ORIGINAL PAPER

Social health inequalities among older Europeans: the contribution of social and family background

Sandy Tubeuf · Florence Jusot

Abstract This analysis aims to get a step further in the understanding of the determining factors of social health inequalities, and to explore particularly the role played by parents' social status and their vital status or age at death on the social health inequalities in adulthood among European older adults. The wealth-related health inequalities are measured using the popular concentration index. We then implement the decomposition method of the indices and evaluate the contribution of the various determinants of health introduced in interval regression models. Health is measured using self-assessed health and country-specific cut-points that correct observed differences in self-report due to cross-cultural differences in reporting styles. This paper uses data for ten European countries from the first wave of the 2004 SHARE. The study highlights significantly higher wealth-related health inequalities in the Netherlands, Denmark and Germany. These social inequalities of health in Europe are explained largely by individuals' current social conditions, particularly wealth. Nevertheless, our analysis attests the existence of a long-term influence of initial conditions in childhood on health in middle-aged and beyond, independently of current social characteristics, which contribute to differences in health status across social groups. This article contributes to the identification of social determinants, which are important determinants of health and follows recommendations suggested to help 'close the gap' in various health inequities.

Keywords Concentration index · Decomposition · Europe · Inequality · Older adults

JEL Classification D63 · I18 · J14

Introduction

A large number of recent European studies have shown persistent social health inequalities in general population data [1, 2], as well as in samples of older adults [3]. Tackling social health inequalities in later life and improving the underlying socioeconomic determinants for older people is at the core of the European Union healthy ageing strategy and health-promotion activity.

Whereas many studies have investigated the understanding of the underlying mechanisms of health inequalities, they tend to highlight the importance of socio-economic characteristics in explaining systematic differences in health status [4, 5]. From a methodological point of view, a large part of the economic literature has developed methods aimed at measuring the level of social health inequality and at understanding the sources of social health inequalities. In this context, the degree of social health inequality is measured using a concentration index, which is then decomposed in order to highlight the pathways through which inequality occurs [6]. This method has been employed mainly to explore income-related differences in health across European countries [7]. In spite of the various possible applications of such a method, most of the empirical analyses have relied on the evaluation of the contribution to

S. Tubeuf (✉)
Academic Unit of Health Economics, Leeds Institute of Health Sciences, University of Leeds, Charles Thackrah Building, 101 Clarendon Road, Leeds LS2 9LJ, UK
e-mail: s.tubeuf@leeds.ac.uk

F. Jusot
LEGOS, Université Paris-Dauphine, Bureau A 522, Place du Maréchal de Lattre de Tassigny, 75775 Paris Cedex 16, France
e-mail: florence.jusot@dauphine.fr

social health inequalities of the same set of current individual determinants, namely income, education level, wealth, social and marital status as well as insurance or geographical characteristics. Nevertheless, if the decomposition of inequalities is critical to explore pathways of social health inequalities, there is a need to explore not only the role played by current characteristics but also past characteristics, such as childhood conditions, which have never been included in these types of analyses. Indeed, if we first refer to differences in the long-term impact of social background on health status in European countries [8], and second to the existence of international differences across intergenerational social mobility [9], it is relevant to understand how much of the magnitude of social health inequalities those factors explain within each country and on inequality differences between European countries.

Therefore, the main motivation for this study is to go a step further in the understanding of the determining factors of social health inequality, and to explore particularly the role played by parents' social status and their vital status or age at death on social health inequalities in adulthood among older adults.

Numerous studies in both the health economics and epidemiological literature have shown that family background is a relevant determinant of health status in adulthood in addition to current social characteristics [10–17]. Two channels of direct influence of childhood circumstances have been highlighted: the direct influence of social background through an effect of childhood living conditions on health status following a latency period, and a transmission of health status across generations through a common genetic inheritance, transmission of lifestyles, risky health-related behaviours, and preferences for health or similar exposure to risky or protective environments. Moreover, differences in the magnitude of the direct impact of family background on health status between European countries have recently been shown [8].

However, we focus on the analysis of health inequalities that display a systematic relationship with indicators of socio-economic status, namely wealth. We therefore restrict our attention to the additional explanation of social health inequalities provided by family background in comparison to current characteristics. Indeed, social background is not randomly distributed across the population if considering social reproduction phenomena. It is thus an important question for the understanding of social health inequalities to know the share of the latter that may be attributable to the direct effect of social background and to the transmission of health status across generations, due to the unequal distribution of family background across wealth groups.

Pioneered by Bourdieu [18], the theory of social reproduction across generations has been well-studied and confirmed in numerous empirical research studies in economics and sociology [17, 19–21]. More recently, the PISA follow-up survey focussing on education achievement and social background of young Europeans aged between 16 and 35 has shown that there is a substantial reproduction effect by the transmission of cultural capital in the family. Nevertheless, it seems that social reproduction differs from one country to another [8, 22] and it is this particular aspect that we are interested in exploring in the present paper: how are social health inequalities in the different European countries influenced by social and family background?

Our study relies on data for ten European countries (Germany, Austria, Spain, Denmark, France, Greece, Italy, the Netherlands, Sweden and Switzerland) from the first wave of the 2004 SHARE. We measure wealth-related health inequalities in each of these countries using the popular concentration index and then implement the decomposition method to evaluate the contribution of the various new and relevant determinants of health. Health is measured using self-assessed health and country-specific cut-points [23], which correct observed differences in self-reports due to cross-cultural differences in reporting styles within an interval grouped regression [24]. We explore the impact of current and past living conditions on cross-country differences in estimated inequality.

The following sections (Data and methods) describe the data, the method and the variables used. A section on Results results then follows, with a final concluding section (Conclusion).

Data and methods

Data

This study relies on the Survey of Health, Ageing and Retirement in Europe (SHARE) carried out in 2004/2005. SHARE is a longitudinal survey that aims to collect medical, social, and economic data on the population aged over 50 in 11 European Union countries (Austria, Belgium, Denmark, France, Germany, Sweden, Greece, Italy, the Netherlands, Spain, and Switzerland) [25]. Our study focus on all these countries except Belgium; the country-specific cut-points we will use later to generate the health variable are not yet available for Belgium [23]. SHARE follows the design of the US Health and Retirement Study and the English Longitudinal Study of Ageing. It has the advantage of linking an individual's health status in adulthood with his social background. In addition to their current situation, individuals are asked about past circumstances such as their parents' final social status and demographic characteristics (age at death for deceased parents, and age at the time of the survey for parents still alive).

Measuring and decomposing inequalities

The analysis relies on the decomposition of health inequalities into explained factors using the methodology introduced by Wagstaff et al. [6]. This original empirical method permits not only the study of inequalities within each country but also comparison of the magnitude of inequalities from one country to another. The method originally analysed health inequalities over a social dimension, measured mostly by income, and takes into account various determinants influencing health, and has been meanwhile associated to the social dimension. It simultaneously decomposes inequalities into various determining factors introduced into a linear additive regression model of health, and measures the relative contribution of each of these factors to inequality.

The inequality measure relies on the calculation of a concentration index. This index relies on a health concentration curve, which plots the cumulative proportion of the population ranked by increasing social status against the cumulative proportion of health status. If health is distributed equally over the social dimension, the concentration curve coincides with the diagonal. If the sickest are concentrated among the most socially disadvantaged, then the concentration curve is below the diagonal. The farther the concentration curve is from the diagonal, the higher the degree of inequality. Conversely, if the concentration curve is above the diagonal, then the sickest are concentrated among the most socially advantaged. The concentration index is analogous to the Gini index and equals twice the area between the concentration curve and the diagonal. The concentration index takes values between -1 and $+1$. It is positive (or negative, respectively) if the concentration curve is above (below) the diagonal. The lowest (highest) value corresponds to the situation where all the health status in the population is concentrated on the most disadvantaged (most advantaged) group.

Defining y_i as individual health and R_i as the cumulative proportion of population ranked according to the social dimension up to the ith individual, the concentration index is defined by the following formula:

$$C = \left(\frac{2}{\bar{y}}\right)\text{cov}(y_i, R_i) \quad \text{where } \bar{y} = E(y_i) \tag{1}$$

If individuals are ranked in the same way according to health and social variable, then the concentration index equals the health Gini index.

The concentration index has some advantages common to those of the Gini index. Firstly, it provides both a quantified and a graphical measure of inequality. Secondly, it provides an inequality measure whose sign depends on the socioeconomic gradient of the inequalities in health. Its measurement is sensitive to changes in distribution of the population across the socioeconomic dimension. Thirdly, it can be used to compare health distributions across different populations, on condition that the indicator of health is similar from country to country. Similarly, if the indicator of health is comparable from one period to another, this tool gives an indication of changes in inequalities over a period of time.

One of the popular features of the concentration index is its ability to incorporate an econometric model for health with several control variables and subsequently proceed to the decomposition of inequality to take account of the contribution of each of these regressors. Decomposition relies on the assumption that the explained variable (i.e. health) is the sum of its regressors. The decomposition method permits inequality to be observed, and to identify its sources.

We assume that the following linear regression model defines the health status of individual i according to k regressors, such as $k = (1,\dots,K)$

$$y_i = \alpha + \sum_{k=1}^{K} \beta_k x_{ki} + u_i \tag{2}$$

The random error term, u_i is assumed to have an expected mean value equal to zero and constant variance. The β_k values are assumed constant for every individual i. By substituting this equation in the concentration index formula, we obtain

$$C = \sum_{k=1}^{K} \left(\beta_k \frac{\bar{x}_k}{\bar{y}}\right) C_k + \left(\frac{2}{\bar{y}}\right)\text{cov}(u_i, R_i) \tag{3}$$

The concentration index is assumed to be made up of two components: an explained component, equal to the weighted sum of the concentration indices of the k regressors, and a residual component. The weight represents the estimated health elasticity with respect to the regressor k. The estimated inequality in heath is thus expressed as the sum of the inequality in each of its determinants, weighted by their own elasticity with health. This decomposition method emphasises the contribution of each regressor to the explanation of inequality. It gives the respective impact on health of each regressor through the elasticity parameter $\hat{e}_k$ as well as the degree of inequality of the distribution of this regressor with respect to the social dimension through the concentration index $\hat{C}_k$.

$$\hat{C} = \sum_{k=1}^{K} \hat{e}_k \hat{C}_k \tag{4}$$

Therefore, various regressors can be considered: traditional socioeconomic regressors, such as income, education level, and activity status; geographical conditions, such as region, area or urban conditions; health insurance conditions; demographics as well as health status

characteristics, such as limitations or healthy behaviours, etc. We suggest including innovative regressors such as childhood characteristics. The main advantage of such a decomposition is that it permits computation of the contributions of particular conditions on which policymakers may concentrate and intervene.

Variables

Measurement of health

Self-assessed health (SAH) is a very widespread variable in health surveys. Although its health content has been questioned by comparison to other health indicators, it has also been found to contribute more to supplementary health information than other health indicators, even those determining mortality [26]. In the SHARE dataset, this measure of health is derived from the respondent's assessment of his/her health status at the date of the interview. It is presented as a categorical variable resulting from the question: "Would you say that your health is (1) excellent, (2) very good, (3) good, (4) normal, (5) bad".

There are two main challenges in investigating health inequalities using SAH: (1) it does not provide a cardinal measure of health, and (2) it suffers from biases such as state-dependant reporting bias [27], scale of reference bias [28], and response category cut-point shift [29].

Several methods for the cardinalisation of this measure have been proposed in response to the first point. Van Doorslaer and Jones [24] suggested modelling SAH within an interval regression. They combined external information on the distribution of a generic measure of health, such as the empirical distribution of the Health Utility Index (HUI) in the 1994 Canadian National Population Health Survey, with the distribution of observed SAH in order to obtain the thresholds of generic health that delimit the categories of the variable. This method has been found best to mimic the distribution of generic health. Subsequently the same predicted thresholds have been used in some European studies, where it was assumed that distributions of health in any European country were comparable to the Canadian distribution of health [7, 30, 31]. Although the Canadian distribution of health status is likely to be more similar to the distribution of health in Europe than in developing countries, its use at European level may be questioned as there are cultural differences in the way people report less-than-good health. Using SHARE data, large differences in general indicators of physical health, such as SAH, long-standing health problems, and activity limitations have been emphasised between countries [25]. For instance, when it comes to SAH, Germans are likely to rate their health more negatively than Dutch or Danish people, and the same applies to Italian and Spanish people as compared

to the French and Greeks. The use of the estimated Canadian HUI thresholds is therefore inadvisable despite the quality of the interval regression model.

As for the second point, there are indeed cross-country differences in reporting of health status. For example, Danes and Swedes are likely to largely overestimate their health, whereas German people underestimate [23]. Olsen and Dahl [32] propose five explanations for this. Firstly, characteristics of wellbeing, such as social benefits, are considered vital for population health. Secondly, socio-economic development is an important predictor of health: countries having a higher GDP per capita have better population health, although the marginal effect on health of an increase in GDP per capita diminishes with the country's wealth. The third explanation proposed is the correlation between health disparities and income inequalities. Fourthly, social capital and wellbeing are important determinants of health differences within countries. Finally, lifestyle and risky behaviours related to food, exercise, stress, and alcohol and tobacco consumption have been found to strongly explain poor health in some countries.

Jürges [23] has investigated the reliability of SAH as a "true" health variable on the SHARE dataset, and computed a health measure that is adjusted for cross-cultural biases. He uses several objective health indicators[1] to estimate generalised ordered Probit regressions of SAH and constructed a 0-to-1 health index, where 0 represents the worst observed health state and 1 represents perfect health. Furthermore, his health index incorporated country-cultural effects related to cultural perceptions of SAH response categories.

Consequently, we follow the cardinalisation procedure and use the estimated thresholds as calculated by Jürges [23]. Table 1 reproduces the country-specific cut-points from that study and shows, for example, that the health status of a Swedish person will be assumed to belong to the interval [0; 0.560] when reporting poor health; to the interval [0.560; 0.692] if he reports fair health; to the interval [0.692; 0.890] if he reports good health; to the interval [0.890; 0.955] if he reports very good health; and to the interval [0.955; 1] if he reports excellent health.

Concretely, we compute these estimated thresholds in country-specific interval regression models of SAH in five categories. We thus use the predictions for the latent variable defined within the econometric model described in Eq. 2, where

---

[1] The quasi-objective health indicators are 15 different reported diagnosed physical conditions, whether ever treated for depression, body mass index, grip strength and walking speed.

Table 1 Country-specific cutpoints transforming the 0-to-1 health index into self-assessed health (SAH) categories (from Jürges [23])

	Poor to fair	Fair to good	Good to very good	Very good to excellent
Austria	0.655	0.812	0.935	0.983
Germany	0.643	0.840	0.955	1.000
Sweden	0.560	0.692	0.890	0.955
Netherlands	0.604	0.809	0.938	0.983
Spain	0.625	0.813	0.948	1.000
Italy	0.616	0.821	0.948	0.983
France	0.650	0.807	0.948	1.000
Denmark	0.616	0.776	0.880	0.953
Greece	0.600	0.811	0.925	0.987
Switzerland	0.626	0.792	0.936	0.983

$$y_{i,k} = a \quad \text{if } c_{a-1,k} < y_{i,k}^* \leq c_{a,k} \tag{5}$$

The parameter $a = 1, 2, 3, 4, 5$ denotes the five categories of SAH, and the variables $c_{a-1,k}$ et $c_{a,k}$ are the estimated thresholds for country k whose values are given in Table 1. The health measure used in the subsequent analysis is thus linear and presents a useful feature for the computation and decomposition of inequality measures.

This cardinalisation procedure provides some dispersion into the initial ordered categorical distribution of SAH. Moreover, the interval regression presents several advantages. Firstly, this method avoids the inappropriate use of ordinary least squares (OLS) to model an ordinal categorical variable. Secondly, the interval regression considers country-specific and more objective health information to scale the categories of SAH, which outperforms a construction based on arbitrary rescaling that could predict health status values outside of the [0;1] interval. Finally, it considers a vector of individual characteristics, which leads to greater individual-level variations in the measurement of health. In this context, individual health is predicted considering that an individual has some particular characteristics, K.

The ranking variable

The construction of the concentration index relies on the ranking of individuals over a social dimension. Most studies on health inequalities using a concentration index rank individuals according to the log of household income per consumption unit. Nevertheless, we chose to consider household wealth. Indeed, our sample is composed of individuals aged 50 years old and this population is particularly heterogeneous as regard to income levels. Individuals who are less than 55 years old are mainly active, those around the age of 60 (between 55 and 65 years old)

are in a transition period between professional activity and retirement and, finally, the older individuals are relatively more modest considering their income level. In this context, an analysis based only on the monetary resources of a household, that is to say mainly retirement pensions for 65-year-olds and above, would partially take into account living standards. In fact, average inheritance and wealth result from a process of accumulation over the life cycle and may be higher for older adults than for younger ones. Older adults more often own their houses. In that way, a good proxy for the social situation of older adults would be to supplement the usual standard of living measures with a measurement of household inheritance [33, 34]. In the SHARE dataset, wealth is a generated variable using a precise questionnaire; we use it as provided in the data but considered in log.

Other variables

Current individual characteristics such as age, sex, social occupation, education level, log of wealth, etc. are traditionally considered to explain health status. Our paper considers a wider vector of individual characteristics and includes childhood characteristics. Social background is measured by both the father's and the mother's last occupations, as described in the ISCO (International Standard Classification of Occupations) classification. A proxy variable of parents' health is also constructed using the only health information available in the survey: their vital status or age at death. Considering the age of the studied sample, most of the respondents have lost their parents: only 9.04% of the fathers are still alive and 22.36% of the mothers. Concerning the health status of deceased parents, we propose an indicator based on their age at death. We divided the deceased parents in two groups, those who died earlier than the median age at death of their own country and those who died later than the median age at death of their own country. We assume thus that health is better if the person has lived longer than other people in his country. Parental health is then measured as a discrete variable in three categories: alive, deceased at a late age, and prematurely deceased. In this context, we assume that accidental deaths are not significant.

Results

Descriptive analysis

Descriptive statistics are presented in Table 2 and provide preliminary cross-country comparisons. The mean value of predicted health (predicted within the interval regression whose results are presented in Table 3) varies from one

Table 2 Descriptive statistics

	Austria	Germany	Sweden	Netherlands	Spain	Italy	France	Denmark	Greece	Switzerland
Sample	1,828	2,934	2,997	2,863	2,353	2,499	3,052	1,599	2,680	945
Continuous variables										
Average predicted health	0.859	0.849	0.842	0.861	0.811	0.823	0.842	0.845	0.849	0.885
Average household wealth (Euros)	39,513	48,296	53,179	53,655	25,088	30,545	51,791	60,734	18,791	75,595
Average household income (Euros)	215262	369178	298646	474984	441778	477330	507602	356587	225899	545407
Age (years)	65.3	64.4	65.1	63.6	66.6	64.7	64.9	64.5	64.6	64.9
Sex										
Male	42.5%	46.7%	46.9%	47.3%	42.0%	45.1%	44.9%	47.3%	46.3%	48.3%
Female	57.5%	53.3%	53.1%	52.7%	58.0%	54.9%	55.1%	52.7%	53.7%	51.7%
Individual's professional occupation										
Senior managers and professionals	14.6%	19.8%	29.4%	25.4%	9.9%	8.6%	17.6%	23.8%	9.0%	28.0%
Technicians and associate professionals and armed forces	12.1%	15.3%	15.3%	10.8%	5.0%	5.0%	18.2%	17.4%	2.4%	16.8%
Office clerks and service workers, and shop and market sales workers	23.6%	24.3%	28.0%	26.9%	10.1%	10.2%	21.0%	23.0%	5.5%	27.6%
Skilled agricultural and fishery workers	4.9%	3.4%	3.2%	2.4%	9.2%	6.2%	7.2%	2.4%	9.3%	3.7%
Craftsmen and skilled workers	20.5%	21.8%	16.7%	14.9%	21.2%	22.1%	16.9%	16.7%	11.9%	10.8%
Elementary occupations and unskilled workers	13.5%	8.8%	5.1%	10.7%	17.3%	11.0%	9.1%	11.7%	4.4%	8.4%
Unknown	10.8%	6.6%	2.3%	8.9%	27.2%	36.9%	10.0%	4.9%	57.6%	4.7%
Individual's education										
Primary	0.2%	0.9%	35.7%	16.9%	67.4%	59.0%	45.6%	0.0%	51.9%	21.8%
Secondary	76.4%	71.7%	35.5%	63.5%	25.6%	33.7%	36.4%	69.0%	31.5%	53.0%
A-levels and higher	23.4%	27.4%	28.8%	19.6%	7.0%	7.2%	18.1%	31.0%	16.6%	25.2%
Father's professional occupation										
Senior managers and professionals	9.2%	11.7%	25.0%	18.0%	9.0%	11.8%	10.9%	23.3%	13.3%	15.7%
Technicians and associate professionals and armed forces	5.8%	10.1%	8.1%	12.2%	2.8%	2.7%	5.3	5.4%	2.6%	6.5%
Office clerks and service workers, and shop and market sales workers	7.5%	7.7%	5.2%	10.0%	5.7%	7.6%	4.6%	5.0%	6.3%	26.6%
Skilled agricultural and fishery workers	19.5%	15.5%	17.6%	15.4%	37.3%	28.4%	16.4%	17.2%	40.3%	17.1%
Craftsmen and skilled workers	39.4%	42.7%	35.0%	34.2%	26.1%	27.7%	23.0%	29.8%	17.8%	23.9%
Elementary occupations and unskilled workers	7.2%	3.5%	5.7%	7.2%	14.3%	18.6%	3.0%	8.9%	3.8%	6.8%
Unknown	11.3%	8.8%	3.3%	3.1%	4.8%	3.1%	36.8%	10.4%	15.8%	3.5%
Father's health										
Father alive	6.7%	7.7%	10.0%	8.6%	7.0%	7.5%	11.7%	9.7%	10.5%	11.1%
Father's average age at death	68.7	67.7	73.3	72.0	70.7	70.9	70.0	73.0	72.6	72.1
Mother's professional occupation										
Senior managers and professionals	2.8%	2.1%	5.9%	3.8%	1.7%	3.0%	13.7%	5.1%	1.5%	3.6%
Technicians and associate professionals and armed forces	2.4%	5.4%	2.6%	0.6%	0.2%	0.6%	1.7%	3.1%	0.2%	3.5%
Office clerks and service workers, and shop and market sales workers	5.9%	12.4%	22.1%	4.4%	1.1%	2.3%	6.5%	13.8%	0.5%	22.1%
Skilled agricultural and fishery workers	11.3%	6.8%	11.0%	1.7%	6.2%	8.4%	9.2%	1.1%	20.6%	7.8%
Craftsmen and skilled workers	5.0%	9.2%	6.1%	2.0%	2.4%	3.7%	5.7%	5.6%	2.2%	4.2%
Elementary occupations and unskilled workers	7.0%	6.6%	9.5%	2.2%	4.4%	7.1%	5.2%	11.4%	1.7%	2.2%
Homemakers	60.7%	52.9%		81.2%	80.1%	71.9%		39.7%		50.1%
Unknown	5.0%	4.6%	42.8%	4.2%	3.8%	3.0%	58.0%	20.2%	73.3%	6.5%
Mother's health										
Mother alive	18.8%	21.5%	24.8%	21.9%	17.8%	19.6%	27.7%	23.8%	24.9%	23.0%
Father's average age at death	73.9	74.6	76.0	75.7	74.1	75.0	74.8	74.7	74.5	76.2

country to another: it is higher than 0.800 in all these countries but Switzerland clearly enjoys a better health status as the average predicted health value is 0.885. The lowest mean health is observed in Spain followed by Italy, which are also among the poorest countries in this group.

Switzerland and Denmark are the significantly richest countries considering annual average household income. On the contrary, Greece, Spain and Italy are the poorest countries and also the countries where mean health is the lowest. The ranking of countries according to average wealth level is different. Whereas Switzerland remains the most advantaged country, it is followed by France, Italy, and the Netherlands. Similarly, whereas Greece stays the most socially disadvantaged country, the average household wealth level is also very low in Austria and in Sweden.

Cross-country comparisons in education are tricky as diplomas are defined differently from one country to another, particularly among lower education level qualifications. Nevertheless, the proportion of individuals having an education level equal or higher than A-levels is significantly lower in Spain and Italy (7%), whereas in Denmark or in Sweden, almost one-third of the individuals have this level of education. Analogously, social occupations are somewhat difficult to compare; we noted a high proportion of unknown social occupations in Spain, Italy and Greece. Since the studied sample concerns older adults, we can assume that a large part of this large proportion of unknown professional occupations represents women who are homemakers. The proportion of clerks is high in northern Europe whereas in southern countries, as well as in Germany, there are larger proportions of craftsmen, skilled and unskilled workers. A 10% proportion of agricultural workers is notable in Spain and Greece, whereas agricultural workers represent less than 5% in most of the other countries [except in France (7%) and Italy (6%)].

We find similar a similar distribution of the fathers' social occupation, particularly for occupations at the two ends of the social status scale. There are higher proportions of fathers who were senior managers in Sweden, Denmark, and the Netherlands, and higher proportion of fathers were skilled workers in Spain and Italy. The distribution of social occupation among fathers shows the evolution of professional status in Europe in the twentieth century. The increase of jobs in the tertiary sector to the detriment of the primary sector is notable: there were more agricultural workers in the fathers' generation than in the descendants' generation. In the parental generation, each country counts at least 15% of agricultural workers, with much higher proportions in southern countries.

As for the mothers' professional occupation, this was largely not reported in Sweden, France and Greece. We can assume that those unknown occupations are homemakers. This assumption relies on both the age of the studied sample but also on a comparison with the proportions of homemakers in other countries. Moreover, if we refer to a study where a more precise codification of mothers' occupations was performed on only the French part of the

SHARE, our proportion of unknown occupation is clearly comparable to the proportion of homemakers in that study [17]. Therefore mothers in Europe were mainly homemakers: more than 70% in the Netherlands, in Spain, in Greece, and in Italy and between 40% and 60% in Sweden, Denmark, Switzerland and France. When mothers were active, they were more likely to work in agriculture in Greece (20.6%), Austria (11.3%) and Sweden (11%), and more likely to be an office clerk in Switzerland (22%), Denmark (14%) and Germany (12.4%). The high proportion of senior manager mothers (13.7%) in France is striking.

The proportion of fathers and mothers who are still alive is lower in Austria, Spain, Italy and Germany. Higher proportions of parents alive are observed in Greece and in France. The average age at death for fathers is always lower than the average age at death of mothers. The average age at death of fathers is higher for Swedish and Danish fathers, whereas Swedish and Swiss mothers experience the highest average age at death in Europe. Austria and Germany have the lowest average ages at death in Europe.

Interval regression analysis

The analysis of inter-individual variation in health relies on the specification of a theoretical model explaining health. The various models we have estimated are not derived from formal models of health production and investment but can be compared to reduced-form estimates of a static model of the demand for health. The interval regression does not provide a structural model for health and so the estimated parameters cannot be interpreted from a causal point of view. The first step of the method allows us to analyse interval regression models per country, explaining health according to a vector of current living conditions and a vector of childhood circumstances. For discrete variables, a reference category is omitted; therefore the reference individual is a woman, unskilled worker, without diploma, born to two prematurely deceased parents, who were unskilled workers. The results of the interval regression are presented in Table 3. From a general point of view, differences can be observed in terms of significance and, in very few cases, in terms of sign of their effect on health.

First of all, the estimated coefficients of the log of wealth are directly comparable across countries since wealth as well as health are measured in the same units whatever the country. Wealth has a positive and significant coefficient in every country: health increases with wealth. Age significantly influences health: health worsens in old age. As for the influence of gender on health, it is not significant in Austria, Germany, the Netherlands, and Denmark, and men

Table 3 Results of the interval regressions

	Austria			Germany			Sweden			The Netherlands			Spain		
	Coef.	S.E.	P > z	Coef.	S.E.	P > z	Coef.	S.E.	P > z	Coef.	S.E.	P > z	Coef.	S.E.	P > z
Age	−0.003	0.000	0.000	−0.004	0.000	0.000	−0.002	0.000	0.000	−0.001	0.000	0.000	−0.003	0.000	0.000
Sex															
Male	0.005	0.006	0.349	0.007	0.005	0.133	0.013	0.005	0.006	0.002	0.005	0.671	0.030	0.006	0.000
Female	ref.														
Log of the average household wealth moyeme	0.002	0.001	0.001	0.006	0.001	0.000	0.005	0.001	0.000	0.007	0.001	0.000	0.003	0.001	0.008
Individual's professional occupation															
Senior managers and professionals	0.035	0.011	0.001	0.013	0.009	0.172	0.054	0.011	0.000	0.032	0.008	0.000	0.008	0.012	0.498
Technicians and associate professionals and armed forces	0.039	0.010	0.000	0.008	0.009	0.389	0.047	0.011	0.000	0.024	0.009	0.011	0.034	0.014	0.019
Office clerks and service workers, and shop and market sales workers	0.051	0.009	0.000	0.010	0.008	0.206	0.026	0.011	0.016	0.012	0.008	0.109	0.042	0.011	0.000
Skilled agricultural and fishery workers	0.021	0.014	0.130	−0.001	0.014	0.930	0.001	0.016	0.927	0.021	0.015	0.161	0.024	0.011	0.038
Craftsmen and skilled workers	0.036	0.009	0.000	−0.012	0.009	0.167	0.011	0.011	0.315	−0.001	0.008	0.883	0.014	0.009	0.133
Elementary occupations and unskilled workers	ref.														
Unknown	0.028	0.010	0.007	0.005	0.011	0.665	0.001	0.017	0.948	0.011	0.009	0.232	0.017	0.009	0.050
Individual's education															
Primary	ref.														
Secondary	0.087	0.064	0.174	0.057	0.024	0.016	0.013	0.006	0.020	0.012	0.006	0.048	0.030	0.007	0.000
A-levels and higher	0.097	0.064	0.130	0.071	0.024	0.003	0.021	0.007	0.002	0.016	0.008	0.051	0.038	0.012	0.002
Father's professional occupation															
Senior managers and professionals	0.023	0.013	0.076	0.032	0.013	0.011	−0.005	0.010	0.601	−0.002	0.009	0.856	0.026	0.012	0.034
Technicians and associate professionals and armed forces	0.030	0.014	0.034	0.025	0.013	0.055	0.009	0.012	0.433	−0.012	0.010	0.218	0.033	0.018	0.070
Office clerks and service workers, and shop and market sales workers	0.024	0.013	0.065	0.009	0.013	0.485	−0.004	0.013	0.778	−0.020	0.010	0.047	0.028	0.013	0.040
Skilled agricultural and fishery workers	0.026	0.012	0.031	0.021	0.012	0.095	0.008	0.011	0.466	0.001	0.009	0.902	0.011	0.009	0.196
Craftsmen and skilled workers	0.019	0.010	0.066	0.004	0.011	0.705	−0.006	0.010	0.526	−0.006	0.008	0.501	0.006	0.009	0.527
Elementary occupations and unskilled workers	ref.														
Unknown	0.020	0.012	0.104	0.014	0.013	0.301	0.001	0.015	0.934	−0.011	0.014	0.435	0.029	0.015	0.045
Father's health															
Father alive	−0.004	0.011	0.709	0.015	0.008	0.067	0.017	0.008	0.031	0.017	0.008	0.031	0.007	0.011	0.545
Father deceased in later ages	0.007	0.005	0.164	0.008	0.004	0.068	0.013	0.005	0.007	0.013	0.004	0.002	−0.008	0.006	0.144
Father prematurely dead	ref.														

Table 3 continued

	Austria			Germany			Sweden			The Netherlands			Spain		
	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$
Mother's professional occupation															
Senior managers and professionals	0.039	0.018	0.033	0.013	0.016	0.445	0.021	0.011	0.070	0.018	0.017	0.298	0.007	0.025	0.765
Technicians and associate professionals and armed forces	0.020	0.019	0.275	0.006	0.012	0.635	0.004	0.015	0.775	0.038	0.029	0.197	0.040	0.059	0.492
Office clerks and service workers, and shop and market sales workers	0.008	0.014	0.581	0.020	0.010	0.046	0.002	0.008	0.840	0.019	0.017	0.249	−0.008	0.028	0.764
Skilled agricultural and fishery workers	−0.006	0.013	0.672	−0.017	0.012	0.161	0.002	0.011	0.888	0.041	0.021	0.052	0.023	0.017	0.182
Craftsmen and skilled workers	0.000	0.014	0.978	0.003	0.011	0.776	0.005	0.011	0.666	0.025	0.020	0.201	0.033	0.022	0.126
Elementary occupations and unskilled workers	ref.														
Homemakers	0.012	0.010	0.207	0.010	0.009	0.232				0.013	0.014	0.363	0.037	0.013	0.006
Unknown	0.013	0.015	0.388	0.010	0.013	0.427	0.003	0.008	0.718	0.010	0.017	0.543	0.062	0.019	0.001
Mother's health															
Mother alive	0.014	0.008	0.076	0.024	0.006	0.000	0.012	0.006	0.062	0.016	0.006	0.007	0.018	0.008	0.039
Mother deceased in later ages	0.013	0.006	0.020	0.006	0.005	0.232	0.006	0.005	0.200	0.003	0.005	0.542	0.008	0.006	0.219
Mother prematurely dead	ref.														
Constant	0.836	0.068	0.000	0.922	0.032	0.000	0.878	0.024	0.000	0.818	0.025	0.000	0.873	0.028	0.000

	Italy			France			Denmark			Greece			Switzerland		
	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$	Coef.	S.E.	$P > z$
Age	−0.003	0.000	0.000	−0.003	0.000	0.000	−0.001	0.000	0.000	−0.004	0.000	0.000	−0.001	0.000	0.000
Sex															
Male	0.026	0.005	0.000	−0.010	0.005	0.033	−0.004	0.006	0.545	0.025	0.004	0.000	0.012	0.007	0.067
Female															
Log of the average household wealth	0.004	0.001	0.000	0.004	0.001	0.000	0.005	0.001	0.000	0.004	0.001	0.000	0.005	0.001	0.000
Individual's professional occupation															
Senior managers and professionals	0.000	0.012	0.974	0.040	0.009	0.000	0.041	0.011	0.000	0.032	0.013	0.013	0.024	0.014	0.075
Technicians and associate professionals and armed forces	0.006	0.014	0.664	0.038	0.009	0.000	0.031	0.011	0.006	0.017	0.017	0.334	0.013	0.014	0.335
Office clerks and service workers, and shop and market sales workers	0.030	0.011	0.008	0.013	0.008	0.116	0.008	0.010	0.414	0.036	0.014	0.010	0.008	0.013	0.530
Skilled agricultural and fishery workers	−0.006	0.013	0.662	0.013	0.011	0.212	0.024	0.020	0.249	0.010	0.013	0.448	0.039	0.020	0.048
Craftsmen and skilled workers	0.010	0.010	0.283	−0.003	0.009	0.722	0.007	0.011	0.552	0.014	0.012	0.256	−0.017	0.015	0.256
Elementary occupations and unskilled workers															
Unknown	0.013	0.009	0.172	0.005	0.010	0.620	0.027	0.015	0.082	0.026	0.011	0.017	−0.006	0.019	0.743

Table 3 continued

	Italy			France			Denmark			Greece			Switzerland		
	Coef.	S.E.	P > z	Coef.	S.E.	P > z	Coef.	S.E.	P > z	Coef.	S.E.	P > z	Coef.	S.E.	P > z
Individual's education															
Primary															
Secondary	0.039	0.006	0.000	0.017	0.005	0.001	0.010	0.007	0.168	0.035	0.006	0.000	0.015	0.009	0.090
A-levels and higher	0.061	0.011	0.000	0.029	0.007	0.000	0.016	0.011	0.163	0.050	0.007	0.000	0.030	0.011	0.005
Father's professional occupation															
Senior managers and professionals	−0.007	0.010	0.479	0.013	0.014	0.355	0.014	0.016	0.358	0.011	0.013	0.388	−0.002	0.015	0.909
Technicians and associate professionals and armed forces	0.014	0.017	0.382	0.032	0.015	0.035	−0.001	0.016	0.964	0.015	0.017	0.367	−0.013	0.017	0.449
Office clerks and service workers, and shop and market sales workers	0.005	0.011	0.672	0.026	0.015	0.094	0.015	0.012	0.219	0.009	0.014	0.514	−0.004	0.015	0.804
Skilled agricultural and fishery workers	0.003	0.008	0.699	0.022	0.014	0.104	0.011	0.011	0.322	0.008	0.012	0.497	−0.002	0.015	0.920
Craftsmen and skilled workers	−0.001	0.008	0.919	0.012	0.013	0.355	0.018	0.013	0.165	0.004	0.012	0.721	0.011	0.014	0.420
Elementary occupations and unskilled workers															
Unknown	−0.010	0.016	0.509	0.014	0.012	0.275	0.019	0.011	0.068	0.019	0.013	0.135	0.015	0.024	0.536
Father's health															
Father alive	0.012	0.010	0.263	0.014	0.007	0.061	0.015	0.006	0.011	0.018	0.008	0.024	0.019	0.012	0.119
Father deceased in later ages	0.007	0.005	0.215	0.006	0.004	0.191	−0.027	0.016	0.085	0.014	0.005	0.003	0.004	0.007	0.599
Father prematurely dead															
Mother's professional occupation															
Senior managers and professionals	−0.010	0.018	0.574	0.027	0.011	0.013	0.004	0.018	0.829	−0.025	0.024	0.289	0.008	0.027	0.759
Technicians and associate professionals and armed forces	0.015	0.035	0.664	0.017	0.018	0.341	−0.011	0.011	0.328	−0.048	0.052	0.356	0.013	0.027	0.632
Office clerks and service workers, and shop and market sales workers	−0.022	0.019	0.250	0.009	0.012	0.474	−0.016	0.029	0.572	−0.064	0.035	0.064	0.032	0.023	0.164
Skilled agricultural and fishery workers	−0.004	0.014	0.748	0.006	0.012	0.650	−0.012	0.015	0.402	−0.028	0.017	0.109	0.027	0.025	0.278
Craftsmen and skilled workers	−0.002	0.016	0.924	0.016	0.013	0.194	−0.016	0.010	0.113	−0.061	0.022	0.005	0.043	0.026	0.100
Elementary occupations and unskilled workers															
Homemakers	−0.006	0.010	0.571	0.018	0.010	0.063							0.017	0.022	0.425
Unknown	0.009	0.018	0.609				−0.023	0.011	0.029	−0.038	0.016	0.020	0.014	0.027	0.604
Mother's health															
Mother alive	0.015	0.008	0.047	0.008	0.006	0.190	0.011	0.008	0.175	0.006	0.006	0.328	0.010	0.010	0.327
Mother deceased in later ages	0.008	0.006	0.192	0.014	0.005	0.004	0.008	0.007	0.234	0.002	0.005	0.751	0.006	0.007	0.396
Mother prematurely dead															
Constant	0.919	0.029	0.000	0.930	0.024	0.000	0.835	0.028	0.000	1.009	0.029	0.000	0.862	0.036	0.000

tend to have better health than women except in France and Denmark. Having a diploma is associated with better health in every European country, but this effect is not significant in Austria and Denmark. Individuals at the top of the social scale (senior managers and professionals, and technicians and associate professionals) are in significantly better health than individuals at the bottom of the social scale (unskilled workers) except in Italy, Germany, Switzerland and Spain (for senior managers and associate professionals). If our assumption, according to which a large proportion of the unknown professions are homemakers, is also true for the descendants themselves, then homemakers are in significantly better health than unskilled workers in Austria, Spain, Denmark and Greece.

Individuals born to a father who was at the top of the social scale have significantly better health in Austria, Germany, Spain, and France than descendants of unskilled workers. The descendants of office clerks are in significantly better health than the descendants of unskilled workers in Austria and Spain, whereas they are in significantly less good health in the Netherlands. The health of descendants of agricultural workers is better than health of descendants of unskilled workers in Austria and Germany. Generally, in Austria, descendants of unskilled workers have a significantly less good health status than any other individuals.

The mother's socioeconomic occupation influences health in adulthood less significantly than the father's occupation. Nevertheless, in Austria and France, individuals born to a mother who was in a higher social position have significantly better health than those born to a mother who was an unskilled worker. Unexpectedly, we observe the opposite in Denmark, which may be due to the relatively higher rate of mothers who were unskilled workers in Denmark as compared to other European countries. The effects of being born to a mother who was an office clerk also differs from one country to another: whereas in Germany, such individuals have significantly better health than those born to an unskilled mother, in Greece they are in significantly less good health. This opposite result comes from the very weak proportion of mothers who are unskilled workers in Greece. Similarly, being born to a mother who was a skilled worker significantly protects more health in adulthood than being born to an unskilled mother in Spain. Finally, individuals born to a mother who was homemaker are in significantly better health than those born to an unskilled worker in Spain and France, whereas the opposite is observed in Denmark and Greece.

Individuals having a father still alive as well as individuals whose father died at a later age are in significantly better health than individuals whose father was prematurely deceased in Sweden, in the Netherlands and in Greece. It is also true in Denmark for still living fathers. As for mothers that are still alive, their descendants are in significantly better health than the descendants of women that died prematurely in Germany, the Netherlands, Spain, and Italy. Having a mother who died old is less protective for health in adulthood than having a father who died old; indeed, there is a significantly protective effect on health only in Austria and France.

Concentration indices over the distribution of wealth

Concentration indices measured using Eq. 3 and presented in Table 4 allow an understanding of wealth-related health inequalities. First of all, we observe that, in all these European countries, health is unequally distributed in favour of the richest individuals. Figure 1 represents the classification of the countries according to the extent of the degree of concentration with the confidence intervals. In all countries, the level of inequality is largely significant and different from zero. We observe large differences between countries. In the Netherlands and Greece, the inequality is significantly higher than in all the other countries of Europe except Germany. At the other end of the ranking, inequality is significantly lower in Switzerland, Spain and Austria than in all the other countries. The concentration index associated to the logarithm of wealth is a one-dimension concentration index and is thus comparable to a Gini index.[2] Its positive value translates to the existence of important inequalities in the distribution of wealth within the population. In all the countries, wealth-related health inequalities are weaker than wealth inequalities. The two indices have a positive and significant correlation ($r = 0.25$). In addition, these two measurements of inequality do not lead to the same classification of these European countries. The most surprising change of position is that of Greece, where wealth inequalities are among the weakest, whereas wealth-related health inequalities are very large. Switzerland and Sweden, which are the countries with the weakest health inequalities, experience relatively high wealth inequalities.

The concentration indices when they are positive (or negative, respectively) represent the concentration of individuals with high (low) levels of wealth. As expected, senior managers and associate professionals concentrate among the richest, particularly in Italy and Spain. Intermediate occupations, namely technicians and associate professionals, also concentrate among the richest people in all the countries except Switzerland, where they belong to the average social classes. Moreover, in Greece these occupations concentrate more strongly among the richest

---

[2] Since the Gini index is calculated using a logarithmic form then its value is lower than it would be if this transformation was not used.

**Table 4** Concentration indices of the explanatory variables

	Austria	Germany	Sweden	Netherlands	Spain	Italy	France	Denmark	Greece	Switzerland
Self-assessed health predicted within interval regression	0.011	0.018	0.016	0.020	0.011	0.014	0.014	0.017	0.021	0.011
Age	−0.017	−0.012	−0.013	−0.019	−0.013	−0.011	−0.009	−0.022	−0.029	−0.004
Sex										
Male	0.086	0.040	0.038	0.026	0.032	0.046	0.060	0.058	0.089	0.082
Female	ref.									
Log of the average household wealth	0.158	0.141	0.129	0.136	0.097	0.120	0.125	0.152	0.103	0.124
Individual's professional occupation										
Senior managers and professionals	0.190	0.226	0.207	0.208	0.275	0.275	0.239	0.227	0.150	0.215
Technicians and associate professionals and armed forces	0.126	0.096	0.098	0.156	0.174	0.168	0.153	0.142	0.199	−0.045
Office clerks and service workers, and shop and market sales workers	−0.030	0.011	−0.096	−0.003	0.076	0.060	−0.062	−0.117	0.144	−0.072
Skilled agricultural and fishery workers	0.099	−0.111	0.004	0.336	−0.094	−0.109	0.003	0.285	−0.314	0.051
Craftsmen and skilled workers	−0.023	−0.144	−0.206	−0.222	0.024	−0.016	−0.133	−0.164	−0.134	−0.048
Elementary occupations and unskilled workers	ref.									
Unknown	−0.067	0.006	−0.035	−0.146	−0.064	0.000	−0.099	−0.035	0.049	−0.109
Individual's education										
Primary	ref.									
Secondary	−0.065	−0.059	0.013	−0.002	0.065	0.131	0.063	−0.101	0.140	0.001
A-levels and higher	0.218	0.175	0.206	0.310	0.321	0.312	0.272	0.226	0.299	0.164
Father's professional occupation										
Senior managers and professionals	0.193	0.140	0.120	0.167	0.149	0.192	0.097	0.147	0.187	0.144
Technicians and associate professionals and armed forces	0.093	0.125	0.091	0.090	0.234	0.155	0.086	0.084	0.263	0.116
Office clerks and service workers, and shop and market sales workers	−0.014	0.053	0.010	−0.038	0.055	0.001	−0.005	−0.026	0.032	−0.072
Skilled agricultural and fishery workers	0.012	−0.035	−0.027	0.115	−0.012	−0.040	−0.069	0.040	−0.082	−0.047
Craftsmen and skilled workers	−0.032	−0.034	−0.063	−0.121	0.008	0.029	−0.140	−0.059	−0.014	0.007
Elementary occupations and unskilled workers	ref.									
Unknown	−0.017	−0.064	−0.111	−0.249	−0.056	0.094	0.085	−0.153	0.019	−0.099
Father's health										
Father alive	0.212	0.145	0.055	0.117	0.113	0.062	0.084	0.110	0.141	−0.018
Father deceased in later ages	0.018	0.021	0.015	0.007	−0.030	0.003	0.015	−0.013	−0.029	0.037
Father prematurely dead	ref.									
Mother's professional occupation										
Senior managers and professionals	0.284	0.188	0.219	0.236	0.087	0.121	−0.066	0.234	0.156	0.154
Technicians and associate professionals and armed forces	0.060	0.111	0.053	0.289	0.099	0.169	0.088	0.146	−0.062	0.142
Office clerks and service workers, and shop and market sales workers	0.059	−0.022	0.059	0.137	0.187	−0.002	−0.018	0.064	0.126	−0.045
Skilled agricultural and fishery workers	0.056	−0.084	−0.018	0.227	−0.074	−0.069	−0.054	0.067	−0.095	−0.070
Craftsmen and skilled workers	−0.091	−0.120	−0.063	0.079	0.132	0.131	−0.086	−0.058	−0.035	−0.017
Elementary occupations and unskilled workers	ref.									
Homemakers	−0.015	0.039	0.000	−0.016	0.007	−0.006		−0.026		0.020
Unknown	0.080	−0.007	−0.038	−0.098	−0.020	0.247	0.044	−0.026	0.026	−0.016
Mother's health										
Mother alive	0.123	0.090	0.051	0.137	0.115	0.098	0.067	0.096	0.155	0.038
Mother deceased in later ages	−0.025	0.002	0.007	−0.014	−0.030	−0.002	−0.006	−0.010	−0.051	0.017
Mother prematurely dead	ref.									

than senior managers and associate professionals. The social situation of agricultural workers is very different from one country to another, being concentrated strongly among the richest in Denmark and the Netherlands, but belonging to the poorest groups in Greece and in Germany, Italy and, to a lesser extent, Spain. Craftsmen and skilled

Fig. 1 Health inequalities in Europe: concentration index and confidence intervals
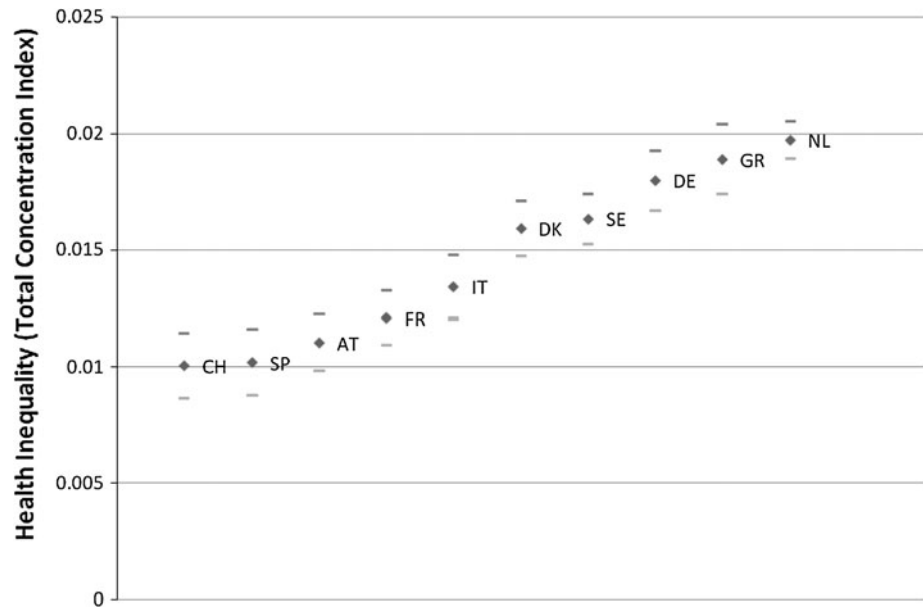
workers concentrate in the lower social classes, particularly in Sweden, the Netherlands, and Denmark; however, they are middle class in Spain, Italy and Austria.

Regardless of the country, senior managers and highly educated individuals (at least A-level) concentrate strongly among socially favoured individuals in Spain, Italy, the Netherlands and Greece. Whereas Italian and Greek people having a diploma at most equivalent to secondary level concentrate among the richest, in the other European countries this characteristic does not really translate to strong social differences. Individuals born to a father who had a higher profession (senior manager and professional) and of a mother who was senior manager, concentrate among the socially favoured individuals in every country, and even more strongly in Greece, Italy, Spain, Austria and the Netherlands. This result thus confirms a social reproduction across generations, particularly for individuals at the top of the social scale. Moreover, an individual's wealth is measured over their whole life cycle and thus takes into account the inheritance transmitted by his/her parents. In the Netherlands, sons of agricultural workers are concentrated strongly among the richest.

Lastly, individuals whose parents are still alive concentrate among the richest in Europe, more particularly in Austria, Germany and Greece for fathers and in Greece, Austria, the Netherlands and Spain for mothers.

Contributions to wealth-related health inequality

The decomposition method enables us to understand how the various vectors of individual characteristics contribute to the extent of inequalities in Europe. These contributions can be positive or negative; their sign depends on the sign of their relationship to health as measured by the elasticity, and of their distribution according to wealth, as measured by the concentration index. A contribution of $x\%$ of characteristic K is interpreted as follows: inequality would be $x\%$ weaker, ceteris paribus, if either K was distributed equally according to wealth or K had a zero health elasticity. Figure 2 decomposes the total health inequality in each country according to the extent of the contribution of demographic characteristics, current social characteristics and childhood circumstances. This decomposition highlights the fact that, regardless of the country, the most important contribution to wealth-related health inequality is that of current socio-economic variables. Moreover, we observe that the contribution of childhood circumstances is small but not negligible in the majority of the European countries, and is particularly important in Germany, Spain, the Netherlands and Austria. That contribution is less important in Greece—this lower contribution is due to the very strong contribution of demographic characteristics in this country. Demographic characteristics contribute to explaining wealth-related health inequalities to a considerable extent, particularly in Greece, Germany, Austria, Spain and Italy. The main advantage of the decomposition of inequality in its determining factors is to provide information useful to public policy makers. Considering that inequalities related to demographic characteristics cannot be corrected by government interventions, the contribution of these variables is widely thought of as policy irrelevant and the extent of inequalities is often measured by standardising the contribution of demographic characteristics, i.e. by considering the degree of inequality that would be observed if age and sex were distributed equally according to wealth. This level of inequality is

Fig. 2 Decomposition of health
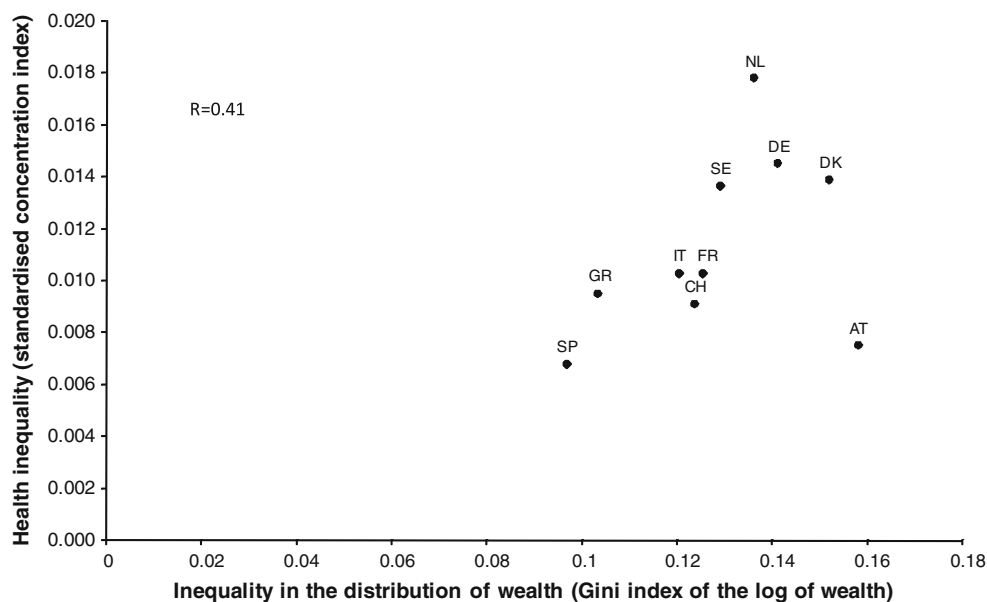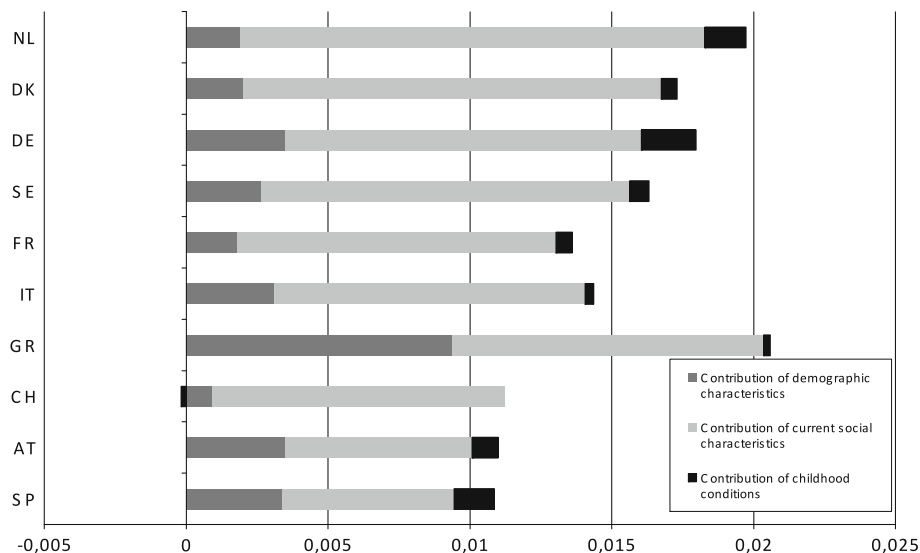inequalities in Europe
(unstandardised CI)

Fig. 3 Relationship between health inequalities and wealth inequalities in Europe

obtained by subtracting the contributions of age and sex
from the total wealth-related health inequality. This
inequality represents social health inequality [35].
Regardless of country, social health inequality is weaker
than total health inequality. Figure 3 represents the dis-
crepancy between social health inequality, as measured by
the age- and sex-standardised concentration index, and
wealth inequality as measured by the Gini index of the
logarithm of wealth. The two indices have a positive and
significant correlation ($r = 0.41$), which is larger than the
correlation between the Gini index and the non-standard-
ised health concentration index.

Figure 4 shows the detailed contributions of current
characteristics and childhood circumstances to the social
health inequality in each country of Europe. This inequality
results particularly from the dominating contribution of
wealth inequalities in all these countries, except in Greece
where it is very slightly higher than that of education
because of a lower elasticity of health with wealth. An
individual's professional occupation contributes weakly to
health inequality in Italy and Spain, and it even appears that
the contributions of the professional occupations of both
parents is equal or even higher. In the same way, in Ger-
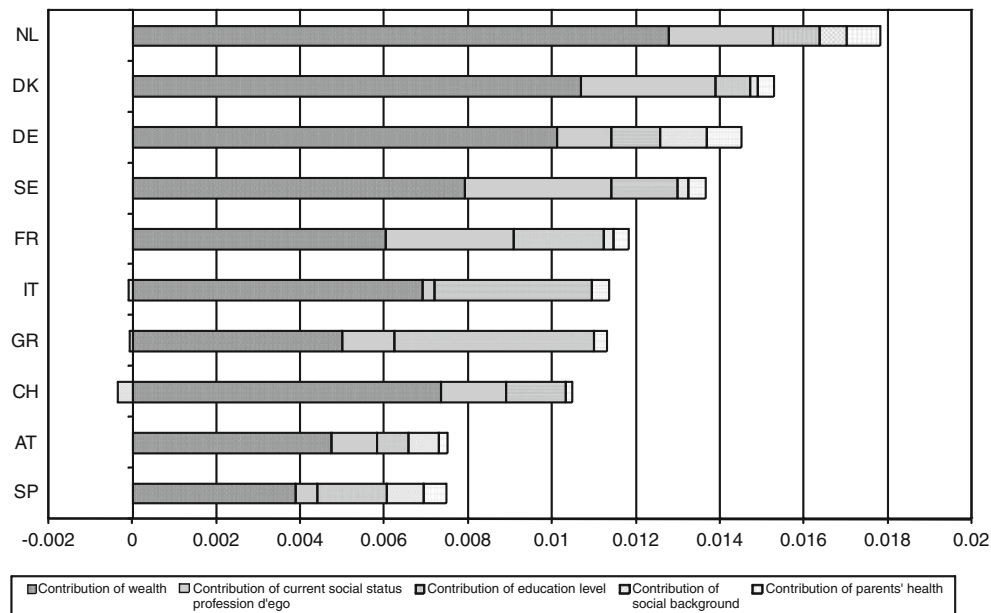many and Austria, the share of social health inequality that

Fig. 4 Contribution of current characteristics and social background to social health inequalities in Europe

is explained by the level of education is equal to the share due to social background. Therefore, we demonstrate the great advantage of taking into account childhood circumstances in the analysis of health in adulthood: the characteristics usually considered in previous studies contribute equally or even less than childhood characteristics. The magnitude of the contribution of both social background and parental health varies from one country to another. Social background positively and significantly contributes to wealth-related health inequality in all countries except Switzerland. In Switzerland, circumstances tend to decrease inequalities, and this diminution is explained by a negative elasticity of health with the father's social position. Parental health tends to increase significantly social health inequalities in the Netherlands, Germany, Denmark, France and Sweden in a more marked way than social circumstances in childhood. Thus, a share of the wealth-related health inequalities in adulthood would be explained by transmission of health across generations.

Conclusion

This analysis shows that there are significant social health inequalities among older Europeans, and explains that these are driven mainly by current social conditions. The analysis is based on an original methodology of cardinalisation of SAH using country-specific cutpoints that correct for cultural differences in the way health status is reported and provide a high-quality health measurement. Concentration indices are then generated and decomposed

using an additive regression model that simultaneously explores the role played by current living conditions and childhood circumstances. The study highlights the significantly higher wealth-related health inequalities in the Netherlands, Denmark and Germany. These social inequalities of health in Europe are explained largely by an individual's current social circumstances, particularly wealth. Nevertheless, the independent contribution of childhood circumstances is far from negligible. In particular, the contribution of social and family background to social health inequality is often more important than the contribution of an individual's social occupation or education level, e.g. in the Netherlands, Germany, Austria and Spain. A share of the wealth-related health inequalities in adulthood would thus be explained by transmission of health across generations, particularly in the Netherlands, Denmark and Spain.

Our empirical strategy has several limitations. First of all, as we stressed in the description of the data, some characteristics can be very different from one country to another and thus induce very different situations. For example, very few individuals in Denmark, Austria or Germany do not have a diploma of some sort, whereas this situation applies to more than half of Italian, Spanish, and Greek people. We also note the case of agricultural workers, who are socially favoured in the Netherlands, Denmark and Belgium but underprivileged in Greece. Those differences prevent us from describing patterns at a European level in our results. Furthermore, when measuring parents' health, it would have been preferable to have other health measures, particularly the health status of the

parents during their childhood. Finally, the data do not enable us to distinguish whether the influence of childhood health circumstances on health in adulthood comes from a common genetic inheritance, from transmission of particular preferences for health, or from a common environment.

Although the main bulk of social health inequality can be explained by current social characteristics, our analysis attests to the existence of the long-term influence of initial conditions in childhood on health in middle-age and beyond, independently of current social circumstances, and which contribute to differences in health status across social groups. Furthermore, as social reproduction across generations is important, we suspect a much more important effect of childhood circumstances on inequalities and thus recommend controlling the harmful effects of those determinants of health.

It remains difficult to give precise recommendations regarding public policies aimed at reducing social health inequalities. Nevertheless, referring to the recent report of the World Health Organization's Commission on the Social Determinants of Health [36], our study contributes to the identification of social determinants that are important determinants of health and follows recommendations suggested to help 'close the gap' in various health inequities, such as suggesting ways to measure and understand the problem [37].

References

1. Mackenbach, J.P., Bos, V., Andersen, O., Cardano, M., Costa, G., Harding, S., et al.: Widening socioeconomic inequalities in mortality in six western European countries. Int. J. Epidemiol. **32**, 830–837 (2003)
2. Hernandez-Quevedo, C., Jones, A., Lopez, A.N., Rice, N.: Socioeconomic inequalities in health: a comparative longitudinal analysis using the European community household panel. Soc. Sci. Med. **63**(1246), 1262 (2007)
3. Masseria, C., Mossalios, E., Allin, S.: Measurement of socioeconomic inequality of health in 10 European countries: an exploratory analysis of SHARE using three approaches. European Commission–Research Note LSE (2006)
4. Evans, R.G., Barer, M.L., Marmor, T.R.: Why are some people healthy and others not? The determinants of health of populations (social Institutions and social change). de Gruyter, New York (1994)
5. Marmot, M., Wilkinson, R.: Social determinants of health. Oxford University Press, Oxford (1999)
6. Wagstaff, A., van Doorslaer, E., Watanabe, N.: On decomposing the causes of health sector inequalities with an application to

malnutrition inequalities in Vietnam. J. Econ. **112**(1), 207–223 (2003)
7. van Doorslaer, E., Koolman, X.: Explaining the differences in income-related health inequalities across European countries. Health Econ. **13**(7), 609–628 (2004)
8. Jusot, F., Tubeuf, S., Trannoy, A.: Tel père, tel fils: L'influence de l'origine sociale et familiale sur la santé des descendants en Europe. In: Attias-Donfut C, Sirven N (eds) Famille et vieillissement en Europe—Enquête Share. Retraite et Société **11**, 63–85 (2009)
9. Lefranc, A., Pistolesi, N., Trannoy, A.: Le revenu selon l'origine sociale. Economie Statistique **371**, 49–82 (2004)
10. Case, A., Fertig, A., Paxson, C.: The lasting impact of childhood health and circumstance. J. Health Econ. **24**, 365–389 (2005)
11. Currie, J., Hyson, R.: Is the impact of health shocks cushioned by socioeconomic status? The case of birth weight. Am. Econ. Rev. **89**(2), 2455–2550 (1999)
12. Elstad, J.I.: Childhood adversities and health variations among middle-aged men: a retrospective lifecourse study. Eur. J. Pub. Health **15**(1), 51–58 (2005)
13. Hyde, M., Jakub, H., Melchior, M., Van Oort, F., Weyers, S.: Comparison of the effects of low childhood socioeconomic position and low adulthood socioeconomic position on self-rated health in four European studies. J. Epidemiol. Commun. Health **60**, 882–886 (2006)
14. Melchior, M., Lert, F., Martin, M., Ville, I.: Socioeconomic position in childhood and in adulthood and functional limitations in midlife: data from a nationally-representative survey of French men and women. Soc. Sci. Med. **63**(11), 2813–2824 (2006)
15. Melchior, M., Berkman, L.F., Kawachi, I., Krieger, N., Zins, M., Bonenfant, S.: Lifelong socioeconomic trajectory and premature mortality (35–65 years) in France: findings from the GAZEL cohort study. J. Epidemiol. Commun. Health **60**, 937–944 (2006)
16. Power, C., Hertzman, C.: Social and biological pathways linking early life and adult disease. Br. Med. Bull. **53**(1), 210–221 (1997)
17. Trannoy, A., Tubeuf, S., Jusot, F., Devaux, M.: Inequality of opportunities in health in France: a first pass. Health Economics, Jul 8. [Epub ahead of print] (2009)
18. Bourdieu, P.: Power and ideology in education. In: Karabel, J., Halsey, A.H. (eds.) Cultural reproduction, social reproduction. Oxford University Press, Oxford (1977)
19. Marks, G.: Declining inequality? The changing impact of socioeconomic background and ability on education in Australia. Br. J. Sociol. **54**(4), 453–471 (2003)
20. Lefranc, A., Pistolesi, N., Trannoy, A.: The link between inequality of opportunity for income acquisition and income inequality: the French example 1977–1993. Mimeo (2007)
21. Rosa-Dias, P.: Inequality of opportunities in health: evidence from a UK cohort study. Health Econ. **18**(9), 1057–1074 (2009)
22. Lefranc, A., Pistolesi, N., Trannoy, A.: Inequality of opportunities vs inequality of outcomes: are Western societies all alike? Rev. Income Wealth **54**(4), 513–546 (2006)
23. Jürges, H.: True health vs response styles: exploring cross-country differences in self-reported health. Health Econ. **16**(2), 163–178 (2007)
24. van Doorslaer, E., Jones, A.: The determinants of self-reported health inequalities: validation of a new approach to measurement. J. Health Econ. **22**, 61–87 (2003)
25. Börsch-Supan, A., Brugiavini, A., Jürges, H., Mackenbach, J.P., Siegrist, J., Weber, G.: Health, ageing and retirement in Europe—first results from the Survey of Health, Ageing and Retirement in Europe. MEA, Mannheim (2005)
26. Idler, E.L., Benyamini, Y.: Self-rated health and mortality: a review of twenty-seven community studies. J. Health Social Behav. **38**, 21–37 (1997)

27. Kerkhofs, M., Lindeboom, M.: Subjective health measures and state dependent reporting errors. Health Econ. **4**, 221–235 (1995)

28. Groot, W.: Adaptation and scale of reference bias in self-assessments of quality of life. J. Health Econ. **19**, 403–420 (2000)

29. Sadana, R., Colin, D.M., Lopez, A.D., Murray, C.J.L., Moessgaard Iburg, K.M. Comparative analyses of more than 50 household surveys on health status. Summary Measures of Population Health. World Health Organization (2003)

30. Garcia Gomez, P., Lopez, A.N. Regional differences in socioeconomic health inequalities in Spain 1973/74–2003. 2007

31. Lecluyse, A., Cleemput, I.: Making health continuous: implications of different methods on the measurement of inequality. Health Econ. **15**(1), 99–104 (2006)

32. Olsen, K., Dahl, S.A.: Health differences between European countries. Soc. Sci. Med. **64**(8), 1665–1678 (2007)

33. Baclet, A. Les seniors: des revenus plus faibles pour les plus âgés, compensés par un patrimoine plus élevé. Les revenus et le patrimoine des ménages. 2006 edn. France: INSEE, pp. 25–37 (2006)

34. Jusot, F.: The shape of the relationship between mortality and income in France. Annales d'Economie et de Statistique **83–84**, 89–122 (2006)

35. van Doorslaer, E., Wagstaff, A., Bleichrodt, H., Calonge, S., Gerdtham, U.G., et al.: Income-related inequalities in health: some international comparisons. J. Health Econ. **16**, 93–112 (1997)

36. Marmot, M., Friel, S., Bell, R., Houweling, T., Taylor, S.: On behalf of the commission on social determinants of health. Closing the gap in a generation: health equity through action on the social determinants of health. Lancet **372**, 1661–1669 (2008)

37. Epstein, D., Jimenez-Rubio, D., Smith, P.C., Suhrcke, M.: Social determinants of health: an economic perspective. Health Econ. **18**(5), 495–502 (2009)