Social indicators to explain response in longitudinal studies

Economic and social studies use longitudinal panels to estimate change in variables and aggregates of interest. Attrition in such studies may threaten the validity of the estimates from the panels. This study deepens the knowledge on attrition making reference to three waves of the UK Household Longitudinal Study. While traditionally participation behaviour in panel surveys has been mostly studied with reference to socio-demographic variables and not distinguishing different components of the response process, the focus here is on the role of social indicators and personality traits in explaining contact and cooperation, beyond demographic variables. Findings show that some indicators of community attachment affect the likelihood of making contact with members of the panel and indicators of social participation are significant in explaining cooperation given contact. Personality factors and well-being related variables turn out not to be significant factors.

Keywords: non-response, attrition, panel surveys, Big-Five, social participation, well-being

1 Introduction

The problem of declining or low response rates in organizational and household surveys (De Leeuw and De Heer 2002; Tourangeau 2003), the need to send many reminders, and poor data quality (due to non-response and measurement errors) have driven researchers' attention to the investigation of factors undermining the response process. The hypothesis is that participation in a survey is not random; rather, there are differences across subgroups. The understanding of factors affecting participation is even more relevant in panel surveys.

A panel is a set of units (e.g., households, individuals, or companies) that are recruited for participating in surveys run at different points in time (called panel waves) (Lynn 2009a). Over time,

there is usually a dropout of some respondents. Panel dropout is called attrition and it is one of the most important sources of non-sampling errors. Attrition poses at least two problems: the reduction of the sample size that implies a reduction of the precision of the estimates and, most importantly, the possible presence of systematic bias in relevant estimates, due to over-representation or under-representation of certain subgroups.

Although the process of attrition is similar to non-response in a cross-sectional survey in many ways, those who drop out in a panel survey did participate in at least one wave of the study. This implies that there is a wide range of information available for each sample member from previous waves, allowing to draw stronger inferences about causality on non-response. At the same time, sample units have prior experience of the interview and prior knowledge of the survey content and this is expected to have an effect on response at subsequent waves. Longitudinal studies also have to deal with problems related to tracking sample members who move and to respondents' fatigue associated with repeated survey participation (Laurie et al. 1999). Another distinctive feature of longitudinal studies is that non-response tends to accumulate over time. On the other hand, high response rates are essential to allow longitudinal analyses (Lynn 2018), since nonresponding sample members cannot be replaced by new sample members. Thus, response rates are more important in the longitudinal framework than in cross-sectional surveys.

Traditionally, response behavior in households or individuals surveys has been mostly related to a few ''core'' variables, such as household composition, change in address, employment situation, socioeconomic status (education and income), and the use of incentives and other survey design features (Watson and Wooden 2009). The potential effect of social indicators and socio-psychological variables (e.g. personality traits and life satisfaction) on the response process has been much less investigated, partially also because those measures are not included in large surveys on a standard basis. However, the potential effect of social indicators and socio-psychological variables is important for at least two reasons. First, these variables are expected to be related to aspects of the response process, like willingness to participate in further waves and panel fatigue, and possibly might have

more explanatory power than socio-demographic variables (Lugtig 2014; Satherley et al. 2015; Sassenroth 2013). Second, any influence of personality traits and social indicators on attrition could be problematic in light of the extensive recent use of longitudinal panels for research on well-being and personality development (Lucas and Donnellan 2011; Specht et al. 2011; Bayliss et al. 2017; Smith et al. 2017). Clearly, if the reasons behind panel attrition are related to the variable of interest, estimates will be biased.

After a period of declining interest in motivation studies, at the time being, motivation and commitment to the survey are back on the research agenda. However, studies investigating the effect of socio-psychological variables on attrition in general do not examine components of the response process separately, thus confounding the effects related to different steps. Examining components of the response process separately is desirable as theoretically different predictors are expected to be needed for each component (Lepkowski and Couper 2002).

It is also widely accepted that the mode of data collection (face-to-face, postal, phone, or web) has an impact on response rates. It also impacts the relationship between various characteristics (demographics or others) and response outcomes (Jäckle et al. 2015; Bianchi et al. 2017). Further, the mode of data collection affects the possibility of identifying different components of the response process. For example, the distinction in attrition due to failure to locate sample members, noncontacts, and refusals is not possible in studies based on Internet panels.

It is also well known that the non-response process is not uniform across waves of a panel. Attrition rates are highest at the second wave and then tend to decline over time (Lugtig 2014; Schoeni et al. 2013; Uhrig 2008). There is also evidence that the correlates of nonresponse may change over waves of a survey (Farrant and O'Muircheartaigh 1991) and that changes in correlates of nonresponse at each subsequent wave are lower compared to the previous one (Bianchi and Biffignandi 2017a).

Finally, even though general trends in panel attrition across countries are well documented, also specificities, especially related to the sizes of the effects, have been reported (Nicoletti and Peracchi 2005; Behr et al. 2005).

There is thus a need for studies that broaden the focus of research on survey participation and panel attrition beyond socio-demographic variables, and distinguishing different components of the response process. It is also important to extend the analyses on selective attrition to different modes of data collection, to different stages of panels, and to a wide range of nations.

Taking into account the above considerations, this paper focuses on understanding factors (including social and socio-psychological factors) associated with selective attrition in a longitudinal face-to-face study in the UK, the UK Household Longitudinal Study (UKHLS). The panel collects yearly data about people's social and economic circumstances, attitudes, behaviors and health in the United Kingdom, and provides up-to-date evidence to Government and decision makers in the UK and more broadly. The UKHLS started in 2009 and is currently running its eighth wave of data collection. The original contribution of this study stems from investigating predictors of panel attrition through a model that considers the role of personality traits, social interactions and community attachment, together with the traditional socio-demographic variables and from distinguishing the effects of predictors on different steps of the response process. This is a very relevant topic in socio-economic surveys, particularly in National Statistical Institutes (NSIs) surveys, that has been scarcely investigated so far. The analysis provides a contribution to household/or individual panels for improving response rates and survey quality in general. The identification of factors associated with selective attrition provides information useful in the management of data collection over time and in fighting attrition by acting on specific subgroups. It also provides variables that can be used to correct for the effects of attrition. Further, it yields evidence of possible biases on the analyses of some social indicators and psychological variables based on longitudinal panels.

The paper is organized as follows. Section 2 presents a literature overview on factors affecting attrition and Section 3 describes the main research questions under study. The database used in the empirical analysis is described in Section 4, with a special focus on the aspects relevant for the analyses of this study. Results and discussion of the findings are presented in Section 5, followed by some concluding remarks in Section 6.

2 Factors affecting attrition

Lepkowski and Couper (2002) suggest to divide the response process into three conditional steps: location of the sample member, contact with the sample member given location, and interview of the sample member given contact. Empirical studies on attrition that examine the different components of response separately are relatively scarce and very few of them use social and psychological indicators to explain the response process. The main studies we are aware of are the following. Watson and Wooden (2009) analysed response at Waves 2, 3, and 4 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey; Nicoletti and Peracchi (2005) examined response over the first five waves of the European Community Household Panel (ECHP); Nicoletti and Buck (2004) reported on three waves of the British Household Panel Survey (BHPS) and the German Socio-Economic Panel (GSOEP); Lepkowski and Couper (2002) analysed response in Wave 2 in two longitudinal surveys in the US – the Americans' Changing Lives (ACL) and the National Election Studies (NES); Thomas et al. (2001) examined attrition in the four-year follow-up to the 1993 Indonesian Family Life Survey; Gray et al. (1996) reported on response to two waves of a health and lifestyle survey conducted in Britain in 1984-1985 and 1991-1992.

In the following, we briefly summarise factors that are generally related to each of the three above-mentioned components of the response process. Note that we mainly restrict the description to studies that have analysed attrition separating different components of response. For a more detailed overview of the relevant literature, see Watson and Wooden (2009).

Traditionally, the probability of locating a sample member is mainly determined by factors related to whether the unit has moved from one wave to the next or not. Literature has related this probability to survey design features, like number of panel waves, length of time between waves, topic of the survey, between-wave contact efforts, and adopted tracking procedures (Couper and Ofstedal 2009). Also household and personal characteristics affect the moving likelihood: age (younger people are more mobile), the number of years at a residence, and household tenure (those who rent are more likely to move). Lepkowski and Couper (2002) relates the likelihood of moving to social aspects of community attachment, arguing that individuals engaged in the civic aspects of their community are expected to be less likely to move. Further, in case they move, they are expected to leave many traces about their new address. On the other hand, socially isolated individuals are expected to be more difficult to track if they move. In their empirical study, the authors found weak evidence of the influence of community attachment on the likelihood of location. Their analysis refers to response at Wave 2 of two longitudinal surveys in the US.

Given a panel member has been located, the probability of making contact is related to the accessibility of the dwelling (in case of face-to-face interviews), the use of answering machines (in case of telephone interviews), and a number of survey design features, and variables related to the willingness to be found and to the likelihood of finding someone at home (Watson and Wooden 2009). Survey design features that might affect the likelihood of making contact are the length of the fieldwork period (Groves and Couper 1998), interviewers' continuity and workloads (Nicoletti and Buck 2004), the number and timing of visits or calls. It is straightforward that making additional contact attempts increases the probability of contacting sample members. Empirical evidence from longitudinal studies also shows that sample members requiring more visits/calls at previous wave are more likely not to respond at subsequent waves (Nicoletti and Buck 2004; Nicoletti and Peracchi 2005). Individual characteristics associated with the likelihood of finding someone at home are age, sex, marital status, employment status, household size and composition (Watson and Wooden 2009). Particularly, the presence of young children is expected to be associated with greater likelihood of

finding the respondent at home. Also, the presence of a long-standing illness is expected to increase this likelihood. Willingness to be found related variables are generally represented by variables describing the survey experience at previous waves, like being from a partially responding household, not returning the self-completion questionnaire (if requested in the survey), the presence of item nonresponse, the assessment of respondent cooperation by the interviewer.

Turning to cooperation, many of the factors affecting cooperation once contact has been made are the same that influence location and contact. Variables related to prior waves experience (listed above) are expected to have an influence on the cooperation process (Kalton et al. 1990; Laurie et al. 1999; Lepkowski and Couper 2002). Also, survey design features may have an effect on response. For example, the likelihood of cooperation has been found to be influenced by the use of incentives (Laurie and Lynn 2009), the survey topic, interviewer continuity (Laurie et al. 1999; Nicoletti and Buck 2004; Nicoletti and Peracchi 2005), and survey mode. Respondent characteristics related to cooperation in the literature are sex, with women more likely to respond than men (Lepkowski and Couper 2002), age with lower response rates for younger people, rece/ethnicity, marital status, household size and composition, educational level (higher educated people more likely to respond), income, employment status and urbanicity of the region of residence (higher attrition among sample members living in urban locations). Lepkowski and Couper (2002) included also variables related to social integration, like friends and relatives support, and participation in voluntary activities. They found that these variables were significant for explaining cooperation at Wave 2 of the ACL survey. Further, some literature has examined the effect of personality traits and well-being related variables on response in longitudinal studies. Willingness to participate in further waves of a survey can be expected to vary with individual personality traits. Personality factors are generally measured by the Big-Five personality traits: Agreeableness, Conscientiousness, Extraversion, Neuroticism, and Openness (Goldberg 1981; Goldberg 1990). Agreeableness is the tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others. It is also a measure of one's trusting and helpful nature, and whether a person is generally well tempered or not. Conscientiousness

is associated with diligence and the will to carry out and complete tasks. Extraversion is related to energy, positive emotions, sociability and the tendency to seek stimulation in the company of others, and talkativeness. Neuroticism refers to the tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, and vulnerability. Openness reflects the degree of intellectual curiosity, creativity and a preference for novelty and variety a person has. Results on possible effects of personality traits on participation are not always consistent. Sikkel and Hoogendoorn (2008) found no correlation between the Big-Five and the duration of panel membership in the CentERpanel. Lugtig (2014), analyzing response in an Internet panel in the Netherlands – the Longitudinal Internet Studies for the Social Sciences (LISS) panel, found that respondents in the highest response probabilities class had higher scores on Conscientiousness. On the other hand, Sassenroth (2013) did not find a link between Conscientiousness and participation in the LISS. He found Extraversion and Openness to be related with panel attrition. Satherley et al. (2015) studied participation in the New Zealand Attitudes and Value Study (NZAVS) and identified four categories of respondents (constant respondents, intermittent respondents, explicit withdrawals, and lost respondents[1]). They found Conscientiousness to be positively associated with membership in the constant respondent class and Extraversion and Neuroticism to be associated with membership in the lost respondent class. Richter et al. (2014) found that Openness had a positive effect on panel participation in the German Socio-Economic Panel study.

As for well-being, Satherley et al. (2015) found that life satisfaction was significantly and negatively associated with the lost respondent class relative to the constant respondent class. Radler and Ryff (2010), with reference to the second wave of the Midlife in the United States (MIDUS) study, found that participants who report better subjective health are more likely to respond to follow-up waves.

[1] Constant respondents are defined as panel members who responded at every wave from Time 1 to Time 4, intermittent respondents are those who responded to any two or three waves including Time 1, explicit withdrawals refer to those who actively withdrew from the study at any time following Time 1, and lost respondents are panel members who have not responded following Time 1, but not explicitly withdrawn.

One thing that has to be noticed is that none of these studies that include measures of well-being and personality traits distinguished among different components of the response process. Of course, the distinction in attrition due to failure to locate sample members, noncontacts, and refusals is not possible in studies based on Internet panels (Lugtig 2014; Sassenroth 2013). Also, these studies are not entirely comparable with the others, as web mode is well known to play a role on non-response and measurement errors (Fan and Yan 2010).

3 Research Questions

Following Watson and Wooden (2009), we note that in many cases it is empirically difficult to distinguish between location and contact. We thus consider survey response as the occurrence of location/contact (hereafter referred to as contact) and cooperation, given contact. We investigate four research questions: the first one refers to the contact stage, the other three focus on the cooperation stage.

First, we investigate whether the social aspects of community attachment may affect the likelihood of moving and hence making contact in later waves of a panel. The expectation is that individuals engaged in civic activities within their communities are less likely to move and, in case they move, they are easier to be traced (Lepkowski and Couper 2002). As the variables we need to use in the models were only collected in Wave 3 of the UKHLS, we focus on Waves 4 to 6 of the panel. We thus explore whether social indicators related to community attachment are predictive of contact in later waves of a panel (First Research Question). Lepkowski and Couper (2002) investigated this aspect of location and found weak empirical evidence of the influence of community attachment on the likelihood of location, when studying response in Wave 2 only of two longitudinal panels in the US.

Second, we investigate whether the behavior of individuals with regard to social activities and social relations contributes to explaining cooperation given contact. Our expectation is that how one relates in the social world has an influence on response behavior as well (Second Research Question). To

explore this hypothesis, we consider variables related to the sense of belonging and social participation. These variables denote greater propensity towards participation in general and this is expected to be reflected in cooperation in the panel, too.

The third research question is related to the effect of personality traits on cooperation. Our expectation is that personality traits can explain some aspects related to survey cooperation (Third Research Question). As outlined in Section 2, research on the effect of personality on panel participation is rather scarce, results are inconsistent, and not always comparable. Here we study the effect of personality traits on both contact and cooperation. Further, this analysis is informative as it provides insight into the reliability of studies of personality development based on longitudinal studies. Indeed, recent research on personality has used longitudinal panels to investigate the development of personality traits over time (Lucas and Donnellan 2011; Specht et al. 2011). It is clear that an association between attrition and personality traits could provide biased results.

Finally, willingness to participate in further waves of a survey can be expected to vary with the level of well-being of the respondent. Our hypothesis is that life satisfaction could influence an individual's interest in participating to a panel study. We investigate whether self-reported levels of life satisfaction are associated to the likelihood of cooperation in later waves of a panel (Fourth Research Question). This aspect was investigated in Satherley et al. (2015) in the NZAVS panel, where the authors do not distinguish different components of the response process. Further, the use of longitudinal data to analyse the dynamics of subjective well-being is currently widely recognized and attested by the many studies on well-being based on panel data (Bayliss et al. 2017; Smith et al. 2017). It is thus important to assess the extent to which subjective well-being has an effect on panel attrition.

4 Dataset for empirical analysis

In this section, first we describe the UK Household Longitudinal Study (Section 4.1) and then we provide details on the dataset selection that we use in the empirical analyses (Section 4.2).

4.1 The UK Household Longitudinal Study

The UK Household Longitudinal Study (UKHLS) is a longitudinal survey of individuals in the United Kingdom. At the moment, seven waves of data are available, for the years 2009-2016. The UKHLS has four sample components: the General Population Sample (GPS), the Ethnic Minority Boost sample (EMB), the sample of participants from the British Household Panel Survey (BHPS), and the Immigrant and Ethnic Minority Boost Sample (IEMBS). The sample designs are similar in having multi-stage sample designs mostly with stratification and clustering (Lynn 2009b). For the GPS, an overall sample of 49,920 addresses was selected. The overall response rate at the first wave for the GPS at the household level was 57.3%. The EMB is an over-sample of around 4,000 ethnic minority households consisting of 13,000 individuals and has been selected from high ethnic minority concentration areas of Great Britain. From the second wave onwards, the sample of households that had not dropped out after the 18th wave of the BHPS became eligible for inclusion into the UKHLS, resulting in an additional 6,600 interviewed households consisting of about 16,500 individuals. The IEMBS was included in the main study from Wave 6 onward and consists solely of immigrants and ethnic minorities (Lynn et al. 2017).

The UKHLS involves interviews at twelve-month intervals with the initial sample members and all members of the current household of each sample person. Data collection for each wave takes place over a 24 month period. The periods of waves overlap, and individual respondents are interviewed around the same time each year. Household response at any wave can be complete if all household members answer the survey or partial, if only some of the household members participate. Only sample members who were in participating households at the first wave for that sample were re-approached for interview at subsequent waves. From Wave 2 onwards, nonresponse at one wave did

not preclude an interview attempt at the next wave, although cases where the household had adamantly refused to take part or moved to an unknown location were not issued to the field.

Following rules are implemented in order to mimic the demographic processes by which the population is reproduced, including births and deaths, partnership formations and dissolutions, and emigration. They provide a natural sampling method over time, which represents the evolving pattern of households and families in the UK. The one exception is that there is no direct way in which following rules capture immigrants into the UK. Specifically, the individuals found at selected households in the first wave are designated as Original Sample Members (OSMs). These are retained as part of the sample as long as they live in the UK. Individuals joining the household of an OSM after the first interview are Temporary Sample Members (TSMs). TSM participants are interviewed in successive waves as long as they live in the household of an OSM. Births to an OSM mother after Wave 1 are also classified as OSMs. The father of an OSM child born after Wave 1 is a Permanent Sample Member (PSM). PSMs are followed for interview after they no longer live with an OSM.

Interviews collect information on household and individual circumstances, such as health, work, education, income, family, and social life (Buck and McFall 2012). The study collects both objective and subjective indicators. Questions are organized in topical modules which appear annually or are rotated less frequently. Rotating modules vary in frequency, depending on the subject matter and expected rates of change. The annual core is approximately 50% of the interview length.

Several survey instruments for members in selected households are used in the UKHLS. One household member completes the household enumeration grid and the household interview, which takes about 15 minutes. Each person aged 16 or older is then requested to answer the individual adult interview (32 minutes) and the self-completion questionnaire (8 minutes). The household and adult main interviews are conducted face-to-face via Computer Aided Personal Interview (CAPI). The adult self-completion questionnaire shifted from paper to computer administered self-interview (CASI) in Wave 3. From Wave 3 onwards, there was also a telephone mop-up at the end of the

fieldwork period for each sample month. Finally, there is also a proxy interview in which limited information is collected about adults who could not be interviewed in person.

4.2 Data

The analyses performed in Section 5 are on individuals aged 16 or over of the GPS sample that were issued to the field at Wave 4 and were eligible at Waves 4, 5, and 6 – counting individuals not issued to later waves as (eligible) nonrespondents (any household that did not respond at either wave $w - 1$ or w would not be issued at $w+1$). For those individuals issued to Wave 4 and not issued to later waves, nonresponse is classified using the nonresponse classification from the last available wave. For the purposes of our analysis, proxy responses were considered as non-response. Looking at the reason for proxy response, we classified proxy responses as either noncontact, refusal or other. If the reason was 'Unable to contact', we classified non-response as non-contact, if it was 'Individual refused but allows proxy' we classified non-response as refusal, otherwise we classified non-response as other non-response. Further, we restrict the sample to Wave 3 main adult interview respondents as most of the variables to be used to answer our research questions were asked in Wave 3 only. The resulting final sample size is 27,143. To answer the third and fourth research questions, variables included in the self-completion questionnaire of Wave 3 only are needed, leading to a reduced sample of size 21,934. Details about response outcomes at each wave for our analysis sample are shown in Table 1 (the classification is done according to standard definitions for household surveys in AAPOR (2015)). It is worth noticing that the amount of non-contact in Wave 6 has doubled compared to Waves 4 and 5. Indeed, between Wave 5 and Wave 6 there has been a change of the fieldwork provider and we infer that this might be the cause for the observed difference.

Table 1 Wave 4, 5, and 6 response status for GPS sample issued to the field at Wave 4, eligible at Waves 4, 5, and 6 and responding to the adult main interview at Wave 3.

Status	Wave 4	Wave 5	Wave 6

Full interview	24,908	23,603	21,325
Non-contact	823	951	1,913
Refusal	1,078	2,158	3,357
Other	334	431	548
Total	27,143	27,143	27,143

5 Analyses and Results

5.1 Methodology

To investigate the effect of respondents' characteristics on their response behaviour, we considered contact and cooperation given contact separately at Waves 4, 5, and 6. As for contact, we distinguished two categories: those who were contacted in all three waves (N=24,134) and those who were never contacted or were contacted once or twice across the three waves (N=3,009). For cooperation given contact, we restricted the sample to those who were contacted in all three waves and we considered three groups: those who never responded, those who responded once or twice, and those who always responded. In the adult main interview sample, sample sizes of each cooperation category are 667, 3680, and 19,787, respectively, while they are 564, 3242, and 18,128, respectively, in the self-completion questionnaire sample.

For contact, we fitted a logit model predicting contact in all three waves. For cooperation, we fitted a multinomial logistic regression for cooperation given contact. The class of those that always responded was the reference category. Covariates in the models are described in Section 5.2. They are collected at Wave 3 or the most recent available interview prior to Wave 3. We used listwise deletion of participants with missing value for the covariates in the models. Estimates are adjusted for sampling design (strata and clusters). We report unweighted results as we are mostly interested in the functioning of the panel, rather than in inferring results at the population level.

5.2 Variables

Association between contact and cooperation with respondent characteristics and survey design features are not the main focus of this paper. Nevertheless, these are important factors that cannot be ignored (see Section 2). Therefore, we control for these factors when studying the effect of social indicators on contact and cooperation.

In the contact model, we considered respondents characteristics, including socio-demographics, variables related to previous wave interview experience, and community attachment variables. As regards socio-demographics, the following variables have been included in the model: gender, age, urbanicity, number of children, number of adults, (de facto) marital status, in paid employment, and housing tenure. Country dummy variables were inserted into the model to capture time invariant unobserved heterogeneity across countries. We also included two variables related to the mobility status (prefers to move house, expects to move house next year). The choice to use the respondents' expectation of a move rather than an actual move indicator was made because respondents' expectation of a move variable is available at the previous wave. Thus, if this variable turns out to be associated with the likelihood of making contact, special measures can be adopted for those cases by survey managers between waves in order to increase the probability of making contact. As for variables related to previous wave interview experience, we included being from a partially responding household, not returning the self-completion questionnaire, item non-response at Wave 3 for the variable gross pay, the level of cooperation as recorded by the interviewer on a scale from 1 (=very good) to 5 (=very poor), and the number of visits made by the interviewer at last interview. With reference to community attachment variables, we considered: whether the respondent goes out socially, membership of an organization (general), and membership of a number of specific organizations (political party, trade unions, environmental group, tenants/resident group, religious/church organization, voluntary services group, social/working man club, sports club).

The probability of cooperation given contact is modelled using the same covariates that are used for contact. We also included variables related to education[2], general health, an objective measure of the financial situation (equivalized household income) as well as a subjective measure of the financial situation. Further, to answer our second research question, we included some variables capturing the sense of belonging and the attitude toward social relationships, like going out socially, belonging to a social website, and being member of an organization. Notice that going out socially and being a member of an organization characterize both community attachment and social participative behavior. We also included interest in politics as an indicator of social involvement. Interest in politics is measured in the politics module. We considered the variables support a particular political party (yes/no) and level of interest in politics (very, fairly, not very, not at all interested).

Using respondents to the self-completion questionnaire only, we were able to include some socio-psychological indicators, indicators of well-being, and two other indicators of social participation. As for psychological indicators, we considered the Big-Five personality traits scores. In the UKHLS, they are computed combining three items' scores on the relevant subdomain. Respondents were asked to "Please choose the number which best describes how you see yourself, using a scale from 1 to 7 where 1 means 'does not apply to me at all' and 7 means 'applies to me perfectly'". The component score is the average item response if no more than one of the three input responses is missing (John and Srivastava 1999). The items for each personality trait are the following:

- Agreeableness: "I see myself as someone who is sometimes rude to others" (reverse coded), "I see myself as someone who has a forgiving nature", "I see myself as someone who is considerate and kind to almost everyone";

[2] Education is coded into the following classes: Degree (that corresponds to tertiary education, Bachelor, Master, or Doctoral degree – ISCED (International Standard Classification of Education) 5, 6, 7, or 8), A-level etc. (upper secondary education or post-secondary non-tertiry education – ISCED 3 or 4), GCSE (General Certificate of Secondary Education) etc. (secondary education – ISCED 2 or 3), other qualifications, and no qualification. See UNESCO (2012).

- Conscientiousness: “I see myself as someone who does a thorough job”, “I see myself as someone who tends to be lazy” (reverse coded), “I see myself as someone who does things efficiently”;
- Extraversions: “I see myself as someone who is talkative”, “I see myself as someone who is outgoing, sociable”, “I see myself as someone who is reserved” (reverse coded);
- Neuroticism: “I see myself as someone who worries a lot”, “I see myself as someone who gets nervous easily”, “I see myself as someone who is relaxed, handles stress well” (reverse coded);
- Openness: “I see myself as someone who is original, comes up with new ideas”, “I see myself as someone who values artistic, aesthetic experiences”, “I see myself as someone who has an active imagination”.

As measures of subjective well-being we added four life satisfaction indicators. In the UKHLS, respondents were asked to rate aspects related to health, income, leisure time, and life overall, by choosing “the number which you feel best describes how dissatisfied or satisfied you are with the following aspects of your current situation”. A scale from 1 (completely dissatisfied) to 7 (completely satisfied) was used.

Finally, as further indicators of social involvement, we selected some questions from the self-completion neighborhood module. Respondents were asked to “Please enter the number that indicates how strongly you agree or disagree with each statement” (1=strongly agree, 5=strongly disagree). The self-completion neighbourhood module includes eight variables. We chose “I borrow things and exchange favours with my neighbours” and “would be willing to work together with others on something to improve my neighbourhood”. These characteristics correspond to a participative personality.

5.3 Results

Looking at the results on the probability of making contact (Table 2), we observe that:

a. Contact probabilities are lower for young people, men, single persons, and renters and increase with the number of children under 15 for whom the respondent is responsible. The number of adults living in the household is not associated with the probability of making contact.

b. Being in paid employment is associated with higher propensities of making contact. This finding agrees with results in Watson and Wooden (2009) and, as they justified, probably reflects more extensive social networks among the employed which makes it easier to trace and contact them.

c. Mobility related variables (prefers to move and expects to move next year) are strongly and negatively associated with making contact with the respondent. Respondents' expectation of a move can be considered as a proxy of the actual move indicator. The advantage of using the proxy is that it is available at the previous wave. Thus this variable can be used to identify subjects at risk of non-contact and for whom special between waves measures can be adopted.

d. The dwelling type in which respondents live is associated with the probability of making contact. Those living in a terraced house or other types of dwellings are more difficult to make contact with than those living in a detached house. This result is in general agreement with the literature that identifies the accessibility of the dwelling to be a predictor of the probability of making contact (Groves and Couper 1998, Chapter 4).

e. Living in an urban area is not a significant predictor of the probability of making contact. This finding is contrary to the usual expectation that residents in urban areas are less available and harder to reach (Kalton et al. 1990; Gray et al. 1996). Lepkowski and Couper (2002) report evidence similar to ours.

f. Having a long-standing illness is predictive of the probability of making contact. This result agrees with findings in Watson and Wooden (2009).

g. The size and the statistical significance of the country of residence variable indicates the presence of heterogeneity across countries.

h. Indicators of interview experience at the last interview are strong predictors of contact at Waves 4, 5, and 6. Belonging to a fully responding household is associated with higher contact propensities. Not surprisingly, a respondent showing very good cooperation at last interview is also more likely to be contacted at the next waves. The number of visits made by the interviewer at Wave 3 is negatively associated with the probability of making contact with the respondent at successive waves. This finding agrees with literature evidence that the sample members requiring the most effort in terms of the number of calls made at previous wave are at greatest risk of attrition (Nicoletti and Peracchi 2005; Nicoletti and Buck 2004). The explanation for this phenomenon is that the number of calls needed is indicative of both how difficult it is to find the respondent at home and how evasive the respondent might have been when setting up interview appointments.

   Overall, these indicators identify subjects at risk of attrition, that might need better monitoring for the actual achievement of contact to reduce non-response.

i. With respect to social indicators related to aspects of community attachment, those who are a member of an organization show higher contact probabilities. Particularly, being a member of an environmental group is positively associated with the probability of making contact.

   So, to answer the first research question on the effect of community attachment variables on the likelihood of making contact, we found a significant effect revealed by membership of an organization, holding other variables in the model fixed. The other variables related to community attachment included in the model are mildly or not associated with the probability of making contact.

Table 2 Logistic regression results for contact in Waves 4, 5, and 6 – N=25,531.

Variable	Category	Estimate		p-value (joint test)	Odds Ratios (OR)
Respondent characteristics					
Intercept		1.349			3.855
Age	21-30	0.423	***	0.000	1.526
(Ref. 16-20)	31-40	0.579	***		1.785
	41-50	0.956	***		2.602
	51-60	1.338	***		3.811
	61-70	1.713	***		5.545
	71+	1.559	***		4.755
Gender	Male	-0.234	***		0.791
Urban area		0.048			1.049
Country of residence	Wales	-0.335	***	0.001	0.716
(Ref. England)	Scotland	-0.198	**		0.820
Number of children under 15 responsible for		0.100	***		1.106
Number of adults		0.005			1.005
Marital Status (de facto)	Partnered	0.161	**	0.001	1.175
(Ref. Single)	Separated/Divorced	-0.078			0.925
	Widowed	-0.236	*		0.790
In Paid Employment		0.112	**		1.119
Long-standing illness		0.081			1.085
Prefers to move house	Prefer to move	-0.129	***		0.879
(Ref. Stay here)					
Expects to move next year		-0.314	***		0.731
Dwelling type	Terraced house	-0.171	***	0.007	0.843
(Ref. Detached house)	Flat	0.015			1.015
	Other	-0.480	*		0.619
Housing tenure	Own/mortgage	0.322	***		1.381
(Ref. Rented)					
Previous interview experience					
Respondent co-operation	Good	-0.191	***	0.000	0.826
(Ref. Very good)	Fair/poor/very poor	-0.478	***		0.620
Partially responding household		-0.408	***		0.665
Did return SCQ		0.143			1.154
Number of visits made		-0.082	***		0.922
Item non-response Gross pay		-0.075			0.928
Community attachment					
Go out socially *(Ref. No)*		-0.087			0.917
Member of an organization *(Ref. No)*		0.198	***		1.218
Member of a political party *(Ref. No)*		0.257			1.293
Member of trade unions *(Ref. No)*		0.114			1.121
Member of an environmental group *(Ref. No)*		0.354	*		1.424
Member of a tenants/resident group *(Ref. No)*		0.005			1.005
Member of a religious/church organization *(Ref. No)*		-0.043			0.958
Member of a voluntary services group *(Ref. No)*		0.062			1.064
Member of a social/working man club *(Ref. No)*		-0.140			0.869
Member of sports club *(Ref. No)*		-0.099			0.906

*Note: * 0.10≥p>0.05, **0.05≥p>0.01, ***0.01≥p*

Turning to the probability of cooperation given contact, we first look at results for respondents to the main interview. Table 3 shows the logit values as well as the odds ratios (OR) of never responding or responding occasionally versus always responding.

a. In both attriting classes, we find younger, more elderly, and less educated people, compared to the class of members that always responded (base category). By means of example, the logit parameter -0.447 for the age group 21-30 means that, compared to those that always responded, the proportion of 21-30 years old is 0.447 log odds lower in the class of occasionally responding panel members compared to the reference age group 16-20. This corresponds to an odds ratio of 0.640, holding all other variables in the model fixed. In simple language, this means that the 21-30 years old group is under-represented in the occasionally responding class and over-represented in the always responding class compared to the 16-20 years old group, indicating overall that 21-30 years old members are more likely to respond than 16-20 years old members. Further, in both attriting classes response probabilities decrease with the number of adults living in the house.

   Having poor general health is a significant predictor of responding occasionally. This finding agrees with results in Watson and Wooden (2009) and denotes lower ability/willingness to participate for people with poor health. Being male is a mild predictor of never responding. This result agrees with some limited evidence from the literature that, conditional on contact, men are less likely to continue survey participation in panel surveys (Nicoletti and Buck 2004; Lepkowski and Couper 2002).

b. The country of residence variable is significant only for those responding occasionally and indicates heterogeneity across countries.

c. Turning to the previous wave experience, belonging to a partially responding household and not providing an answer to the gross pay question at Wave 3 are strong predictors of non-response in both attriting classes. These findings are in agreement with those reported in the literature (Watson and Wooden 2009). In general, item non-response at the previous

wave tends to be negatively associated with the likelihood of cooperation in the following wave. This effect is not observed across all survey items, and in general negative associations are significant when item non-response occurs in the income or childcare and housing sections or in the self-completion questionnaire. Not surprisingly, the interviewer's assessment of the respondent's cooperation at last interview is predictive of response in the next waves. Respondents who were less cooperative at last interview are more likely to never respond or occasionally respond at the three successive waves. Not returning the self-completion questionnaire is predictive of occasional response vs. constant response. The number of visits made by the interviewer at last interview has the expected positive association with occasionally responding compared to always responding.

d. As for participative behaviour indicators, being member of a (generic) organization is a significant predictor of cooperation, such that those who are member of an organization were 0.87 times as likely as those who are not member to be occasional respondents rather than constant respondents. Particularly, being a member of an environmental group is a strong predictor of cooperation given contact. Another interesting significant indicator of social participation is belonging to a social web site, which is a positive predictor of cooperation.

e. Equivalized household income is a mild predictor only for the class of occasionally responding panel members. It has a U-shaped effect, showing a positive effect on response for positive levels of income (greater than zero income). This result agrees with longitudinal survey literature findings that in general report mild effects of income on re-interview rates (Watson and Wooden 2009). The subjective financial situation at last interview is also a significant predictor of response at successive waves.

f. The level of interest in politics is predictive of occasional response vs constant response, with people not at all interested being 1.298 times as likely as those who are very interested to be occasional respondents rather than constant respondents.

So, to answer the second research question on effects of social behaviour on cooperation, as expected we find a positive effect, so that variables denoting greater propensity towards participation in general are predictive of cooperation in the panel too. This supports with general trends in the literature and enriches the field by the finding that belonging to a social website and being member of an organization are strong predictors of cooperation given contact.

Looking at results obtained from the self-completion questionnaire sample, we may notice that findings on the variables considered so far are similar to those obtained for the main interview sample. Further:

g. The sense of belonging (modelled here using neighbourhood related variables) is not associated with the probability of cooperation.

h. The five personality traits variables are jointly not significant predictors of either never responding (p=0.494) or occasionally responding (p=0.547), after controlling for other variables in the model.

i. Variables related to well-being are jointly not significant for both attriting classes (p=0.451 and p=0.134, respectively). The biggest effect (-0.031) is observed for satisfaction with health which has a positive effect on constant vs. occasional response.

So, to answer the third and fourth research questions, effects of personality traits and subjective well-being are not significant for explaining cooperation, after controlling for other variables in the model. This is a positive signal that recent research on these topics using the UKHLS data should not be biased with respect to selective attrition.

Table 3 Multinomial logistic regression results for cooperation given contact in Waves 4, 5, and 6 – Wave 3 main adult interview sample (N=25,531) and self-completion sample (N=20,882).

		Main adult interview								Self-completion questionnaire							
		Never responded				Responded once or twice				Never responded				Responded once or twice			
Variable	**Category**	**Estimate**		**p-value (joint test)**	**OR**	**Estimate**		**p-value (joint test)**	**OR**	**Estimate**		**p-value (joint test)**	**OR**	**Estimate**		**p-value (joint test)**	**OR**
Respondent characteristics																	
Intercept		-3.757	***		0.023	-1.769	***		0.171	-4.146	***		0.016	-1.913	***		0.148
Age	21-30	-0.243		0.005	0.784	-0.447	***	0.000	0.640	-0.344		0.018	0.709	-0.484	***	0.000	0.617
(Ref. 16-20)	31-40	-0.447	*		0.640	-0.595	***		0.552	-0.572	**		0.564	-0.612	***		0.542
	41-50	-0.335			0.715	-0.727	***		0.483	-0.429	*		0.651	-0.764	***		0.466
	51-60	-0.748	***		0.473	-0.824	***		0.438	-0.836	***		0.433	-0.841	***		0.431
	61-70	-0.428			0.652	-0.775	***		0.461	-0.452	*		0.636	-0.850	***		0.427
	71+	-0.054			0.948	-0.427	***		0.652	-0.213			0.808	-0.498	***		0.608
Male	Male	0.153	*		1.165	-0.021			0.980	0.193	**		1.213	-0.010			0.990
Urbanicity	Urban area	0.045			1.046	0.047			1.048	0.037			1.038	0.044			1.045
(Ref. Rural area)																	
Country of residence	Wales	-0.085		0.724	0.918	0.366	***	0.000	1.442	-0.068		0.706	0.934	0.341	***	0.000	1.406
(Ref. England)	Scotland	0.120			1.127	0.267	***		1.306	0.139			1.149	0.286	***		1.331
Number of children under 15 responsible for		-0.051			0.951	0.017			1.017	-0.021			0.980	0.016			1.016
Number of adults		0.106	*		1.112	0.083	**		1.087	0.108	*		1.114	0.086	**		1.090
Marital Status (de facto)	Partnered	0.016		0.181	1.016	0.120	*	0.003	1.128	0.048		0.019	1.050	0.113		0.005	1.120
(Ref. Single)	Separated/Divorced	-0.152			0.859	-0.170	*		0.844	-0.322			0.725	-0.168	*		0.845
	Widowed	-0.459	*		0.632	-0.084			0.920	-0.813	**		0.444	-0.135			0.874
In Paid Employment		-0.041			0.960	0.052			1.053	-0.054			0.947	0.046			1.047
Education	A - level etc.	0.305	**	0.024	1.356	0.144	**	0.020	1.155	0.272	*	0.068	1.312	0.140	**	0.012	1.150
(Ref. Degree)	GCSE etc.	0.392	***		1.479	0.129	**		1.138	0.351	**		1.420	0.136	**		1.145
	Other qualification	0.440	***		1.552	0.211	***		1.235	0.429	**		1.536	0.207	**		1.230
	No qualification	0.414	***		1.514	0.198	***		1.219	0.376	**		1.457	0.263	***		1.301
Long-standing illness		-0.169			0.844	-0.038			0.963	-0.215	*		0.807	-0.041			0.960
General Health	Very good	-0.071		0.082	0.932	0.105	*	0.000	1.111	0.016		0.543	1.016	0.089		0.013	1.093
(Ref. Excellent)	Good	-0.170			0.843	0.128	*		1.137	-0.067			0.936	0.089			1.093

	Fair	0.072			1.075	0.295	***		1.343	0.196			1.217	0.244	***		1.277
	Poor	0.316			1.372	0.429	***		1.536	-0.017			0.983	0.347	***		1.415
Housing tenure	Own/mortgage	0.140			1.150	-0.048			0.953	0.082			1.086	-0.080			0.923
(Ref. Rented)																	
Previous interview experience																	
Respondent co-operation	Good	0.252	**	0.000	1.286	0.211	***	0.000	1.235	0.256	*	0.000	1.292	0.225	***	0.000	1.252
(Ref. Very good)	Fair/poor/very poor	1.270	***		3.559	0.338	**		1.401	1.360	***		3.896	0.394	**		1.482
Partially responding household		0.530	***		1.699	0.275	***		1.317	0.508	***		1.663	0.278	***		1.321
Did return SCQ		-0.176			0.838	-0.200	***		0.818								
Item non-response Gross pay		0.496	***		1.642	0.289	***		1.335	0.591	***		1.805	0.314	***		1.369
Number of visits made		0.031			1.031	0.045	***		1.046	0.034			1.035	0.043	***		1.044
Social participation (sense of belonging)																	
Go out socially		-0.077			0.926	-0.072			0.930	0.094			1.098	-0.062			0.940
Member of an organization		0.020			1.020	-0.139	**		0.870	0.008			1.008	-0.155	***		0.856
Member of a political party		-0.290			0.748	-0.160			0.852	-0.105			0.900	-0.121			0.886
Member of trade unions		-0.068			0.934	-0.002			0.998	-0.007			0.993	0.002			1.002
Member of an environmental group		-1.287	**		0.276	-0.599	***		0.549	-1.168	**		0.311	-0.552	***		0.576
Member of a tenants/resident group		-0.442			0.643	-0.226	*		0.797	-0.520			0.595	-0.199			0.820
Member of a religious/church organization		-0.239			0.787	-0.134	*		0.874	-0.282			0.754	-0.137			0.872
Member of a voluntary services group		-0.418	*		0.658	-0.039			0.962	-0.391			0.676	0.033			1.034
Member of a social/working man club		0.189			1.207	0.001			1.001	0.237			1.268	0.018			1.018
Member of sports club		-0.128			0.880	0.080			1.084	-0.139			0.870	0.050			1.052
Belong to social website		-0.203	*		0.816	-0.096	**		0.909	-0.205	*		0.815	-0.096	*		0.908
Can borrow things from neighbours	Agree									-0.316	*	0.261	0.729	-0.007		0.960	0.993
(Ref. Strongly agree)	Neither agree nor disagree									-0.243			0.784	-0.043			0.958
	Disagree									-0.293			0.746	-0.039			0.962
	Strongly disagree									-0.059			0.942	-0.045			0.956
Willing to improve neighborhood	Agree									0.219		0.220	1.245	0.111		0.115	1.117
(Ref. Strongly agree)	Neither agree nor disagree									0.331	*		1.393	0.133			1.142
	Disagree/Strongly disagree									0.407	*		1.503	0.267	**		1.306
Financial situation																	
Equivalized household income (/10^4)		0.254			1.289	-0.252			0.777	0.836			2.307	-0.417			0.659

Equivalized household income squared ($/10^8$)		0.046		1.047	0.474	*		1.607	-1.197			0.302	0.657	**		1.930
How managing financially now	Doing alright	0.149	0.085	1.161	0.148	***	0.060	1.160	0.138		0.124	1.149	0.104	*	0.149	1.110
(Ref. Living comfortably)	Just about getting it	-0.071		0.932	0.109	*		1.115	-0.105			0.900	0.061			1.063
	Finding it quite difficult	0.211		1.234	0.206	**		1.229	0.180			1.198	0.205	**		1.228
	Finding it very difficult	-0.427		0.653	0.084			1.088	-0.399			0.671	-0.007			0.993
Politics								-								-
Supports a particular political party		-0.067		0.935	-0.028			0.972	-0.044			0.957	-0.010			0.990
Level of interest in politics	Fairly	0.102	0.490	1.108	0.149	**	0.005	1.161	0.062		0.490	1.064	0.129		0.047	1.138
(Ref. Very)	Not very	0.128		1.136	0.107			1.113	0.131			1.140	0.066			1.069
	Not at all interested	0.248		1.281	0.261	***		1.298	0.235			1.265	0.197	**		1.218
Personality Factors (adjusted Wald test for joint significance: p-value (never responded) = 0.484, p-value (occasionally responded) = 0.547																
Agreeableness									-0.027			0.973	-0.001			0.999
Conscientiousness									0.094	**		1.098	0.038	*		1.038
Extraversion									0.009			1.009	0.000			1.000
Neuroticism									-0.002			0.998	0.012			1.012
Openness									-0.033			0.968	-0.015			0.985
Well-being (adjusted Wald test for joint significance: p-value (never responded) = 0.451, p-value (occasionally responded) = 0.134																
Satisfaction with health									-0.002			0.998	-0.031	**		0.969
Satisfaction with income									0.018			1.018	-0.011			0.989
Satisfaction with leisure time									0.031			1.031	0.000			1.000
Satisfaction with life overall									-0.068	*		0.934	0.007			1.007

*Note: OR = odds ratio, * 0.10≥p>0.05, **0.05≥p>0.01, ***0.01≥p.*

6 Conclusions

In this study, a broad perspective on the characteristics of individual participation in a survey is applied. Beyond demographics, special attention is devoted to social indicators and psychological traits. The paper helps further the research in this area in two main respects. First, it considers the role of personality traits, well-being, and personal behaviours towards relationships, together with the traditional socio-demographic variables and survey design features. Second, it disentangles effects of predictors on different steps of the response process.

The empirical findings are also subject to a number of limitations. Above all, in the UKHLS many of the social indicators and psychological traits variables were asked in Wave 3 only. This implied that we had to consider aggregated response outcomes over three waves and that we had to restrict to the adult main interview respondents sample and to the self-completion questionnaire sample in Wave 3. However, with respect to variables included in both cooperation models, significant effects were very similar. This provides some indication that our conclusions are somewhat robust.

The main conclusions are the following. The analysis confirms that attrition is selective. Findings of our study support the theory that factors beyond demographic characteristics play a relevant role. With respect to contact, traditional demographic variables affecting selectivity are age, gender, marital status, and number of children under 15 the respondent is responsible for. Further, factors predictive of the likelihood of making contact are variables related to mobility of the respondent, dwelling type, household tenure, and a number of variables related to previous interview experience. These results in general agree with findings from the literature (Watson and Wooden 2009; Groves and Couper 1998; Lepkowski and Couper 2002; Nicoletti and Peracchi 2005; Nicoletti and Buck 2004). Regarding possible effects of community attachment (First Research Question), being a member of an organization is strongly significant, controlling for other variables in the model. Other

variables related to community attachment did not reach the 5% level of significance. This result is in line with findings in Lepkowski and Couper (2002), but referring to three later waves of a panel.

Turning to cooperation given contact, being aged 41-70 and having higher levels of education are associated with high participation propensity. Having good general health was predictive of constant response vs. occasional response. Also these findings are in agreement with those reported in the literature (Watson and Wooden 2009). With respect to possible effects of social behavior (Second Research Question), greater propensity towards participation (as assessed by being member of an organization, and particularly an environmental group, and belonging to a social website) is associated with higher cooperation in the panel. With regard to possible effects of personality traits and variables related to well-being (Third and Fourth Research Questions), no significant effect was detected, after controlling for the other variables in the model.

These results represent an important advance in knowledge as we are not aware of any other study investigating the effects of personality traits and variables related to well-being and at the same time separating the contact and cooperation stages of the response process. Overall, the information gained in our study can be useful in three respects. First, it can be used to prevent attrition by assisting survey managers to tailor survey design features at the next wave, using strategies like responsive and adaptive designs (Groves and Heeringa 2006; Schouten et al. 2013; Wagner 2008; Bianchi and Biffignandi 2014; 2017b; Lynn 2015; 2016). Second, it can provide variables that can be used in the construction of non-response adjustment weights. Third, it provides evidence that the analysis of some social indicators and psychological variables based on the UKHLS are not biased with respect to selective attrition. This is an important finding for the users of the panel.

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