HEDG
HEALTH, ECONOMETRICS AND DATA GROUP
THE UNIVERSITY of York

WP 15/06

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June 2015

http://www.york.ac.uk/economics/postgrad/herc/hedg/wps/

# Formal volunteering and self-perceived health. Causal evidence from the UK-SILC

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## Abstract

The paper assesses the causal relationship between formal volunteering and individual health. The econometric analysis employs data provided by the Income and Living Conditions Survey for the United Kingdom carried out by the European Union's Statistics (UK-SILC) in 2006. Based on 2SLS, treatment effect and recursive bivariate probit models, and religious participation as instrument variable, and controlling for social and cultural capital, our results show a positive and causal relationship between formal volunteering and self-perceived health.

**Keywords:** individual health, formal volunteering, social capital, instrumental variable, treatment effect model, recursive bivariate probit model, UK

**JEL codes:** C31, C36, D64, I10, I18, Z10

# 1. INTRODUCTION

Volunteering can be defined as any activity to which people devote time for helping others without asking for monetary compensation in return. Volunteering has been drawing interest among economists as an important concept for understanding a range of socioeconomic outcomes, from wage premium to happiness and domain satisfactions (Day and Devlin 1997, 1998; Hackl et al. 2007; Bruni and Stanca 2008; Meier and Stutzer 2008; Fiorillo 2012; Binder and Freytag 2013). Yet, economists have developed theoretical framework to investigate reasons why people volunteer, integrating voluntary work into standard microeconomic models (Menchik and Weisbrod 1987; Andreoni 1990; Carpenter and Meyers 2010; Bruno and Fiorillo 2012). However, the relationship between volunteering and health has received little attention and it has largely been the domain of epidemiologists, sociologists and political scientists (Wilson 2012, for a review).

A number of epidemiological and sociological studies have found a positive association between high level of volunteering and improved health outcomes (lower cause-specific mortality and improved self-reported health status) (Moen et al. 1992; Musick et al. 1999; Post 2005; Pilivian and Siegel 2007; Musick and Wilson 2008; Tang. 2009; Kumar et al. 2012). Nevertheless, the early literature on volunteering and health has generally plagued with issues of omitted variables and reverse causality (Borgonovi 2008). The observed volunteering-health link could hide the effect of other factors that determine both a high propensity to volunteer and feeling in good health (omitted variable bias) as well as reverse causation: individuals in poor health could reduce their unpaid contribution of time against their will, and people in good health might be more likely to volunteer.

Few recent studies try to address the causality problem using instrumental variables models. Borgonovi (2008), employing the 2000 Social Capital Community Benchmark Survey dataset, uses, as instrument of religious volunteering, the degree of religious fragmentation in the country where respondents live, obtained calculating the Herfinddahl-Hirschman Index (HHI). Such index ranges between 0 and 1, with lower values indicating low level of concentration and high competition among denominations. However, 2SLS estimates that employ HHI as an instrument for religious volunteering, do not find an association with self-reported health. Schultz et al. (2008), using the 2006 Social Capital Community Survey Data, employ, as instruments of volunteering activity, religious attendance and tenure in the community. IV Probit estimates, with religious attendance and

tenure in the community as instruments of voluntary activity, find a positive and statistically significant correlation at 1 percent with self-reported health.

Although in the literature social capital and cultural factors have been found relevant predictors of volunteering (Plagnol and Huppert 2010), causal results on the relationship between formal volunteering and self-reported health are mixed. In addition, a more complete empirical specification of the link between formal volunteering and health, which accounted for social capital and cultural characteristics of individuals, has hitherto been missing.

The present paper contributes to the literature in several ways. First, alike to researches focused on North America (Borgonovi 2008; Schultz et al. 2008), we carry out the first assessment of the causal relationship between formal volunteering and self-perceived health in a North European country, the United Kingdom about which there are no previous similar studies. The analysis uses data from the Income and Living Conditions Survey for the United Kingdom carried out by the European Union's Statistics (UK-SILC) in 2006. Second, as social capital and cultural participation of an individual may (jointly) influence the degree of volunteering and self-reported subjective health, we address these factors in the relationship between formal volunteering and health as robustness check. Third, we account for the causal impact of formal volunteering on health making use of religious participation as instrumental variable and employing alternative empirical models: a two stage least squares estimator, a treatment effect model and a recursive bivariate probit model with an endogenous binary variable.

Our results show a positive and causal relationship between formal volunteering and self-perceived health robust across several empirical models as well as to the inclusion of social and cultural capital variables. We suggest that formal volunteering might affect individual health not only through social relations but also through the internal rewards originating from the intrinsic motivation and, in other words, coming from helping others *per sé*.

The paper is structured as follows. Section 2 reviews both the concept of volunteering and early studies on the UK and analyses plausible channels through which volunteering influences health. Section 3 discusses about social capital in the literature and in our paper. Section 4 focuses on cultural capital and health. Section 5 describes the data. Section 6 introduces the empirical models. Section 7 presents the results. Section 8 concludes.

# 2. VOLUNTEERING AND HEALTH

## 2.1 Definition

Over the past 20 years, volunteering has received much attention in sociology, political science and economy. Snyder and Omoto (2008, 3-5) provide definitional issues, defining volunteering as "freely chosen and deliberate helping activities that extend over time, are engaged in without expectation of reward or other compensation and often through formal organizations". The above definition of volunteering highlights the debate among sociologists and political scientists regarding: whether "remunerated" work is truly volunteering (Smith 1994); whether or not the definition of volunteering should include reference to intentions (Wilson 2000); whether volunteering should be more formalized and public (Snyder and Omoto 1992) or should include helping behaviors (Cnaan and Amrofell 1994). On the other hand, economists view volunteering as one of the most relevant pro-social activities (Meier and Stutzer 2008) considering it within the context of a labor-leisure decision: volunteer labor supply (see among others Brown and Lankford 1992; Duncan 1999; Ziemek 2006).

This paper broadens the sociological and political science debate. Following Wilson and Musick (1999), we define volunteering as any activity to which people devote time to help others without asking for monetary compensation in return. This definition emphases the economic characteristics of volunteering: i) unpaid work (labour supply without a monetary compensation); ii) commitment of time and effort; iii) the intrinsic motivation is only one of the possible motivations explaining why people decide to help others.

Moreover, we share the classification of this activity according to the level of its formality (Cnaan and Amrofell 1994; Wilson and Musick 1997). Therefore, we divide volunteering in *formal volunteering*, unpaid work or free activity undertaken within and or through any kind of organizations, and *informal volunteering*, unpaid work carried out directly in favor of non-household individuals such as helping a neighbor.

To compare our results on the UK with the findings of Borgonovi (2008) and Schultz et al. (2008) on the US, we focus on formal volunteering defining it as any activity, preformed through an organization, to which people devote time to help others without asking for monetary compensation in return.

### 2.2 United Kingdom

Volunteering has a long history in the UK; very often government's policies encouraged, influenced and allowed volunteering, which, in turn, had a positive influence on a wide range of government policies, and throughout society (GHK 2010).

Some stylized facts are the following: in the UK in 2102/13, 29% of adult people (aged from 16 and above) formally volunteered at least once a month, and 44% of people formally volunteered at least once a year. In the same period, there were 161.000 voluntary organisations, £39.2 billion was the voluntary sector income, and 800.000 were the voluntary sector employees (NCVO UK Civil Society Almanac, 2014).

There are very few studies that analyse volunteering and health in the UK. Several study focus on the relationship between social capital and health[1] and use formal volunteering as a measure of social capital. Borgonovi (2010) examines how social capital can promote good physical and mental health, and gets the conclusion that members of groups (among others voluntary groups) and associations (used to assess the extent to which individuals are part of formal social and activities) are less likely to report suffering from limiting long standing illness (Borgonovi 2010, 1931). However, results are different for different age groups and overall membership is not associated with an increase in self-reported health. Therefore, some forms of membership have a positive effect on some health outcomes and a negative one on some others.

Giordano and Lindstrom (2010) investigate how temporal changes in social capital, together with changes in material conditions and other determinants of health affect associations with self-related health. Using data from the British Household Panel Survey for years from 1999 to 2005 and including active social participation among social capital measures, the authors find that increased levels of active social participation are significantly associated with improved health status over time.

Petrou and Kupek (2008), in their study on social capital and its relationship with measures of health status, show a positive correlation between individual's activities in a wide range of social organizations and self-reported good health. The study is based on the 2003 Health Survey for England. Among individual measures of social capital, there is a dichotomous measure of civic participation, based on the individual's activities in a range of political, environmental, educational, religious, voluntary, sporting and social organisations. Results

[1] For a review on social capital and health, see Fiorillo and Sabatini (2015).

show that a lack of participation in at least one civic organisation is associated with a statistically significant reduction in the health-related quality of life score.

In their report on residents of the city of Hull in East Yorkshire, Hunter et al. (2005) emphasize the importance of social capital at tree levels. Level 2 - Community Spirit and Connectedness - includes, among other indicators (citizenship, neighbourliness, trust and shared values, community involvement), volunteering as an important feature of social life that encourages co-ordination and co-operation within and among groups for mutual benefit. Results provide some evidence of a positive association between individual measures of social capital and health, and suggest to encourage greater active citizenship and more formal volunteering in civic life. Similar results in Green et al. (2000, 2005), who, in their reports on residents of the coalfield communities of Barnsley, Doncaster and Rotherham in South Yorkshire, reach the conclusion that social capital, assessed also by a measure of volunteering, has a positive impact on health.

### 2.3 Mechanisms

Potential channels through which volunteering benefits health may be related to motivational reasons why people decide to volunteer.

(1) A first reason for volunteering is linked to the internal rewards originating from the intrinsic motivation and, in other words, coming from helping others *per sé* (Andreoni 1990). According to cognitive social psychology (Deci 1971, 105) “one is said to be intrinsically motivated to perform an activity when one receives no apparent reward except the activity itself”. People enjoy doing the required task in itself, and they receive a “warm glow” from contributing with a time donation. The knowledge of contributing to a good cause is internally self-rewarding, increases self-worth and self-esteem and, in turn, improves mental health (Wilson and Musick 1999).

(2) A second reason, which induces people to volunteer, considers the increase in utility due to extrinsic rewards from volunteering. People volunteer in order to receive a by-product of volunteering: improvements in workers’ career prospects and wage premium (Menchik and Weisbrod 1987; Day and Devlin 1998). Both the possibility of role enhancement and wage premium connected to volunteering may increase job satisfaction (Fiorillo and Nappo 2014) which, in turn, produce significant positive effects on health (Faragher et al. 2005).

(3) A third motivation view volunteering as a behaviour to expand social interactions, to improve social skills and to get social support (Clotfelter 1985; Schiff 1990; Wilson and

Musick 1999; Prouteau and Wolff 2006). Moreover, volunteers performing social roles connected to volunteering fill their life with meaning and purpose. All this, in turn, produces positive effects on social integration with positive effects on physical and mental health (Musick and Wilson 2003; Li and Ferraro 2005). Yet, doing for others develops trust between people, promotes a feeling of security and of reciprocal acceptance among volunteers and who receives their help. Such positive effects of volunteering provide "psychological resources" useful to cope stress (Lin et al. 1999; Choi and Bohman 2007). Finally, people who volunteer have the opportunity to access to health education and information more easily than people who are not part of networks, to discuss each other about cultural norms which may be damaging to health (such as smoking, drinking) and to improve prevention efforts.

## 3. SOCIAL CAPITAL AND HEALTH

In recent years, the literature has extensively analysed the impact of social relations on individual health. Various aspects of the relational sphere of individual lives have been addressed, from relationships with family and friends to membership in several kinds of associations, often grouped together under the common label of social capital (Fiorillo and Sabatini 2015). Loury (1977), Bourdieu (1980), Coleman (1988, 1990) and Putnam (1993) brought the concept of social capital to the attention of social science disciplines. Coleman - as well Loury and Bourdieu - uses the concept in functional terms, focusing on the benefits that individuals derive from participation in a social group. With Putnam the concept of social capital leaves the characteristic of individual resource to become a resource capable of solving problems of collective action (Portes 1998, 181): "features of social organisation such as trust, norms and networks that can improve the efficiency of society by facilitating coordinated actions" (1993, 167).

However, it is widely argued that social capital can be both an individual and a collective attribute (Kawachi 2006; Portinga 2006a, b; Islam et al. 2008). While community social capital informs about the aggregate level of interactions and networks in the community, individual social capital indicates the social capital of a particular person (Iversen 2008).

In the literature, moreover, some authors divide social capital into cognitive and structural components as well as into formal and informal forms (Uphoff 1999; Lochner et al. 2003; Ferlander and Mäkinen 2009). On the one hand, cognitive social capital derives from individuals' perceptions resulting in norms, values and beliefs, while structural social capital concerns individuals' behaviours and mainly takes the form of formal and informal networks,

which can be observed and measured through surveys. On the other hand, informal social capital entails contacts with family and friends, whereas formal social capital comprises rule-bound networks, such as voluntary associations. In this study, we focus on individual structural social capital that is assessed via formal and informal social relations.

Most empirical analyses show a positive relationship between individual structural social capital and health of populations (Carlson 1998; Bolin et al. 2003; Hyyppä and Mäki 2003; Lindstrom et al. 2004; Iversen 2008; Giordano and Lindstrom 2010; Ronconi et al. 2012). The literature has proposed several explanations for the above potential link.

a) More intense social relationships may facilitate individuals' access to social support and healthcare, as well as the development of informal insurance arrangements (Poortinga 2006a; Giordano and Lindstrom 2010).

b) Social relationships can promote the diffusion of health information, increase the likelihood that healthy norms of behavior are adopted (e.g., physical activity and usage of preventive services) and exert social control over deviant health-related behaviors, such as drinking and smoking (Kawachi et al. 1999; Folland 2007).

c) Cohesive networks may exert the so-called "buffering effect", by balancing the adverse consequences of stress and anxiety through the provision of affective support, and by acting as a source of self-esteem and mutual respect (Kawachi et al. 1997; De Silva et al. 2007).

## 4. CULTURAL CAPITAL AND HEALTH

Following Bourdieu's approach (1984), social inequality in health are influenced by cultural capital too. While links between economic and social capital and health have been largely explored, research on the relationship between cultural capital and health is still scarce. To the best of our knowledge, there are no economic studies in this field but only socio-medical ones, which, however generally explore the influence of formal education on health.

Bourdieu classifies cultural capital by three states: incorporated (embodied), institutionalised and objectified cultural capital. The first comprises all skills and knowledge that can be acquired by "culture" (education). In its objectivized state, cultural capital includes books, paintings, machines, technical tools and all the objects that can be considered as material forms and representation of knowledge. Lastly, cultural capital is institutionalized mostly via educational degrees.

The definition of cultural capital that we adopt in this paper is the one elaborated by Bourdieu's critics who consider arts as a privileged indicator of cultural capital. Therefore, close to Bourdieu, who considers behaviours as a form of embodied cultural capital, by cultural capital we mean attendance, participation at high culture arts events (DiMaggio and Mohr 1985; Van Eijck 1997; Mohr and DiMaggio 1995; DeGraaf et al. 2000).

A strand of the socio epidemiological literature finds a positive relationship between attending cultural activities and self-rated health. After controlling for socio-demographic variables, Wilkinson et al. (2007) reach the conclusion that the amount of cultural activities attended by respondents is positively related to self-rated health. Also Bygren et al. (2009), Johansson et al. (2001) and Nummela et al. (2008) have found a positive effect of cultural participation on self-rated health. Pinxten and Lievens (2014), using data from a representative survey in Flanders (Belgium), reach the conclusion that cultural capital is relevant to study physical health differences.

Following Bygren et al. (2009), mechanisms through which cultural participation could positively affect health may be different: philosophical, biological and psychological. The first emphases the positive effect of aesthetic experiences that support individuals to contextualise and accept their situation. The second and third mechanisms take into consideration the effect of cultural capital on brain and cognitive functioning. Cultural capital help people to improve capacities to understand and to communicate emotions.

In addition, benefits coming from cultural participation are not just due to cultural activities themselves, but also to the social links enlarged because of such activities (Bygren et al. 1996, Lovell 2002), which, in turn, provide resources to improve health.

To study the impact of cultural capital on health, we take in consideration measures for embodied cultural capital including several measurements for cultural participation, focused explicitly on participation in cultural activities.

## 5. DATA AND DESCRIPTIVE STATISTICS

We use data from the Income and Living Conditions Survey for the United Kingdom (UK-SILC) carried out by the European Union's Statistics on Income and Living Conditions (EU-SILC) in 2006. The EU-SILC database provides comparable multidimensional data on income, social exclusion and living conditions in European countries.

The 2006 wave of the UK-SILC is a nationally representative sample of about 23.000 individuals that contains data on income, education, health, demographic characteristics,

housing features, neighbourhood quality, size of municipality, social capital and cultural participation. Information on volunteering, social and cultural capital are not provided in other waves of the survey, and regard respondents aged 16 and above. Hence, no panel dimension is available. After deleting observations with missing data on key variables used in the analysis, the final dataset is a cross-section sample of about 17000 observations.

*Perceived Health*

Our dependent variables are obtained through the question "In general, would you say that your health is very good, good, fair, poor, or very poor?". We consider two health variables. First, answers are recorded on a scale from 1 to 5, with 1 being "very poor" and 5 being "very good". This variable is called self-perceived health (*SPH*). Second, answers are then coded into a binary variable that is equal to 1 in cases of "good" and/or "very good" health, 0 in cases of "fair", "poor" and/or "very poor" health. This is the self-perceived good health (*SPGH*). Self-assessed health is widely used in the literature as a proxy for health and, despite its very subjective nature; previous studies have shown that it is correlated with objective health measures such as mortality (Idler and Benyamini 1997).

*Formal volunteering*

Our key and endogenous independent variable, formal volunteering (*ForVol*), is a dummy variable that is equal to 1 if the respondent, during the previous twelve months, worked unpaid for charitable organisations, groups or clubs (it includes unpaid work for churches, religious groups and humanitarian organisations and attending meetings connected with these activities); 0 otherwise.

*Instrumental variable: religious participation*

We use a binary instrumental variable, religious participation (*Relpar*), equal to 1 if the respondent, during the last twelve months, participated in activities related to churches, religious communions or associations (attending holy mass or similar religious acts or helping during these services is also included); 0 otherwise.

*Control variables (1): demographic, housing and neighbourhood features, size of municipality*

In order to account for factors that may influence simultaneously health status and formal volunteering, we include in the analysis a full set of control variables: demographic

characteristics as well as housing features, neighbourhood quality and the size of municipality.

At the individual level, we account for gender (*female)* with *male* as the reference category, for marital status, including categories for *married*, *separated*/*divorced* and *widowed* against a base category of being *single* and age *(age 31-50*, *age 51-64*, *age>65)*. Based on the International Standard Classification of Education (ISCED), three indicators are constructed to represent the level of education attained: *low secondary*, *secondary*, and *tertiary*, with *no education/primary education* being the reference category. We consider the respondent's country of birth (European Union, other), the number of individuals living in the household (*household size*), the natural logarithm of annual net household income (*household income*(*ln*)), unmet needs for medical examinations and treatments and tenure status (*homeownership*). We further control for self-defined current economic status: *employed part time*, *unemployed*, *student*, *retired*, *disabled*, *domestic tasks*, *inactive* with *employed full time* as reference group.

Housing features concern two categories of housing problems (*warm*, *dark problem*). We measure the quality of the surrounding environment through three indicators of subjective perception (*noise*, *pollution* and *crime*), and we control for two categories of the size of municipality (*densely populated area* and *intermediate area*) with *thinly populated area* as reference category.

*Control variables (2): social and cultural capital*

Information on social and cultural capital are self-assessed by individuals who are asked to report: i) frequency of getting/being in contact with friends and relatives; ii) participation in formal organizations; iii) participation in cultural events.

Individual structural social capital is captured by six variables: *professional*, *political* and *other participations*, *meetings with friends* and *meetings with relatives*. Moreover, we consider several forms of cultural participation, i.e. the frequency of going to the cinema (*cinema*), going to any *live performance* (plays, concerts, operas, ballet and dance performances), visiting historical monuments, museum, art galleries or archaeological sites (*cultural site*), attending live *sport events*.

Table A1, in Appendix A, describes all variables employed in the empirical analysis, while Table 1 presents weighted descriptive statistics.

Table 1. Weighted descriptive statistics

| | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| SPH | 4.024 | 0.908 | 0 | 5 |
| SPGH | 0.766 | 0.423 | 0 | 1 |
| ForVol | 0.082 | 0.275 | 0 | 1 |
| Relpar | 0.103 | 0.304 | 0 | 1 |
| Female | 0.514 | 0.500 | 0 | 1 |
| Married | 0.508 | 0.500 | 0 | 1 |
| Separated/divorced | 0.104 | 0.305 | 0 | 1 |
| Widowed | 0.072 | 0.258 | 0 | 1 |
| Age 31- 50 | 0.360 | 0.480 | 0 | 1 |
| Age 51- 64 | 0.208 | 0.406 | 0 | 1 |
| Age > 65 | 0.197 | 0.398 | 0 | 1 |
| Lower second. education | 0.315 | 0.465 | 0 | 1 |
| Secondary education | 0.401 | 0.490 | 0 | 1 |
| Tertiary education | 0.284 | 0.451 | 0 | 1 |
| Household size | 2.797 | 1.413 | 1 | 12 |
| EU birth | 0.011 | 0.104 | 0 | 1 |
| OTH birth | 0.100 | 0.300 | 0 | 1 |
| Household income (ln) | 10.406 | 0.743 | 2.564 | 13.745 |
| Unmeet need for medical exa. | 0.043 | 0.202 | 0 | 1 |
| Homeowner | 0.729 | 0.445 | 0 | 1 |
| Employed part time | 0.124 | 0.329 | 0 | 1 |
| Unemployed | 0.022 | 0.147 | 0 | 1 |
| Student | 0.048 | 0.215 | 0 | 1 |
| Retired | 0.203 | 0.402 | 0 | 1 |
| Disabled | 0.043 | 0.202 | 0 | 1 |
| Domestic tasks | 0.057 | 0.232 | 0 | 1 |
| Inactive | 0.008 | 0.091 | 0 | 1 |
| Home warm | 0.954 | 0.209 | 0 | 1 |
| Home dark problem | 0.132 | 0.338 | 0 | 1 |
| Noise | 0.220 | 0.414 | 0 | 1 |
| Pollution | 0.134 | 0.340 | 0 | 1 |
| Crime | 0.276 | 0.447 | 0 | 1 |
| Densely populated area | 0.743 | 0.437 | 0 | 1 |
| Intermediate area | 0.181 | 0.385 | 0 | 1 |
| Political parties/trade unions | 0.024 | 0.153 | 0 | 1 |
| Professional participation | 0.044 | 0.206 | 0 | 1 |
| Other organizations part. | 0.029 | 0.167 | 0 | 1 |
| Meetings with friends | 0.465 | 0.499 | 0 | 1 |
| Meetings with relatives | 0.419 | 0.793 | 0 | 1 |
| Cinema | 0.265 | 0.441 | 0 | 1 |
| Live performance | 0.331 | 0.471 | 0 | 1 |
| Cultural site | 0.282 | 0.450 | 0 | 1 |
| Sport events | 0.155 | 0.362 | 0 | 1 |

## 6. EMPIRICAL MODELS

We describe the causal relationship between formal volunteering and health using a two equations model

$$H^* = \alpha_0 + \alpha_1 V + X\alpha_2 + \alpha_3 SC + \alpha_4 CC + \varepsilon_H \qquad (1)$$

$$V^* = \beta_0 + \beta_1 Z + X\beta_2 + \beta_3 SC + \beta_4 CC + \varepsilon_V \qquad (2)$$

where $H^*$ is individual health, $V^*$ is formal volunteering, *X*, *SC*, *CC* are a set of control variables common to both equations, *Z* is a control variable specific to equation (2), $\varepsilon_H$ and $\varepsilon_V$ are error terms. The asterisks indicate that individual health and formal volunteering are latent variables.

In the model (1-2) $\alpha_1$ represents the causal effect of *V* on *H*. Our identification of $\alpha_1$ is based on two assumption (Angrist *et al*. 1996). The first assumption is that *Z* is uncorrelated with the disturbances $\varepsilon_H$ and $\varepsilon_V$. The assumption that the correlation between $\varepsilon_H$ and *Z* is zero and the absence of *Z* in equation (1) captures the notion that any effect of *Z* on *H* must be through an effect of *Z* on *V*. This is the key non-testable assumption of exclusion restriction of instrumental variables. The second assumption is that the covariance between the endogenous variable *V* and the instrumental variable *Z* differs from zero, which can be interpreted as requiring that $\beta_1$ in equation (2) differs from zero. This is the assumption of relevance condition.

Our empirical strategy follows three steps. First, we ignore the latent nature of both dependent variables in model (1-2), hence, we estimate the model (3) by the two stage least squares method

$$H = \alpha_0 + \alpha_1 V + X\alpha_2 + \alpha_3 SC + \alpha_4 CC + \varepsilon_H \qquad (3)$$

$$V = \beta_0 + \beta_1 Z + X\beta_2 + \beta_3 SC + \beta_4 CC + \varepsilon_V$$

Second, we add structure to account for the binary nature of the endogenous variable volunteering. Hence, the model becomes

$$H = \alpha_0 + \alpha_1 V + X\alpha_2 + \alpha_3 SC + \alpha_4 CC + \varepsilon_H \qquad (4)$$

$$V^* = \beta_0 + \beta_1 Z + X\beta_2 + \beta_3 SC + \beta_4 CC + \varepsilon_V$$

$$\text{with} \quad \begin{array}{l} V = 1 \ \text{if} \ V^* > 0 \\ V = 0 \ \text{if} \ V^* \le 0 \end{array}$$

where the error terms, $\varepsilon_H$ and $\varepsilon_V$, are assumed to be correlated bivariate normal.

$$\begin{pmatrix} \varepsilon_H \\ \varepsilon_V \end{pmatrix} \sim \mathrm{N}, \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma & \rho \\ \rho & 1 \end{pmatrix} \right]$$

The binary endogenous variable $V$ is viewed as a treatment indicator. If $V = 1$ we receive treatment and if $V = 0$ we do not receive treatment. We estimate the treatment effect model (4) using a maximum likelihood method.

Finally, we take into account for the binary nature of both individual health and volunteering variables. Thus, the model turns into

$$H^* = \alpha_0 + \alpha_1 V + X\alpha_2 + \alpha_3 SC + \alpha_4 CC + \varepsilon_H \qquad (5)$$

$$V^* = \beta_0 + \beta_1 Z + X\beta_2 + \beta_3 SC + \beta_4 CC + \varepsilon_V$$

$$\text{with} \quad \begin{matrix} H = 1 \ if \ H^* > 0 \\ H = 0 \ if \ H^* \leq 0 \end{matrix} \quad \text{and} \quad \begin{matrix} V = 1 \ if \ V^* > 0 \\ V = 0 \ if \ V^* \leq 0 \end{matrix}$$

where the error terms, $\varepsilon_H$ and $\varepsilon_V$ are assumed to be correlated bivariate normal

$$\begin{pmatrix} \varepsilon_H \\ \varepsilon_V \end{pmatrix} \sim \mathrm{N}, \left[ \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix} \right]$$

The recursive bivariate probit model with endogenous binary variable (5) is estimated through a maximum likelihood method.

### 6.1 Instrumental variable

As regards the relevance condition, the literature shows that there is a link between religion and volunteering. Precisely, religiosity has long been identified as a major predictor of the likelihood or level of volunteering (Berger 2006; Bekkers and Schuyt 2008; Yeung 2004). Religiosity includes several activities such as religious service attendance, and involvement in other religious activities: all those practises have a positive impact on volunteering. In addition, private religiosity has been found to influence positively volunteering. Furthermore, people, who read the Bible daily, pray, have faith in traditional religious principles, and hold religious values as important are more active in volunteering than people who do not (Monsma 2007; Wuthnow 2004).

Links between religion and volunteering have been theoretically explained from psychological, social and cultural points of views. From a psychological perspective, religion is thought related with pro-social and altruistic ideals and motivations (Cnaan et al. 2010; Yeung 2004). People that are more religious are more altruistic, and consequently volunteer more than non-religious. As regards social interpretation, religious groups tend to encourage volunteering among their affiliates promoting their values, norms, and practices (Park and Smith 2000). In other words, religious people are induced to volunteer by a kind of religious capital (Iannacone 1990) coming from behaviours and practises related to religion. From a cultural point of view, following Musick and Wilson (1997, 699), religion is an indicator of cultural capital and religiosity prepares people for participation in volunteering. This is likely to happen since religion participation favours the development and the improvement of skills reflective of helping others.

With regard to the exclusion restriction, although the common belief is that religious people are healthier, the link between religion and health is still not clear. The evidence is mixed. However, it seems that "suggestions that religious activity will promote health are unwarranted" (Sloan et al. 1999). "Even in the best studies, the evidence of an association between religion, spirituality, and health is weak and inconsistent" (Sloan et al. 1999, 667). Sloan and Bagiella (2002) reviewed 266 articles published in the year 2000 and identified by the Medline search, and highlighted that only 17% of them were significant to assertions of health benefits associated with religious involvement. The authors reached the conclusion that there is little empirical basis for assertions that religious involvement or activity is associated with beneficial health outcomes. Miller and Thoresen (2003, 33) claimed that "substantial empirical evidence points to links between spiritual/religious factors and health in U.S. populations, although the processes by which these relationships occur are poorly understood and evidence is sometimes exaggerated". According to Sloan (2005), Powell et al. (2003) review of the literature on religion and health is superior to the large but highly dubious Handbook of Religion and Health by Koenig et al. (2001). Powell et al. (2003) reached the conclusion that only as regards the link between attendance at religious services and mortality the evidence was persuasive, in all the other cases "the evidence was at best equivocal".

Interpretations why religion should have an impact on health are multiple, and the number of pathways through which this happens is abundant. However, since religion influences health through these pathways, religion seems acting in an indirect way on health and not directly. Beliefs that religion has a positive impact on health comes from the idea that the vast

majority of medical, psychiatric patients and those with terminal illnesses having religious or spiritual needs, use religion to be able to cope with their illnesses. In this case, religious people can experience a better mental health, more positive psychological states, more optimism and faith, which, in turn, can lead to a better physical state due to less stress. However, for many other patients, religion may become a consistent risk factor because of negative effects of religious straggle with their illness. Religion can promote health behaviours and healthy lifestyle such as discouragement of drinking alcoholic beverages, smoking and using drugs. Following this interpretation, good practises and healthy behaviours acquired by religion have an impact on health, not religion in itself. Furthermore, religion promotes social support that, in turn, can benefit health. Religious people can experience social relationships among them and often develop a network of social relations that can support them in case of need. Once again, religion does not affects health, but both social capital and a sense of belonging to a group that religion builds have a positive impact on health. Therefore, the effects of religion on health are not direct but always mediated by something different from religion.

Moving from the above statements, we expect that religion does not matter for health. Our expectations are supported also by the fact that observing the UK official statistics, the country religious make-up is complex and multicultural with over 170 distinct religions counted, with 170 different creeds. However, English people are not very religious: comprehensive professional research found that in 2006 two thirds (66% - 32.2 million people) in the UK have no connection with any religion or church (Ashworth et al. 2007).

## 7. RESULTS

Tables 2, 3 and 4 present the estimates, respectively of model (3), (4) and (5). Column 1 reports the coefficients of the covariates of formal volunteering, while Column 2 shows the coefficients of the regressors of self-reported health (as discrete variable in Tables 2 and 3, and binary variable in Table 4).

As regard Column 1, in all models, our instrumental variable, religious participation enters in formal voluntary equation with the right sign and it is statistically significant at 1 percent level. Hence, religious participation is highly positively correlated with formal volunteering. Furthermore, in Table 1, the F-statistic of the test of exclusion of the instruments (210.49) indicates that religious participation is not a weak instrument. Moreover, in all Tables, the Wu-Hausman F test (3.07) and the Wald chi(2) tests of $\rho=0$ (12.98 and 10.48) show that

Table 1. Two stage least squares of SPH

| | First stage | | 2SLS | |
|---|---|---|---|---|
| | ForVol | | SPH | |
| | Coeff. | Std. Err. | Coeff. | Std. Err. |
| ForVol | | | 0.282** | 0.132 |
| Relpar | 0.146*** | 0.010 | | |
| Female | 0.005 | 0.005 | -0.028** | 0.013 |
| Married | 0.001 | 0.006 | -0.015 | 0.019 |
| Separated/divorced | 0.001 | 0.008 | -0.048* | 0.025 |
| Widowed | -0.003 | 0.011 | -0.066** | 0.033 |
| Age 31- 50 | 0.017** | 0.007 | -0.120*** | 0.021 |
| Age 51- 64 | 0.055*** | 0.009 | -0.264*** | 0.027 |
| Age > 65 | 0.054*** | 0.013 | -0.374*** | 0.038 |
| Secondary education | 0.042*** | 0.006 | 0.111*** | 0.018 |
| Tertiary education | 0.069*** | 0.007 | 0.192*** | 0.022 |
| Household size | -0.007*** | 0.002 | 0.016*** | 0.006 |
| EU birth | -0.044** | 0.017 | -0.033 | 0.067 |
| OTH birth | -0.015* | 0.008 | -0.033 | 0.022 |
| Household income (ln) | 0.019*** | 0.004 | 0.015 | 0.011 |
| Unmeet need for medical exa. | 0.011 | 0.011 | -0.457*** | 0.034 |
| Homeowner | 0.008* | 0.005 | 0.134*** | 0.017 |
| Employed part time | 0.047*** | 0.008 | -0.060*** | 0.020 |
| Unemployed | 0.048*** | 0.014 | -0.199*** | 0.051 |
| Student | 0.074*** | 0.013 | 0.071** | 0.033 |
| Retired | 0.047*** | 0.011 | -0.296*** | 0.030 |
| Disabled | 0.037*** | 0.010 | -1.440*** | 0.039 |
| Domestic tasks | 0.045*** | 0.010 | -0.111*** | 0.029 |
| Inactive | 0.052** | 0.024 | -0.264*** | 0.072 |
| Home warm | 0.002 | 0.010 | 0.116*** | 0.034 |
| Home dark problem | 0.006 | 0.007 | -0.086*** | 0.020 |
| Noise | 0.001 | 0.006 | -0.058*** | 0.016 |
| Pollution | 0.018** | 0.007 | -0.038* | 0.020 |
| Crime | 0.007 | 0.005 | -0.086*** | 0.014 |
| Densely populated area | -0.014 | 0.010 | -0.053** | 0.026 |
| Intermediate area | 0.006 | 0.011 | -0.056** | 0.028 |
| Political parties/trade unions | 0.126*** | 0.020 | -0.063 | 0.041 |
| Professional participation | 0.166*** | 0.016 | -0.004 | 0.036 |
| Other organizations part. | 0.032** | 0.015 | 0.006 | 0.035 |
| Meetings with friends | 0.016*** | 0.004 | 0.053*** | 0.013 |
| Meetings with relatives | 0.001 | 0.004 | 0.047*** | 0.012 |
| Cinema | 0.017*** | 0.005 | 0.039*** | 0.014 |
| Live performance | 0.014*** | 0.005 | 0.043*** | 0.013 |
| Cultural site | -0.002 | 0.005 | 0.055*** | 0.013 |
| Sport events | 0.020*** | 0.007 | 0.069*** | 0.016 |
| Observations | 16591 | | | |
| | | | | |
| Test of exclusion of the instruments | | | | |
| F(1, 16551) | 210.49 | (p-value 0.00) | | |
| Test of endogeneity | | | | |
| Wu-Hausman F test (1, 16550) | 3.07 | (p-value 0.07) | | |

Note: The dependent variable *Self-perceived health* takes discrete values (1 very poor, 2 poor, 3 fair, 4 good, 5 very good). See appendix A, Table A1 for a detailed description of all covariates. The standard errors are corrected for heteroskedasticity. The symbols ***, **, * denote that the coefficient is statistically different from zero at the 1, 5 and 10 percent.

Table 2. Treatment effects model of SPH

| | ForVol | | SPH | |
|---|---|---|---|---|
| | Coeff. | Std. Err. | Coeff. | Std. Err. |
| ForVol | | | 0.297*** | 0.046 |
| Relpar | 0.620*** | 0.036 | | |
| Female | 0.051 | 0.031 | -0.028** | 0.013 |
| Married | 0.011 | 0.046 | -0.015 | 0.019 |
| Separated/divorced | 0.014 | 0.059 | -0.048* | 0.025 |
| Widowed | 0.013 | 0.070 | -0.066** | 0.033 |
| Age 31- 50 | 0.141*** | 0.054 | -0.120*** | 0.021 |
| Age 51- 64 | 0.362*** | 0.063 | -0.265*** | 0.026 |
| Age > 65 | 0.379*** | 0.083 | -0.375*** | 0.037 |
| Secondary education | 0.292*** | 0.041 | 0.110*** | 0.018 |
| Tertiary education | 0.450*** | 0.044 | 0.191*** | 0.019 |
| Household size | -0.045*** | 0.015 | 0.016*** | 0.006 |
| EU birth | -0.395** | 0.185 | -0.032 | 0.067 |
| OTH birth | -0.098* | 0.054 | -0.033 | 0.023 |
| Household income (ln) | 0.118*** | 0.028 | 0.014 | 0.010 |
| Uneed meet for medical exa. | 0.072 | 0.068 | -0.457*** | 0.034 |
| Homeowner | 0.072* | 0.039 | 0.134*** | 0.017 |
| Employed part time | 0.273*** | 0.045 | -0.060*** | 0.019 |
| Unemployed | 0.239** | 0.115 | -0.200*** | 0.050 |
| Student | 0.518*** | 0.080 | 0.069** | 0.031 |
| Retired | 0.263*** | 0.061 | -0.296*** | 0.029 |
| Disabled | 0.226*** | 0.081 | -1.440*** | 0.039 |
| Domestic tasks | 0.236*** | 0.068 | -0.112*** | 0.028 |
| Inactive | 0.348** | 0.146 | -0.264*** | 0.071 |
| Home warm | 0.018 | 0.077 | 0.116*** | 0.034 |
| Home dark problem | 0.029 | 0.045 | -0.086*** | 0.020 |
| Noise | 0.010 | 0.038 | -0.058*** | 0.016 |
| Pollution | 0.110*** | 0.042 | -0.038** | 0.020 |
| Crime | 0.037 | 0.033 | -0.087*** | 0.014 |
| Densely populated area | -0.088 | 0.057 | -0.053** | 0.026 |
| Intermediate area | 0.034 | 0.062 | -0.056** | 0.028 |
| Political parties/trade unions | 0.524*** | 0.071 | -0.065* | 0.038 |
| Professional participation | 0.623*** | 0.052 | -0.004 | 0.036 |
| Other organizations part. | 0.178** | 0.071 | 0.007 | 0.027 |
| Meetings with friends | 0.110*** | 0.029 | 0.053*** | 0.012 |
| Meetings with relatives | 0.005 | 0.029 | 0.047*** | 0.012 |
| Cinema | 0.098*** | 0.032 | 0.039*** | 0.013 |
| Live performance | 0.104*** | 0.030 | 0.042*** | 0.013 |
| Cultural site | 0.017 | 0.032 | 0.055*** | 0.013 |
| Sport events | 0.121*** | 0.039 | 0.068*** | 0.016 |
| $\rho$ | -0.169 | 0.027 | | |
| $\sigma$ | 0.784 | 0.005 | | |
| $\rho\sigma$ | -0.132 | 0.021 | | |
| Observations | 16591 | | | |
| | | | | |
| Test of endogeneity | | | | |
| Wald test of $\rho$=0 chi2(1) | 12.98 (p-value 0.00) | | | |

Note: The dependent variable *Self-perceived health* takes discrete values (1 very poor, 2 poor, 3 fair, 4 good, 5 very good). See appendix A, Table A1 for a detailed description of all covariates. The standard errors are corrected for heteroskedasticity. The symbols ***, **, * denote that the coefficient is statistically different from zero at the 1, 5 and 10 percent.

Table 3. Recursive bivariate probit model of SPGH

| | ForVol | | SPGH | |
|---|---|---|---|---|
| | Coeff. | Std. Err. | Coeff. | Std. Err. |
| ForVol | | | 0.452*** | 0.135 |
| Relpar | 0.617*** | 0.036 | | |
| Female | 0.053* | 0.031 | -0.024 | 0.025 |
| Married | 0.010 | 0.045 | -0.039 | 0.039 |
| Separated/divorced | 0.012 | 0.059 | -0.086* | 0.048 |
| Widowed | 0.011 | 0.070 | -0.069 | 0.054 |
| Age 31- 50 | 0.145*** | 0.054 | -0.207*** | 0.048 |
| Age 51- 64 | 0.363*** | 0.063 | -0.423*** | 0.056 |
| Age > 65 | 0.387*** | 0.083 | -0.520*** | 0.069 |
| Secondary education | 0.287*** | 0.041 | 0.167*** | 0.031 |
| Tertiary education | 0.447*** | 0.043 | 0.279*** | 0.038 |
| Household size | -0.044*** | 0.015 | 0.049*** | 0.012 |
| EU birth | -0.394** | 0.184 | -0.081 | 0.109 |
| OTH birth | -0.098* | 0.055 | -0.030 | 0.043 |
| Household income (ln) | 0.118*** | 0.028 | 0.038* | 0.020 |
| Uneed meet for medical exa. | 0.070 | 0.068 | -0.703*** | 0.054 |
| Homeowner | 0.072* | 0.039 | 0.216*** | 0.030 |
| Employed part time | 0.274*** | 0.045 | -0.159*** | 0.041 |
| Unemployed | 0.249** | 0.115 | -0.370*** | 0.081 |
| Student | 0.521*** | 0.080 | 0.068 | 0.082 |
| Retired | 0.264*** | 0.061 | -0.479*** | 0.049 |
| Disabled | 0.235*** | 0.080 | -1.795*** | 0.064 |
| Domestic tasks | 0.237*** | 0.068 | -0.255*** | 0.054 |
| Inactive | 0.342** | 0.147 | -0.502*** | 0.111 |
| Home warm | 0.016 | 0.077 | 0.182*** | 0.057 |
| Home dark problem | 0.028 | 0.045 | -0.124*** | 0.037 |
| Noise | 0.010 | 0.037 | -0.071*** | 0.031 |
| Pollution | 0.112*** | 0.042 | -0.100*** | 0.035 |
| Crime | 0.034 | 0.033 | -0.129*** | 0.027 |
| Densely populated area | -0.087 | 0.057 | -0.085* | 0.049 |
| Intermediate area | 0.034 | 0.062 | -0.117** | 0.053 |
| Political parties/trade unions | 0.522*** | 0.071 | -0.157** | 0.079 |
| Professional participation | 0.625*** | 0.052 | -0.007 | 0.067 |
| Other organizations part. | 0.177** | 0.071 | 0.061 | 0.068 |
| Meetings with friends | 0.110*** | 0.029 | 0.069*** | 0.024 |
| Meetings with relatives | 0.004 | 0.029 | 0.085*** | 0.024 |
| Cinema | 0.097*** | 0.032 | 0.072** | 0.029 |
| Live performance | 0.103*** | 0.031 | 0.062*** | 0.026 |
| Cultural site | 0.015 | 0.032 | 0.106*** | 0.027 |
| Sport events | 0.119*** | 0.039 | 0.106*** | 0.036 |
| ρ | -0.245 | 0.073 | | |
| Observations | 16591 | | | |
| | | | | |
| Test of endogeneity | | | | |
| Wald test of ρ=0 chi2(1) | 10.48 (p-value 0.00) | | | |

Notes: The dependent variable *Self-perceived good health* takes binary values (1 very good, good, 0 very poor, poor, fair). See appendix A, Table A1 for a detailed description of all covariates. The standard errors are corrected for heteroskedasticity. The symbols ***, **, * denote that the coefficient is statistically different from zero at the 1, 5 and 10 percent.

formal volunteering is an endogenous variable. Finally, as expected, social and cultural capital variables are highly positively associated with formal volunteering in all models (with few exceptions).

As regard the second column, in line with our hypothesis, formal volunteering is found to be strongly and positively associated with self-reported health, irrespective of the estimation procedure and health status measures. In Table 1, individuals who supply formal volunteering have a self-perceived health premium of 28%, statistically significant at 5 percent level. In Table 2, volunteers (treated group) have a mean score 30% greater than non volunteers (control group) in self-perceived health, statistically significant at 1 percent level. Finally, in Table 3, supplying formal volunteering increases the probability of reporting self-perceived good health by around 1% (marginal effect), significant at 1 percent level.

These results reinforce previous investigations on the UK, such as Petrou and Kupek (2008), Giordano and Lindstrom (2010) who consider formal volunteering as a measure of exogenous social capital.

Moreover, as in the literature on social capital and health (D'Hombres et al. 2010; Fiorillo and Sabatini 2011; Ronconi et al. 2012), we find that meetings with friends and relatives are strongly and positively correlated with individual health, while social participation in associations is not in all the models (with one exception). Finally, in line with the literature reviewed in Section 4, cultural capital variables are all positively and significantly associated with self-reported health in all three models.

To sum up, instrumental variable results, obtained with alternative health status measures and empirical methods, as well as checking the robustness through social and cultural capital variables, show that formal volunteering is positively related to self-reported health. Since the estimates account for omitted variables and endogeneity problems, we are confident that this positive association can be interpreted as a result of a causal effect of formal volunteering on self-perceived health.

## 8. DISCUSSION AND CONCLUSION

The health economics community has largely overlooked the link between volunteering and health. This paper has investigated the impact of formal volunteering on individual self-perceived health for a large, representative sample of British individuals. We rely on an indicator of formal volunteering – unpaid work for charitable organizations, groups or clubs instrumented by religious participation in religious associations – and employ alternative

health status measures and empirical procedures to estimate the impact of formal volunteering on individual health. To the best of our knowledge, this paper is the first that assesses the impact of formal volunteering in a North European country, the United Kingdom, trying to overcome the main empirical concerns involved in assessing the relationship, such as omitted variable bias and reverse causality. Our results suggest that formal volunteering is positively and significantly correlated with self-perceived (good) health.

This result begs the question of how the impact works. As stated in Section 2.3, one of the reasons why individuals volunteer is to enlarge social relations. Volunteering is an activity generally performed in groups, it is a way to expand one's personal network, and to improve social skills too (Clotfelter 1985; Schiff 1990; Prouteau and Wolff 2006). There is a link between this strand of the literature and the social integration theory, following which multiple social roles provide meaning and purpose in life, promote social support and interactions (Musick and Wilson 2003; Li and Ferraro 2005; Choi and Boham 2007). The theory assumes that people gain mental, emotional and physical benefits when they think themselves as an active, accepted part of a collective. Without such a sense of connection, people can experience depression, isolation and physical illness.

Hence, first we run our models only on control variables (1) (see Section 5), and then on control variables (1) plus relationships with family and friends, participations in several kinds of associations, i.e. structural social capital, and cultural participation - a powerful platform for the production of social relations (Becchetti et al. 2011). In the second case, coefficients of the formal volunteering variable decrease a bit remaining significant and quantitatively important.[2] Thus, our results suggest that the social relations hypothesis does not fully explain the positive relationship between formal volunteering and individual health.

Hence, we hypothesize that formal volunteering might affect individual health not only through social relations but also through the internal rewards originating from the intrinsic motivation and, in other words, coming from helping others *per sé* (Andreoni 1990). Volunteers bear utility also from the act of volunteering in itself, not only from the goods they contribute to provide. In this case, volunteering gives people the opportunity to be recognized as «good» by society. So, volunteering impacts positively on volunteers' social recognition: volunteers are recompensed with gratitude and admiration and are thought as altruist. Consequently, being engaged in such activities may promote feelings of self-worth and self-esteem. In addition, providing help is a self-validating experience. Furthermore, whilst

[2] Results are available on request.

performing social roles connected to volunteering, volunteers may be distracted from personal problems and become less self-preoccupied, fill their life with meaning and purpose. All this, in turn, produces positive effects on socio-psychological factors (Musick and Wilson 2003; Choi and Bohman 2007).

Our results suggest that health disparities in the UK may be addressed also to the scarce involvement of people in activities performed within psychological rewarding environments, like volunteering groups. Feelings of self-worth and self-esteem are not always promoted in everyday settings such as labour environments that are often highly competitive. Therefore, volunteering groups become contexts where sharing aims distracts from personal problems, decreases self-preoccupations and improves health. However, because volunteering is a free, non-remunerated activity, not everyone has the possibility to volunteer. In other words, people with low income not always has the possibility to donate their time that has to be employed in remunerative activities. This is why volunteering often is considered an elitist activity: an activity only for reach people. Given volunteering beneficial impact on health, governments should create the conditions for everyone to volunteer. The majority still not adequately knows psychological rewards of volunteering and consequent positive health impact of such activity. This is why national government should not only create the conditions, but also motivate people to volunteer, underling that helping others is highly beneficial to the helper too. Boosting volunteering could be also a way to solve frequent free-rider problems in society where there is population scarce participation to the production of public goods. So, volunteers while increase their social inclusion and gain good health, produce services and contribute to overcome free-rider problems.

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**Appendix A.** Table A1.Variable definitions

| *Variable* | *Description* |
|---|---|
| *Dependent variable* | |
| Self-perceived health | Individual assessment of health. Dummy, 1=good and/or very good; 0 otherwise |
| Self-perceived good health | Individual assessment of health. Coded from 1 to 5, with 1= very poor; 5=very good" |
| *Key independent variables* | |
| Formal Volunteering | Dummy, 1 if the respondent, during the last twelve months, participated in the unpaid work of charitable organisations, groups or clubs. It includes unpaid charitable work for churches, religious groups and humanitarian organisations. Attending meetings connected with these activities is included; 0 otherwise |
| *Instrumental variable* | |
| Religious participation | Dummy, 1 If the respondent, during the last twelve months, participated in activities related to churches, religious communions or associations. Attending holy mass or similar religious acts or helping during these services is also included; 0 otherwise |
| *Demographic and socio-economic characteristics* | |
| Female | Dummy, 1 if female; 0 otherwise**. Reference group: male** |
| Married | Dummy, 1 if married; 0 otherwise; **Reference group: single status** |
| Separated/divorced | Dummy, 1 if separated/divorced; 0 otherwise |
| Widowed | Dummy, 1 if widowed; 0 otherwise |
| Age 31- 50 | Age of the respondent. Dummy, 1 if age between 31 and 50. **Reference group: age 16 - 30** |
| Age 51- 64 | Age of the respondent. Dummy, 1 if age between 51 and 64 |
| Age > 65 | Age of the respondent. Dummy, 1 if age above 65 |
| Lower secondary edu | Dummy, 1 if the respondent has attained lower secondary education; 0 otherwise. **Reference group: no education/primary education** |
| Secondary edu | Dummy, 1 if the respondent has attained secondary education; 0 otherwise |
| Tertiary edu | Dummy, 1 if the respondent has attained tertiary education; 0 otherwise |
| Household size | Number of household members |
| EU birth | Dummy, 1 if the respondent was born in a European Union country; 0 otherwise. **Reference group: country of residence** |
| OTH birth | Dummy, 1 if the respondent was born in any other country; 0 otherwise |
| Household income (ln) | Natural log of total disposal household income (HY020) |
| Unmet need for medical examination | Dummy 1, if there was at least one occasion when the person really needed examination or treatment but did not; 0 otherwise |
| Homeowner | Dummy, 1 if the respondent owns the house where he/she lives; 0 otherwise |
| Employed part time | Self-defined current economic status of the respondents; 1 = employed part time; **Reference group: employed full time** |
| Unemployed | Self-defined current economic status of the respondents; 1 = unemployed; 0 otherwise |
| Student | Self-defined current economic status of the respondents; 1 = student; 0 otherwise |
| Retired | Self-defined current economic status of the respondents; 1 = retired; 0 otherwise |
| Disabled | Self-defined current economic status of the respondents; 1 = permanently disabled; 0 otherwise |
| Domestic tasks | Self-defined current economic status of the respondents; 1 = domestic tasks; 0 otherwise |
| Inactive | Self-defined current economic status of the respondents; 1 = other inactive person; 0 otherwise |
| *Housing feature* | |
| Home warm | Dummy, 1 if the respondent is able to pay to keep the home adequately warm; 0 otherwise |
| Home dark problem | Dummy, 1 if the respondent feels the dwelling is too dark, not enough light; 0 otherwise |

| *Variable* | *Description* |
|---|---|
| *Neighbourhood quality* | |
| Noise | Dummy, 1 if the respondent feels noise from neighbours is a problem for the household; 0 otherwise |
| Pollution | Dummy, 1 if the respondent feels pollution, grime or other environmental problems are a problem for the household; 0 otherwise |
| Crime | Dummy, 1 if the respondent feels crime, violence or vandalism is a problem for the household; 0 otherwise |
| *Size of municipality* | |
| Densely populated area | Dummy, 1 if the respondent lives in local areas where the total population for the set is at least 50,000 inhabitants. **Reference Group: Thinly-populated area** |
| Intermediate area | Dummy, 1 if the respondent lives in local areas, not belonging to a densely-populated area, and either with a total population for the set of at least 50,000 inhabitants or adjacent to a densely-populated area. |
| *Social and cultural capital variables* | |
| Political parties and/or trade unions | Dummy, 1 if the respondent, during the last twelve months, participated in activities related to political groups, political association, political parties or trade unions. Attending meetings connected with these activities is included; 0 otherwise |
| Professional participation | Dummy, 1 if the respondent, during the last twelve months, participated in activities related to a professional association. Attending meetings connected with these activities is included; 0 otherwise |
| Participation in other organisations | Dummy, 1 if the respondent, during the last twelve months, participated in the activities of environmental organisations, civil rights groups, neighbourhood associations, peace groups etc. Attending meetings connected with these activities is included; 0 otherwise |
| Meetings with friends | Dummy 1, if the respondent gets together with friends every day or several times a week during a usual year; 0 otherwise |
| Meetings with relatives | Dummy 1, if the respondent gets together with relatives every day or several times a week during a usual year; 0 otherwise |
| Cinema | Dummy. 1 if the respondent goes to the cinema 1-3 times a year; 0 otherwise |
| Live performance | Dummy. 1 if the respondent goes to any live performance (plays, concerts, operas, ballet and dance performances) 1-3 times a year; 0 otherwise |
| Cultural site | Dummy. 1 if the respondent visits historical monuments, museum, art galleries or archaeological sites 1-3 times a year; 0 otherwise |
| Sport events | Dummy. 1 if the respondent attends live sport events 1-3 times a year; 0 otherwise |