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Long-term health consequences of recessions during working years

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ABSTRACT

Economic crises may have severe consequences for population health. We investigate the long-term effects of macroeconomic crises experienced during prime working age (20–50) on health outcomes later in life using SHARE data (Survey of Health Aging and Retirement in Europe) from eleven European countries. Analyses are based on the first two waves of SHARE data collected in 2004 and 2006 (N = 22,886) and retrospective life history data from SHARELIFE collected in 2008 (N = 13,732). Experiencing a severe crisis in which GDP dropped by at least 1% significantly reduces health later in life. Specifically, respondents hit by such a shock rate their subjective health as worse, are more likely to suffer from chronic diseases and mobility limitations, and have lower grip strength. The effects are twice as large among low-educated respondents. A deeper analysis of critical periods in life reveals that respondents' health is more affected by crises experienced later in the career (between age 41 and 50). The labor market patterns show that these people drop out of the labor force. While men retire early, women are more likely to become home makers. In line with the literature on the negative consequences of retirement on health, this suggests that early retirement in times of economic crises might be detrimental to health.

1. Introduction

The recent economic crises and high unemployment rates, especially among young Europeans, have spiked a debate about the short- and long-term effects of macroeconomic conditions on population well-being. We contribute to this debate by reporting evidence of negative long-term effects of past economic crises experienced during prime working age on health later in life. We determine the most sensitive periods in peoples' working lives and investigate how crises, labor market outcomes, and later-life health are related.

Economic crises are seen as times of severe economic downturn, i.e., times of low economic growth and high unemployment. Generally, they are perceived to put a burden on population health. Shocks to wealth and income, less access to social protection and health care, and an increase in stress due to job loss or job insecurity are detrimental for health (see, e.g., Bucher-Koenen and Mazzonna, 2013; Sullivan and von Wachter, 2009 for recent evidence). On the other hand, aggregate mortality has been shown to be positively correlated with business cycle fluctuations: in times of economic growth mortality increases and in recessions mortality declines (see, e.g., Gerdtham and Ruhm, 2006; Ruhm, 2005, 2000). The explanations put forward are that during economic downturns opportunity costs of time decrease and individuals may follow healthier lifestyles, i.e. smoke and drink less and spend more time exercising and eating healthy. Additionally, there are fewer costs due to external effects like pollution and congestion that have detrimental effects on health (see Ruhm, 2015 for a review of the literature). However, evidence from the recent economic crisis shows deviations from the pro-cyclical behavior of mortality (e.g., Karanikolos et al., 2016; Ruhm, 2015). This was, for example, observed in Greece—a country that was severely hit by the consequences of the economic crisis and the subsequent debt crisis (Drydakis, 2015). Such evidence seems to point out that the health effects of small business cycle fluctuations might be very different from that of severe recessions.

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Fewer studies have looked into the long-term effects of economic fluctuations because those effects are hard to identify. In particular, it is complicated to define a proper control group, since when a crisis hits a country, it might potentially affect all its citizens. One way to overcome this problem is to consider crises experienced during very specific critical periods in life such as early childhood (see, e.g., van den Berg et al., 2009, 2006; Doblhammer et al., 2013) or early adulthood (see, e.g., Cutler et al., 2014; Hessel and Avendano, 2013). Favorable economic conditions at the time of birth have been found to lower mortality and increase cognitive functioning later in life. Good economic conditions during early adulthood lead to better labor market trajectories for graduating cohorts compared to those graduating during a crisis (see, e.g., Kahn, 2010; Oreopoulos et al., 2012), which in turn is related to better health later in life (Cutler et al., 2014).

However, little is known about the (long-term) effects of crises experienced during adulthood. A notable exception is the work by Burstrom et al. (2012) that shows the presence of delayed effects of the Swedish recession in the 1990s on the employment opportunities and take-up of disability pensions of people from low socio-economic groups.

Our objective is to study the effects of severe macroeconomic shocks which occur during the years when a person is most likely to be active on the labor market (age 20 to 50) on various health outcomes later in life. We examine a broad set of subjective and objective physical and mental health indicators. Thus, we test if severe macro-economic shocks experienced during prime working age (20–50) have detrimental long-term effects for health. Moreover, we split this rather large period into 5-year windows to identify critical periods in which individuals are most vulnerable. Leist et al. (2013) use a similar approach to analyze the effect of business cycle fluctuations on cognitive functioning.

Different from the previous literature (e.g., van den Berg et al., 2009; Leist et al., 2013) we are interested in the effects of severe macroeconomic shocks and not in the effects of business cycle fluctuations. Specifically, we define a crisis year as a year in which GDP dropped by more than 0.95% compared to the previous year. In post-war Europe, this corresponds to the 5% worst years in terms of GDP growth across countries and we cover periods such as the oil crisis in the 1970ies and the European Monetary System crisis in the beginning of the 1990ies. The effect of economic downturns on individuals' health is determined by comparing different cohorts across different European countries. Differing crisis periods between European countries and between cohorts within a country make our study particularly powerful.

We use the first two waves of the Survey of Health Ageing and Retirement in Europe (SHARE) and focus on respondents between age 50 and 70. Specifically, we use data from more than 20,000 individuals living in eleven European countries who experienced different macroeconomic and labor market conditions during their working lives. We calculate the number of country-specific macroeconomic crises during individuals' working years (age 20 to 50) based on GDP data and match those data to the individual-level SHARE data. The SHARE data offers a very rich set of subjective as well as more objective self-reported and measured health variables allowing us to draw a very broad picture of the effect of macro-economic shocks on health later in life.

We find significant negative effects of the number of crises experienced between age 20 and 50 on health later in life. Self-reported health is rated as significantly worse by respondents hit by a macroeconomic shock compared to respondents who experienced no shocks. The effect of experiencing one additional severe crisis is approximately equivalent in size to becoming two years older. Moreover, respondents who experienced a severe macro-economic downturn suffer from more chronic health problems and mobility limitations, and have lower grip strength. The effects are substantially stronger (up to twice the size) for respondents with low levels of education. In addition, the low-educated are more likely to suffer from depression after having experienced a severe macro-economic shock. These results are in line with our initial conjecture that severe macro-economic shocks experienced during adulthood might have detrimental long-term effects for health.

Moreover, our analysis of more specific critical periods shows that in particular individuals experiencing crises, when they are between age 41 and 50, have worse health outcomes later in life. In order to understand possible underlying mechanisms we investigate the relationship between crises and labor market trajectories at that age. We find that individuals who experienced a crisis in their forties are significantly more likely to drop out of the labor force permanently. In particular, low educated men affected by a crisis during their forties are more likely to retire early, whereas women are more likely to become homemakers, probably because they do not qualify for early retirement options that require a certain amount of minimum contributions.

In line with the literature on the negative consequences of retirement on health and cognition (Bonsang et al., 2012; Mazzonna and Peracchi, 2012), we show that early retirement caused by recessions is associated with negative long-term consequences for health.

2. Methods

2.1. SHARE and SHARELIFE data

We use SHARE data, a multidisciplinary and cross-national bi-annual household panel survey coordinated by the Munich Center for the Economics of Aging (MEA) with the technical support of CentERdata at Tilburg University. For information on the data collection and methodology see Börsch-Supan et al. (2005); Börsch-Supan and Jürges (2005) and Börsch-Supan et al. (2013). During waves 1 to 4, SHARE has been reviewed and approved by the Ethics Committee of the University of Mannheim (see http://www.share-project.org/fileadmin/pdf_FAQ/SHARE_Ethics_Reviews_Statement.pdf for more information). The survey collects data on health, socio-economic status, and social and family networks for nationally representative samples of older people in the participating countries. The target population consists of individuals aged 50 and older who speak the official language of each country and do not live abroad or in an institution, plus their spouses or partners irrespective of age. Our data are from release 2 of the first two waves (2004 and 2006) of SHARE (Börsch Supan, 2011a,b, DOI: 10.6103/SHARE.w1.250, 10.6103/SHARE.w2.250). In wave 3 of the SHARE data collection retrospective life data was collected (SHARELIFE). We are using these data in the second part of our analysis.

Our main sample consists of the respondents of wave 1 (conducted in 2004) and the refreshment sample of wave 2 (conducted in 2006) residing in eleven European countries, namely Sweden, Denmark, the Netherlands, Austria, Germany, France, Switzerland, Belgium, Greece, Spain, and Italy. We are observing each participant only once. The use of the refreshment sample from wave 2 increases the number of observations and also helps to disentangle age and cohort effects (for instance the 1954 cohort is 50 years old in 2004 and 52 in 2006). We restrict our sample to cohorts born between 1934 and 1954. This means respondents were between 50 and 70 years old at the time of the first wave data collection (2004)

Table 1
Samples by country.

Country	Full sample	Job Episodes sample
	SHARE W1 and W2	SHARELIFE
Austria	1291	532
Germany	2658	1257
Sweden	2450	1283
Netherlands	2577	1509
Spain	1718	979
Italy	2313	1458
France	2332	1416
Denmark	1907	1326
Greece	2092	1545
Switzerland	998	717
Belgium	2550	1710
Total	22,886	13,732

Note: In the Full sample we include respondents from SHARE wave 1 and the refreshment sample in wave 2. Respondents are born between 1934 and 1954 and have lived in their current country of residence after age 20. They have worked at least once between age 20 and 50. The data from the Job Episodes sample stems from SHARE wave 3. Here we restrict the respondents to those that reported to be active on the labor market at the age of 40.

and between the age of 20 and 50 (the reference age window to observe the effect of macroeconomic shocks during the most active period in the labor market) in the period between 1954 and 2004. We do not include individuals older than 70 in the sample since it could increase the selective mortality problem (we comment further on selective mortality in the robustness checks). Our sample consists of 17,781 respondents from wave 1 and 5,099 respondents from wave 2. The baseline sample consists of all individuals who have lived in the country of current residence after age 20 and who have worked at least once in the period between 20 and 50. This sample selection criterion is meant to focus on people that were more exposed to the effect of macroeconomic fluctuations. Indeed, we noted that including those who never worked reduces the effect of crisis on health (results available upon request). We also exclude migrants who entered the country after age 20 because, first, migration can be related to macroeconomic conditions both in the country of origin and the country of migration and, second, we cannot precisely estimate by which crises these persons were affected. The sample varies slightly depending on the type of analysis due to missing information on some health indicators.

Once we have assessed the effect of crises experienced during individuals' working life on old age health, we investigate what labor market patterns are associated with these crises. For this analysis, we use retrospective data from SHARELIFE to investigate the labor market outcomes of the individuals in our sample at the point in time when they were hit by the macroeconomic crisis. Using the retrospective information from SHARELIFE, we can trace back the complete labor market history of all individuals that participate in the SHARELIFE survey. Specifically, we use the so-called "SHARE Job Episodes Panel" that rearranges information taken from waves 1 to 3 of SHARE in order to create a "balanced panel" in which it is possible to identify the labor market status of each SHARE respondent in each year of his/her life (Antonova et al., 2013; Antonova et al., 2014; Brugiavini et al., 2013; DOI: 10.6103/SHARE.jep.100). Table 1 shows our two working samples by country. The Job Episodes sample contains a smaller number of respondents due to attrition across the three waves and because we further restrict the attention to respondents that reported to be active on the labor market at the age of 40. This additional restriction is meant to analyze the labor market outcomes of people affected by a severe macroeconomic shock in the age window 41 to 50, the most sensitive period according to the estimates we report in Table 6. Further details about how we take care of the sample selection are provided later in this section. It is worth noting that, despite the potential selection issue that might arise when using the Job Episodes sample we can replicate our main analysis using this restricted sample—overall the effects of macroeconomic shocks on health later in life remain very similar (but standard errors increase).

2.2. Health measures, labor market outcomes, and covariates

2.2.1. Subjective health

Our main dependent variable is a self-rated health measure. Respondents are asked to evaluate their current health on a 5-point scale from "1-excellent" to "5-poor". Our indicator takes value 1 if the self-reported health is "1-excellent" or "2-very good" and 0 otherwise. Self-reported health status is among the most common measures used in public health surveys; it reflects various physical, emotional, social aspects of health and well-being and has been found to predict mortality (see, e.g. Idler and Benyamini, 1997; Jylha, 2009). About 37% of the respondents in our sample rate their health very good or better (see Table 2).

Table 2
Summary statistics.

	Mean	Std.dev	Min. value	Max. value
Health measures:				
Dummy Good health	0.37	0.48	0	1
Dummy Symptoms	0.35	0.48	0	1
Grip strength	36.66	12.25	0	100
Dummy IADL	0.88	0.32	0	1
Dummy Chronic diseases	0.32	0.48	0	1
Dummy Mobility limitations	0.61	0.49	0	1
Dummy Depression (Euro-D < 4)	0.79	0.40	0	1
Crises measures:				
No. of crises - GDP, 5%	1.85	1.17	0	5
No. of booms - GDP, 5%	1.01	1.93	0	8
No. of crises - GDP, 10%	3.59	1.77	1	9
Dummy (≥ 1 GDP crisis) 20–25	0.23	0.42	0	1
Dummy (≥ 1 GDP crisis) at age 26–30	0.24	0.43	0	1
Dummy (≥ 1 GDP crisis) at age 31–35	0.23	0.42	0	1
Dummy (≥ 1 GDP crisis) at age 36–40	0.30	0.46	0	1
Dummy (≥ 1 GDP crisis) at age 41–45	0.31	0.46	0	1
Dummy (≥ 1 GDP crisis) at age 46–50	0.24	0.97	0	1

Table 2 (*continued*)

	Mean	Std.dev	Min. value	Max. value
Covariates:				
Females	0.51	0.50	0	1
Age	59.80	5.94	50	72
Low education	0.43	0.50	0	1
Labor market:				
Not working (41–50)	0.18	0.39	0	1
Retired (41–55)	0.04	0.18	0	1
Inactive (41–55)	0.16	0.37	0	1

Note: Summary statistics for the sample including 22880 respondents from wave 1 and 2 of the SHARE data set, who satisfy all the following conditions: 1) were born between 1934 and 1954; 2) reside in one of the following countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, Switzerland; 3) did not immigrate in the country after the age of 20; 4) report having worked at least once in their lives.

2.2.2. Objective health

In addition to that, we provide analyses of a variety of more objective health measures. Those measures are still self-reported during the interview. However, they are more objective in the sense that they are related to very specific conditions and limitations, or require a doctors's diagnosis. The variable symptoms reports the number of symptoms that respondents experienced in the last six months from a suggested list of eleven symptoms, such as fatigue, pain in the back, heart trouble, sleeping problems, etc. We also measure the number of chronic conditions out of twelve possible diseases, including high blood pressure, heart attack, diabetes etc. Furthermore we have information on limitations in the instrumental activities of daily living (IADL), and mobility limitations. Depression is measured using the EURO-D depression scale (a 12 items depression symptoms scale) and a cut-off value larger than 3. This cut-off point has been validated in the EURODEP study, across the continent, against a variety of clinically relevant indicators (Braam et al., 2005). All health variables are defined as dummies indicating that the respondent is healthy, i.e. not suffering from any conditions or limitations of the respective health measure. In Section C of the Online Appendix we list the exact definitions of all health variables.

Grip strength is our most objective measure of health since the task is performed during the interview. It reflects the overall muscle status of the respondent and has been linked to mortality in previous research (see, e.g., Gale et al., 2007). Table 2 presents the summary statistics.

2.2.3. Labor market outcomes

In addition, we are using labor market status in the age window 41–50 (55) from SHARELIFE. Specifically, we measure if individuals leave employment, whether they retire, or become homemakers.

2.2.4. Covariates

As covariates we use information on the country of residence, gender, age, and birth year. Educational attainment is differentiated between low education—primary and lower secondary education (ISCED level 0–2)—and middle and high education—upper secondary, non-tertiary post secondary, and tertiary education (ISCED level 3–6). Table 2 reports descriptive statistics for the covariates. In a robustness check we use data on childhood health and socioeconomic circumstances, namely we use measures of respondents' height, their self-reported health at age 10, and their father's occupation.

2.3. Macroeconomic crises

Our central covariate of interest is a measure that captures the severe macroeconomic crises an individual experienced between age 20 and 50. For the cohorts included in this study that corresponds to the macroeconomic conditions in the years between 1954 and 2004. Despite the fact that this period was characterized by post-war economic growth all over Europe, some serious macroeconomic recessions still happened, e.g., the oil crisis 1973–1975 and the European Monetary System crisis 1992–1993.

GDP per capita is a widely used measure of macroeconomic conditions (see, for example, Barro and Ursua, 2012). Specifically, we use GDP per capita in 1990 PPP-adjusted dollars from the Agnus Maddison historical statistics on world population. Table 3 provides some critical values of the distribution of the relative change in GDP ($\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$) over the period from 1954 to 2004 for the countries included in our analysis. Average GDP growth was around 2.6% per year.

Table 3
Distribution of the yearly changes in real PPP-adjusted GDP in the period 1954–2004 in eleven European countries.

Percentile	1%	5%	10%	50%	90%	95%	99%
% Δ GDP	−2.75%	−0.95%	−0.09%	2.59%	5.71%	6.85%	10.10%

Note: The data are taken from the Agnus Maddison historical statistics on world population for Austria, Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Spain, Sweden, and Switzerland (See http://www.ggdc.net/MADDISON/oriindex.htm). Germany is treated as one country in this data base even though it was separated into East and West between 1949 and 1990. We ran all our regressions dropping respondents from east Germany and also dropping Germany completely and our results do not change.

We define several indicators for crises and booms in this period. Our standard measure is the following: we define the worst 5% of the years in terms of GDP dynamics as “crisis years”. The worst 5% of the country-years in terms of GDP growth correspond to the years when GDP dropped by at least 0.95% compared to the previous year. The number of crises experienced between 20 and 50 varies from 0 (in Austria) to 5 (in Switzerland). In Fig. 1 we show the average number of crises per cohort of birth by country, while in the Online Appendix, Section A we provide the years of crises by countries according to this definition. Even though some crises, like the oil crisis in 1974/75 or the European monetary crisis in 1992/93, were common for some of the countries considered, there is geographical and between-cohort variation in the number of crises experienced. On average, the respondents in our sample experienced slightly less than two severe crises during their working lives (see Table 2). Since our purpose is to evaluate the effect of recession years and not of business cycle fluctuations, we are using the 5% worst years from the pooled year-country observations. If we would instead use country-specific 5% of the years, the number of crises for each country in the 50-year period would be identical by construction. Moreover, there would be variation in the crises strength between countries and in some cases “artificial” crisis

years could be created for some cohorts who are not affected by any recession.

In order to understand the sensitivity of our results to the definition of a crisis, we alternatively define crises as worst 10% of the country-years in terms of GDP growth—this corresponds to an annual GDP drop larger than 0.09%. Moreover, in some specifications we analyze the effects of economic booms, where "boom years" are defined as the 5% best years in terms of GDP growth. In those years GDP per capita increased by at least 6.85%.

Finally, we split the age period 20 to 50 into 5-year intervals to check for sensitive periods. Thus, we construct indicators of experiencing a crisis at age 20–25, 26–30, …and 46–50 and include them as regressors simultaneously. The summary statistics for all measures are reported in Table 2. Additionally, we create alternative period specific measures based on the mean unemployment rate experienced. For this we use data on the country-specific rate of unemployment between 1956 and 2004 taken from the OECD Statistics. Results are reported in the Online Appendix, Section B.

2.4. Empirical strategy

Our empirical strategy is composed of two steps. In a first step, we would like to identify the effects of macroeconomic crises on older people's health. In the second step, we are interested in potential mechanisms that relate crises to health through labor market patterns. Therefore, we will investigate how crises influence labor market trajectories.

The effect of severe macroeconomic shocks on individuals' health later in life is identified based on the health deviations of the cohorts affected by the shock from their country-specific health trend. A similar empirical strategy has already been applied in the literature (see, e.g. Doblhammer et al., 2013 or Giuliano and Spilimbergo (2014)).

More specifically, we estimate the following equation:

$$Y_{itc} = \beta_0 + \beta_1 M_{tc} + \beta_2 X_{itc} + \delta_c + f(t,c) + u_{itc} \quad (1)$$

where Y_{itc} is the health outcome of individual i born in year t in country c; M_{tc} measures the macroeconomic crises (or booms) experienced during ages 20 to 50 by the cohort t in country c; in our baseline specification this is a variable counting the number of crises (or booms). In the analysis of the most sensitive periods M_{tc} is a vector of six dummies indicating if a crisis hits the respondent in one of the six 5-year age intervals (i.e., 20–25, 26–30, …and 46–50). The crises measures thus indicate if respondents experienced at least one year with a GDP drop larger than 0.95% in the respective period. As robustness check, we also use the mean unemployment rate experienced in those age brackets. X_{itc} contains other control variables, such as gender and age (for simplicity we do not include the subscript for age in equation (1)). We also control for country fixed effects, δ_c, and country-specific polynomial trends (linear and quadratic) in birth cohort $f(t,c)$. We estimate the model separately by sex and educational level to evaluate the presence of heterogeneity in the effect of interest. Standard errors are clustered at the household level. We present average marginal effects (AME) derived after estimating probit models in all tables except models with outcome grip strength in Table 5; for grip strength we estimate OLS models.

2.4.1. Identification issues and robustness checks

Since the identification of the effect of interest comes from variation between cohorts and countries, one concern is that we are picking up other country and cohort specific trends in health that are correlated with the number of crises. When looking at the trends in population health in Europe, we observe that health improved substantially over time, but the patterns were quite different among the European countries. At the same time, Fig. 1 shows that the number of crises seems to have increased by cohort while the number of booms decreased for most of the countries considered. Thus, it is essential to control for country-specific trends in health. In this way, we are able to control for a wide variety of unobservable factors that might affect health and avoid spurious correlations with our macroeconomic indicator. In our main specification we therefore include linear and quadratic country-specific trends in health. In addition, we perform robustness checks with a variety of other trend specifications and show that our results are robust to these alternative specifications (see Online Appendix B for details).

We also implement a set of placebo tests to check whether there is an effect of our crisis indicators on childhood health, body height (a well-known marker of childhood health and nutrition) and father's occupation, a proxy for the childhood socio-economic background. The intuition is that macroeconomic crises experienced during working life should be unrelated with childhood circumstances unless the relationship is driven by other predetermined cohort-specific characteristics. This would be the case, e.g., if all individuals experiencing a crisis during working life also experienced a crisis at birth or other stressful events that are varying at the cohort level which have an influence on their lifetime health. Such effects are for example reported by van den Berg et al. (2009, 2006) and Doblhammer et al. (2013). Since we do not find such effects, we do not think that our results are driven by predetermined cohort specific factors.

Another point of concern is selective mortality since our sample is composed of individuals aged 50 and older. As discussed in the introduction, for example Ruhm (2000) shows that mortality exhibits pro-cyclical fluctuations in the short run. This might imply that, at the time of observation, those cohorts who have experienced worse macroeconomic conditions during their working years are positively selected by mortality. At the same time, such unfavorable health effects are partially or fully offset in the medium term if the economic growth is long-lasting. This means that in the presence of selective mortality the direction of the bias is not clear. We take this problem into account by including cohort-specific survival rates. Such a strategy should also solve the selection effect due to the Second World War. In this second case, the main concern is that our results might be driven by the fact that some of the cohorts involved in this study are born during the war years. As another robustness check we restrict our analysis to the post-war cohorts only. The results from all the robustness checks are shown in the Online Appendix, Section B and they never cast doubt on our identification strategy.

2.5. Potential mechanism: labor market trajectories

In a second step we would like to understand how the crises are related to labor market outcomes. In particular, we want to evaluate how and to what extent these crises affected the individuals' labor market opportunities and choices. In this part we will use labor market outcomes during critical periods and estimate the effects of severe macroeconomic shocks on the probability to leave the labor market and to retire. Specifically, as estimation method, we use the Cox proportional hazard model to estimate the instantaneous hazard rate of going out of employment. In particular, the analysis of the critical period as described above will point out that macroeconomic shocks experienced between age 41 and 50 strongly

affect old-age health, therefore our analysis will focus on labor market patterns in that age window.

The dependent variable is the amount of time that an individual spends in employment before leaving the labor force or becoming unemployed (not working). As two alternative specifications we also model the time until (early) retirement and the time until becoming inactive but not retired. This model assumes that the hazard function h of the individual i has the following form:

$$h(t/C_{ia}, X_i) = h_0(a)\exp(\beta C_{ia} + X_i'\gamma) \quad (2)$$

where $h_0(a)$ is the baseline hazard function at age a and X_i is the same set of controls used in the previous section (i.e. sex, education and country-specific quadratic age trends). The main variable of interest is, C_{ia}, a time-varying crisis indicator. This indicator is specified in two different ways. In order to measure the instantaneous effect of a crisis on leaving employment we define a dummy variable that indicates if an individual is hit by a crisis at age a. This indicator is only one in the crisis year and zero otherwise. In a second analysis, we measure the medium and long-term effects of a crisis on specific labor market trajectories (early retirement and inactivity). To do so, we define an indicator that is equal to one if an individual is hit by a crisis at age a and that stays one thereafter. In other words, this second analysis is meant to measure the delayed effects of crises for example on the probability to retire early within a certain time window (here until age 55). In this second analysis, we include only the respondents who were interviewed in wave 1 or 2 before the age of 55 to avoid the possibility that their health status is measured before early retirement and inactivity. We estimate these models by sex and we evaluate the presence of education heterogeneity by interacting C_{ia} with an indicator for middle and high education. It is worth noting that in case of repeated exits or failure, we only consider the first individual spell.

The main advantage of the semi-parametric Cox model is that we do not need any assumption regarding the shape of the hazard function but we assume that covariates have a constant impact on the hazard rate over the whole at-risk period (proportionality assumption). We believe that this is a reasonable approximation, but in particular in the case of retirement this assumption might not hold if the effect of the crisis is time (age) dependent. For this reason, we evaluate the robustness of our results using a parametric alternative (Weibull model). Additionally, in the Online Appendix, Section B we also use panel data methods, namely a probit model with random effects. In both cases results are qualitatively and quantitatively similar to the ones presented here.

2.5.1. Attrition

As already mentioned, the Job Episodes sample contains a smaller number of respondents because of attrition across waves. We deal with panel attrition (and missing information due to our sample restrictions) by estimating our duration model using inverse probability weighting (IPW) (see Wooldridge, 2007). Specifically, we estimate a probit model for the probability of participation in the third wave of SHARE by conditioning on the values of the variables observed in the first wave and information about the interview process such as the individual willingness to answer (as reported by the interviewer) and the interview date. We then use the inverse of the fitted probability to construct the weights that we use in our main equation. The inclusion of information related to the interview process allows us to better estimate the selection process compared to the survey weights provided in SHARE which only account for age, sex, and country. When we replicate our main analysis using the selected (wave 3) sample and the IPW method, we estimate exactly the same effects of macroeconomic shocks on health later in life as in the full sample (results are available upon request).

3. Results

3.1. The effect of crises on health later in life

In this section we present empirical evidence of the effect of economic crises experienced during working years on health outcomes later in life. Table 4 presents the effect of the number of crises on self-reported health in the overall sample and separately by gender and education levels. Each cell in the table represents results from a separate regression. An increase in the number of severe macroeconomic crises significantly decreases the probability to report good health later in life by about 2.3%. If compared with the age coefficient, the effect of one additional crisis year on self-reported health is equivalent to becoming almost two years older.

Table 4
Average marginal effects of experiencing one or more crises on the probability to report good health by levels of education and gender.

	(1) All	(2) Low Education	(3) Middle & High Education
A. All	−0.0225**	−0.0424***	−0.0013
	(0.010)	(0.013)	(0.015)
N	22880	9778	12752
B. Men	−0.0164	−0.0386**	0.0085
	(0.014)	(0.020)	(0.021)
N	11286	4441	6678
C. Women	−0.0288**	−0.0444**	−0.0122
	(0.014)	(0.018)	(0.022)
N	11594	5337	6074
D. All (crisis: 10% worst years)	−0.0107	−0.0230**	0.0021
	(0.009)	(0.012)	(0.012)
N	22880	9778	12752
E. All (booms: 5% best years)	0.0318***	0.0300**	0.0369**
	(0.011)	(0.014)	(0.018)
N	22880	9778	12752

Note: This table shows AME calculated after running probit regression models. The dependent variable is the probability to report good subjective health. The main control variable is the number of crisis or booms experienced between age 20 and 50—where a crisis year is defined as a year in which real GDP in the country dropped by 1% or more with respect to the previous year (rows A., B., C.; 0.01%—row D., respectively). Boom years (row E.) are defined as years in which GDP grew by at least 6.85%. Additional control variables are: gender, birth year, squared birth year, age, country dummies and country-specific linear and quadratic trends in birth year. Standard errors are clustered at the household level and displayed in parentheses. For each panel, the number of observations (*N*) is displayed below the standard errors. The number of stars denotes the significance level: *p < 0.10, **p < 0.05, ***p < 0.01.

Separating the effects by education—column (2) and (3) reveal that the effect of macroeconomic crises on health is primarily driven by individuals with low levels of education. Among the low educated, experiencing an additional crisis during working life decreases the probability to report good health by 4.2%. That is almost twice the effect in the overall sample. The effect is substantially smaller and insignificant among those with higher educational levels.

The influence of macroeconomic shocks on health later in life is larger for women than for men (see rows B. and C.). However, analyzing the interaction with education demonstrates that this is driven by differences in the levels of education between men and women. Low educated men and women are about equally affected by experiencing crises during their working lives while the effects of crises for men and women with higher levels of education both are zero.

We would also like to know if the intensity of the macroeconomic shocks is an important factor to take into account. We already stressed in the introduction that most of the literature does not distinguish severe macroeconomic shocks from small business cycle fluctuations. One of the reasons why the effects of economic fluctuations on health are not measured consistently across studies could be that crises are defined in different ways. Both the results of the regressions with the baseline and the alternative crises variables on self-reported health are provided in Table 4 for ease of comparison. As before, each cell represents a separate regression result. When we relax the definition of the crisis years and consider also years with smaller drops in GDP, the influence of macroeconomic crunches on health weakens (compare row A. and D.). Specifically, we define crisis years as years in which GDP dropped by at least 0.09% which corresponds to the worst 10% of years in terms of GDP growth in all countries. In the overall sample the effect is about half its original size and insignificant. For individuals with low education the effect is reduced by about half and still significant. These results suggest that only severe crises significantly harm population health in the long-run.

On the other hand, we test if booms, i.e. periods of exceptionally high economic growth, have the reverse effect on health (bottom row E.). We find that not only crises but also booms have a long-term impact on subjective health. Experiencing an additional economic boom increases the probability of reporting good old-age health by about 3.2%. Effects are significant among the low and high educated and slightly higher among those with high educational degrees. If we control for booms and busts simultaneously, results are consistent (not shown).

In addition to self-reported health we estimate the effect of macroeconomic shocks on a set of more objective health measures and find consistent results (see Table 5). Respondents who experienced a larger number of crises during their potentially active labor market years are less healthy in terms of the likelihood to report chronic diseases, and general mobility limitations compared to those who experienced no or fewer crises. They also show lower grip strength, which is a measure of frailty and has been linked to mortality. There are no effects on the probability to report suffering from symptoms, like pain or fatigue, depression or to have restrictions in the activities of daily living for the overall sample. All effects are stronger and more frequently significant among those with low levels of education. Among the low educated individuals the effects of crises on depression and suffering from symptoms like pain or fatigue are about two to three times the size of the overall sample and statistically significant at the 10% level.

Table 5
Average marginal effects of experiencing one or more crises on health.

	(1) All	(2) Low education	(3) Middle & high education
Dummy Symptoms	−0.012	−0.024*	0.002
	(0.010)	(0.014)	(0.015)
N	22879	9779	12750
Dummy Chronic diseases	−0.031***	−0.039***	−0.018
	(0.011)	(0.015)	(0.017)
N	17772	7876	9793
Grip strength	−0.401**	−0.529**	−0.309
	(0.173)	(0.256)	(0.238)
N	21245	9003	11937
Dummy Mobility limitations	−0.037***	−0.046***	−0.028*
	(0.010)	(0.015)	(0.014)
N	22866	9769	12747
Dummy IADL	−0.007	−0.013	−0.001
	(0.007)	(0.011)	(0.008)
N	22977	9796	12771
Dummy Depression (Euro-D < 4)	−0.007	−0.023*	0.009
	(0.009)	(0.014)	(0.012)
N	22554	9615	12610

Note: This table shows AME calculated after running probit models (or OLS in case of grip strength). The dependent variables are different health indicators. All variables except grip strength are dummy variables taking value 1 if the respondent has none of the corresponding conditions and 0 if at least one (or at least three depression symptoms in case of depression). The exact definition of the variables is reported in Online Appendix. The main explanatory variable of interest is the number of crises experienced between age 20 and 50—where a crisis year is defined as a year in which real GDP in the country dropped by 1% or more with respect to the previous year. Additional control variables are: gender, birth year, squared birth year, age, country dummies and country-specific linear and quadratic trends in birth year. Standard errors are clustered at the household level and displayed in parentheses. For each regression, the number of observations (*N*) is displayed below the standard errors. The number of stars denotes the significance level: *p < 0.10, **p < 0.05, ***p < 0.01.

3.2. Timing of crises periods

In order to single out periods in which individuals are particularly vulnerable to macroeconomic shocks, we control for a vector of period-specific crises measures simultaneously. Such critical periods could for example be during childhood and around labor market entry as shown in the previous literature (see, e.g., van den Berg et al., 2006; Cutler et al., 2014). However, they could also occur

at other points in time.

Results of this exercise are presented in Table 6 for the complete sample and separated by education. Especially crises experienced later in the career—between age 41 and 50—have a negative effect on old-age health. This effect is once more particularly strong among the low educated subsample. It is worth noticing that also other age windows show negative and sizeable coefficients (20–25 for the low educated and 36–40 for the high educated) but their standard errors are quite large. Some concern might arise regarding this analysis because crises at later ages (i.e., 41–50) are also more recently experienced and so more likely to affect individual's health (and not because these ages represent a more sensitive period). In the Online Appendix Section B we implement a robustness check that seems to reject alternative interpretations.

Table 6
Average marginal effect of having at least 1 crisis in 5-years interval on the probability to be in good health.

	(1) All	(2) Low educ.	(3) Middle & high educ.
20–25	0.0106	−0.0256	0.0412
	(0.03)	(0.03)	(0.04)
26–30	0.0007	−0.0074	0.0115
	(0.02)	(0.03)	(0.03)
31–35	−0.0090	−0.0098	−0.0001
	(0.02)	(0.03)	(0.03)
36–40	−0.0247	−0.0118	−0.0335
	(0.02)	(0.02)	(0.02)
41–45	−0.0370***	−0.0400**	−0.0271
	(0.01)	(0.02)	(0.02)
46–50	−0.0323***	−0.0450***	−0.0165
	(0.01)	(0.02)	(0.02)
N	22880	9778	12752

Note: This table shows AME calculated after running probit regressions. The dependent variable is the probability to report good subjective health. The main explanatory variables of interest are indicator variables for crises experienced in the respective age intervals—where a crisis year is defined as a year in which real GDP in the country dropped by 1% or more with respect to the previous year. Additional control variables are: gender, birth year, squared birth year, age, country dummies and country-specific linear and quadratic trends in birth year. Standard errors are clustered at the household level and displayed in parentheses. The number of observations (*N*) is displayed at the bottom of the Table. The number of stars denotes the significance level: *p < 0.10, **p < 0.05, ***p < 0.01.

Finally, we report in the Online Appendix (Table B6) the results using mean unemployment as an alternative measure in the same age interval. The results point out the importance of having favorable economic conditions during early adulthood (20–30). This is also consistent with the literature mentioned before, which considers this period as critical because individuals make the transition from school to work (Cutler et al., 2014; Hessel and Avendano, 2013). However, such an alternative approach means analyzing the effect of the average economic condition experienced at that age and might not capture the effect of a severe negative macroeconomic shock.

Overall, our results suggest that people with a high level of education are not severely hit by economic crises and experience positive effects from economic booms on their health. At the same time, those with low levels of education are severely hit by economic crises and moderately profit from economic booms. Those individuals report lower subjective health and show worse objectively measured health if they are hit by a severe macroeconomic downturn. Last but not least, individuals seem to be particularly vulnerable to shocks experienced later in their career—between age 41 and 50.

3.3. The effect of crises on labor market trajectories

In this section, we investigate what drives the relationship between macroeconomic shocks and health later in life observed so far. In particular, given the analysis of the sensitive periods presented above, we will focus on labor market experiences between age 40 and 50. However, in order to evaluate the effects of these crises on the hazard of early retirement, we extend the observation period to age 55, because there are very few transitions to early retirement before the age of 50. We do not further increase the observation period (for instance up to age 60) to remain consistent with the analysis presented previously. Moreover, by extending the observation period too far we face problems with the "normal" retirement windows of many countries, like for example in Italy, Greece, and France.

Notice that our analysis conditions on labor market participation at age 40. Given the very low labor force attachment of the female cohorts in SHARE, this sample selection criterion reduces the women's sample.

Table 7 shows the results divided into three panels. The reported coefficients are average marginal effects (with respect to the relative hazard). In Panel 1 we focus on the instantaneous effect of economic crises on employment duration by gender. This means the dependent variable is the duration of work, where the failure event is not working. The main explanatory variable is whether individuals experienced a crisis in a specific year. For men and women, column (2) and (4), we investigate the heterogeneity across educational groups by interacting the crisis variable with education. Consistently with the effect reported on health, a crises experienced between age 41–50 dramatically increases the probability of not working mainly for low educated men (+56%) and for high educated women (+64%). The fact that only high education women were affected might be due to the quite low labor force attachment of low educated women (more than 40% of them do not work in this period).

However, in order to explain why there might be a relationship between the crises experienced at a specific age, the labor market outcomes, and health later in life, we would also like to examine the long-term effects of severe macroeconomic shocks on labor market choices. For this reason, in Panel 2 and 3 we investigate the presence of lasting effects on employment patterns. Specifically, we look at the effect of crises experienced in the period 41–50 on early retirement (the failure event is retirement before age 55). As explained before, here the crisis indicator has to be defined slightly differently from the approach chosen in Panel 1. In particular, the crisis indicator remains one if a crisis has hit. The results show that severe economic shocks strongly increase the hazard of retiring early for low educated men (by 35%). This result is consistent with both the instantaneous effect on employment duration reported in Panel 1 of Table 7 and the health effects reported in the previous section.

The evidence suggests that low educated men affected by severe macroeconomic shocks might have experienced problems to re-enter the labor market, pushing them towards early or pre-retirement schemes (depending on their countries' social security regulation). On the other hand, these crises do not seem to affect women's hazard to retire. This sex heterogeneity might be explained by the contribution requirements that characterize pre-retirement schemes in many European countries. Consistent with this hypothesis, SHARELIFE data clearly show that low educated men typically start to work in early adulthood (often around age 16) with quite continuous careers, while women's careers, if ever working, were very discontinuous. This suggests that only few women fulfill contribution requirements that allow them to opt for

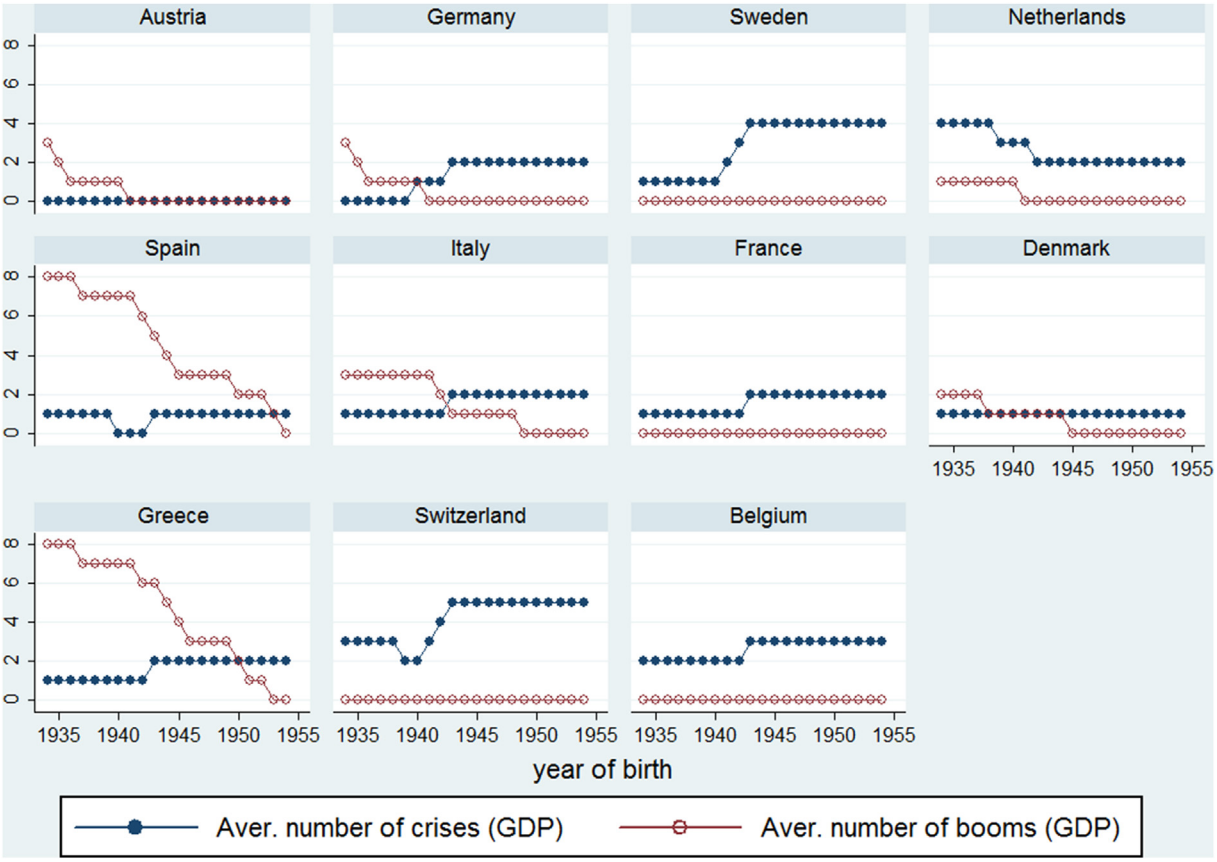

Fig. 1. GDP crises and booms over birth cohorts by country.

early retirement. The argument is further confirmed by the results in Panel 3. Here we consider being out of the labor force but not retired as failure event. The table shows that all women exposed to a severe macroeconomic shock during their forties have a significantly higher probability (+24%) of being out of the labor force afterwards. This means that women affected by a crisis during their forties have a higher probability of becoming a homemaker, while men have a higher probability of retiring before the age of 55.

4. Discussion

This paper investigates the causal effect of the number of macroeconomic crises experienced during prime working age (20–50) on different health outcomes in old age merging macroeconomic data with individual data from SHARE. We exploit the variation in the number of macroeconomic crises experienced during prime working age between countries and cohorts to identify the effect.

Our results indicate that individuals that experience bad economic times—in which GDP dropped by at least 1%—show a significantly lower probability of being in good health. They are more likely to report bad subjective health, to be chronically ill and limited in their mobility, and have lower grip strength. We find some remarkable heterogeneity in the effects. The results are larger in magnitude and more often significant for the low educated subsample, while high educated respondents seem to be mostly positively affected by times of exceptional macroeconomic growth.

Further, we find that within this rather large age interval 20–50 we can determine smaller periods in which experiencing a crisis is critical for health. In particular, severe GDP drops experienced later in the career (in the forties) significantly reduce health of respondents with low education. An investigation of labor market trajectories suggests that low educated men and women are much more likely to drop out of the labor force when a crisis hits. In the mid-term (early fifties) men are likely to opt for early retirement while women become homemakers.

Our results clearly show that the strength of a crisis matters. Only severe macroeconomic shocks have negative long-term consequences on health. Moreover, how we measure crises matters. Using mean unemployment instead of GDP drops captures the effect for different age groups. Consistent with Cutler et al. (2014), we find that high unemployment rates have long-term consequences for people that are hit early in their career (under 30) but not for older workers. This alternative measure captures the effect of the average economic condition experienced at that age and might not capture the effect of a severe negative macroeconomic shock. In addition, this result could be the consequence of the fact that older workers were pushed out of the labor force through easy access to early retirement pathways, especially during the 1990ies. However, our results suggest that the policy reaction—easing the access to early retirement during severe macroeconomic shocks—can have negative long-term consequences on older workers' health. Such a result is also consistent with the recent literature on the negative effect of retirement on health and cognitive abilities (e.g., Bonsang et al., 2012; Mazzonna and Peracchi, 2012).

Of course, more research is needed to draw a tighter connection between macroeconomic shocks, labor market pathways, and health later in life. Furthermore, it is also needed to gain a better understanding of the precise mechanisms which are at work and, ultimately, to point to effective policy interventions.

Table 7
Effect of economic crises on employment duration, early retirement and inactivity (average marginal effects).

	Men		Women	
	(1)	(2)	(3)	(4)
Panel 1—Failure: not working (age 41–50)				
Crisis	0.195	0.559**	0.381***	0.013
	(0.196)	(0.250)	(0.131)	(0.208)
Crisis*		−0.745*		0.635**
Middle & high educ.		(0.391)		(0.264)
N	64152	64152	42399	42399
Panel 2—Failure: early retirement (age 41–55)				
Crisis 41–50	0.211	0.347**	0.066	0.024
	(0.142)	(0.163)	(0.142)	(0.165)
Crisis 41–50*		−0.353*		0.089
Middle & high educ.		(0.214)		(0.216)
N	89733	89733	88395	88395
Panel 3—Failure: inactive but not retired (age 41–55)				
Crisis 41–50	0.057	0.178	0.244***	0.207*
	(0.134)	(0.177)	(0.107)	(0.095)
Crisis 41–50 *		−0.241		0.082
Middle & high educ.		(0.226)		(0.159)
N	87932	87932	59612	59612

Note: This table reports the results of Cox proportional hazard models run on three different failure events (not working, early retirement and inactivity). The table reports the average marginal effects (with respect to the relative hazard) on the crisis variable and its interaction with the high education dummy. In Panel 1, the crisis dummy measures the instantaneous effect of a crisis at age *a* on not working at age *a*. In Panels 2 and 3, the observation period is extended to age 55 and the crisis dummy takes value one if the respondents experienced a crises in the current or in previous years. The model also includes as controls sex, high education, and country-specific quadratic age trends. Estimates are weighted using inverse probability weighting (IPW) to account for attrition. Standard errors are clustered at the individual level and displayed in parentheses. The number of observations (*N*) is displayed at the bottom of each panel. The number of stars denotes the significance level: *p < 0.10, **p < 0.05, ***p < 0.01.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2017.06.025.

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