1.9
	(0.7)	(0.0)	(0.5)	(0.5)	(1.0)	(0.0)	(0.7)	(0.7)
England	2.0	0.0	-0.2	2.2	0.3	0.0	-0.5	0.8
	(0.3)	(0.0)	(0.3)	(0.2)	(0.7)	(0.0)	(0.5)	(0.5)
US	1.6	-0.1	-0.8	2.6	1.5	-0.0	-0.9	2.5
	(0.3)	(0.0)	(0.2)	(0.2)	(0.5)	(0.0)	(0.3)	(0.4)
Average	2.5	-0.0	-0.3	2.8	1.5	-0.0	0.4	2.0
	(0.2)	(0.0)	(0.1)	(0.2)	(0.5)	(0.0)	(0.3)	(0.4)

Notes: HLE stands for the gender gap in healthy life expectancy at age 50. HLE_a, HLE_b, and HLE_c correspond to the counterfactual gender gaps in healthy life expectancies when genders differ only in the health distribution at age 50, only in the health transition conditional on survival, and only in probability of survival respectively. Panel A refers to non-college individuals, Panel B to individuals with a college degree. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE 9: Decomposition of ULE gender gaps

	A. Low educated				B. High educated			
	ULE	ULE_a	ULE_b	ULE_c	ULE	ULE_a	ULE_b	ULE_c
Western Europe	1.0	-0.0	0.0	1.1	0.5	-0.0	-0.0	0.5
	(0.3)	(0.0)	(0.2)	(0.2)	(0.5)	(0.0)	(0.5)	(0.2)
Austria	0.8	-0.0	0.0	0.8	-0.0	-0.0	-0.3	0.4
	(0.4)	(0.0)	(0.3)	(0.2)	(0.7)	(0.0)	(0.6)	(0.4)
France	1.3	-0.0	0.1	1.3	0.9	0.0	0.2	0.6
	(0.3)	(0.0)	(0.3)	(0.2)	(0.8)	(0.0)	(0.7)	(0.3)
Eastern Europe	1.6	0.0	-0.0	1.6	0.6	0.0	-0.5	1.1
	(0.2)	(0.0)	(0.2)	(0.1)	(0.4)	(0.0)	(0.4)	(0.2)
Czechia	1.1	0.0	-0.2	1.3	1.8	0.0	-0.1	1.7
	(0.3)	(0.0)	(0.2)	(0.2)	(0.9)	(0.0)	(0.7)	(0.5)
Estonia	2.4	0.0	0.3	2.0	0.4	0.0	-0.7	0.9
	(0.3)	(0.0)	(0.3)	(0.2)	(0.6)	(0.0)	(0.5)	(0.3)
Poland	1.5	-0.1	0.0	1.5	0.1	0.0	0.1	-0.0
	(0.5)	(0.0)	(0.4)	(0.3)	(2.0)	(0.0)	(1.6)	(1.2)
Slovenia	0.8	0.0	-0.4	1.2	-0.4	0.0	-1.4	1.2
	(0.5)	(0.0)	(0.4)	(0.3)	(1.1)	(0.0)	(0.9)	(0.8)
Mediterranean	2.3	-0.0	1.0	1.3	-0.8	-0.0	-0.7	-0.2
	(0.2)	(0.0)	(0.2)	(0.1)	(0.6)	(0.0)	(0.6)	(0.3)
Italy	2.4	0.0	1.3	1.1	-1.5	-0.0	-1.6	0.1
	(0.3)	(0.0)	(0.2)	(0.2)	(1.1)	(0.0)	(1.1)	(0.5)
Spain	2.1	-0.0	0.7	1.5	-0.1	0.0	0.1	-0.2
	(0.3)	(0.0)	(0.2)	(0.2)	(0.7)	(0.0)	(0.7)	(0.3)
Scandinavia	0.6	0.1	0.1	0.5	-0.1	0.0	-0.3	0.2
	(0.3)	(0.0)	(0.2)	(0.1)	(0.4)	(0.0)	(0.3)	(0.2)
Denmark	0.4	0.1	-0.2	0.4	-0.5	0.0	-0.5	0.0
	(0.4)	(0.0)	(0.4)	(0.2)	(0.4)	(0.0)	(0.4)	(0.2)
Sweden	0.7	-0.0	0.2	0.5	0.4	0.0	-0.2	0.5
	(0.3)	(0.0)	(0.3)	(0.2)	(0.6)	(0.0)	(0.6)	(0.3)
England	1.5	-0.0	0.1	1.4	0.9	-0.0	0.4	0.6
	(0.2)	(0.0)	(0.2)	(0.1)	(0.5)	(0.0)	(0.4)	(0.3)
US	1.6	0.1	0.5	1.1	1.4	0.0	0.5	0.8
	(0.1)	(0.0)	(0.1)	(0.1)	(0.2)	(0.0)	(0.2)	(0.1)
Average	1.4	0.0	0.2	1.2	1.4	0.0	-0.3	0.6
	(0.1)	(0.0)	(0.1)	(0.1)	(0.3)	(0.0)	(0.2)	(0.1)

Notes: ULE stands for the gender gap in unhealthy life expectancy at age 50. ULE_a, ULE_b, and ULE_c correspond to the counterfactual gender gaps in unhealthy life expectancies when genders differ only in the health distribution at age 50, only in the health transition conditional on survival, and only in probability of survival respectively. Panel A refers to non-college individuals, Panel B to individuals with a college degree. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE 10: Compression of morbidity

	A. Males			B. Females		
	(1)	(2)	(3)	(1)	(2)	(3)
slope	-0.11	-0.15**	-0.04	-0.28*	-0.46**	-0.02
	(0.07)	(0.06)	(0.09)	(0.14)	(0.17)	(0.16)
Country FE	No	Yes	No	No	Yes	No
Edu FE	No	No	Yes	No	No	Yes
N	24	24	24	24	24	24

Notes: This Table displays the estimated slope parameter of a regression of ULE against LE, standard errors in parenthesis. Statistical significance: * at 10%, ** at 5%, *** at 1%

educated individuals not only live longer but also spend fewer years in disability, that is, they have smaller ULE. This result is a cross-sectional version of the recent findings on the compression of morbidity: the conjecture that the increase in LE over the last decades has happened in parallel to a decline in ULE, so that as we live longer we also spend less time in disability.[14]

In order to look at these results in more detail, we regress the ULE against the LE for all countries and education groups, separately for males and females. A negative sign would be evidence of compression of morbidity across education and countries. The results are reported in Table 10. In the first column of each Panel we see an estimated negative correlation between ULE and LE for both males and females, which is marginally non-significant. When we add country fixed effects to the regression —to isolate the variation coming from education— the point estimates are still negative, larger and more precise, see the second column in each Panel. In particular, an extra year of life is associated with almost 2 fewer months in disability for males and almost 6 fewer months in disability for females. If instead we add education fixed effects —to explore cross-country variation only— the estimations show a lack of correlation between ULE and LE, see the third column in each Panel. All in all, there is a clear compression of morbidity across education groups within countries but no compression of morbidity across countries.

Finally, our decomposition results discussed in Section 5.3 show how the compression of morbidity appears across education groups. Mortality differences across education groups do not generate a negative correlation between ULE and LE but a positive one.

[14]Fries (1980) was the first to note that the delay in mortality in the US may have been associated to an even larger delay in the onset of disease or disability, thereby reducing the average time spent in poor health. This was in contrast to Gruenberg (1977), who argued that delays in mortality are associated to smaller delays in the onset of disease and hence to increases in unhealthy life expectancy. Recent results by Cutler et al. (2013) confirm the compression of morbidity in the US since the 90's. See Fries et al. (2011) for a survey of this literature.

TABLE 11: Women get sicker but men die quicker

	A. Low educated			B. High educated		
	(1)	(2)	(3)	(1)	(2)	(3)
slope	0.19**	0.34***	-0.01	0.01	0.12	-0.06
	(0.08)	(0.04)	(0.09)	(0.10)	(0.07)	(0.14)
Country FE	No	Yes	No	No	Yes	No
Gender FE	No	No	Yes	No	No	Yes
N	24	24	24	24	24	24

Notes: This Table displays the estimated slope parameter of a regression of ULE against LE, standard errors in parenthesis. Statistical significance: * at 10%, ** at 5%, *** at 1%

This means that the high educated experience lower mortality in the bad health state, which prolongs the duration of this state. Instead, the compression of morbidity is created by education differences in the health transition: because education protects the health evolution after age 50, the high-educated visit disability less often and hence have lower average ULE.

6.2 Women get sicker but men die quicker

The gender differences in life expectancy are not associated to a compression of morbidity. In particular, in Section 5.5 we showed that females, who live longer, also tend to spend more time in disability: on average across our 12 countries, low educated females live 3.9 more year than men and spend 1.4 more years in disability, whereas high educated females live 2.8 more years than men and spend 0.4 more years in disability. The higher morbidity among females is a well-known phenomenon, see Van Oyen et al. (2013) and Case and Paxson (2005) for recent evidence in the EU and the US respectively.

In order to look at these results in more detail, we regress the ULE against the LE for all countries and gender groups, separately for low educated and high educated individuals. A positive sign would be evidence of the phenomenon "women get sicker but men die quicker", which is the opposite from a compression of morbidity. The results are reported in Table 11, Panel A for the low educated and Panel B for the high educated. The first column in Panel A shows a positive and significant coefficient equal to 0.19. When adding country fixed effects to the regression in order to isolate gender variation only, the estimated coefficient increases to 0.34 and it is estimated with even more precision, see the second column in Panel A. This means that among the low educated each extra year of LE for females is associated to 4 extra months in disability. Instead, this pattern is much less clear among the high educated. In the first column of Panel B we see that the estimated

TABLE 12: Cross country regressions: education gradients

	A. Males			B. Females		
	LE	HLE	ULE	LE	HLE	ULE
Gini income	0.10*	0.10*	0.00	-0.09	-0.04	-0.05
	(0.05)	(0.05)	(0.05)	(0.09)	(0.09)	(0.07)
Health spending	-0.44**	-0.08	-0.35**	-0.12	0.09	-0.18
	(0.19)	(0.23)	(0.14)	(0.35)	(0.34)	(0.25)
Edu gradient ever smoked, (m,f)	-1.13	-3.41	2.09	-8.55	-2.90	-6.09
	(5.02)	(4.80)	(3.72)	(6.00)	(6.30)	(4.39)

Notes: Each entry reports the regression coefficient of the corresponding life expectancy on the gini index of income (first row), the health spending over GDP (second row), and the education gradient in smoking for males or females (third row). Standard errors in parenthesis. Statistical significance: * at 10%, ** at 5%, *** at 1%

coefficient is 0.01 among the high educated, which increases to 0.12 when adding country fixed effects, see column 2. However, in both cases the estimated coefficients have very little precision and are not statistically different from zero. Therefore, the well-known notion that "women get sicker but men die quicker" seems to be absent among high educated individuals.

Finally, the decomposition results in Section 5.6 shows that the "women get sicker but men die quicker" phenomenon among the low-educated is driven by gender differences in mortality not transitions. That is to say, when in bad health low-educated women survive more than low-educated men, which extends their duration in disability.

6.3 Country regressions

In Section 5 we have organized our results by geographical region. Alternatively, one can relate the heterogeneity of life expectancies across countries to other country-specific economic outcomes. This is useful in order to shed light on possible determinants of the observed gradients. In particular, we collect country-specific variables from different sources. First, we use data on the Gini index of income for the year 2004 from the World Development Indicators; second we use data on the share of public health spending over GDP in the year 2010 from OECD (2018); and third, we collect data on smoking behavior for males and females of different education lecels from Eurostat (2017) for the year 2014. In Table 12 we present the results of regressing the LE, HLE, and ULE gradients for males and females in each country against these variables (a different regression for each variable).

For males, we find a positive but weak correlation between inequality and the education

gradient in LE. The regression coefficient is 0.10, which indicates that the education gradient in LE is 1.6 years larger when the gini index goes from 24.9% (the lowest in the sample, Slovenia) to 40.5% (the highest in the sample, US). When looking at the relationship between inequality and the gradients in HLE and ULE, we see that all the effect goes to the HLE gradient: more unequal countries tend to have larger education gradients in LE and the extra years are all spent in good health.[15] For males, we also find a negative and strong correlation between public spending on health and the gradient in LE. The estimated regression coefficient is -0.44, which indicates that the education gradient in LE is 1.9 years smaller when the health spending goes from 4.6% of GDP (the lowest in the sample, Poland) to 8.8% (the highest in the sample, Denmark). When looking at the relationship between public health spending and the gradients in HLE and ULE, we see that all the effect goes to the ULE gradient: countries with more public health spending tend to have smaller education gradients in LE, the same gradient in HLE, and larger (in absolute value) gradients in ULE. One way to interpret this result is that public health spending allows less privileged individuals to live longer but in worse health, which would be consistent with public health spending improving the survival of less educated individuals in bad health but not improving their health transitions. Consistent with this interpretation, we find that the negative effect of public health spending on the counterfactual gradients of Section 5.3 is apparent in LE_c and ULE_c but not in LE_b and ULE_b.[16]

However, the effects for females are less clear. In particular, more income inequality is associated to lower not bigger education gradients in LE, although the less precise point estimates are far from any notion of statistical significance. For females, public spending on health is also negatively related to the education gradient in LE, but the point estimate is much smaller and less precisely estimated than for males.

These patterns relate to the literature on the determinants of the educational gradient of health outcomes, and to the question whether the gradient is the result of the income channel (the fact that more educated individuals are richer). Lleras-Muney (2005) shows how changes in compulsory education laws from 1915 to 1939 in the US led to large falls in mortality, thereby implying a causal effect of education on health.[17] Buckles et al. (2016), using the draft-avoidance behavior during the Vietnam War, show that college

[15]Because the covariance is a linear operator and LE=HLE+ULE, the regression coefficients for the gradients of HLE and ULE add up to the he regression coefficients for the gradient of LE.

[16]The regressions of the counterfactual gradients can be found in Table B.6 of Appendix B.

[17]However, evidence for other countries is less clear. For instance, using the same type of variation as Lleras-Muney (2005), Clark and Royer (2013) and Meghir et al. (2013) report no effect of an additional year of schooling on adult mortality in Britain and Sweden, respectively.

completion reduces cumulative mortality by 30 percent for males. But support for the income channel is weak. For instance, evidence from the quasi-natural experiments of the Rand Health Insurance Experiment and the Oregon Health Insurance Experiment (see Aron-Dine et al. (2013) and Finkelstein et al. (2012) respectively) points to mild or null improvements in health outcomes as a result of giving access to public health care to low income individuals. Our own evidence is inconclusive: results for males seem to support the income channel but when putting together males and females the picture that emerges is more complex.

Finally, education gradients in LE may also arise because of different behavior or lifestyle across groups that do not need to be related to income differences. There is evidence that higher socio-economic groups benefit more from newly arising opportunities for lowering mortality, see for instance Mackenbach et al. (2015a) and Mackenbach et al. (2017). Among these opportunities smoking is a clear case as it is a strong predictor of mortality and is today more prevalent among the low educated. Furthermore, differences in smoking among demographic groups have already been related to differences in mortality, see for instance Preston and Wang (2006). For this reason, we regress our education gradients in life expectancies against measures of smoking gradients across countries. We find no significant relationship across countries between the smoking gradients and the life expectancy gradients, see 3rd row in Table 12.

7 Conclusions

The use of harmonized household-level panel data for the elderly, allows to compare morbidity and mortality across countries and in particular, their relationship with a wealth of demographic and socio-economic variables. In this paper we have unlocked the potential of the SHARE data set for the first time to compare life expectancy and healthy life expectancy across countries, with a focus on the interaction between education and gender.

The common patterns that emerge across countries are interesting and some of them novel. In particular, we document that the interaction between gender and socio-economic status —a dimension that has been largely overlooked— is important. We find that the education gradient in life expectancy tends to be larger for males than for females and that the gender gap in life expectancy tends to be larger among the low educated than among the high educated. Furthermore, we find that the compression of morbidity across education groups turns out to be larger among females than among males and that the well-known phenomenon that females experience higher morbidity alongside lower mortality, the "women get sicker but men die quicker", is almost absent among the high-

educated individuals.

Of course, there is heterogeneity in these patterns across countries and further research may want to exploit these different experiences to learn something about the underlying causes of health inequality.

Appendix A: Building life expectancies

In this Appendix we explain how we compute the life expectancy, the healthy life expectancy and the unhealthy life expectancy from our estimated multi-state life tables. Given the parameter estimates, we recover $p_{ij}(a)$, the probability that an individual with health $i \in \{1,2\}$ transits into health $j \in \{0,1,2\}$ from age a to age $a+1$. We define Γ_a as the three-state transition matrix containing these probabilities,

$$\Gamma_a = \begin{bmatrix} p_{11}(a) & p_{21}(a) & 0 \\ p_{12}(a) & p_{22}(a) & 0 \\ p_{10}(a) & p_{20}(a) & 1 \end{bmatrix}$$

where each matrix entry is the probability of transiting between any two states at age a (of course, dead is an absorbing state). Now, let's define the 3×1 vector z_a as the vector describing the fraction of individuals in each state $(z_0(a), z_1(a), z_2(a))$. Given an initial health distribution at age $a = 50$ (our initial age) we can compute, $z_{a+1} = \Gamma_a z_a$ for all ages.[18]

To derive the expected duration in each health status, we start by computing the expected years lived in each health status in the interval $(a, a+1)$. The expected years lived in status $i \in \{1,2\}$ is given by:

$$z_i(a)p_{ii}(a) + \frac{1}{2}z_i(a)\Big[p_{ij}(a) + p_{i0}(a)\Big] + \frac{1}{2}z_j(a)p_{ji}(a)$$

where $j \in \{1,2\}$ and $j \neq i$. The first term counts a full year for those individuals who were in health i at age a and remain in health i at age $a+1$, the second term counts half-year for those individuals who were in health i at age a and change state (either to health j or to death) before age $a+1$, and the third term counts half-year for those individuals who were in health j at age a and transit to state i before age $a+1$. Thus the expected duration at age 50 in status i is given by:

$$ED_i = \sum_{a=50}^{\bar{a}} z_i(a)p_{ii}(a) + \frac{1}{2}z_i(a)\Big[p_{ij}(a) + p_{i0}(a)\Big] + \frac{1}{2}z_j(a)p_{ji}(a)$$

where $\bar{a} = 90$. Keeping with our notation, HLE $\equiv ED_2$, ULE $\equiv ED_1$, and LE = HLE+ULE.

[18] To compute the health distribution at age 50 we use the average share of individuals in good health between ages 50 and 54

Appendix B: Extra tables

TABLE B.1: Educational Attainment

	EUROSTAT (Age 55-74)		Sample (Age 55-74)		Sample (Age 50-90)	
	Males	Females	Males	Females	Males	Females
Austria*	19.6	7.9	20.0	14.2	20.3	14.6
Belgium	22.7	17.2	29.1	24.4	29.7	25.6
Czechia*	13.9	7.8	20.6	11.7	20.3	12.1
Denmark*	25.1	23.1	36.5	36.5	37.4	37.7
Estonia*	26.8	31.4	21.4	20.5	21.7	21.2
France*	15.9	13.2	20.5	16.5	20.8	16.9
Germany	30.1	13.8	33.5	20.4	33.6	20.7
Greece	15.3	7.7	18.6	8.8	19.2	9.5
Italy*	8.9	6.3	8.6	5.8	8.9	6.1
Netherlands	29.1	17.0	26.5	16.5	27.2	17.7
Poland*	12.9	10.9	6.4	5.4	6.4	5.3
Slovenia*	17.3	13.1	15.2	10.7	14.9	10.9
Spain*	17.3	9.6	10.8	6.8	11.1	7.9
Sweden*	21.6	26.6	21.8	22.9	21.8	22.9
Switzerland	33.8	12.7	19.3	10.4	19.6	11.3
England*	26.4	23.8	16.4	12.5	16.4	12.6
US*	31.3	24.1	27.7	20.4	27.8	21.1

Notes: An * mark indicates that the country sample has been selected for the main exercises of the paper. Sources: EUROSTAT (Population by educational attainment level, sex and age [edat_lfs_9903]) share of population age 55-74 with ISCED11 tertiary education (levels 5-8), average for years 2004-2012. For the US: OECD (2016) share of population age 55-64 with at least a bachelor's degree. Sample: In continental Europe, share of population with at least 15 years of education. In England, share of population finished full-time education after age 19. In the US, share of population with completed college.

Table B.2: Life expectancies: College

	A. Males			B. Females			C. Difference		
	LE	HLE	ULE	LE	HLE	ULE	LE	HLE	ULE
Western Europe	34.1	30.9	3.2	35.6	31.9	3.7	-1.5	-1.0	-0.5
	(0.6)	(0.6)	(0.3)	(0.6)	(0.6)	(0.4)	(0.8)	(0.8)	(0.5)
Austria	33.5	30.3	3.2	34.3	31.1	3.2	-0.8	-0.8	-0.0
	(0.8)	(0.8)	(0.4)	(0.9)	(0.9)	(0.5)	(1.2)	(1.2)	(0.7)
France	34.7	31.4	3.3	36.7	32.5	4.2	-2.0	-1.1	-0.9
	(0.8)	(0.9)	(0.5)	(0.7)	(0.8)	(0.6)	(1.1)	(1.2)	(0.8)
Eastern Europe	30.2	26.9	3.3	35.7	31.8	3.9	-5.5	-4.9	-0.6
	(0.7)	(0.6)	(0.3)	(0.5)	(0.5)	(0.3)	(0.9)	(0.8)	(0.4)
Czechia	29.6	26.6	2.9	36.9	32.1	4.7	-7.3	-5.5	-1.8
	(1.2)	(1.1)	(0.4)	(0.9)	(1.1)	(0.8)	(1.5)	(1.5)	(0.9)
Estonia	30.1	26.5	3.5	35.2	31.3	3.9	-5.1	-4.8	-0.4
	(1.1)	(1.0)	(0.4)	(0.6)	(0.7)	(0.4)	(1.3)	(1.2)	(0.6)
Poland	30.8	26.1	4.5	31.6	26.7	4.7	-0.9	-0.6	-0.1
	(1.8)	(1.8)	(1.1)	(2.5)	(2.5)	(1.7)	(3.1)	(3.0)	(2.0)
Slovenia	32.1	29.3	2.7	37.0	34.5	2.3	-4.8	-5.2	0.4
	(1.5)	(1.4)	(0.7)	(1.4)	(1.6)	(0.9)	(2.0)	(2.1)	(1.1)
Mediterranean	33.0	30.6	2.4	34.4	32.7	1.6	-1.3	-2.1	0.8
	(0.9)	(0.9)	(0.5)	(1.1)	(1.1)	(0.4)	(1.4)	(1.5)	(0.6)
Italy	33.5	30.3	3.1	36.3	34.5	1.6	-2.7	-4.2	1.5
	(1.3)	(1.4)	(0.8)	(1.6)	(1.8)	(0.8)	(2.0)	(2.2)	(1.1)
Spain	32.5	30.5	1.9	33.4	31.5	1.9	-0.9	-1.0	0.1
	(1.3)	(1.3)	(0.5)	(1.3)	(1.4)	(0.6)	(1.9)	(1.9)	(0.7)
Scandinavia	32.7	30.2	2.5	34.6	32.2	2.4	-1.9	-2.0	0.1
	(0.5)	(0.5)	(0.3)	(0.5)	(0.5)	(0.3)	(0.7)	(0.8)	(0.4)
Denmark	31.6	29.3	2.3	33.1	31.3	1.7	-1.4	-2.0	0.5
	(0.8)	(0.8)	(0.3)	(0.8)	(0.8)	(0.3)	(1.1)	(1.1)	(0.4)
Sweden	33.6	30.8	2.7	36.0	32.9	3.1	-2.4	-2.0	-0.4
	(0.7)	(0.7)	(0.4)	(0.6)	(0.7)	(0.4)	(0.9)	(1.0)	(0.6)
England	32.6	28.2	4.4	33.9	28.5	5.4	-1.3	-0.3	-0.9
	(0.5)	(0.5)	(0.3)	(0.5)	(0.5)	(0.4)	(0.7)	(0.7)	(0.5)
US	31.0	28.2	2.8	33.9	29.8	4.1	-2.9	-1.5	-1.4
	(0.4)	(0.4)	(0.1)	(0.3)	(0.3)	(0.2)	(0.5)	(0.5)	(0.2)

Notes: LE stands for life expectancy, HLE for healthy life expectancy, and ULE for unhealthy life expectancy. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancies that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

Table B.3: Life expectancies: No College

	A. Males			B. Females			C. Difference		
	LE	HLE	ULE	LE	HLE	ULE	LE	HLE	ULE
Western Europe	30.2	26.2	4.0	33.9	28.9	5.0	-3.7	-2.6	-1.0
	(0.5)	(0.4)	(0.2)	(0.3)	(0.3)	(0.2)	(0.6)	(0.5)	(0.2)
Austria	29.6	26.2	3.4	32.6	28.4	4.2	-3.0	-2.2	-0.8
	(0.7)	(0.7)	(0.3)	(0.5)	(0.5)	(0.2)	(0.9)	(0.8)	(0.4)
France	30.7	26.3	4.4	34.9	29.2	5.7	-4.2	-2.9	-1.3
	(0.6)	(0.5)	(0.2)	(0.4)	(0.4)	(0.2)	(0.7)	(0.6)	(0.3)
Eastern Europe	26.2	22.6	3.6	31.8	26.6	5.2	-5.6	-4.1	-1.6
	(0.4)	(0.3)	(0.1)	(0.3)	(0.2)	(0.1)	(0.4)	(0.4)	(0.2)
Czechia	26.0	22.6	3.5	31.0	26.4	4.5	-4.9	-3.8	-1.1
	(0.6)	(0.5)	(0.2)	(0.4)	(0.4)	(0.2)	(0.7)	(0.7)	(0.3)
Estonia	25.5	21.9	3.6	32.7	26.8	5.9	-7.3	-4.9	-2.4
	(0.7)	(0.6)	(0.2)	(0.5)	(0.4)	(0.3)	(0.8)	(0.7)	(0.3)
Poland	25.4	21.6	3.8	30.6	25.4	5.3	-5.3	-3.8	-1.5
	(0.8)	(0.7)	(0.3)	(0.6)	(0.6)	(0.4)	(1.0)	(0.9)	(0.5)
Slovenia	29.6	25.6	3.9	34.0	29.2	4.7	-4.4	-3.5	-0.8
	(0.9)	(0.8)	(0.4)	(0.7)	(0.7)	(0.4)	(1.2)	(1.1)	(0.5)
Mediterranean	30.0	27.2	2.8	33.6	28.6	5.1	-3.7	-1.4	-2.3
	(0.3)	(0.3)	(0.1)	(0.3)	(0.2)	(0.1)	(0.4)	(0.4)	(0.2)
Italy	30.9	28.2	2.7	33.7	28.6	5.1	-2.8	-0.4	-2.4
	(0.4)	(0.4)	(0.2)	(0.3)	(0.3)	(0.2)	(0.6)	(0.5)	(0.3)
Spain	29.0	26.2	2.8	33.4	28.5	5.0	-4.4	-2.3	-2.1
	(0.5)	(0.5)	(0.2)	(0.4)	(0.4)	(0.2)	(0.6)	(0.6)	(0.3)
Scandinavia	30.5	27.3	3.2	32.3	28.5	3.8	-1.8	-1.2	-0.6
	(0.4)	(0.4)	(0.2)	(0.4)	(0.4)	(0.2)	(0.5)	(0.5)	(0.3)
Denmark	29.6	26.3	3.3	31.0	27.3	3.7	-1.3	-0.9	-0.4
	(0.6)	(0.6)	(0.3)	(0.6)	(0.6)	(0.3)	(0.9)	(0.9)	(0.4)
Sweden	31.1	27.9	3.2	33.2	29.3	3.9	-2.1	-1.4	-0.7
	(0.5)	(0.5)	(0.2)	(0.4)	(0.5)	(0.2)	(0.7)	(0.7)	(0.3)
England	29.2	23.5	5.7	32.7	25.5	7.2	-3.5	-2.0	-1.5
	(0.3)	(0.3)	(0.1)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.2)
US	27.5	23.0	4.5	30.7	24.6	6.1	-3.3	-1.6	-1.6
	(0.2)	(0.2)	(0.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.3)	(0.1)

Notes: LE stands for life expectancy, HLE for healthy life expectancy, and ULE for unhealthy life expectancy. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancies that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE B.4: Life expectancies: Pooled education

	A. Males			B. Females			C. Difference		
	LE	HLE	ULE	LE	HLE	ULE	LE	HLE	ULE
Western Europe	31.3	27.4	3.8	34.3	29.5	4.8	-3.0	-2.0	-1.0
	(0.4)	(0.3)	(0.2)	(0.3)	(0.3)	(0.2)	(0.5)	(0.4)	(0.2)
Austria	30.8	27.5	3.3	32.9	28.9	4.0	-2.1	-1.4	-0.7
	(0.6)	(0.5)	(0.2)	(0.5)	(0.4)	(0.2)	(0.7)	(0.7)	(0.3)
France	31.7	27.4	4.2	35.2	29.8	5.4	-3.5	-2.3	-1.2
	(0.5)	(0.4)	(0.2)	(0.3)	(0.3)	(0.2)	(0.6)	(0.6)	(0.3)
Eastern Europe	26.9	23.3	3.6	32.4	27.4	5.0	-5.5	-4.0	-1.4
	(0.3)	(0.3)	(0.1)	(0.2)	(0.2)	(0.1)	(0.4)	(0.4)	(0.2)
Czechia	26.7	23.3	3.3	31.5	27.0	4.5	-4.8	-3.7	-1.2
	(0.5)	(0.5)	(0.2)	(0.4)	(0.4)	(0.2)	(0.7)	(0.6)	(0.3)
Estonia	26.4	22.9	3.5	33.3	27.9	5.5	-6.9	-5.0	-1.9
	(0.6)	(0.5)	(0.2)	(0.4)	(0.4)	(0.2)	(0.7)	(0.6)	(0.3)
Poland	26.0	22.1	3.8	30.8	25.6	5.2	-4.8	-3.4	-1.4
	(0.7)	(0.7)	(0.3)	(0.6)	(0.6)	(0.4)	(0.9)	(0.9)	(0.5)
Slovenia	30.1	26.4	3.7	34.3	29.8	4.5	-4.2	-3.4	-0.8
	(0.8)	(0.8)	(0.3)	(0.6)	(0.6)	(0.3)	(1.1)	(1.0)	(0.5)
Mediterranean	30.2	27.5	2.8	33.7	28.8	4.9	-3.4	-1.3	-2.1
	(0.3)	(0.3)	(0.1)	(0.2)	(0.2)	(0.1)	(0.4)	(0.4)	(0.2)
Italy	31.2	28.4	2.8	33.8	28.8	5.0	-2.7	-0.4	-2.2
	(0.4)	(0.4)	(0.2)	(0.3)	(0.3)	(0.2)	(0.5)	(0.5)	(0.3)
Spain	29.4	26.6	2.8	33.4	28.6	4.8	-4.1	-2.0	-2.0
	(0.5)	(0.4)	(0.1)	(0.4)	(0.3)	(0.2)	(0.6)	(0.5)	(0.2)
Scandinavia	31.1	28.2	3.0	33.0	29.7	3.3	-1.9	-1.5	-0.3
	(0.3)	(0.3)	(0.1)	(0.3)	(0.3)	(0.1)	(0.4)	(0.4)	(0.2)
Denmark	30.3	27.4	2.9	31.8	28.8	3.0	-1.5	-1.4	-0.1
	(0.5)	(0.5)	(0.2)	(0.5)	(0.5)	(0.2)	(0.7)	(0.7)	(0.3)
Sweden	31.8	28.8	3.0	33.9	30.4	3.5	-2.1	-1.6	-0.5
	(0.4)	(0.4)	(0.2)	(0.3)	(0.4)	(0.2)	(0.5)	(0.6)	(0.3)
England	29.8	24.4	5.4	32.8	26.0	6.9	-3.0	-1.6	-1.5
	(0.2)	(0.2)	(0.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.3)	(0.2)
US	28.3	24.3	4.1	31.3	25.5	5.8	-3.0	-1.3	-1.7
	(0.2)	(0.2)	(0.1)	(0.2)	(0.2)	(0.1)	(0.3)	(0.2)	(0.1)

Notes: LE stands for life expectancy, HLE for healthy life expectancy, and ULE for unhealthy life expectancy. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancies that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

Table B.5: Gender-education gradients

	LE	HLE	ULE
Western Europe	5.4	5.6	-0.3
	(0.7)	(0.7)	(0.4)
Austria	4.6	4.9	-0.2
	(1.2)	(1.1)	(0.5)
France	5.9	6.1	-0.2
	(0.9)	(1.0)	(0.7)
Eastern Europe	9.5	9.2	0.3
	(0.6)	(0.6)	(0.4)
Czechia	10.8	9.5	1.2
	(1.1)	(1.2)	(0.8)
Estonia	9.8	9.4	0.3
	(0.9)	(0.9)	(0.5)
Poland	6.3	5.1	0.9
	(2.6)	(2.6)	(1.7)
Slovenia	7.3	8.9	-1.7
	(1.7)	(1.8)	(1.0)
Mediterranean	4.4	5.5	-1.2
	(1.1)	(1.2)	(0.4)
Italy	5.3	6.3	-1.2
	(1.6)	(1.8)	(0.8)
Spain	4.4	5.3	-1.0
	(1.4)	(1.5)	(0.6)
Scandinavia	4.1	4.9	-0.8
	(0.6)	(0.7)	(0.3)
Denmark	3.4	5.0	-1.6
	(1.0)	(1.0)	(0.4)
Sweden	4.9	5.0	-0.1
	(0.8)	(0.8)	(0.5)
England	4.7	5.0	-0.3
	(0.6)	(0.6)	(0.4)
US	6.5	6.8	-0.3
	(0.4)	(0.4)	(0.2)

Notes: LE stands for life expectancy, HLE for healthy life expectancy, and ULE for unhealthy life expectancy, all at age 50. The Gender-education gradient is the difference in the corresponding life expectancy between college females and non-college males. For each country we report the median (and the standard deviation in parenthesis) of the distribution of the corresponding life expectancy that arises from the posterior distribution of the estimated $\boldsymbol{\beta}$ parameters.

TABLE B.6: Cross-country regressions: education gradients and their decompositions

	A. Males			B. Females		
	LE	HLE	ULE	LE	HLE	ULE
Gini income	0.10*	0.10*	0.00	-0.09	-0.04	-0.05
	(0.05)	(0.05)	(0.05)	(0.09)	(0.09)	(0.07)
Health spending	-0.44**	-0.08	-0.35**	-0.12	0.09	-0.18
	(0.19)	(0.23)	(0.14)	(0.35)	(0.34)	(0.25)
Edu gradient ever smoked, (m,f)	-1.13	-3.41	2.09	-8.55	-2.90	-6.09
	(5.02)	(4.80)	(3.72)	(6.00)	(6.30)	(4.39)
	A. Males			B. Females		
	LE_b	HLE_b	ULE_b	LE_b	HLE_b	ULE_b
Gini income	0.01	0.02	-0.01	0.01	0.03	-0.02
	(0.03)	(0.06)	(0.03)	(0.03)	(0.08)	(0.05)
Health spending	0.13	0.34	-0.20*	0.12	0.26	-0.12
	(0.09)	(0.19)	(0.11)	(0.10)	(0.28)	(0.19)
Edu gradient ever smoked, (m,f)	-1.39	-4.00	2.69	0.66	3.60	-2.74
	(2.16)	(4.57)	(2.57)	(1.98)	(5.29)	(3.42)
	A. Males			B. Females		
	LE_c	HLE_c	ULE_c	LE_c	HLE_c	ULE_c
Gini income	0.09	0.07	0.02	-0.10	-0.06	-0.04
	(0.07)	(0.05)	(0.02)	(0.10)	(0.06)	(0.05)
Health spending	-0.55**	-0.41**	-0.13*	-0.23	-0.21	-0.01
	(0.21)	(0.16)	(0.06)	(0.39)	(0.21)	(0.18)
Edu gradient ever smoked, (m,f)	0.55	1.33	-0.80	-12.13*	-6.38	-5.58*
	(5.88)	(4.51)	(1.56)	(6.28)	(3.69)	(2.86)

Notes: Each entry reports the regression coefficient of the corresponding life expectancy gradient on the gini index of income (first row), the health spending over GDP (second row), and the education gradient in smoking for males or females (third row). The top block refers to the actual gradients, the middle block refers to the counterfactual gradients in which education groups only differ in transitions, and the bottom block refers to the counterfactual gradients in which education groups only differ in conditional mortality. Standard errors in parenthesis. Statistical significance: * at 10%, ** at 5%, *** at 1%

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