Social Science & Medicine 75 (2012) 1288–1295

Contents lists available at SciVerse ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Social capital and health of older Europeans: Causal pathways and health inequalities

Nicolas Sirven [a,b,*], Thierry Debrand [a]

[a] IRDES, Paris, France
[b] LAREFI, Université Montesquieu-Bordeaux IV, France

ARTICLE INFO

Article history:
Available online 4 June 2012

Keywords:
Healthy ageing
Social capital
Health inequality
Granger causality
Panel data
Europe

ABSTRACT

This study uses a time-based approach to examine the causal relationship (Granger-like) between health and social capital for older people in Europe. We use panel data from waves 1 and 2 of SHARE (the Survey of Health, Ageing, and Retirement in Europe) for the analysis. Additional wave 3 data on retrospective life histories (SHARELIFE) are used to model the initial conditions in the model. For each of the first 2 waves, a dummy variable for involvement in social activities (voluntary associations, church, social clubs, etc.) is used as a proxy for social capital as involvement in Putnamesque associations; and seven health dichotomous variables are retained, covering a wide range of physical and mental health measures. A bivariate recursive Probit model is used to simultaneously investigate (i) the influence of baseline social capital on current health – controlling for baseline health and other current covariates, and (ii) the impact of baseline health on current participation in social activities – controlling for baseline social capital and other current covariates. As expected, we account for a reversed causal effect: individual social capital has a causal beneficial impact on health and *vice-versa*. However, the effect of health on social capital appears to be significantly higher than the social capital effect on health. These results indicate that the sub-population reaching 50 years old in good health has a higher propensity to take part in social activities and to benefit from it. Conversely, the other part of the population in poor health at 50, may see their health worsening faster because of the missing beneficial effect of social capital. Social capital may therefore be a potential vector of health inequalities for the older population.

Introduction

The literature on social phenomena and health has for a long time been a well-established research topic in public health (Berkman & Syme, 1979; Brown & Harris, 1978; Cobb, 1976; Lynch, 1977). It is only since the 1990's that subsequent studies dealing with social connectedness and social cohesion have systematically been referred to as "social capital". Almost in consequence of this vogue, many charges against social capital have made it one of the "essentially contested concepts" in the social sciences (Szreter & Woolcock, 2004). Nevertheless, empirical research has undoubtedly provided some thriving conceptual and theoretical developments (Kawachi, Subramanian, & Kim, 2008). For the pros, social capital is an encompassing umbrella under which unprecedented patterns of thinking have emerged.

One of the most salient new strands of research investigates joint individual and contextual effects of social capital on health. Several recent studies have already emphasized the positive influence of multi-level measures of social capital on individual health outcomes (e.g. Olsen & Dahl, 2007; Scheffler, Brown, & Rice, 2007). A common finding of these studies suggests that the influence of social capital is underestimated when multi-level influence is not taken into account. Another important contribution of the social capital literature has been to go beyond correlations. The recourse to instrumental variables (IV) shed some light on the until-then little-known causal relationships between social capital and health. By and large, pioneer studies found a causal beneficial impact of social capital on health (e.g. D'Hombres, Rocco, Suhrcke, & McKee, 2010; Folland, 2007; Rocco & Suhrcke, 2008; Ronconi, Brown, & Scheffler, 2010).

The purpose of this research is to contribute to the ongoing debate on the causal relationships between social capital and health with regard to the assumption that both variables influence each other (e.g. Islam, Merlo, Kawachi, Lindström, & Gerdtham, 2006; Von dem Knesebeck, Dragano, & Siegrist, 2005). Two opposite streams of causal relationships can describe the relationship between social capital and health. On one hand, several theoretical pathways are usually invoked to explain the positive influence of social capital on health (e.g. Kawachi & Berkman, 2000; Scheffler et al., 2007). Social

* Corresponding author. IRDES, 10 rue Vauvenargues. 75018 Paris, France. Tel.: +33 (0)1 53 93 43 64.
E-mail address: sirven@irdes.fr (N. Sirven).

0277-9536/$ – see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.socscimed.2012.05.009

capital can enhance the diffusion of health information (Stephens, Rimal, & Flora, 2004; Viswanath, Randolph Steele, & Finnegan, 2006) and can foster norms of healthy behaviours (Brown, Scheffler, Seo, & Reed, 2006) that improve health. Social capital is also thought to provide psychosocial support that can reduce stress and improve mental health (Almedom & Glandon, 2008). On the other hand, poor physical and mental health can reduce the chances of taking part in social organisations since these almost always require a moderate level of activity (just meeting up with people can be difficult for individuals with limitations) and some social aptitudes (depression is a well-known factor of social isolation).

Our contribution is to provide some empirical investigations of the potential existence of a circular relationship between social capital and health, since to our knowledge, no formal evaluations have been yet proposed. A time-based approach (*à la* Granger) is considered in which a two-equation recursive model is used to simultaneously investigate (i) the influence of baseline social capital on current health – controlling for baseline health and other current covariates, and (ii) the impact of baseline health on current participation in social activities – controlling for baseline social capital and other current covariates. We use panel data from the Survey on Health, Ageing, and Retirement in Europe (SHARE). Waves 1 and 2 of SHARE provide a sample made up of 20,000 households (of which at least one member is aged 50 and over), interviewed in 2004 and again in 2006 in eleven European countries. Additional wave 3 data on retrospective life histories (SHARELIFE) are used to fit the dynamic model. No ethical approval was required for this study.

The focus on aged people is motivated by two main reasons. Firstly, "healthy ageing" strategies (WHO, 2006) are now central to public policies as ageing has become a major concern for public health and economic sustainability in Europe. Among the various directions that may help to achieve this goal, the increased participation of older people in social activities (or social capital) may be decisive (see Agren & Berensson, 2006). Secondly, although a growing body of the literature reports the absence of correlation between participation in social activities and self-rated health (Greiner, Li, Kawachi, Hunt, & Ahluwalia, 2004) or other health outcomes (Ellaway & Macintyre, 2007); a close look at the literature advocates that the positive effects of social capital on health could be significant for the sub-population of older people (Kondo, Minai, Imai, & Yamagata, 2007; Sirven & Debrand, 2008; Veenstra, 2000).

The paper is structured as follows: the next section presents data from the SHARE project and some descriptive statistics. The method section deals with statistical issues and the different tests applied here. Regression results and interpretations are given in the results section; while implications for public policy, potential limitations and further research issues are discussed in the final section.

Data

Sample

The Survey on Health, Ageing, and Retirement in Europe (SHARE) is a multidisciplinary and cross-national cohort of individual data on health, socio-economic status and social and family relationships of more than 40,000 individuals aged 50 or over (cf. Börsch-Supan & Jürges, 2005). Eleven countries contributed to the 2004 SHARE baseline study. They are a balanced representation of the various regions in Europe, ranging from Scandinavia (Denmark and Sweden) through Central Europe (Austria, France, Germany, Switzerland, Belgium, and the Netherlands) to the Mediterranean (Spain, Italy and Greece). Further data were collected in 2006–07 during the second wave of SHARE in these countries. SHARELIFE, the third wave of the project, was conducted in 2008–09 over the same population who took part in the two previous waves. This time, the respondents were interviewed about their life history. Different fields such as childhood health, education, job career, family life, housing, etc. were surveyed and provide useful information on initial conditions and life course. The longitudinal sample over the three waves consists of more than 12,000 non-institutionalised individuals born before 1955 in 11 countries (cf. Table 1).

Indicators of social capital

For each wave, a dummy variable for involvement in social activities is derived from the participation (or not) in five social activities (voluntary/charity work, training course, sport/social club, religious organisation, and political/community organisation). Individual i will be assigned 1 as her social capital value if she is involved in at least one of these five associations and 0 elsewhere.

This variable is used as a proxy for social capital as involvement in Putnamesque associations. This is one of the most usual variables of individual social capital in the empirical literature; it is widely used in most surveys and thus enables comparisons to be made with other studies. Social participation is also relevant from a public policy perspective, since voluntary associations are essential partners of government agencies in Europe – to the point that Members of the European Parliament proposed 2011 to be designated the European Year of Volunteering.

Table 2 indicates that more than 40% of the sample respondents (41.7% in wave 1 and 43.1% in wave 2) report taking part in at least one form of the above mentioned social activities. In 2006–07, northern countries (Sweden, Denmark, the Netherlands) and Switzerland have rates of social participation higher than 50%, and southern countries like Spain and Italy have rates under 20%. Notice that Greece keeps averages rates of social participation at both waves since a large majority of the respondents are involved in a religious community. (The instruction for SHARE interviewers states that "Taking part in activities of a religious organisation includes church, synagogue, and mosque attendance.") By and large, living in a northern country significantly strengthens the chances of taking part in social activities. See Hank (2011) for an analysis and detailed discussion of individual and institutional determinants of volunteering, helping, and caring using SHARE data.

Health measures

SHARE data provide an important range of physical and mental health measures. Considering several measures of health in turn as dependant variables may shed light on the various possible phenomena related to social capital, as well as reducing the reporting bias effect. (see Kawachi et al., 2008, for a comprehensive survey of the literature on the relationships between social capital and various

Table 1
Sample description by age class and country.

Country	Age class at wave 1 (2004–05)							
	[50–54]	[55–59]	[60–64]	[65–69]	[70–74]	[75–79]	80+	Total
Austria	90	116	138	113	78	53	30	618
Germany	217	193	249	209	107	63	29	1067
Sweden	192	271	278	222	143	104	81	1291
Netherlands	228	289	240	172	134	72	61	1196
Spain	138	175	159	163	166	101	72	974
Italy	188	300	317	245	182	99	61	1392
France	201	276	205	192	156	129	98	1257
Denmark	159	173	162	116	97	66	60	833
Greece	326	290	251	243	216	110	91	1527
Switzerland	94	101	98	76	63	51	35	518
Belgium	312	445	334	316	289	206	139	2041
N. obs.	2145	2629	2431	2067	1631	1054	757	12,714
As % of total	16.87	20.68	19.12	16.26	12.83	8.29	5.95	100

Table 2
Rates of participation in social activities by country.

Country	Voluntary		Education		Social club, sport	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Austria	0.097	0.107	0.050	0.053	0.161	0.212
Germany	0.160	0.170	0.077	0.080	0.280	0.272
Sweden	0.206	0.236	0.158	0.178	0.285	0.309
Netherlands	0.267	0.287	0.077	0.098	0.328	0.354
Spain	0.025	0.028	0.023	0.042	0.060	0.090
Italy	0.086	0.085	0.010	0.013	0.065	0.086
France	0.181	0.178	0.046	0.041	0.212	0.242
Denmark	0.211	0.257	0.095	0.119	0.351	0.421
Greece	0.029	0.021	0.047	0.031	0.058	0.063
Switzerland	0.174	0.189	0.183	0.166	0.363	0.360
Belgium	0.183	0.186	0.104	0.109	0.237	0.236
Total	0.147	0.156	0.076	0.081	0.207	0.226
Country	**Religious organisation**		**Political**		**Any of them**	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Austria	0.282	0.105	0.066	0.058	0.436	0.357
Germany	0.107	0.112	0.052	0.039	0.432	0.436
Sweden	0.066	0.128	0.050	0.063	0.501	0.564
Netherlands	0.130	0.142	0.038	0.050	0.531	0.566
Spain	0.105	0.121	0.018	0.017	0.196	0.242
Italy	0.059	0.081	0.029	0.018	0.188	0.223
France	0.063	0.083	0.043	0.048	0.386	0.393
Denmark	0.056	0.089	0.055	0.048	0.527	0.621
Greece	0.359	0.305	0.050	0.044	0.459	0.395
Switzerland	0.130	0.168	0.095	0.108	0.582	0.565
Belgium	0.080	0.106	0.081	0.093	0.442	0.466
Total	0.127	0.134	0.051	0.053	0.417	0.432

measures of health.) Table 3 and Table A1 in the appendix present the 7 health variables that were retained in the analysis:

- Poor self-rated health (SRH): a variable dichotomising the US version of self-perceived health into two categories: (0) very good and excellent and (1) less than very good;
- Reporting limitations in ADL's: a dummy indicating if the respondent has difficulties in Katz basic activities of daily living (Dressing, including putting on shoes and socks; Walking across a room; Bathing or showering; Eating, such as cutting up your food; Getting in and out of bed; Using the toilet, including getting up or down);
- Limitations with activities (GALI): a dummy taking the value 1 if the respondent reports having been limited (for the past six months) because of a health problem in activities people usually do, and 0 otherwise;
- Limitations with mobility, arm function and fine motor function: a dummy taking the value 0 if the respondent does not report any limitations, and 1 if she reports one or more limitations with mobility, arm function and fine motor function (walking 100 m; sitting for about 2 h; getting up from a chair after sitting for long periods; etc.);
- Low grip strength: a dummy indicating whether (1) the respondent belongs to the lowest 20% of the distribution of grip strength – by gender and body mass index (BMI) categories (0) or not;

Table 3
Rates of respondents in poor health.

Health measure	Wave 1	Wave 2
Poor SRH	0.266	0.325
ADL2+	0.077	0.089
GALI	0.392	0.406
Mobility	0.466	0.481
Low Grip	0.237	0.229
Euro-D	0.149	0.139
Cog. Imp.	0.045	0.057

- Depressive symptoms (EURO-D scale): this binary index takes the value 1 for individuals reporting more than three depressive symptoms out of twelve (among depression, pessimism, culpability, irritability, etc.), and 0 otherwise (Prince et al., 1999);
- Relative cognitive impairments: an index derived from a cognitive score (Adam, Bay, Bonsang, Germain, & Perelman, 2006) based on a memory test (20 items recall) and a test of executive functions (measuring verbal fluency based on naming as many animals as one can think of). The cognitive impairment dummy takes the value 1 for people whose score is below a minimum value – established at 1.5 standard deviation below the mean (Dewey & Prince, 2005).

Other covariates

The usual covariates to control for in both the health equation and the social participation one are age (in class), gender, education (highest diploma obtained), living with spouse or partner, labour market status (employed), log of household net income per consumption unit (corrected for Purchase Power Parity), and country dummies. In order to take into account the fact that not all respondents are surveyed at the same time – e.g. due to country specific survey schedule – we constructed a variable indicating the time spent in month between the first interview in wave 1 and the last interview in wave 2.

In addition to the usual panel data information provided by wave 1 and 2, SHARELIFE data offer the opportunity to take into account the potential influence of initial conditions and life-course experience on current health status and social participation. Special attention was dedicated to the following variables: being born in the country of residence; reporting a better relative performance in maths and language at school when aged 10; having been in a hospital for more than a month before the age of 10; self-rating own health at 10 years old excellent or very good; having encountered periods of poor health before the age of 10; an index of the features of accommodation when aged 10 (ranging from (0) poor to (6) comfortable); the log of the number of moves from one accommodation to another so far; having ever worked in a voluntary association before the start of wave 1; and, a variable of household size when aged 10. Table A2 in the appendix displays descriptive statistics of these variables. Notice that Havari and Mazzonna (2011) address the ability of old age respondents to recall with good accuracy events that happened decades ago. Their results suggest that retrospective data in SHARELIFE can be reasonably used for research purposes.

Method

The empirical literature indicates that social capital has, in general, a positive causal effect on health status. However, the instrumental variables (IV) estimators do not make clear if the influence of social capital on health could be overestimated (Folland, 2007), underestimated (Rocco & Suhrcke, 2008), or a mixed-bag when using different variables of social capital (D'Hombres et al., 2010).[1] Exploring the causal effect of social capital on health is still at an exploratory stage; more research based on the implementation of IV is necessary and alternative methods are also needed. The principle of IV is basically to isolate one pathway of effects (in the present case, from social capital to

[1] The IV estimates of social capital on health are higher (resp. lower) than the standard correlation coefficient, meaning that in these cases, the non-instrumented effect of social capital on health was underestimated (resp. overestimated) prior to the IV procedure.

health), purged from any "feedback effect". However, studying a potential causal reciprocal influence of social capital and health may have some important consequences in terms of public policy. To our knowledge, such an approach has not yet been taken into account.

The initial intuition, with the aim to measure the causal impact of social participation (d_{t-1}) on health (h_t) is to run a regression on the sub-population of individuals in good health at time $t-1$, in order to estimate the influence of the former variable and other covariates (x_{t-1}) at time $t-1$, on the latter variable at time t. The same reasoning applies for the analysis of the causal effect of h_{t-1} on d_t. However, sample selection in both cases prevents from a joint dynamic estimation. A more appropriate approach would be to consider a joint recursive model in which the dynamics of health are simultaneously associated with the dynamics of social participation. Each equation would take into account lagged values of the dependant variables, as well as lagged values of the dependant variable of the other equation. Formally, the model can be written as follows:

$$\begin{cases} H_{it} = \alpha^H \cdot H_{it-1} + \beta^D \cdot D_{it-1} + X_{it}\gamma^H + \varepsilon_{it}^H \\ D_{it} = \alpha^D \cdot D_{it-1} + \beta^H \cdot H_{it-1} + X_{it}\gamma^D + \varepsilon_{it}^D \end{cases} \tag{1}$$

where H_{it} is individual i's health status at time t which depends on H_{it-1} her health status at date $t-1$ and D_{it-1} her social participation at time $t-1$, and some X_{it} exogenous variables like age, gender, education, etc. In the same way, D_{it} is the social participation for individual i at time t which depends on D_{it-1} her social participation at time $t-1$ and H_{it-1} her self-reported health status at time $t-1$ and the same X_{it} exogenous variables. Using large panel datasets, the error term is usually split into two components; one that captures time invariant individual heterogeneity, and the other that is a time varying idiosyncratic component. However, in our case where $t=2$, the error term cannot be expressed as in a classic panel form. We assume that ε_{it}^H and ε_{it}^D are idiosyncratic components with normal distribution. As a consequence, the endogenous variables (H_{it-1}; D_{it-1}) entirely support the dynamic processes of the model.

A standard sample selection issue in panel data modelling is that the individual's health status or social participation may not be randomly distributed among the sample at the time the data collection starts. To solve this problem of "state dependency" Wooldridge (2005) proposes to model the distribution of the individual effects as a linear function of initial health at the first wave of the panel and of the time means of the X_{it} exogenous variables. Unfortunately, this method requires at least 3 waves of panel data while only the two first waves of share (2004 and 2006) provide classic panel data information on social participation. Nevertheless, SHARELIFE retrospective data are based on a retrospective questionnaire, in which the individuals respond to question about their childhood and living condition in the past (cf. 2.4). We propose to use these retrospective data as initial conditions (C_i) to sort out the "state dependency" issue.

Using SHARELIFE retrospective data also provides a good opportunity to bring into play a specific set of life-event variables that may be correlated either with the health outcome (e.g. childhood health retrospective indicators) or with the social participation outcome variable (e.g. "household size when 10 years old" is a potential candidate[2]). Since identification by functional form relies heavily on the assumption of bivariate normality of the residual terms, it is common practice to impose exclusion restrictions to improve identification of the model (Keane, 1992). We propose here to model the distribution of individual effects as a linear function of these initial conditions.

Another problem in statistical modelling of dynamic models is the difficulty of disentangling "state dependency" from individual heterogeneity. The parameter estimates β^H and β^D would be inconsistent if unobserved individual heterogeneity is correlated with the observed exogenous variables. However, it is possible to parameterize the individual effect to overcome this problem (Wooldridge, 2002, 2005) by inserting $\overline{X}_i$ the average value of covariates X_i over the period 2004–2006 as covariates in the equations (Mundlak specification) – the average would thus capture some "permanent" (i.e. time-invariant) individual characteristics. Consequently, the final model can be written as:

$$\begin{cases} H_{it} = \alpha^H \cdot H_{it-1} + \beta^D \cdot D_{it-1} + X_{it}\gamma^H + \overline{X}_i\delta^H + C_i\eta^H + \varepsilon_{it}^H \\ D_{it} = \alpha^D \cdot D_{it-1} + \beta^H \cdot H_{it-1} + X_{it}\gamma^D + \overline{X}_i\delta^D + C_i\eta^D + \varepsilon_{it}^D \end{cases} \tag{2}$$

where $\overline{X}_i$ is the matrix of the average of time variant exogenous variables for each individual i and matrix C_i consists of the variables describing individual i's initial conditions. Note that α, β, γ, δ, and η are the parameters to estimate. Let us note ρ the correlation coefficient between ε_{it}^H and ε_{it}^D, the residual terms of each equation. If $\rho = 0$, the two equations can be estimated separately. If $\rho \neq 0$; simultaneous estimations the two equations provides better estimates. Since $t = 2$ in our case, the model can be estimated by Maximum Likelihood with a standard bivariate Probit routine.

Results

Model estimates

Models estimates seem sound with standard theory.[3] By and large, the coefficients of the independent variables in the health equation appear to have the expected sign and significance levels. For instance, the probability of having a poor health status increases with age whatever the health measure considered; and a higher level of education reduces the probability of poor health. The influence of the labour market status indicates a classic "healthy worker effect" (e.g. Li & Sung, 1999) – the more healthy people will have higher possibilities of being economically active – in the case of poor self-rated health, limitation with activities, limitation with mobility, and (with lower significance) depressive symptoms. Notice that men seem to be in better health than women when it comes to poor-self rated health, limitations with mobility, low grip strength, and depressive symptoms. Gender differences are not significant in the other health domains. The living with spouse or partner seems to reduce depressive symptoms and poor self-rated health. In this case however, the coefficient is only significant at <10%, which may be too imprecise to remarked. The mean of both income measures (wave 1 and 2) follows from a technical issue (Mundlak specification) and is often difficult to interpret. However, one may say that in this very case it reflects a more precise long-term measure of income and therefore predicts health better. The estimates of this "permanent income" measure suggest here that richer people have a lower propensity to be in poor health (self-reported health, mobility, low grip strength, and Euro-D). Another common trend in every health

[2] Generally speaking, living in a household where the young can be seen as being involved in a social organisation. Social connectedness inside the household grows as the number of people is larger. Larger households are believed to create a socially favourable environment where young individuals are imbedded in a culture of frequent social relationships, making them – on average – more willing and able to interact with others in their future life.

[3] Due to the large number of tables, only full models estimates for Self-Rated Health have been presented in Table A3 in the appendix. Results for all models are available from the authors upon request.

equation is the influence of country dummies suggesting that individual characteristics do not explain all differences in health across Europe. However, the investigation of such differences goes beyond the scope of this study.

The empirical literature on the determinants of social participation is much less developed than the one dealing with health issues providing thus less guidance about the expected mechanisms. Nevertheless, the models estimates support some reasonable assumptions. The probability of becoming involved in a social activity increases from 50 years old to 65 – as people retire and benefit from leisure time (respondents in employment have indeed a lower probability to take part in social activities) –, before it decreases, perhaps because of health deterioration at older ages (cf. Glaeser, Laibson, & Sacerdote, 2002). Education is one of the most salient variables associated with social capital, as suggested by the early literature on the social capital (Coleman, 1988; Putnam, 1993). As expected, respondents at work at wave 2 have a lower chance of taking part in social activities due to the time constraint of their jobs. Gender differences have a lower explanative power once we control for the above mentioned individual characteristics, and income does not appear to be a significant determinant of social participation. Country dummies clearly indicate a north–south gradient in participation in social activities in Europe. Living in a northern country significantly strengthens the chances of taking part in social activities.

The recursive models provide new insights into the mutual influence of health and social capital. At the outset, dynamic Probits indicate that each dependant variable follows a time dependency: on average, respondents' health status at time $t-1$ shapes their condition at time t. The same process occurs with social participation. Crossed effects shed light on the causal reciprocal influence of social capital on health, and *vice-versa*.

Table 4 summarizes the results from the models. In addition to the estimate of β^D and β^H (taken from Table A3 in the appendix), Table 4 displays the Average Causal Effect (ACE) of social capital on health, and the ACE of health on social capital, for the various health measures considered here. A two-tailed test is applied to the difference between $\text{ACE}^{\text{social capital}}$ and $\text{ACE}^{\text{health}}$, and a p-value is given. On one hand, taking part in social activities at time $t-1$ basically reduces respondents' probability of poor health at time t *ceteris paribus*. In other words, after controlling for baseline health and other usual covariates, social participation has a causal beneficial impact on health. However, the magnitude of the effect does vary between health measures. The Average Causal Effects (ACE) of social capital on health is the lowest for ADL and cognitive impairments; and, no causal effect of social participation on health is found in the case of grip strength. On the other hand, the "feedback effect" of health is significant for all health measures considered here. Being in poor health at time $t-1$ reduces the chances to take part in social activities at time t. Whatever the health measure, the impact of health on social capital appears to be significantly higher (two-tailed tests) than the social capital effect on health.

To sum up, these results indicate – as expected – a reversed causal effect: individual social capital has a causal beneficial impact on health and *vice-versa*. However, the effect of health on social capital appears to be significantly higher than the social capital effect on health.

Robustness checks

With the aim of gaining confidence in the results, different model specifications have been tested. First, we modified the thresholds in some of the health variables: (i) the threshold for self-perceived health was reduced and the variable dichotomised into (0) excellent, very good, or good and (1) less than good; and (ii) thresholds for limitations have been raised to the cut-off point of two items for mobility, and (iii) activity limitations cut-off point has been reduced to encompass only "severely limited" respondents. Notice that thresholds for mental health variables have not been changed due to the consensus on measurement of depression and cognitive impairments in the empirical literature, and changing the cut-off point for ADL (i.e. focussing on strictly more than one limitation in activities of daily living) would lead to a very little number of observations. The results indicate that (i) more restrictive health conditions increase the ACE of health on social capital; which is consistent with the idea that worse health impedes social participation; and, (ii) change in cut-off points does not modify the fact that social capital has a significant causal beneficial influence on health – still apart from low grip strength. In the detail, the modification of thresholds does not lead to any significant change in the ACE of social participation on SRH, while increasing the thresholds of mobility and activity limitations improves the influence of social capital on health. This last result suggests a convex negative relationship between social capital and poor health: the marginal effect of social capital is stronger for people whose health status is worse. In the perspective of a health production function (Folland, 2008; Grossman, 1972), social capital (as made of the social investments i.e. the sunk costs of time and efforts in social activities) could be seen as an asset with the usual properties of diminishing returns.

Second, we wanted to check whether the main influence of social participation was actually due to physical activity since "sport clubs" belongs to one of the category of the social activities in SHARE. Respondents at each wave who participate only in "social clubs or sport clubs" were attributed the value 0 with regard to the dummy of social participation, while those who got involved in mixed activities ("social clubs or sport clubs" and at least one other social activity)

Table 4
Bi-directional average causal effects (ACEs) between social capital and health.

	Joint model with health dependant variable:						
	Poor SRH	ADL2+	GALI	Mobility	Low grip	Euro-D	Cog. Imp.
Coeff.							
β^D	−0.095***	−0.082**	−0.055**	−0.068**	−0.039	−0.099**	−0.135**
β^H	−0.173***	−0.197***	−0.099***	−0.096***	−0.082**	−0.160***	−0.410***
ACE							
β^D	−0.025	−0.010	−0.017	−0.020	−0.007	−0.017	−0.010
β^H	−0.053	−0.060	−0.030	−0.030	−0.025	−0.049	−0.122
Diff. in ACE	0.028	0.050	0.014	0.011	0.019	0.032	0.113
t-test	233.1	356.4	211.5	149.4	291.1	226.8	343.1
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Model							
N	12,410	12,411	12,413	12,411	11,389	12,258	12,287
Rho	−0.118***	−0.108***	−0.073***	−0.066***	−0.082***	−0.098***	−0.197***

$^{**}p < .05$; $^{***}p < .001$.

kept the value 1. Although the causal influence of social participation remains significant in most cases (apart from low grip strength), (i) the causal influence of social capital on health is slightly reduced when participation in sport clubs or physical activity is taken into account; and, (ii) β^D becomes significant only at <10% in the case of ADL. Although these results mainly confirm the idea that social capital has a beneficial causal influence on health, they also suggest that the index of social capital that is used here cannot be said to solely reflect the influence of social networks, or social connectedness on health since it partly captures the influence of the "nature" (physically demanding or not) of the social activity.

Discussion

Does social capital contribute to better health?

Dynamic recursive Probit models suggest that taking part into social activities in 2004–05 significantly reduces the chances of poor health in 2006–07 for SHARE respondents, in 11 European countries, once we control for baseline health and the usual current covariates. This result supports the hypothesis of a time-based causal beneficial effect of social capital on health; and as such, it corroborates recent findings of the empirical literature. In the detail, our proxy for social capital predicts notable shrinkage in the chances of reporting poor SRH – and that finding appears to be robust to cut-point shift in the health status categories. Other physical and mental health measures provide comparable results although the magnitude of the impact of social capital on health differs.

However, it is intriguing that no significant effect was ever found here in the case of low grip strength (Notice that Many different cut-off points for grip strength have actually been tried, and since it is originally a continuous variable, linear dynamic recursive regressions were run. In any case, no significant causal effect of social capital on health was found). One immediate explanation could be that grip strength is an objective measure of health while other health measures are self-declared, suggesting that when health variables are "purged" from potential reporting bias, the influence of social capital is not significant anymore. However, this interpretation is potentially fallacious since (i) health variables based on a list of items (ADL; Limitations, Mobility, Euro-d) are less subject to reporting bias than SRH, (ii) the variable for relative cognitive impairments follows from an objective assessment of mental health. Another explanation for the lack of effect of social capital on low grip strength is to be found elsewhere.

The choice of the proxy of social capital has to be discussed with regard to the contribution of our work to the empirical literature of social capital. Our findings may not be generalised to the influence of "social connectedness" or "social relationships" since the results are sensitive to the nature of the social activity that is carried out. It would be difficult to go further in distinguishing among the various features of social activities that may have an impact on health: number of people involved, number of regular contacts with members outside the association, different forms of social support given and received from the people met in the social activities, etc. In order to overcome some of these limits, a name generator for social networks is being added to the wave 4 of SHARE (2010–11). It will provide much more detailed data on individual social capital in the near future.

Does social capital contribute to health inequalities?

Our findings indicate that the average causal effect of social participation on health is always significantly smaller than the "feedback effect" from health on social participation. In the perspective, where people reach 50 years old with different health status – say, good health and poor health – the dynamics of health and social participation may have an impact on how this baseline inequality in health evolves over time. Dynamic recursive models allow for micro-simulations of individuals' situation over the life course. Holding everything else constant (income, living with spouse or partner, etc.), respondents in good health at 50 years old will have a higher propensity to join in social activities and to benefit from it in terms of a lower depreciation of their health in the future, while those in poor health at 50 – who have a lower probability to get involved in social activities – will see their health worsening at a faster rate. As a consequence, social capital may therefore be a potential vector of health inequalities.

The basic idea behind this scenario reflects an already familiar situation: where the category of people who are already privileged in terms of socio-economic status and health usually benefit from health programs such as nutrition campaigns, promotion of physical and mental activity at older ages, etc. Indeed in our case, people taking part in social activities come from an educated background, suggesting a close link between social capital and human capital. The fact that social capital may have individual benefits, and collective drawbacks is not a brand new idea in the social sciences; this concept was employed to describe sources of certain kinds of income disparities (Loury, 1977) and to support the thesis of class reproduction in modern societies (Bourdieu, 1986). Nonetheless, a new-fangled approach may come from the analysis of health distribution among the sub-population of aged people in poor health. According to robustness checks based on changes in cut-points in health measures, it appeared in some cases that social participation may have decreasing returns on health. Under the assumptions that (i) the average causal effect of social capital is especially strong among people whose health is worse; and (ii) this effect remains constant over time; then, health inequalities should increase in the late life-time between people in poor health who do take part in social activities and people in poor health who do not. Meanwhile, health inequalities due to social participation among people in baseline good health should evolve in a much confined way because of the decreasing returns of social capital on health. Although testing for these assumptions will certainly not be easily done, these are promising leads for a better understanding of the relationships between social phenomena and health.

Acknowledgements

The authors would like to thank Paul Dourgnon, M. Kamrul Islam, Pr. Richard Scheffler, the participants to the 3rd Social Capital Global Network Workshop on Social Capital and Health, Oslo (Norway), Sept. 10–11th 2010, Giacomo Pasini, and the anonymous referees for useful comments.

"This work is part of the HEAPS research program (Health Economics of Ageing and Participation in Society) supported by grant number ANR-09-JCJC-0141-01 awarded by the National Research Agency, France. This paper uses data from SHARELIFE release 1, as of November 24th 2010 or SHARE release 2.5.0, as of May 24th 2011. The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001- 00360 in the thematic programme Quality of Life), through the 6th framework programme (projects SHARE-I3, RII-CT- 2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARELIFE, CIT4-CT-2006- 028812) and through the 7th framework programme (SHARE-PREP, 211909 and SHARE-LEAP, 227822). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064, IAG BSR06-11, R21 AG025169) as well as from various national sources is gratefully acknowledged (see www.shareproject. org for a full list of funding institutions)."

Appendix A

Table A1
Rates of respondents in poor health by country.

Country	Poor SRH		ADL2+		GALI		Mobility	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Austria	0.284	0.323	0.071	0.090	0.474	0.518	0.498	0.541
Germany	0.327	0.371	0.072	0.087	0.469	0.501	0.499	0.473
Sweden	0.079	0.261	0.053	0.075	0.419	0.395	0.408	0.433
Netherlands	0.223	0.289	0.035	0.046	0.423	0.453	0.390	0.358
Spain	0.426	0.506	0.124	0.134	0.474	0.462	0.549	0.554
Italy	0.392	0.461	0.084	0.091	0.392	0.434	0.530	0.560
France	0.305	0.368	0.097	0.095	0.356	0.367	0.477	0.469
Denmark	0.202	0.250	0.071	0.069	0.411	0.379	0.382	0.406
Greece	0.286	0.259	0.069	0.070	0.284	0.282	0.502	0.583
Switzerland	0.135	0.162	0.052	0.070	0.324	0.328	0.366	0.352
Belgium	0.231	0.279	0.097	0.122	0.365	0.402	0.465	0.477
Total	0.266	0.325	0.077	0.089	0.392	0.406	0.466	0.481

Country	Low grip		Euro-D		Cog. Imp.	
	Wave 1	Wave 2	Wave 1	Wave 2	Wave 1	Wave 2
Austria	0.176	0.216	0.100	0.108	0.024	0.050
Germany	0.147	0.155	0.096	0.094	0.014	0.023
Sweden	0.197	0.165	0.084	0.078	0.008	0.016
Netherlands	0.153	0.170	0.109	0.099	0.017	0.015
Spain	0.381	0.375	0.290	0.237	0.129	0.173
Italy	0.317	0.285	0.217	0.227	0.114	0.113
France	0.266	0.260	0.216	0.195	0.050	0.058
Denmark	0.195	0.249	0.092	0.094	0.015	0.024
Greece	0.297	0.261	0.154	0.102	0.050	0.066
Switzerland	0.179	0.181	0.086	0.086	0.015	0.025
Belgium	0.227	0.205	0.140	0.156	0.034	0.046
Total	0.237	0.229	0.149	0.139	0.045	0.057

Table A2
Descriptive statistics of independent variables.

Individual characteristics	Mean	S.D.
Gender	0.453	
Age (years) at wave 1	64.409	9.055
Living with spouse/partner at wave 1 (1 = yes)	0.741	
Living with spouse/partner at wave 2 (1 = yes)	0.726	
Log(income per cons. unit) at wave 1	9.421	1.291
Log(income per cons. unit) at wave 2	9.146	1.444
At work	0.277	
Education		
None or Primary	0.514	
Secondary	0.260	
Tertiary	0.219	
Other	0.006	
Initial Conditions		
Migrant (1 = yes)	0.063	
Log(N. of moves in life)	1.448	0.607
Relative School Performance	0.478	
Ever worked in a volunt. Association (1 = yes)	0.019	
Retrospective SRH age 10 (1 > good)	0.090	
2 + illnesses when child (1 = yes)	0.116	
Feat. of accommodation when child	1.861	
Household size when 10	5.671	2.467

Table A3
Individual determinants of social capital and health for older people in Europe.

Table A3 (*continued*)

Dep. var. (Ht, Dt) Indep. var.	Model 1 (Self-rated health only)			
	Poor SRH		Social Capital	
	Coeff.	S.E.	Coeff.	S.E.
Health $t-1$				
Poor SRH	1.337***	0.030	−0.173***	0.030
Social Capital $t-1$				
Take part in social activities (1 = yes)	−0.095***	0.028	1.153***	0.026
Individual Characteristics t				
Gender (1 = man)	−0.086***	0.028	−0.033	0.026
Age class at wave 2				
50–54	−0.360***	0.077	0.312***	0.072
55–59	−0.225***	0.059	0.282***	0.058
60–64	−0.299***	0.055	0.303***	0.054
65–69	−0.286***	0.053	0.272***	0.053
70–74	−0.196***	0.054	0.249***	0.055
75–79	−0.074	0.057	0.122**	0.058
80+	Ref.	Ref.	Ref.	Ref.
Living with spouse/ partner at wave 2 (1 = yes)	0.291*	0.160	−0.262*	0.154
At work at wave 2	−0.319***	0.097	−0.253***	0.089
Log(income per cons. unit) at wave 2	0.048**	0.019	0.011	0.019
Education				
None or Primary	Ref.	Ref.	Ref.	Ref.
Secondary	−0.131***	0.035	0.123***	0.033
Tertiary	−0.227***	0.041	0.267***	0.038
Country of residence				
Germany	Ref.	Ref.	Ref.	Ref.
Austria	−0.189**	0.075	−0.216***	0.073
Sweden	−0.040	0.073	0.395***	0.070
Netherlands	−0.158**	0.066	0.279***	0.061
Spain	−0.006	0.069	−0.096	0.069
Italy	−0.028	0.063	−0.252***	0.061
France	−0.089	0.071	−0.083	0.067
Denmark	−0.292***	0.079	0.536***	0.073
Greece	−0.512***	0.063	−0.030	0.057
Switzerland	−0.531***	0.088	0.233***	0.078
Belgium	−0.279***	0.070	0.040	0.064
Interview time				
Months between waves 1 & 2	0.000	0.004	−0.008**	0.004
Average of time variant covariates				
Living with spouse/ partner at wave 1 & 2	−0.278*	0.163	0.203	0.158
Log(income per cons. unit) at wave 1 & 2	−0.096***	0.026	0.040	0.026
At work at wave 1 & 2	−0.016	0.102	0.095	0.096
Initial Conditions				
Migrant (1 = yes)	0.122**	0.055	−0.200***	0.053
Log(N. of moves in life)	−0.007	0.026	−0.018	0.025
Relative School Performance	−0.036	0.028	0.103***	0.026
Ever worked in a volunt. Association (1 = yes)	−0.055	0.096	0.290***	0.100
Retrospective SRH age 10 (1 > good)	0.189***	0.046	−0.002	0.045
2 + illnesses when child (1 = yes)	0.045	0.043	0.011	0.041
Feat. of accommodation when child	−0.026***	0.009	0.007	0.009
Household size when 10	0.001	0.005	0.011**	0.005
Intercept	0.217	0.206	−1.271***	0.201
Rho			−0.118***	0.018

*$p < .1$; **$p < .05$; ***$p < .001$.

References

Adam, S., Bay, C., Bonsang, E., Germain, S., & Perelman, S. (2006). *Occupational activities and cognitive reserve: a frontier approach applied to the survey on health, ageing, and retirement in Europe (SHARE)*. CREPP Working Paper 2006/05.

Agren, G., & Berensson, K. (2006). *Healthy ageing: A challenge for Europe, Vol. R 2006:29*. Dannemark: Swedish National Institute of Public Health.

Almedom, A. M., & Glandon, D. (2008). Social capital and mental health: an updated interdisciplinary review of primary evidence. In I. Kawachi, S. V. Subramanian, & D. Kim (Eds.), *Social capital and health* (pp. 191–214). New York: Springer.

Berkman, L., & Syme, S. L. (1979). Social networks, host resistance and mortality. *American Journal of Epidemiology, 109*, 186–204.

Börsch-Supan, A., & Jürges, H. (Eds.), (2005). *The survey of health, aging, and retirement in Europe – Methodology*. Germany: Manheim Research Institute for the Economics of Ageing.

Bourdieu, P. (1986). The forms of capital. In J. Ridchardson (Ed.), *Handbook of theory and research for the sociology of education*. Westport: Greenwood Press.

Brown, G. W., & Harris, T. (1978). *Social origins of depression: A study of psychiatric disorder in women*. London: Tavistock Publications.

Brown, T. T., Scheffler, R. M., Seo, S., & Reed, M. (2006). The empirical relationship between community social capital and the demand for cigarettes. *Health Economics, 15*, 1159–1172.

Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine, 38*, 300–314.

Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology, 94*(Suppl.), S95–S120.

Dewey, M., & Prince, M. J. (2005). Cognitive function. In A. Börsch-Supan (Ed.), *Economics of ageing* (pp. 118–125). Germany: Manheim Research Institute for the Economics of Ageing.

D'Hombres, B., Rocco, L., Suhrcke, M., & McKee, M. (2010). Does social capital determine health? Evidence from eight transition countries. *Health Economics, 19*(1), 56–74.

Ellaway, A., & Macintyre, S. (2007). Is social participation associated with cardiovascular disease risk factors? *Social Science & Medicine, 64*, 1384–1391.

Folland, S. (2007). Does "community social capital" contribute to population health? *Social Science & Medicine, 64*, 2342–2354.

Folland, S. (2008). An economic model of social capital and health. *Health Economics, Policy and Law, 3*(4), 333–348.

Glaeser, E., Laibson, D., & Sacerdote, B. (2002). An economic approach to social capital. *Economic Journal, 112*(483), 437–458.

Greiner, K., Li, C., Kawachi, I., Hunt, D., & Ahluwalia, J. (2004). The relationships of social participation and community ratings to health and health behaviours in areas with high and low population density. *Social Science & Medicine, 59*, 2303–2312.

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy, 80*, 223–255.

Hank, K. (2011). Societal determinants of productive aging: a multilevel analysis across 11 European countries. *European Sociological Review, 27*(4), 526–541.

Havari, E., & Mazzonna, F. (2011). *Can we trust older people's statements on their childhood circumstances? Evidence from SHARELIFE*. SHARE Working Paper Series No 05–2011.

Islam, M. K., Merlo, J., Kawachi, I., Lindström, M., & Gerdtham, U. (2006). Social capital and health: does egalitarianism matter? A literature review. *International Journal for Equity in Health, 5*, 3.

Kawachi, I., & Berkman, L. (2000). Social cohesion, social capital, and health. In L. F. Berkman, & I. Kawachi (Eds.), *Social epidemiology* (pp. 174–190). New York: Oxford University Press.

Kawachi, I., Subramanian, S. V., & Kim, D. (2008). *Social capital and health*. New York: Springer.

Keane, M. (1992). A note on identification in the multinomial probit model. *Journal of Business and Economic Studies, 10*, 193–200.

Kondo, N., Minai, J., Imai, H., & Yamagata, Z. (2007). Engagement in a cohesive group and higher-level functional, capacity in older adults in Japan: a case of the Mujin. *Social Science & Medicine, 64*, 2311–2323.

Li, C. Y., & Sung, F. C. (1999). A review of the healthy worker effect in occupational epidemiology. *Occupational Medicine, 49*(4), 225–229.

Loury, G. (1977). A dynamic theory of racial income differences. In P. A. Wallace, & A. Le Mund (Eds.), *Chapter 8 of women, minorities, and employment discrimination*. Lexington, Mass: Lexington Books.

Lynch, J. J. (1977). *The broken heart: The medical consequences of loneliness*. Cambridge: Basic Books.

Olsen, K. M., & Dahl, S.-A. (2007). Health differences between European countries. *Social Science & Medicine, 64*, 1665–1678.

Prince, M. J., Reischies, F., Beekman, A. T., Fuhrer, R., Jonker, C., Kivela, S. L., et al. (1999). Development of the EURO-D scale – a European, Union initiative to compare symptoms of depression in 14 European centres. *The British Journal of Psychiatry, 174*, 330–338.

Putnam, R. D. (1993). *Making democracy work: Civic traditions in modern Italy*. Princeton: Princeton University Press.

Rocco, L., & Suhrcke, M. (2008). *Does social capital make you healthier?*. Communication presented at the OECD/IRDES 2008 Workshop on Social Capital and Health, Paris, mimeo.

Ronconi, L., Brown, T., & Scheffler, R. (2010). Social capital and self-rated health in Argentina. *Health Economics*, 201–208.

Scheffler, R. M., Brown, T. T., & Rice, J. K. (2007). The role of social capital in reducing non-specific psychological distress: the importance of controlling for omitted variable bias. *Social Science & Medicine, 65*, 842–854.

Sirven, N., & Debrand, T. (2008). Social participation and healthy ageing: an international comparison using SHARE data. *Social Science & Medicine, 67*, 2017–2026.

Stephens, K. K., Rimal, R. N., & Flora, J. A. (2004). Expanding the reach of health campaigns: community organizations as meta-channels for the dissemination of information. *Journal of Health Communication, 9*(Suppl. 1), 97–111.

Szreter, S., & Woolcock, M. (2004). Health by association? Social capital, social theory and the political economy of public health. *International Journal of Epidemiology, 33*, 650–667.

Veenstra, G. (2000). Social capital, SES and health: an individual-level analysis. *Social Science & Medicine, 50*, 619–629.

Viswanath, K., Randolph Steele, W., & Finnegan, J. R. (2006). Social capital and health: civic engagement, community size, and recall of health messages. *American Journal of Public Health, 96*(8), 1456–1461.

Von dem Knesebeck, O., Dragano, N., & Siegrist, J. (2005). Social capital and self-rated health in 21 European countries. *Psychosocial Medicine, 2*, Doc02.

WHO (World Health Organization). (2006). *Healthy cities and urban governance*. Geneva, Switzerland: World Health Organization.

Wooldridge, J. (2002). *Econometric analysis of cross-section and panel data*. Cambridge: MIT Press.

Wooldridge, J. (2005). Simple solutions to the initial conditions problem in dynamic, nonlinear panel data models with unobserved heterogeneity. *Journal of Applied Econometrics, 20*(1), 39–54.