Psychological health and structural social capital in UK: A panel analysis

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Abstract

The link between social relations and psychological wellbeing is well established in sociological and psychological studies. From the beginning of the 2000s, it has been gaining new attention and interest in economic and public health studies too. Fifteen years of empirical studies testing the relationship between structural social capital and individual self-rated psychological health have found inconclusive results both because the greatest part of the studies are based on cross sectional data, leaving out individual heterogeneity problems and omitted variable bias, and because the indexes of psychological measures used are often discordant one from the other. This study investigates the relationship between structural social capital and individual self-rated psychological health using five waves of the British Household Panel Survey from year 1991 to year 1995 (unbalanced panel N=44,684). For each wave, the participation rates are the following: wave 1, 95%; wave 2, 86%; wave 3, 84%; wave 4, 87%; and wave 5, 87%. We use three measures of membership in organizations: only member, only active, and both member and active. Self-rated psychological health is assessed by the 12-items of the General Health Questionnaire (GHQ-12). Following Roberts et al. (2011) and Hu et al. (2007), we construct a 36-point scale of all items of the GHQ-12 and principal underlying factors of all items of the GHQ-12. Using fixed effects estimators to take into account heterogeneity and omitted variable bias problem, the study shows that being both member and active in an organization has a strong negative relationship with worse psychological health. In addition, being active within an organization in the previous year also has a negative correlation with worse psychological health in the following year.

JEL codes: C23, D71, I10, I31, Z1

Keywords: structural social capital**,** membership, psychological health, OLS fixed effects, British Household Panel Survey

1. Introduction

Psychological health problems are one of the main causes of the burden of disease worldwide (Vos et al. 2013). Psychological health problems have been linked to lessened human capital, general disability and poor work performance and constitute an important source of world economic costs (Ettner et al. 1997; Phongsavan et al. 2006). As good psychological health is a core indicator of human development, the World Health Organization's (WHO) Mental Health Action Plan 2013-2020 (WHO 2013) calls for integration of psychological health issues into multisectoral polices and laws with education, employment, disability, social protection, poverty reduction and development (Allen et al. 2014).

There is a huge literature on the socioeconomic determinants of psychological health. Robust relationships have been established among low education, low income, unemployment, low standard of living, social isolation and mental illness (Bartley 1994; Seeman 1996; Weich and Lewis 1998; Berkman et al. 2000; Fryers et al. 2005; Lund et al. 2010; Catalano et al. 2011; Campion et al. 2013).

The relationship between social relations and psychological wellbeing, which is well established in sociological and psychological studies (see Umberson and Montez 2010; Thoits 2011a), has been gaining new attention and interest in economic and public health studies from the beginning of the 2000s with the label of social capital. Social capital is commonly referred as formal and informal social relationships, norms of reciprocity and trust that exists in a community (Putnam et al. 1993; Kawachi and Berkman 2001). Scholars disaggregate the notion of social capital into cognitive and structural components, with the former related to individuals' perception and mental processes resulting in values, norms and trust and the latter representing the extent and the intensity of social networks (Uphoff 2000; Fujiwara and Kawachi 2008). In the sociological, economic and public health literature, there is a strong view to consider social relations as structural social capital, i.e., a resource embedded within an individual's social network that a person can draw on as long as he/she remains in an active relationship within the group (Bourdieu 1986; Coleman 1988; Glaeser et al. 2002; Kim et al. 2011; Song 2011). In this paper, we are focusing on structural social capital.

In the last fifteen years, several empirical studies have tested the relationship between structural social capital and individual self-rated psychological health with inconclusive results. While several

cross-section studies found a positive or no correlation between individual structural social capital and self-rated psychological health (Lindström 2004; Phongsavan et al. 2006; Nieminen et al. 2010; Carpiano and Hystad 2011; Ahnquist et al. 2012; Bassett and Moore 2013), a cross-section investigation with instrumental variables showed a negative association (Goryakin et al. 2014), whereas a few longitudinal analyses found no relationship (Giordano and Lindström 2011; Lindström and Giordano 2016). These pieces of evidence highlight two main critical considerations. First, longitudinal data are required to control for individual heterogeneity because unobservable features, such as personality and motivation, may be associated with reported behaviour and a key independent variable of interest as structural social capital. Second, most earlier studies concentrate only on the extreme of the psychological health distribution, ignoring the entire continuum distribution.

Our main contribution to the literature is evaluating the relationship between structural social capital, measured by membership in associations, and psychological health, assessed by the 12-items of the General Health Questionnaire (GHQ-12). We control for several socioeconomic features such as education, income, unemployment and health problems and use longitudinal data from the British Household Panel Survey (BHPS), from years 1991 to 1995, and a fixed effects estimator. We also contribute to the literature in other ways. We employ a structural dimension of social capital; therefore, our paper is related to the huge literature on social relations and physical and mental health that we try to summarize, highlighting the mechanisms through which structural social capital may have a positive effect on psychological health. In addition, we introduce also the lagged variable for structural social capital variables. Following Roberts et al. (2011), we construct a 36-point scale of all items of the GHQ-12; however, having in mind the limits of this aggregation, we use principal component analysis (PCA) (Hu et al. 2007) to compare our results, which is missing in the literature.

In what follows, Section 2 considers the background literature on social relations, structural social capital and psychological health. Section 3 describes the data and the variables employed as well as sets out the econometric model. Section 4 reports the results, and Section 5 discusses them.

2. Background

2.1. Social relations and health

Since Durkeim's ([1897] 1951) pioneering study on social integration and suicide, significant sociological and psychological studies have investigated the associations between various aspects of social relations and different health outcomes (see Song 2010; Thoits 2011a). Early studies in the 1970s and the 1980s focused on the structural aspects of social relations - involvement in informal

and formal social ties (*social integration*) such as ties with spouse, close friends and relatives and participation in groups - showing that the lack of social ties predicted mortality from almost every cause of death (House et al. 1988; Berkman 1995). The second wave of research, in the 1980s, focused on qualitative aspects of social relations, i.e., on various forms of aid that individuals receive or perceive from their social networks, such as emotional, instrumental and informational support (*social support*), and their relationship with physical health, mental health and longevity (LaRocca et al. 1980; Smith and Christakis 2008).

Despite the substantial literature on the link between social relations and health, few studies investigated how social ties work improve health and wellbeing (Thoits 2011b). These studies focus either on physical health outcomes (Berkman et al. 2000; Cohen 2004) or on mental health (Thoits 1986; Kawachi and Berkman 2001) and on both (Thoits 2011b). Two models were presented to explain mechanisms throughout which social relations may affect health. These are the main effect model and the stress-buffering model (Cohen and Wills 1985; Kawachi and Berkman 2001). The former highlights that social ties have positive effects on health regardless of whether individual are under stress. The latter suggests that social relationships are related to wellbeing only for persons under stress. Summarizing, mechanisms through which social ties may have beneficial effects on psychological health of individuals who are not under stress are the following:—

(a) *Social influence/social comparison/social control.* Social influence/social comparison regards the way by which members of social networks acquire guidance about health relevant behaviours, which may have a positive influence on psychological health (Berkman et al. 2000; Kawachi and Berkman 2001). People obtain both normative and behavioural guidance by comparisons with others in their reference groups. Norms about health behaviours are acquired through such comparison processes: for example, norms about physical activity, alcohol consumption or cigarette smoking. Social influence through comparison processes may have protective consequences for health, depending on the reference groups that individuals view as salient and on the predominant health beliefs and behaviours within those groups (Thoits 2011b). Social control is another mechanism through with social relations affect health, through its effects on health behaviours (Berkman et al. 2000; Umberson and Montez 2010). Social control refers to the explicit attempts of social network members to monitor, to encourage, to persuade, to remind or to pressure a person to adopt or to adhere to positive health practices. As with social influence, social control may be beneficial for mental health depending on strategies that others employ to regulate the person's behaviour (Thoits 2011a, b).—

(b) *Social integration* considers integration in social networks that may have a positive effect on psychological states through social roles, self-esteem and belonging (Brunner and Marmot 1999;

Cohen 2004). Roles are positions in the social structure (i.e., friend-friend) to which are attached reciprocal sets of normative rights and obligations. Commitments and responsibilities to role identities exert implicit pressures on individuals to avoid risky or deviant behaviours and to engage in self-care, which in turn should have positive effects on psychological health (Berkman et al. 2000; Umberson and Montez 2010; Thoits 2011b). Moreover, social roles affect positively self-esteem beliefs regarding how good, worthy or competent we are in general (Rosenberg et al. 1995). Self-esteem, in turn, is associated with lower symptoms of anxiety, depression and distress (Baumeister et al. 2003; Taylor and Stanton 2007). Social ties are sources of a sense of belonging (Cobb 1976; Uchino 2004). Belonging implies acceptance and inclusion in a social network, and it provides security that individual needs will be met by the group (Thoits 2011b). A close corollary of acceptance is companionship: one has others with whom one can share social activities (Berkman et al. 2000; Uchino 2004). Companionship produces a positive effect, which, in turn, enhances psychological wellbeing (Uchino 2004).

(c) *Social support.* Social ties are channels of emotional (i.e., demonstrations of caring, esteem and value, encouragement), informational (i.e., provision of facts and advice that may help an individual to solve problems) and instrumental (i.e., offering behavioural and material assistance) support (House and Kahn 1985; Lin and Westcott 1991). Studies have shown that social support positively and directly influences psychological wellbeing (Lin et al. 1999; Taylor and Stanton 2007) and indirectly sustains self-esteem, a sense of mattering to others, and perceived control over minor or impeding obstacles (Umberson and Montez 2010; Thoits 2011b).

2.2. Structural social capital

In the late 1990s, the popularity gained by the concept of social capital prompted a wave of empirical studies that started to investigate the potential role of its various dimensions – including social relationships, civic engagement and trust – in actual and perceived health (Fiorillo and Sabatini 2015). Although the concept of social capital gained popularity in the 1990s by means of Putnam et al. et al. (1993), it is traced back to the works of Bourdieu (1980) and Coleman (1988). Bourdieu defines social capital as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual understanding and recognition" (Bourdieu 1986, 248). For Bourdieu, social capital is one of three forms of capital (economic, cultural and social), which, taken together, "explain the structure of dynamics of differentiates societies" (Bourdieu and Wacquant 1992, 119). According to Bourdieu, "the volume of social capital possessed by a given agent … depends on the size of the network of connections he can effectively mobilize and on the volume of the capital (economic, cultural and

symbolic) possessed in his own right by each of those to whom he is connected" (Bourdieu 1986, 249). Hence, Bourdieu treats the concept of social capital as instrumental, focusing on the benefits that individuals derive from participating in groups and on the importance of constructing social relations as social networks. Social relations are not a natural given but must be constructed through investment strategies. According to Coleman "social capital is defined by its function. It is not a single entity but a variety of different entities with two elements in common: they all consist of some aspects of social structure, and they facilitate certain actions of actors – whether persons or corporate actors – within the structure. Like other forms of capital, social capital is productive, making possible the achievement of certain ends that in its absence would not be possible… Unlike other forms of capital, social capital inheres in the structure of relations between actors and among actors. It is not lodged either in the actors themselves or in physical implements of production" (Coleman 1998, S98). Like Bourdieu, Coleman notes that social capital is embodied in the relations among persons and that these social relationships can give individuals access to resources not otherwise available; individuals can use them to achieve their interests.—

Putnam and colleagues regard social capital as "features of social organisation, such as trust, norms and networks, that can improve the efficiency of society by facilitating coordinated actions" (1993, 167). With Putnam, the concept leaves the characteristic of individual resource to become a resource that is capable of solving problems of collective action (Portes 1998, 18). These perspectives highlight that social capital can be both an individual and a collective attribute (Kawachi et al. 2004; Poortinga 2006) and it can be operationalised as social network and trust (Fujiwara and Kawachi 2008; Giordano and Lindström 2010), representing, respectively, the structural and cognitive dimension of social capital (Uphoff 2000; Ehsan and De Silva 2015). A social network is an empirically directly observable aspect of social capital that can be measured by asking respondents to what extent they are engaged in formal and informal social activities. Trust represents a more immaterial aspect of social capital that is objectively measurable to a lesser extent (Lindström 2004; Landstedt et al. 2016).

In this paper, we focus on the individual structural dimension of social capital and refer to the definitions of Bourdieu (1986) and Coleman (1988), according to whom social capital is an individual resource that individuals can access through social networks. We adopt the indicator that most closely fits with the above definitions, i.e., membership in associations (Harpham et al. 2002). We hypothesize that membership in associations has a negative relationship with psychological disorder through the mechanisms of (i) *social influence/social comparison/social control*, (ii) *social integration* and (iii) *social support*.

2.3. Structural social capital and psychological health

A number of empirical papers have estimated the link between social capital and mental health (for review, see Ehsan and De Silva 2015). For the aims of this paper, we are interested in the link between psychological health and individual structural social capital. Hence, we consider only studies that measure individual structural social capital by participation in social activities, membership in formal groups/associations and community participation. De Silva et al. (2005), who found no evidence of an association between individual structural social capital and all mental illness, offer an interdisciplinary review of primary evidence.

Some later studies adopt a cross-section and longitudinal design focusing on self-reported psychological health measured from the 12-item of the General Health Questionnaire (GHQ-12). Lindström (2004) dichotomised the 12-item General Health Questionnaire in two alternatives, denoting good psychological health and bad psychological health. If three or more of the 12 items denoted bad psychological health, the general psychological health (GHQ-12) was denoted as bad. He found that higher participation in social activities was positively associated with general (good) psychological health in Southern Sweden for the year 2000. Nieminen et al. (2010) measured psychological wellbeing as the sum of 12 questions of the GHQ-12 with a range between 0 and 12. They showed a positive association between participation in social activities and psychological wellbeing for Finns in the year 2000. Ahnquist et al. (2012) analysed for Sweden the socioeconomic determinants of psychological distress using the GHQ-12 total score ranging from 0 to 12. The authors found a negative correlation between participation in social activities and psychological distress only for men for the year 2009. Giordano and Lindström (2011) investigated the link between active membership in formal groups and changes in self-rated psychological health, measured as in Lindström (2004), with the BHPS (2000/2007). The authors found that active membership in associations had no effect on self-rated psychological health. Lindström and Giordano (2016) employed data from BHPS before and immediately after the 2008 crisis, with the aim of studying the social support effects of active membership in formal groups against worse psychological wellbeing (GHQ-12), measured as in Lindström (2004), during and after the 2008 financial crisis. The authors found that social participation was not associated with psychological health. Fiorillo et al. (2017), using five waves of the BHPS from 1991 to 1995, did not aggregate the GHQ-12 items and analysed them one by one. They showed that being both a member and active within associations is linked to all positive items of self-rated psychological health.

Further studies used different measure of psychological health/distress/wellbeing. Phongsavan et al. (2006) used the 10-item Kessler psychological distress scale (K10) with scores grouped in the "high and very high" level of psychological distress. They found no correlation between community participation and psychological distress for Australian adults in the year 1997. Carpiano and Hystad

(2011) considered Canadian General Social Survey data for the year 2008 to show that membership in formal groups was not related to self-reported good psychological health. Bassett and Moore (2013) made use of data from the 2008 Montreal Metropolitan Area and Healthy Ageing Study: depressive symptoms were measured with the Center for Epidemiologic Studies 10-item Depression Scale (CES – D Scale), with a cut off of more than three symptoms used to indicate depressive symptoms. The authors found that social participation was not correlated with depressive symptoms. Goryakin et al. (2014) used data drawn from a nationally representative survey collected in 2011 for a sample of nine former Soviet Republics to analyse the effect of individual structural and cognitive social capital on mental good health measured by a self-reported mental health symptom questionnaire with 12 items. The authors instrumented their measures of social capital – i.e., social trust, membership in associations, and self-reported loneliness – with community-based instruments given by the community-level social capital (measured by the average levels of social trust, membership and loneliness). Another instrument employed for the mental distress specification was whether the individual, during the past 12 months, was a victim of physical violence. The study found that membership in associations had a significant negative effect on good mental health.

3. Data, variables and methodology

3.1. Data

We use data from the first five waves of the British Household Panel Survey covering the survey years from 1991 to 1995. We limit our study to 1-5 waves because only for those years our social capital variables are continuously present. The first wave in 1991 was designed as a nationally representative random sample of the population of Great Britain in private households. More than 8,000 household addresses were selected in all of Great Britain. Among these, more than 5,000 answered, and approximately 10,000 individual household members were interviewed. The original respondents were followed and interviewed at annual intervals thereafter. They provided information on various domains of their lives, ranging from income to jobs, household consumption, education, health, and social and political values. As a consequence of this sample design, there is a full representation of the population in Great Britain because households in the entire country were covered; therefore, population non-response rates do not invalidate the representativeness of the individual sample.

We use an unbalanced panel of individuals aged 16 and over, excluding missing data on any relevant variables. We do not restrict the sample further. However, the probability of losing some piece of information is consistent with panel data, and it could be of the three types that we

illustrate in Table 1. The first is due to participation rates that are the percentages of people in the designed sample who did not response to the questionnaire. The second is due to the rate of attrition, cumulated with respect to the first wave. Moreover, the loss of information could be due to those who do not answer specific questions of interest in our paper. The last line of Table 1 shows the cumulative number of observations of our sample for every year.

[Insert Table 1 here]

The BHPS has a number of strengths for the aims of this paper. It is a national representative sample, it is a longitudinal dataset, it is able to track changes in people's events over time, and it takes in a number of variables useful to identify both social participation and psychological health.

3.2. Dependent variables

The dependent variable is from the General Health Questionnaire (GHQ-12). The GHQ-12 contains twelve questions that were developed to identify minor psychiatric disorders (Goldberg and Williams 1988); however, they are also used to investigate psychological (mental) health more generally (Argyle 1989). The items take the form of responses to the following questions:

"Have you recently:

1. Been able to concentrate on whatever you are doing?
2. Lost much sleep over worry?
3. Felt that you were playing a useful part in things?
4. Felt capable of making decisions about things?
5. Felt constantly under strain?
6. Felt you could not overcome your difficulties?
7. Been able to enjoy your normal day-to-day activities?
8. Been able to face up to problems?
9. Been feeling unhappy or depressed?
10. Been losing confidence in yourself?
11. Been thinking of yourself as a worthless person?
12. Been feeling reasonably happy, all things considered?"

The 12-item GHQ comprises six "positive" and six "negative" items concerning the past few weeks (Hu et al. 2007). Positive items include 1, 3, 4, 7, 8 and 12 listed above. The remainders are negative items. Positive items have as responses: "Better than usual" (1), "Same as usual" (2), "Less than usual" (3) and "Much less than usual" (4). Responses to negative items are the following: "Not at all" (1), "No more than usual" (2), "Rather more than usual" (3) and "Much more than usual" (4).

All items are rescored so that a low score (0) is indicative of endorsement of these items (i.e., Better than usual/Not at all), while higher scores (3) indicate greater difficulty of these items (i.e.,

Much less than usual/Much more than usual). Following previous studies (Roberts et al. 2011; Taylor et al. 2011), we add all items together providing a total GHQ-12 score of worse psychological health ranking from 0 to 36. We label this total GHQ-12 score *PSH*. We label worse psychological health as psychological disorder. This aggregation method is the most used in the literature; it is very simple to figure out and produces a unique variable of psychological health. However, it attributes the same relevance to all the GHQ-12 items and answer. Moreover, *PSH* states that each respondent has in mind the same scale of importance for each single GHQ-12 question. As a consequence, *PSH* aggregation has some pitfalls, but we can use it as our reference method for robustness checks with other methodologies.

An alternative method of aggregation of the GHQ-12 items, mainly used in psychometric field, is implementing a principal component analysis (PCA) (Kalliath et al. 2004; Shevlin and Adamson 2005; Marjanovic et al. 2013). This method attributes different weights to each single item, starting from the data reliability; that is, the items that are similar in answer have similar weights. However, it usually does not produce a unique variable explaining the psychological health, and all those variables may do not have a clear meaning. To aggregate using the PCA method, we have to consider that all items are ordinal variables, and their descriptive statistics are illustrated in Table 2. The higher the values of the variable, the lower the level of psychological health. They are all ordinal variables varying from 1 to 4. The number of observations is very large.

[Insert Table 2 here]

Avoiding the clear meaning for each PCA aggregation variable, Hu et al. (2007) noted on similar data that we can distinguish between positive and negative items. Attending their example, we implement PCA to aggregate both the positive and negative items of the GHQ. The direction (positive/negative) is not relevant for the PCA predicted variables. This is due to the correlation among variables because in both directions they can be linked to the aggregate variable positively or negatively. It follows that we can compare the results obtained by the separate PCAs with relative total GHQ-6 scores.

With the aim of using and comparing different criteria of aggregation, we repeat the same sum procedure of *PSH* but aggregating separately positive from negative items. We obtain two variables from dividing GHQ-12 into two GHQ-6 scores for positive and negative psychological health, ranking, this time, from 0 to 18. We label these two total GHQ-6 scores, respectively, *PSHP* for positive and *PSHN* for negative items.

Appling the PCA, we follow Tabachnick and Fidell (2013). We test for reliability, and we obtain Cronbach's α = 0.8782 in the case of the GHQ-12, meanwhile for the positive GHQ-6 *PSHP* α = 0.7913 and for the negative GHQ-6 *PSHN* α = 0.8526. We also test for the Kaiser Meyer Oblim measure of sampling adequacy (all 0.912, positive 0.840 and negative 0.854) and the Bartlett's test of sphericity (all F=20,400, p=0.000; positive F=66,752, p=0.000; negative F=1.09e+05, p=0.000). All tests indicate that variables are factorable.

In the case of the GHQ-12 items, the screeplot indicates that we find two eigenvalues larger than one; therefore, we generate two variables "*PSHpc1* and *PSHpc2*" representing the individual state of psychological health. To support this decision, we also implement parallel analysis (Dinno 2009). In the case of the positive GHQ-6 items, the screeplot and the parallel analysis report only a variable for psychological health that we named *PSHpcP*. We obtain similar results for the negative GHQ-6 items, and we generate the variable *PSHpcN*.

The descriptive statistics of all dependent variables are shown in Table 3.

[Insert Table 3 here]

The first seven lines of Table A.2 (in Appendix A) present the correlations among dependent variables. We observe that *PSH* is highly correlated with other dependent variables except for *PSHpc2*. Moreover, *PSHpc1* is highly correlated with *PSHP*, *PSHN*, *PSHpcP* and *PSHpcN*. High correlation occurs between *PSHP* and *PSHpcP* as well as between *PSHN* and *PSHpcN*, as well.

In Appendix A, graphs A.1 to A.7 represent the distributions of all of our dependent variables. With regard to *PSH*, *PSHP*, and *PSHN* aggregate psychological health measures, although they are built so that high values indicate a worse psychological health status, the means hold towards low values, in particular for *PSHN*. Indeed, if we look at the *PSHN* (as *PSHpcN*) distribution, we observe a variable skewed towards better psychological health instead of towards a roughly normal distribution that occurs for the *PSH* and *PSHP* variables. A roughly normal distribution appears also for the *PSHpc1*, *PSHpc2* and *PSHpcP* variables. Hence, if we compare the distribution of positive items in sum and the factor analysis, they are both distributed in a unimodal way; negative items, which are bimodal and strongly asymmetric, show a bias towards the lowest value compared with positive and total aggregations.

3.3. Structural social capital

Our key independent variables are *Member*, *Active* and *Member*Active*. In years from 1991 to 1995, the same individuals were asked: "Are you currently a member of any of the types of

organizations on this card" and "Are you currently active in any of the types of organizations on this card".

The types of organisations used for determining both variables are: Environmental (orgmc, orgac), Parental (orgmd, orgad), Tenants or Residents (orgme, orgae), Religious (orgmf, orgaf), Voluntary Service (orgmg, orgag), Community (orgmh, orgah), Social (orgmi, orgai), Sports club (orgmj, orgaj), Women's Institute (orgmk, orgak), Women's Group (orgml, orgal) and Others (orgmm, orgam)[4].

Member is equal to 1 if the respondent is only a member of at least one of the organizations listed above but she/he is not active in the organizations. *Active* is equal to 1 if the respondent is only active in at least in one of the organizations listed above, that is, an individual who spends his or her own spare time thorough an organization without being a formal member. Finally, *Member*Active* is equal to 1 if the respondent is both a member and active at least in one of the organizations listed above.

The descriptive statistics of the key independent variables are reported in Table 3. The correlations among social participation and dependent variables are presented in Table A.2 from row 8 to 10.

3.4. Control variables

To account for other features that might simultaneously influence individual psychological health and membership in associations, we include in the analysis a full set of socio-demographic variables largely used in the literature (Giordano and Lindström 2011). Table A.1 in Appendix A reports the questions' wording relative to our control variables.

We grouped several characteristics as socioeconomic status (ses) variables: i) *Married*, a dummy variable that takes value 1 if the respondent is married; ii) *Children* is the number of children in household aged from 0 to 18 years; iii) *O_CSE*, *HND_A*, *DEGREE* are three dummy variables indicating the highest education qualification (taking no qualification as reference group); and iv) C_age and C_age2 are the demeaning age and age square[5].

4 In each bracket, the first term indicates being member; the second term represents being active.

5 We demean the variable age to avoid the effect of collinearity of introducing the variable and its square in a regression. As a consequence of that all, our regressions have a limited VIF.

We consider *LNINCOME*, which is the equivalent uninflated annual household income, and *Unemployed*, a dummy indicating if the interviewed has not been employed during the year, as the economic group of control variables.

The group of controls for the health status comprises *hl2gp*, the number of visits to the general practitioner and *HFPR*, a dummy that indicates if the interviewed has health problems (arms, legs, hands, sight, hearing, skin conditions/allergy, chest, heart/blood pressure, stomach or digestion, diabetes). Finally, we control for year dummies and regional dummies[6].

Table 3 reports descriptive statistics of all control variables. Table A.2 in Appendix A presents the correlations between control and dependent variables.

3.5. Methodology

We implemented a linear model because our dependent variable has a sufficient number of observations to be considered continuous. Moreover, most of the literature (Roberts et al 2011, Taylor et al 2011) considers the GHQ variable as continuous and uses the same type of OLS regression. In addition, in estimating the effect of social participation on psychological health, it is important considering both observed factors (as income and economic features) and unobserved factors (as personality traits and psychological characteristics), which are likely to be associated with social participation and psychological health. Hence, our methodology is also based on fixed effect estimations with annual longitudinal data for a larger number of individuals. We decide to use fixed effects rather than random effects correcting for the Mundlak (1978) approach because for a short period (five years), it is presumable that unobserved heterogeneity is constant. The basic model is denoted

$$GHQit = \alpha + \beta 1 Memberit + \beta 2 Activeit + \beta 3 Memberit * Activeit + \gamma Zit + ui + \varepsilon it \qquad (1)$$

6 Regional dummies take values equal to 1 if the interviewed is resident in a region, and zero otherwise. In the BHPS, Great Britain is divided into 18 regions that are standard in the UK geographical classification distinguishing Metropolitan Counties and Inner and Outer London.

where GHQ_{it} is the measure of the psychological health of individual i at time t; Memberit, Activeit, and Memberit*Activeit are the key independent variables; Zitis the set of conditioning variables; εit is the random error term; and ui is the unobserved individual specific component, assumed to be time invariant and correlated with the observed explanatory variables.

We introduce also the lagged variable for the key independent variables. We use only one lagged variable. In this way, we try to understand whether being a member, active and both member and active of an organization in the previous year (time t-1) can have an effect on psychological health in the following year (time t). The FE estimator with social participation lagged variables is

$$GHQit= \alpha+\beta1Memberit-1+\beta2Activeit-1+\beta3Memberit-1*Activeit-1+\gamma Zit +ui+\varepsilon it \quad (2)$$

However, because of the introduction of a lagged independent variable, there is a reduction in the number of observations. Thus, to compare results of contemporarily and lagged variables, we also operate regressions reducing the observation to the case of lagged variables. In this last state, the FE model is

$$GHQit= \alpha+\beta1Memberit+\beta2Activeit+\beta3Memberit*Activeit++\beta5Activeit-1+\beta6Memberit-1*Activeit-1+\gamma Zit +ui+\varepsilon it \quad (3)$$

4. Results

Table 4 and Tables from 1 to 6 in Appendix B report the results of the FE estimations for the aggregate measures of psychological health. Each table accounts for four regressions. The first column considers the regression for all the control variables and membership variables in the same year of psychological health status (Equation 1). The second column reports the same equation regression but restricting the sample taking into account whether the observations have an existing lagged variable. The third column shows the regression only on the lagged variables of membership (Equation 2), while the last column details the results for all contemporary and lagged social participation variables (Equation 3). The findings of time and regional dummies are not reported for brevity. As to the coefficients, the tables show some typical measures of fit and testing.

4.1 Results for PSH

[Insert Table 4 here]

We focus on *PSH*: the GHQ-12 ranking is from 0 to 36. Table 4 illustrates the results of the OLS fixed effects estimators. The coefficients associated with *Member* are negatively related to *PSH* and statistical significant at 10% in the first and second columns. In the last column, we have the same negative effect for the *Member* parameter but it is not significant as in the preceding two columns. Comparing column (2) with the last one, insisting on the same sample, we can observe that if *t-1* variables are introduced in our regression sign and the intensity of *Member* remains almost stable, the significance is reduced to below the level of 10% but close to it. This could be due to the reduction in the number of observations. In columns (3) and (4), the relationship between being only a member at time *t-1* and psychological health is not statistically significant. Moving on *Active* coefficients, they are never significant at time *t*, and they do not assume a determined sign. Instead, when we focus on time *t-1*, being only an active within an organisation is negatively related with psychological disorder. This relationship, columns (3) and (4), results in being between 27% and 30% and significant at the 5% level. Being both a member and active at time *t* in an organisation results in always being negatively related to worse psychological health. The intensity of this relationship is between 19.7% and 21.2% and significant at the 5% (column 4) and 1% levels (column 1). However, the interaction variable is always negative but not significant at time *t-1*.

Regarding the other covariates, being married is negatively related to psychological disorder in all regressions, and the magnitude of this effect is large, from the 81% to the 91.5%. The number of

children is also negatively correlated to worse psychological health, and it ranges from 16.5% to 20.1%. The higher is the level of education, the better is psychological health. Being graduated (*DEGREE*) and having completed some high school (*HND_A*) are always statistically significant at the 5% level. The *LNINCOME* variable is generally not statistically significant in any of the regressions. Being unemployed and visiting the GP have a strong positive relationship with psychological disorder in all the estimates and are significant at the 0.1% level. The HFPR variable is also positively and statistically significant, indicating that the physical problems have a negative impact on psychological status.

4.2 Robustness checks

Being our *PSH* a questionable aggregation of the GHQ-12 items, we implement a robustness check using other methods of aggregation of psychological health. Hereafter, we compare our main results (Table 4) with those of the other aggregation variables illustrated from Tables 1 to 6 in Appendix B.

In Tables B.1 and B.2, we repeated the same regressions for *PSHpc1* and *PSHpc2* obtained from PCA on GHQ-12. For *PSHpc1*, we have similar results for *Member* and *Active* and as well as for their interaction. The results seem to be less intense but with the same significance. Turning to PSHpc2, the results are similar for *Member* and *Member*Active*; the intensity is lower but the significance is larger. In contrast, *Active* is significant at time *t* and not significant at time *t-1*.–

Tables B.3 and B.4 report the results of the OLS fixed effects estimators respectively for the *PSHP* and the *PSHpcP* variables. Compared with the *PSH* results, the estimates of the parameters associated with being a member, active and both a member and active in an organization are statistically significant with a higher level of significance but a lower intensity for time *t* and *t-1*. Instead, Tables B.5 and B.6 show the results for negative items *PSHN* and *PSHpcN* that are never significant for membership variables and, as a consequence, dissimilar from *PSH*.

With some marginal exceptions, a large part of the results obtained for the control variables are in line with those of the PSH regressions.

Moreover, to understand the results when fixed effects and control variables are absent, as in many previous studies, we add some regressions that do not consider fixed effects. Table 5 in the first column, illustrates the coefficients in all the preceding cases for the key independent variables, in the second column, it shows the results in the absence of fixed effects and considering the control variables, and in the last column, we have the results with fixed effects and without control variables. Comparing the coefficients of pooled with the fixed effect regressions, we find that in all cases, but the PSHpc2 regression, unobserved variables reduce the coefficients of social

participation variables. Therefore, a pooled or a simple cross section analyses may bias the coefficients in favour of psychological health of social participation and overestimate the significance of the relationships. Comparing coefficients with and without controls, we find a small effect of control variables on social participation coefficients. Therefore, we think that our results can be generalised to a larger population.

[Insert Table 5 here]

5. Discussion

In this paper, we analysed the relationship between structural social capital, for which membership in an organization serves as a proxy, and self-rated psychological health, assessed by the 12-items of the General Health Questionnaire (GHQ-12), in a large representative sample of the British population, using five waves of the British Household Panel Survey from year 1991 to year 1995 and a fixed effects estimator. We controlled for several standard socioeconomic individual characteristics and for health, considering for the latter the number of visits to the general practitioner and a dummy indicating whether the interviewed person has physical health problems.

The paper reveals main findings on structural social capital: 1) being both a member and active in an organization is negatively associated with worse psychological health in all the OLS regressions except for the negative items of the GHQ-12; 2) being an active member in an organization in the previous year (t-1) is negatively related to worse psychological health in the following year (time t) in all the OLS estimations except for the negative items of the GHQ-12.

The positive relationship between being both a member and active in an organization and psychological wellbeing can be interpreted in three ways. First, passive and active membership in an association makes individuals feel part of a group; this type of feeling develops a sense of being "accepted" within the group. Inclusion and acceptance provides feelings of security that the group will meet the individual's needs. In addition, a sense of being "accepted" within the group affects positively self-esteem beliefs regarding how good, worthy or competent individuals are in general. Some authors have suggested self-esteem as a mechanism by which social capital may enhance general wellbeing (Kawachi and Berkman 2001). Second, passive and active membership may be considered an indicator of social relationships: a person who is member of an association is a person who shares relationships with others. Greater social relationships within a group may foster health-related social behaviours, i.e., more physical activity, less alcohol consumption, and non-smoking, which may have a protective role on psychological health. Finally, people with greater social ties are likely to receive social support, which may be protective against the development of

psychological disorders. Social ties imply social networks: the broader is the individual's social networks, the greater is the probability for the individual of having access to various forms of emotional, informational and material support that directly and indirectly influences psychological wellbeing.

Regarding the relationship between being active within an organization in the previous year (time t-1) and psychological wellbeing in the following year (time t), it is an issue that has not been widely examined in previous studies. The results show that the above relationship is positive, and this finding can be mainly interpreted with the social support channel. Active membership in groups increases the probability of building strong personal ties over time. People with strong person-to-person relationships over time are likely to have more emotional, informational and material support to cope with psychological disorders.

The findings on socioeconomic characteristics show that marital status, number of children and education protect against worse psychological health over time. Marriage reduces morbidity and mortality, risk-taking behaviour and stress (Giordano and Lindström 2011). The presence of children rises self-worth and makes individuals capable of making decisions (Hansen et al. 2009). Education is a personal resource, which is capable of buffering the impact of stress on health (Lochner et al. 2003). The relationship between income and psychological health is mixed and inconclusive in the literature, and many researchers find that the link between income and mental wellbeing is both positive and negative (Nieminen et al. 2010; Bassett and Moore 2013; Allen et al. 2014). Our results seem to be in line with previous investigations when statistically significant.

Moreover, unemployment, the number of visits to the GP and health problems harm psychological wellbeing. Unemployment leads to the occurrence of physical and mental health problems (Wang et al. 2010; Catalano et al. 2011). The larger the number of visits to the GP or family doctor, the worse the psychological wellbeing. It is likely that when people go to see the family doctor, stress accumulates since the reason for going is that they feel ill, and this condition is stressful per se. This is why with increasing the number of visits to the GP, psychological wellbeing decreases. Empirical investigations found that physical illnesses are correlated with worse psychological health (see Thornicroft 2011). Additionally, in this case, our results are quite similar with those of previous studies.

These results have several implications. First, they indicate that individual structural social capital and individual socioeconomic characteristics are key factors for policymakers aiming to enhancing psychological health and wellbeing. Second, policymakers have to address both socioeconomic characteristics and structural social capital simultaneously improving economic conditions and encouraging social participation. In particular, since social participation in

organizations has an immediate and a short-term positive relationship with psychological health, it could represent an opportunity for investment in population health. However, it is important to underline that the above statements are true if the nature of relationships is inclusive. Meaning that to take advantage of the social capital as a resource the individual should be embedded in the group.

The paper presents several strengths and limitations. As concerns strengths, this is the first study within the field of social capital that both implements aggregate and a principal component analysis (PCA) on the 12 items of the GHQ to build a comparative measure of psychological health. In addition, following Hu et al. (2007), we separate it them into six positive and six negative items, and we repeat both aggregation and PCA for those subsamples. This robustness check was useful to understand some effects of structural social capital on psychological status. When we compare the aggregation method with the PCA method, we obtain similar results that confirm the relationship between structural social capital and psychological health. Meanwhile, when we distinguish between positive and negative items aggregation, our results are stronger for the positive and absent for negative. That shed light on the relevance of the methods of aggregation and how this can influence the results. A possible explanation for our lack of findings for psychological negative items could be due to a bias in the distribution of the aggregate variables towards the lower values. It could mean that questions with a negative sense in the survey may discourage interviewees to reveal their real self-psychological status, minimising their negative answers. This attitude can induce some response biases in the estimates of both our results and past results.

Another strength is that we use well designed panel data. On the one hand, the design of the BHPS started from households, covering the entire country for five consecutive years and thus allowed a full representation of the population in Great Britain. In fact, households in the entire country were covered; thus, population non-response rates support the representativeness of the individual sample. On the other hand, panel data consent a fixed effects estimator to accommodate the unobserved heterogeneity as this estimator, imposing that the heterogeneity is time-invariant, permits unbiased coefficients to be estimated. As we showed in our robustness checks, in Table 5, when we ignore fixed effects, omitted variable bias can increase the correlation between social participation and psychological health and misjudge the significance of the relationships. Therefore, our results show that there is an overestimation of the relationships between being only a member and being only active and psychological health. In addition, when we ignore the control variables, we find a small effect of the control variables on the social participation coefficients. Therefore, we think that our results can be generalised to a larger population.

The paper takes into account unobservable features, but it does not consider reverse causality. It could be that people in good psychological health are more likely to participate in associations.

Although there is a variety of available controls in the dataset, we cannot account for the direction of the causality.

Following our results, in further research, we would be interested in developing a dynamic model that investigates both the endogeneity and lagged variables effect on psychological health. Moreover, it would be also relevant for our aims to identify several population subsamples for which relationships between structural social capital and psychological health are expected to be larger and more significant.

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Table 1. Participation, attrition, non-response rates and number of observations across waves.

	1991	1992	1993	1994	1995
Eligible adults (> 16 years old)	10,751	11,477	11,388	10,863	10,605
Total interviewed	10,264	9,845	9,600	9,481	9,249
Participation rates	95.47%	85.78%	84.29%	87.27%	87.21%
Attrition rate*		8.9%	12.80%	15.82%	18.39%
Response	9,538	9,352	8,730	8,775	8,563
Non-response	7.07%	5.01%	9.06%	7.45%	7.42%
Cumulated Unbalanced sample	9,822	18,616	27,346	36,121	44,684

*(compared with the first wave)

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over.

Table 2. Descriptive statistics of the twelve items of GHQ.

	mean	sd	min	max
Positive items				
ghqa: concentration	2.161	0.549	1	4
ghqc: playing a useful role	2.016	0.586	1	4
ghqd: capable of making decisions	1.957	0.507	1	4
ghqg: enjoy day-to-day activities	2.130	0.590	1	4
ghqh: ability to face problems	2.021	0.493	1	4
ghql: general happiness	2.013	0.570	1	4
Negative items				
ghqb: loss of sleep	1.855	0.786	1	4
ghqe: constantly under strain	2.116	0.788	1	4
ghqf: problem overcoming difficulties	1.811	0.715	1	4
ghqi: unhappy or depressed	1.918	0.824	1	4
ghqj: losing confidence	1.646	0.744	1	4
ghqk: believe in self-worth	1.393	0.650	1	4
Observations	44,684			

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over.

Table 3. Descriptive statistics of the dependent, social participation and other control variables

	mean	s.d.	min	max
Dependent variables				
PSH	11.04	5.174	0	36
PSHP	6.299	2.309	0	18
PSHN	4.740	3.428	0	18
PSHpc1	-0.002	2.278	-4.993	11.18
PSHpc2	0.001	1.158	-5.361	6.949
PSHpcP	-0.003	1.716	-4.694	8.737
PSHpcN	-0.002	1.859	-2.550	7.247
Structural social capital variables				
Member	0.103	0.304	0	1
Active	0.065	0.246	0	1
Member*Active	0.412	0.492	0	1
Control variables				
C_age2 age centered squared	332.9	364.6	0.00006	2808.2
C_age age centered	-0.296	18.24	-29.01	52.99
Married =1 if Married	0.570	0.495	0	1
Children Number of Kids in household	0.593	0.948	0	9
DEGREE Graduated	0.088	0.283	0	1
HND_A Higher school	0.302	0.459	0	1
O_CSE Lower than lower school	0.109	0.311	0	1
LNINCOME Equivalent uninflated annual household income	9.220	0.716	-0.524	12.04
Unemployed if Unemployed in the year	0.333	0.471	0	1
hl2gp # of visits to GP	2.376	1.188	1	5
HFPR Health Physical Problems	0.492	0.500	0	1
# Observations	44,684			

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over.
The questions' wording of control variables are reported in Appendix B.

Table 4. Estimates for psychological health: GHQ-12 ranking from 0 to 36 (PSH).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.148+	-0.194+		-0.170
	(0.089)	(0.111)		(0.113)
Active	-0.017	0.084		0.023
	(0.099)	(0.120)		(0.125)
Member*Active	-0.212**	-0.197*		-0.204*
	(0.075)	(0.094)		(0.096)
Member t-1			0.103	0.106
			(0.113)	(0.116)
Active t-1			-0.301*	-0.270*
			(0.123)	(0.129)
Member t-1*Active t-1			-0.040	-0.040
			(0.092)	(0.094)
C_age2	-0.002***	-0.001*	-0.001+	-0.001*
	(0.000)	(0.001)	(0.001)	(0.001)
C_age	0.008	0.094	0.095	0.094
	(0.108)	(0.132)	(0.131)	(0.132)
Married	-0.810***	-0.916***	-0.885***	-0.915***
	(0.173)	(0.234)	(0.233)	(0.234)
Children	-0.165**	-0.198*	-0.201*	-0.197*
	(0.061)	(0.087)	(0.087)	(0.087)
DEGREE	-1.046*	-1.305*	-1.285*	-1.302*
	(0.433)	(0.575)	(0.568)	(0.573)
HND_A	-0.449*	-0.639*	-0.655*	-0.636*
	(0.188)	(0.254)	(0.254)	(0.254)
O_CSE	-0.038	0.205	0.183	0.195
	(0.288)	(0.534)	(0.537)	(0.533)
LNINCOME	-0.071	-0.009	-0.012	-0.009
	(0.061)	(0.081)	(0.081)	(0.081)
Unemployed	0.656***	0.866***	0.846***	0.862***
	(0.085)	(0.129)	(0.128)	(0.129)
hl2gp	0.430***	0.421***	0.421***	0.420***
	(0.029)	(0.034)	(0.034)	(0.034)
HFPR	0.200**	0.145+	0.162+	0.146+
	(0.069)	(0.087)	(0.087)	(0.087)
Constant	11.544***	10.463***	10.387***	10.489***
	(0.812)	(1.089)	(1.083)	(1.089)
Year Dummies	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES
N	44,684	31,852	32,065	31,852
adj. R^2	0.019	0.016	0.016	0.017
AIC	230,936.9	162,032.0	163,272.5	162,027.2
BIC	231,241.7	162,316.5	163,557.3	162,336.9
rmse	3.205	3.077	3.085	3.077
F	13.80	8.444	8.404	7.915
ll	-115,433.5	-80,982.0	-81,602.3	-80,976.6
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.

Table 5. Estimates for social participation coefficients comparing fixed effect, pooled regressions and fixed effect without control variables

	(1)	(2)	(3)
	ALL	NOFE	NOCONTR
Table 4 results (PSH)	b/se	b/se	b/se
Member	-0.148+	-0.203**	-0.155+

	(0.089)	(0.078)	(0.090)
Active	-0.017	-0.197*	-0.025
	(0.099)	(0.089)	(0.100)
Member*Active	-0.212**	-0.471***	-0.202**
	(0.075)	(0.059)	(0.075)
Table B.1 results (PSHpc1)			
Member	-0.072+	-0.095**	-0.075+
	(0.040)	(0.035)	(0.040)
Active	-0.016	-0.097*	-0.020
	(0.044)	(0.039)	(0.044)
Member*Active	-0.102**	-0.215***	-0.098**
	(0.033)	(0.026)	(0.034)
Table B.2 results (PSHpc2)			
Member	-0.049*	-0.047*	-0.053*
	(0.021)	(0.018)	(0.021)
Active	-0.066**	-0.085***	-0.062*
	(0.024)	(0.022)	(0.024)
Member *Active	-0.078***	-0.067***	-0.081***
	(0.017)	(0.013)	(0.017)
Table B.3 Results (PSHP)			
Member	-0.099*	-0.118**	-0.107*
	(0.044)	(0.037)	(0.045)
Active	-0.100*	-0.193***	-0.099*
	(0.049)	(0.043)	(0.049)
Member*Active	-0.170***	-0.273***	-0.171***
	(0.037)	(0.027)	(0.037)
Table B.4 Results (PSHpcP)			
Member	-0.075*	-0.089**	-0.080*
	(0.033)	(0.028)	(0.033)
Active	-0.073*	-0.144***	-0.074*
	(0.037)	(0.032)	(0.037)
Member*Active	-0.126***	-0.201***	-0.125***
	(0.027)	(0.020)	(0.027)
Tab B.5 results (PSHN)			
Member	-0.046	-0.084+	-0.046
	(0.055)	(0.050)	(0.056)
Active	0.079	-0.012	0.073
	(0.062)	(0.057)	(0.062)
Member*Active	-0.039	-0.198***	-0.030
	(0.046)	(0.038)	(0.047)
Table B.6 results (PSHpcN)			
Member	-0.027	-0.047+	-0.027
	(0.030)	(0.027)	(0.030)
Active	0.042	-0.009	0.039
	(0.034)	(0.031)	(0.034)
Member*Active	-0.023	-0.109***	-0.018
	(0.025)	(0.020)	(0.025)

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over.
Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.
Column (1) fixed effect estimations with control variables (not presented); Column (2) pooled regressions with control variables; Column (3) fixed effects estimations without control variables.

Age	Age at date of interview
Married	Present legal marital status
	Married
	Separated
	Divorced
	Widowed
	Never Married

Children	Sum of:
	Number of children in household aged 0-2
	Number of children in household aged 3-4
	Number of children in household aged 5-11
	Number of children in household aged 12-15
	Number of children in household aged 16-18
DEGREE	Highest education qualification:
	Higher Degree
	First Degree
HND_A	Highest education qualification:
	Teaching QF
	Other Higher QF
	Nursing QF
	GCE A Levels
	GCE O Levels or Equi
O_CSE	Highest education qualification:
	Commercial QF, No O
	CSE grade 2-5, Scot G
	Apprenticeship
	Other QF
	Still at school
LNINCOME	Annual household income
	HH equivalence scale before housing costs
Unemployed	Employment Status
	Under 16
	Working
	Unemployed
	Retired
	Family Care
	F-T Education
	Other
hl2gp	Since September 1st last year, approximately how many times have you talked to, or visited a GP or family doctor about your own health?
HFPR	Health problems: Arms, legs, hands, etc
	Health problems: Sight
	Health problems: Hearing
	Health problems: Skin conditions/allergy
	Health problems: Chest/breathing
	Health problems: Heart/blood pressure
	Health problems: Stomach or digestion
	Health problems: Diabetes

APPENDIX A

Table A.1. Control variables questions' wording.

Table A.2. Correlations among the dependent, social participation and control variables.

	PSH	PSHP	PSHN	PSHpc1	PSHpc2	PSHpcP	PSHpcN
PSH	1						
PSHP	0.8516*	1					
PSHN	0.9356*	0.6120*	1				
PSHpc1	0.9986*	0.8722*	0.9195*	1			
PSHpc2	-0.0385*	0.4553*	-0.3649*	0.0012	1		
PSHpcP	0.8506*	0.9991*	0.6106*	0.8720*	0.4586*	1	

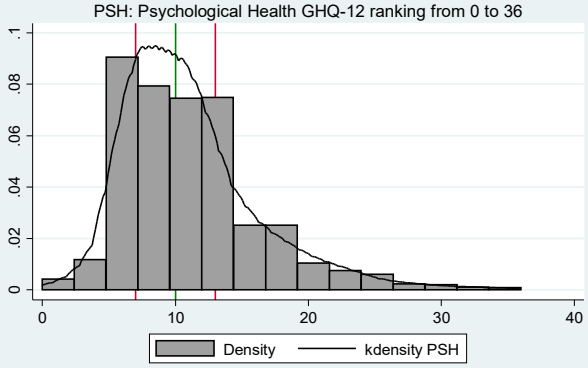
PSHpcN	0.9362*	0.6136*	0.9996*	0.9208*	-0.3567*	0.6127*	1
Member	-0.0614*	-0.0565*	-0.0546*	-0.0613*	-0,0134	-0.0552*	-0.0552*
Active	-0.0696*	-0.0741*	-0.0551*	-0.0703*	-0.0305*	-0.0725*	-0.0558*
Member*Active	-0.0670*	-0.0621*	-0.0592*	-0.0668*	-0,0121	-0.0606*	-0.0597*
C_age2	-0.0296*	0.0396*	-0.0703*	-0.0244*	0.1468*	0.0381*	-0.0678*
C_age	0.0521*	0.1676*	-0.0335*	0.0606*	0.2466*	0.1682*	-0.0324*
Married	-0,007	0.0298*	-0.0311*	-0,0045	0.0549*	0.0319*	-0.0325*
Children	0.0232*	-0.0240*	0.0510*	0.0201*	-0.0945*	-0.0234*	0.0502*
DEGREE	-0,0119	-0.0390*	0,008	-0,0139	-0.0606*	-0.0381*	0,0075
HND_A	-0.0500*	-0.0601*	-0.0353*	-0.0511*	-0.0447*	-0.0599*	-0.0362*
O_CSE	0,0065	0,0075	0,0052	0,0065	0,0032	0,0067	0,0053
LNINCOME	-0.0844*	-0.0782*	-0.0753*	-0.0844*	-0.0261*	-0.0768*	-0.0767*
Unemployed	0.1023*	0.1183*	0.0756*	0.1041*	0.0835*	0.1167*	0.0775*
Hl2gp	0.2486*	0.2121*	0.2332*	0.2469*	-0,0094	0.2114*	0.2325*
HFPR	0.1318*	0.1447*	0.1022*	0.1329*	0.0557*	0.1440*	0.1019*

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over.

* The coefficients are statistically different from zero at $p<0.001$.

Graph A.1

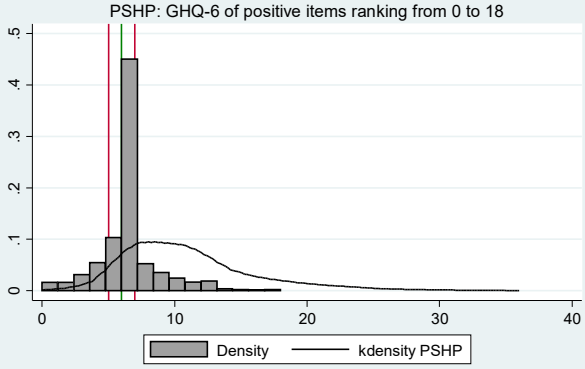
PSH: Psychological Health GHQ-12 ranking from 0 to 36



Note: our elaboration on BHPS, UK, years 1991-1995; individuals aged 16 and over

Graph A.2

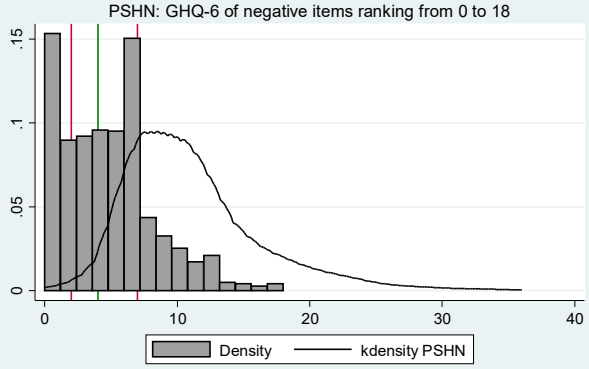
PSHP: GHQ-6 of positive items ranking from 0 to 18



Note: our elaboration on BHPS, UK, years 1991-1995; individuals aged 16 and over

Graph A.3

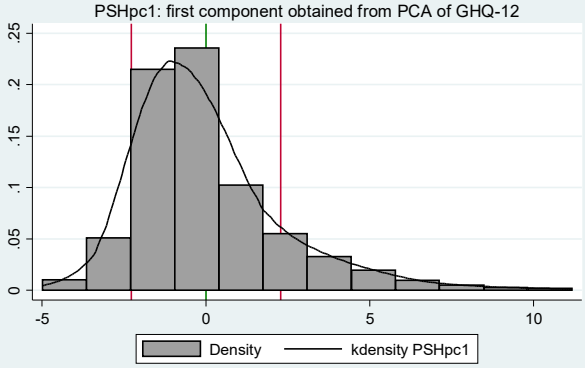
PSHN: GHQ-6 of negative items ranking from 0 to 18



Note: our elaboration on BHPS, UK, years 1991-1995; individuals aged 16 and over

Graph A.4

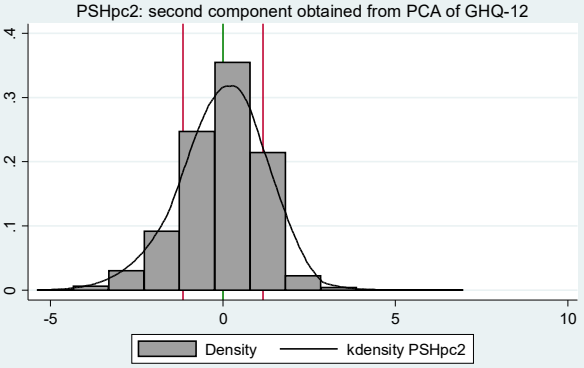
PSHpc1: first component obtained from PCA of GHQ-12



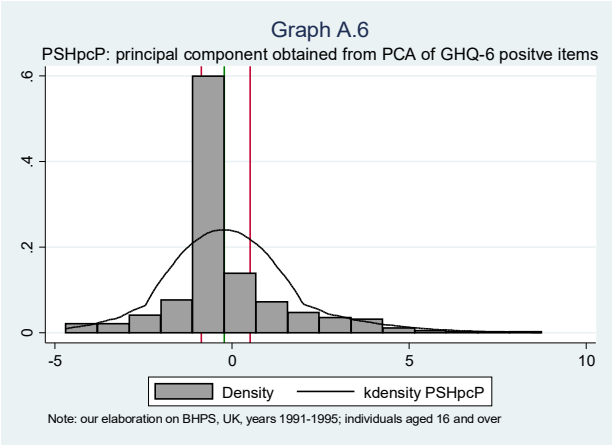
Note: our elaboration on BHPS, UK, years 1991-1995; individuals aged 16 and over

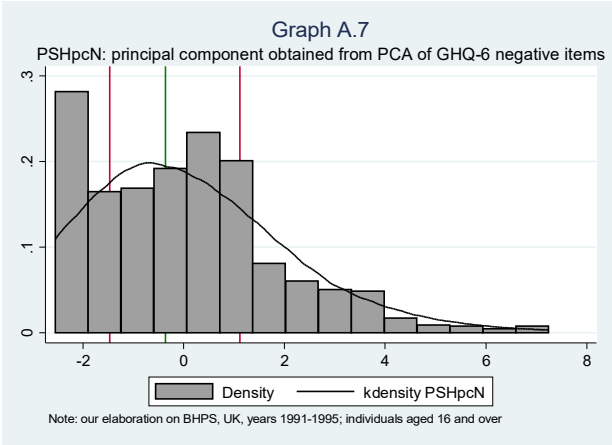
Graph A.5

PSHpc2: second component obtained from PCA of GHQ-12



Note: our elaboration on BHPS, UK, years 1991-1995; individuals aged 16 and over





APPENDIX B

Table B.1. Estimates for psychological health: first component obtained from PCA of GHQ-12 (PSHpc1).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.072+	-0.088+		-0.078
	(0.040)	(0.049)		(0.051)
Active	-0.016	0.030		0.002
	(0.044)	(0.053)		(0.056)
Member*Active	-0.102**	-0.094*		-0.097*
	(0.033)	(0.042)		(0.043)
Member t-1			0.045	0.046
			(0.050)	(0.052)
Active t-1			-0.136*	-0.125*
			(0.055)	(0.058)
Member t-1*Active t-1			-0.019	-0.020
			(0.041)	(0.042)
C_age2	-0.001***	-0.000+	-0.000+	-0.000+
	(0.000)	(0.000)	(0.000)	(0.000)
C_age	0.004	0.042	0.043	0.042
	(0.048)	(0.059)	(0.058)	(0.059)
Married	-0.349***	-0.394***	-0.380***	-0.393***
	(0.077)	(0.104)	(0.104)	(0.104)
Children	-0.070*	-0.083*	-0.084*	-0.082*
	(0.027)	(0.039)	(0.039)	(0.039)
DEGREE	-0.454*	-0.576*	-0.568*	-0.575*
	(0.193)	(0.256)	(0.253)	(0.256)
HND_A	-0.196*	-0.280*	-0.287*	-0.279*
	(0.084)	(0.113)	(0.113)	(0.113)
O_CSE	-0.013	0.081	0.072	0.077
	(0.127)	(0.236)	(0.237)	(0.235)
LNINCOME	-0.031	-0.003	-0.004	-0.003
	(0.027)	(0.036)	(0.036)	(0.036)
Unemployed	0.291***	0.386***	0.377***	0.384***
	(0.038)	(0.058)	(0.057)	(0.058)
hl2gp	0.190***	0.186***	0.186***	0.186***
	(0.013)	(0.015)	(0.015)	(0.015)
HFPR	0.084**	0.061	0.069+	0.061
	(0.031)	(0.039)	(0.039)	(0.039)
Constant	0.192	-0.300	-0.334	-0.287
	(0.362)	(0.487)	(0.484)	(0.487)
Year Dummies	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES

N	44,684	31,852	32,065	31,852
adj. R^2	0.018	0.016	0.016	0.016
AIC	158,495.3	110,467.1	111,363.8	110,461.7
BIC	158,800.1	110,751.6	111,648.6	110,771.4
rmse	1.425	1.370	1.373	1.370
F	13.44	8.336	8.290	7.822
ll	-79,212.7	-55,199.5	-55,647.9	-55,193.9
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.

Table B.2. Estimates for psychological health: second component obtained from PCA of GHQ-12 (PSHpc2).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.049*	-0.044+		-0.045+
	(0.021)	(0.026)		(0.026)
Active	-0.066**	-0.041		-0.049+
	(0.024)	(0.029)		(0.030)
Member*Active	-0.078***	-0.072***		-0.076***
	(0.017)	(0.021)		(0.021)
Member t-1			-0.012	-0.017
			(0.026)	(0.027)
Active t-1			-0.033	-0.042
			(0.029)	(0.030)
Member t-1*Active t-1			-0.029	-0.039+
			(0.022)	(0.022)
C_age2	0.000***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
C_age	-0.017	-0.020	-0.024	-0.020
	(0.026)	(0.031)	(0.030)	(0.031)
Married	0.096**	0.089+	0.086+	0.089+
	(0.035)	(0.046)	(0.046)	(0.046)
Children	0.019	0.048*	0.048*	0.048*
	(0.014)	(0.019)	(0.019)	(0.019)
DEGREE	-0.003	-0.170	-0.171	-0.173
	(0.110)	(0.143)	(0.142)	(0.143)
HND_A	0.011	0.010	0.003	0.010
	(0.045)	(0.062)	(0.061)	(0.061)
O_CSE	0.100	0.098	0.086	0.097
	(0.082)	(0.150)	(0.150)	(0.150)
LNINCOME	0.032*	0.046**	0.046**	0.046**
	(0.014)	(0.017)	(0.017)	(0.017)
Unemployed	0.100***	0.147***	0.147***	0.146***
	(0.019)	(0.028)	(0.028)	(0.028)
hl2gp	0.016*	0.009	0.009	0.009
	(0.007)	(0.008)	(0.008)	(0.008)
HFPR	-0.032*	-0.036+	-0.033	-0.036+
	(0.016)	(0.020)	(0.020)	(0.020)
Constant	-0.375+	-0.849***	-0.859***	-0.824***
	(0.193)	(0.239)	(0.238)	(0.239)
Year Dummies	YES	YES	YES	YES

Regional Dummies	YES	YES	YES	YES
N	44,684	31,852	32,065	31,852
adj. R^2	0.007	0.005	0.004	0.005
AIC	104,482.3	71,220.9	71,809.6	71,220.3
BIC	104,787.1	71,505.5	72,094.4	71,529.9
rmse	0.779	0.740	0.741	0.740
F	6.461	3.209	2.968	3.047
ll	-52,206.2	-35,576.5	-35,870.8	-35,573.1
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.

Table B.3. Estimates for psychological health: GHQ-6 of positive items ranking from 0 to 18 (PSHP).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.099*	-0.106+		-0.100+
	(0.044)	(0.055)		(0.056)
Active	-0.100*	-0.033		-0.073
	(0.049)	(0.059)		(0.061)
Member*Active	-0.170***	-0.158***		-0.168***
	(0.037)	(0.046)		(0.047)
Member t-1			0.014	0.014
			(0.056)	(0.057)
Active t-1			-0.179**	-0.184**
			(0.062)	(0.064)
Member t-1*Active t-1			-0.060	-0.072
			(0.046)	(0.047)
C_age2	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
C_age	-0.021	0.010	0.008	0.011
	(0.053)	(0.064)	(0.063)	(0.064)
Married	-0.221**	-0.257*	-0.251*	-0.256*
	(0.082)	(0.112)	(0.111)	(0.112)
Children	-0.040	-0.020	-0.019	-0.020
	(0.030)	(0.043)	(0.043)	(0.043)
DEGREE	-0.378+	-0.664*	-0.663*	-0.667*
	(0.215)	(0.290)	(0.288)	(0.289)
HND_A	-0.157+	-0.255*	-0.267*	-0.253+
	(0.093)	(0.130)	(0.129)	(0.130)
O_CSE	0.057	0.134	0.127	0.128
	(0.136)	(0.262)	(0.263)	(0.262)
LNINCOME	0.004	0.034	0.032	0.034
	(0.030)	(0.040)	(0.040)	(0.040)
Unemployed	0.318***	0.439***	0.429***	0.436***
	(0.042)	(0.064)	(0.063)	(0.064)
hl2gp	0.191***	0.181***	0.181***	0.181***
	(0.014)	(0.017)	(0.017)	(0.017)
HFPR	0.052	0.032	0.041	0.033
	(0.034)	(0.044)	(0.044)	(0.044)
Constant	6.109***	5.428***	5.399***	5.474***
	(0.415)	(0.553)	(0.550)	(0.554)
Year Dummies	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES
N	44,811	31,940	32,153	31,940
adj. R^2	0.012	0.013	0.013	0.013
AIC	168,909.6	118,123.0	119,049.4	118,111.8
BIC	169,214.5	118,407.6	119,334.3	118,421.6
rmse	1.593	1.537	1.540	1.536
F	9.530	7.084	7.038	6.749
ll	-84,419.8	-59,027.5	-59,490.7	-59,018.9
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.

Table B.4. Estimates for psychological health: principal component obtained from PCA of GHQ-6 positive items (PSHpcP).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.075*	-0.079+		-0.074+
	(0.033)	(0.041)		(0.042)
Active	-0.073*	-0.023		-0.052
	(0.037)	(0.044)		(0.046)
Member*Active	-0.126***	-0.116***		-0.123***
	(0.027)	(0.034)		(0.035)
Member t-1			0.012	0.012
			(0.041)	(0.043)
Active t-1			-0.130**	-0.133**
			(0.046)	(0.048)
Member t-1*Active t-1			-0.044	-0.053
			(0.034)	(0.035)
C_age2	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
C_age	-0.014	0.008	0.007	0.009
	(0.040)	(0.048)	(0.047)	(0.048)
Married	-0.158**	-0.186*	-0.182*	-0.185*
	(0.061)	(0.083)	(0.083)	(0.083)
Children	-0.029	-0.016	-0.015	-0.015
	(0.022)	(0.032)	(0.032)	(0.032)
DEGREE	-0.284+	-0.482*	-0.481*	-0.484*
	(0.160)	(0.215)	(0.214)	(0.215)
HND_A	-0.117+	-0.188+	-0.197*	-0.187+
	(0.069)	(0.096)	(0.096)	(0.096)
O_CSE	0.043	0.088	0.083	0.084
	(0.101)	(0.194)	(0.195)	(0.194)
LNINCOME	0.001	0.025	0.023	0.025
	(0.023)	(0.030)	(0.030)	(0.030)
Unemployed	0.231***	0.318***	0.310***	0.315***
	(0.031)	(0.047)	(0.047)	(0.047)
hl2gp	0.141***	0.134***	0.134***	0.134***
	(0.011)	(0.013)	(0.012)	(0.013)
HFPR	0.039	0.025	0.032	0.025
	(0.025)	(0.032)	(0.033)	(0.032)
Constant	-0.143	-0.673	-0.694+	-0.640
	(0.308)	(0.410)	(0.407)	(0.410)
Year Dummies	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES
N	44,811	31,940	32,153	31,940
adj. R^2	0.012	0.013	0.012	0.013
AIC	142,288.9	99,178.8	99,983.1	99,168.1
BIC	142,593.8	99,463.4	100,267.9	99,477.9
rmse	1.183	1.142	1.145	1.142
F	9.449	6.981	6.927	6.647
ll	-71,109.5	-49,555.4	-49,957.5	-49,547.1
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.

Table B.5. Estimates for psychological health: GHQ-6 of negative items ranking from 0 to 18 (PSHN).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.046	-0.084		-0.067
	(0.055)	(0.068)		(0.070)
Active	0.079	0.117		0.096
	(0.062)	(0.075)		(0.078)
Member*Active	-0.039	-0.035		-0.032
	(0.046)	(0.058)		(0.059)
Member t-1			0.090	0.093
			(0.069)	(0.072)
Active t-1			-0.122	-0.088
			(0.076)	(0.079)
Member t-1*Active t-1			0.017	0.028
			(0.056)	(0.057)
C_age2	-0.002***	-0.001***	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
C_age	0.026	0.082	0.085	0.081
	(0.067)	(0.082)	(0.082)	(0.082)
Married	-0.592***	-0.667***	-0.642***	-0.667***
	(0.105)	(0.140)	(0.139)	(0.140)
Children	-0.124***	-0.178***	-0.182***	-0.178***
	(0.038)	(0.052)	(0.052)	(0.052)
DEGREE	-0.671*	-0.626+	-0.607+	-0.619+
	(0.269)	(0.349)	(0.344)	(0.348)
HND_A	-0.293*	-0.381*	-0.384*	-0.380*
	(0.117)	(0.156)	(0.157)	(0.156)
O_CSE	-0.103	0.069	0.053	0.065
	(0.201)	(0.355)	(0.357)	(0.355)
LNINCOME	-0.078*	-0.043	-0.044	-0.042
	(0.036)	(0.048)	(0.048)	(0.048)
Unemployed	0.337***	0.429***	0.419***	0.428***
	(0.052)	(0.078)	(0.077)	(0.078)
hl2gp	0.242***	0.241***	0.241***	0.241***
	(0.018)	(0.021)	(0.021)	(0.021)
HFPR	0.148***	0.115*	0.123*	0.115*
	(0.043)	(0.053)	(0.053)	(0.053)
Constant	5.422***	4.995***	4.952***	4.977***
	(0.484)	(0.630)	(0.628)	(0.630)
Year Dummies	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES
N	44,760	31,906	32,119	31,906
adj. R^2	0.020	0.015	0.015	0.015
AIC	189,215.1	131,747.8	132,786.0	131,747.6
BIC	189,519.9	132,032.4	133,070.8	132,057.4
rmse	2.002	1.906	1.911	1.906
F	15.37	7.879	7.820	7.331
ll	-94,572.6	-65,839.9	-66,359.0	-65,836.8
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.

Table B.6. Estimates for psychological health: principal component obtained from PCA of GHQ-6 negative items (PSHpcN).

	(1) t	(2) t-1	(3) SP_{t-1}	(4) all
Member	-0.027	-0.048		-0.038
	(0.030)	(0.037)		(0.038)
Active	0.042	0.062		0.050
	(0.034)	(0.041)		(0.043)
Member*Active	-0.023	-0.021		-0.019
	(0.025)	(0.031)		(0.032)
Member t-1			0.050	0.051
			(0.038)	(0.039)
Active t-1			-0.066	-0.048
			(0.041)	(0.043)
Member t-1*Active t-1			0.010	0.016
			(0.031)	(0.031)
C_age2	-0.001***	-0.001***	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
C_age	0.016	0.046	0.048	0.046
	(0.036)	(0.045)	(0.044)	(0.045)
Married	-0.322***	-0.362***	-0.348***	-0.362***
	(0.057)	(0.076)	(0.075)	(0.076)
Children	-0.066**	-0.096***	-0.098***	-0.096***
	(0.020)	(0.028)	(0.028)	(0.028)
DEGREE	-0.365*	-0.345+	-0.334+	-0.341+
	(0.145)	(0.189)	(0.187)	(0.189)
HND_A	-0.160*	-0.207*	-0.208*	-0.206*
	(0.064)	(0.085)	(0.085)	(0.085)
O_CSE	-0.054	0.038	0.029	0.036
	(0.109)	(0.193)	(0.193)	(0.192)
LNINCOME	-0.042*	-0.022	-0.023	-0.022
	(0.020)	(0.026)	(0.026)	(0.026)
Unemployed	0.187***	0.239***	0.234***	0.238***
	(0.028)	(0.042)	(0.042)	(0.042)
hl2gp	0.131***	0.131***	0.131***	0.130***
	(0.010)	(0.011)	(0.011)	(0.011)
HFPR	0.078***	0.060*	0.064*	0.060*
	(0.023)	(0.029)	(0.029)	(0.029)
Constant	0.366	0.122	0.097	0.111
	(0.262)	(0.342)	(0.341)	(0.342)
Year Dummies	YES	YES	YES	YES
Regional Dummies	YES	YES	YES	YES
N	44,760	31,906	32,119	31,906
adj. R^2	0.020	0.015	0.015	0.015
AIC	134,477.0	92,724.9	93,503.1	92,724.6
BIC	134,781.8	93,009.5	93,787.9	93,034.3
rmse	1.086	1.034	1.037	1.034
F	15.34	7.899	7.836	7.353
ll	-67,203.5	-46,328.5	-46,717.5	-46,325.3
VIF	3.20	3.30	3.31	3.25

Notes: BHPS, UK, years 1991-1995; individuals aged 16 and over. Columns (3) (4) have less observations because of the introduction of the lag variables. Meanwhile, in column (2) sample is restricted to 1992-1995 to be comparable with lag variable models. Standard Deviation in parentheses; + p<0.1,* p<0.05, ** p<0.01, *** p<0.001.