Sample attrition in SHARE and SILC surveys and its effect on cross-sectional estimates of population health

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1 Introduction

Longitudinal samples are subject to attrition, which is a drop out of participants between subsequent interviews. Attrition reduces the sample size and likely leads to wrong results and conclusions as it biases the sample by changing its composition and making it no longer representative for the study population. Due to attrition the sample can be selected on the variable of interest or other characteristics correlated with the dependent variable (Deng et al., 2013; Goodman and Blum, 1996). This is, in particular, apparent in health studies, where the outcome variable, health status, is also a known determinant of attrition from the sample (Ahern and Le Brocque, 2005; Desmond et al., 1998; Graaf et al., 2000; Hoeymans et al., 1998; Levin et al., 2000; Michaud et al., 2011). Decreased health status leads to all types of attrition: failure to locate, refusal to participate, morbidity and mortality (Graaf et al., 2000). Other recognized attrition factors are demographic characteristics related to health, i.e. sex, old-age, marital status and educational attainment (Ahern and Le Brocque, 2005; Desmond et al., 1998; Graaf et al., 2000; Hoeymans et al., 1998; Levin et al., 2000). While the issue of sample attrition and its potential bias on the measurement of phenomena and their relationships is commonly acknowledged in studies based on longitudinal datasets, it is rarely acknowledged in studies based on cross-sectional data that comes from panel longitudinal samples. In the case of cross-sectional studies, attrition might violate the assumption of random sampling in the data collection (Goodman and Blum, 1996). This is evident, particularly in health studies, where it is likely that the research is conducted and inferences are made based on non-random samples, conditioned on the outcome variable of interest (Ahern and Le Brocque, 2005; Graaf et al., 2000).

The Survey of Health, Ageing and Retirement in Europe (SHARE) and the European Union Statistics on Income and Living Conditions (SILC) are the most commonly used sources of information on the health status of the European populations. Both surveys provide data in the longitudinal and cross-sectional form based on predominantly longitudinal samples. Hence, the health composition of cross-sectional samples of both SHARE and SILC is likely biased by the problems related to the longitudinal sample design and so are the results of the studies based on these datasets. This article aims to answer two research questions: First, if health status and health-related demographic characteristics influence the probability of attrition from the panel samples of SILC and SHARE. Second, if the cross-sectional estimates of the prevalence of different health states and resulting health-state expectancy values are biased due to the panel attrition. To our knowledge this is the first study to point out the importance of the health-status-related sample attrition in SHARE and SILC surveys for the cross-sectional estimates of population health.

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2 Data

This study is based on the most recent cross-sectional samples of 50+ years old respondents from the EU Statistics on Income and Living Conditions Survey (SILC) (Eurostat, 2021) and Wave 7 of the Survey of Health, Ageing and Retirement in Europe (SHARE) (Börsch-Supan, 2020; Börsch-Supan et al., 2013), and all observations for the corresponding longitudinal samples that ultimately formed the cross-sectional samples under study.

For SILC, the 2018 cross-sectional sample consists of four rotational sub-samples: one newly drawn 2018 sample and three longitudinal sub-samples that have been initially drawn in 2015, 2016 and 2017. We include 20 countries that provide both longitudinal and cross-sectional data in SILC, and included four rotational sub-samples in 2018 cross-sectional sample.

In the part of the study based on SHARE, we use data from Waves 1-2 and 4-7 (Börsch-Supan, 2020; Börsch-Supan et al., 2013). Because of a different questionnaire used in SHARELIFE Wave 3, data from this wave is excluded from analyses. The cross-sectional data comes from Wave 7, which was conducted in the study countries in 2017. The sample in SHARE is a panel sample with irregular refreshment samples, that are drawn individually in each country. We include 18 countries that participated in wave 7 and at least one wave before.

Health status is specified across limitations in activities of daily living across the Global Activity Limitation Indicator (GALI). GALI has been systematically accessed as a comparable health measure instrument across the European countries (Berger et al., 2015; Jagger et al., 2010; Van Oyen et al., 2006).

3 Methods

First, we study the development of the longitudinal samples. Attrition of an unknown character, labeled further as "attrition", is examined separately from mortality. Attrition due to death is an expected phenomenon in the panel samples and only if higher than the officially registered mortality or selected on the characteristics of interest differently than the patterns observed in the general population, it is biases the studied samples (Mihelic and Crimmins, 1997; Smith et al., 2009). Hence, in the first step we assess this potential source bias by comparing country- and sex-specific age-standardized mortality rates of each surveys' longitudinal sample to the registered data. Next, we estimate multinomial logistic regression models where the outcome variable of interest is the interview status at the end of each wave. We differentiate the effect of health on the odds of attrition by age by estimating separate models by sex and country of residence with an interaction effect between health status and age specified by the two large age-groups (50-70 and 70+ years in the cross-sectional samples), together with the main age-effect, as independent variables.

Next, we assess the effect of the longitudinal sample attrition on the cross-sectional estimates of population health. The summary measures of population health are health expectancy and the average number of years lived in moderate and acute activity limitations. A standard solution to assess and adjust the bias caused by attrition is to apply external sources of information. Refreshment and rotational samples of a panel study are the most reliable source of auxiliary information (Deng et al., 2013; Hirano et al., 1998; Si et al., 2015) and, apart from stabilizing the number of observations, these sub-samples are drawn for this exact purpose (Frick et al., 2006). Due to the rotational sample design in SILC, we can directly compare the distribution of health and resulting health expectancy across the partly attrited longitudinal sample with those of the new rotational sample. As the refreshment samples are not drawn regularly in SHARE, we apply an empirical approach to assess the potential bias: We apply microsimulation to determine health status at the Wave 7 of those who attrited from the sample prior to that wave. Combined with the sample who participated in wave 7, they constitute the initially drawn sample. By comparing health distribution of the originally drawn sample and that of the remaining observed sample, we assess the bias in cross-sectional estimates of health caused by the sample attrition in SHARE.

4 Preliminary Results

As space is limited in the abstract, we discuss the preliminary results of the study and include only one Figure to illustrate them.

Mortality of the SILC respondents in all countries is lower than in the registered data (also demonstrated by Klotz and Göllner (2019); Klotz et al. (2017). This lower mortality is likely a result of underreporting of deaths in the survey data with the "missing" deaths coded as sample attrition. In addition, there is a considerable variation across the countries in the difference between the survey and registered mortality: ranging from only 18% for Swedish men to 88% for Serbian men. Similar to the findings of Kusumastuti et al. (2017); Solé-Auró et al. (2015), in majority of the study countries in the SHARE study mortality is under-reported. For most countries, smaller differences between reported and registered mortality are observed for SHARE than SILC datasets.

In both studies and all countries, those with severe limitations across GALI have significantly higher odds of dying than those with no limitations. Also, in the majority of countries, health-related limitations of moderate level increase odds of mortality in both surveys. Different from the part of the models concerning mortality, the effect of decreased health on the probability of attrition is not universal between the countries and across the two studies. In addition, opposite to what was expected, in some countries those with moderate health-related limitations have a higher probability of remaining in the sample than those in full health. For women this effect is significant in the higher number of the study countries than for men. In the majority of countries in both studies, severe health-related limitations increase the odds of attrition. The effect of decreased health on the odds of attrition differs between younger and older age-groups. In Figure 1, we present the effect of health on the odds of attrition in two large age groups at the cross-sectional interview: below 70 and at 70+ years in each study country separately by sex. In both surveys, for the older age group the direction of the effect is most likely to be similar for health limitations of moderate and severe levels and positive. This effect is more likely to be significant for severe than moderate health limitations. The effect of health limitations on the odds of attrition is insignificant for the younger age groups in all SILC and most SHARE countries.

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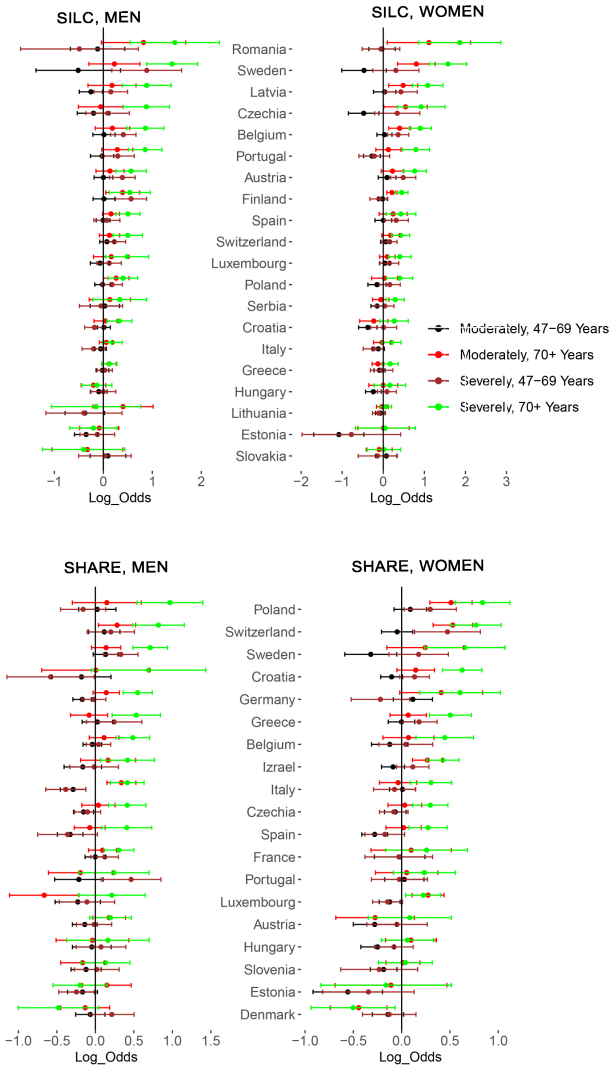
Figure 1: Odds of Attrition from SILC and SHARE Longitudinal Samples by Health Status, Age, Sex and Country



95% confidence intervals
Source: Authors‘ own estimations based on Börsch-Supan (2020); Eurostat (2021)