SURVEY FUTURES

SURVEY DATA COLLECTION METHODS COLLABORATION

Working Paper 4:

Are interviewer administered follow-ups of web non-respondents still needed to maximise respondent dataset quality? Evidence using Understanding Society: the UK Household Longitudinal Study

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Abstract

Many social surveys have adopted web-first sequential mixed mode designs in which first a web questionnaire is offered, then non-respondents are followed up in interviewer administered modes, i.e. either face-to-face (Computer Assisted Personal Interviewing (CAPI) or by telephone (Computer Assisted Telephone Interviewing (CATI). Evidence suggests such designs may be less costly than CAPI or CATI only designs and may produce datasets of higher quality than web-only designs. However, with rising levels of internet access and use, the question arises as to whether this evidence is still valid. We investigate whether follow-ups of web non-respondents with CAPI / CATI are still required to maximise dataset quality, and how this pattern may have changed over time. The analysis uses data from Understanding Society: the UK Household Longitudinal Study (UKHLS).

Key findings are: 1) follow-ups are still required to maximise response rates and dataset sizes, though impacts have declined over time; 2) the impact of follow-ups on representativeness (how well datasets resemble study populations) has declined over the period 2012- 2018, with web and web plus CAPI datasets from later years not differing; 3) impacts of follow-ups on the under-representation of hard-to-reach population subgroups, such as older adults and those not in work, have declined and become negligible over a similar timescale; and 4) impacts of follow-ups on non-response biases remaining after non-response weighting, have similarly declined and become negligible over this timescale. We then discuss the implications of our findings for survey practice.

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Research Strand 8 addresses nonresponse and the project led by Prof Gabriele Durrant focusses on non-response follow-ups to web surveys of the UK general population. It is a collaboration between the University of Southampton and the University of Essex, jointly with IPSOS, Verian, NatCen and ONS. The aim of the workstream is to review existing evidence, analyse recent data and trends and to provide guidance to survey agencies and researchers with regards to follow-up of non-respondents and representativeness in web surveys. The work was also supported by the National Centre for Research Methods (NCRM, 2020-2025) (ESRC grant ES/T000066/1).

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1. Introduction

In recent years, many social surveys have adopted web-first sequential mixed mode designs in which first a web questionnaire is offered, then non-respondents are followed up in interviewer administered modes, i.e. either face-to-face (Computer Assisted Personal Interviewing, CAPI) or by telephone (Computer Assisted Telephone Interviewing, CATI) (Brown & Calderwood 2020). There are a number of advantages to such designs. Compared to CAPI or CATI only designs, they can reduce costs (Dillman 2014, p.401). Compared to web-only designs, they can increase dataset quality in terms of dataset size, resemblance to the study population (representativeness) and non-response bias, although they can also cause measurement differences, where survey estimates are affected by respondent answers depending on mode used (De Leeuw 2018; Burton & Jäckle 2020). However, with rising levels of internet access and use, it is unclear whether the evidence supporting the need for follow-ups of non-respondents is still valid. Answering this important question for survey designers is the main focus of this paper.

To address this question, we investigate whether follow-ups of web non-respondents with CAPI or CATI are required to maximise dataset quality, with a focus on how patterns have changed over time. For the purposes of our work, we define *dataset quality* in terms of response rates and therefore dataset sizes, representativeness, and non-response biases remaining after non-response weighting. Whilst we acknowledge the importance of potential measurement differences between modes, they are not considered in this paper and are left to future work. We use data from Understanding Society: the UK Household Longitudinal Study (UKHLS) to consider the following four research questions: Are CAPI / CATI follow-ups of web non-respondents required to

RQ1: maximise response rates, and how has this changed over time?

RQ2: maximise dataset representativeness, and how has this changed over time?

RQ3: maximise response by under-represented hard-to-reach population subgroups, and how has this changed over time?

RQ4: minimise non-response biases remaining after non-response weighting, and how has this changed over time?

1.1. Motivation: challenges faced in modern survey designs and changing internet use

Many social surveys face significant challenges. One is declining response rates (de Heer & de Leeuw 2002; Luiten et al. 2020). Lower response rates reduce dataset size, inflating survey estimate variances. In addition, if non-respondents and respondents differ, estimates may deviate from sample values (non-response biases), causing invalid inference. Given this, survey designers expend considerable effort on maximising survey dataset quality. Measures may be undertaken before or during data collection to increase response rates and improve dataset representativeness by increasing response in under-represented population subgroups, for instance by re-contacting non-respondents or offering multiple interview modes (bias prevention measures: Groves et al. 2001; Groves & Heeringa 2006; Wagner 2008). They may also be undertaken post collection to reduce remaining biases, such as producing non-response weights or imputing responses for non-respondents (bias adjustment measures: Carpenter & Kenward 2013; Valliant & Dever 2013; Little & Rubin 2014). Note as well that an interaction exists between the two: bias prevention measure success can increase bias adjustment effectiveness (Lundquist & Sarndal 2013; Sarndal & Lundquist 2014a, b; Schouten et al. 2016; Moore et al. 2024).

These efforts to maximise dataset quality increase survey costs. One solution to this issue concerns interview mode. It may be possible to replace traditional CAPI or CATI modes with

less costly modes such as web (Couper et al. 2007; Schonlau et al. 2009; Baker et al. 2010; Olson et al. 2020). Another advantage of web mode is that response may be greater for some population subgroups than with other modes (e.g. McGonagle & Sastry 2023). Its disadvantages are that overall response rates are often lower (Fricker et al. 2005; Jäckle et al. 2015; Kirchner & Felderer 2016; Daikeler et al. 2020; Wu et al. 2022), and that dataset quality, with the proviso concerning measurement differences mentioned in the first paragraph, tends to be maximised by use of both web and other modes (mixed mode designs: e.g. Cornese & Bosnjak 2018; Burton & Jäckle 2020; Peytchev et al. 2022). Hence, many surveys have begun to adopt designs in which first web is offered, then non-respondents are followed up by CAPI or CATI, i.e. web-first sequential mixed mode designs (see, for example, Klausch et el. 2015; Brown & Calderwood 2020; van Berkel et al. 2020, 2024; Institute for Social and Economic Research 2021, 2024a, 2024b; Lipps & Pekari 2021; Voorpostel et al. 2021; McGonagle & Sastry 2023; Office for National Statistics 2023). These can reduce costs compared to CAPI or CATI only designs (e.g. Lipps & Pekari 2021; McGonagle et al. 2023) and improve dataset quality compared to web-only designs (Dillman et al. 2009; Klausch et el. 2015; Lipps & Pekari 2021; Mackeben & Sakshaug 2023; McGonagle & Sastry 2023; Moore et al. 2024; Moore & Durrant in prep.; see section 1.2).

Whether the evidence justifying the use of costly CAPI / CATI follow-ups of web non-respondents is still valid though, is unclear. Proportions of populations with access to the internet are increasing over time, including among sub-groups that previously required use of other modes to obtain sufficient responses. For example, in the UK in 2024 86% of those aged 65+ lived in HHs with internet access, a rise of five percentage points from 2023 (Ofcom 2023, 2024). In the US in 2024, this figure was 90%, up from 88% in 2023 (Pew Research Centre 2024; see Eurostat 2024 for data from countries in the EU). In addition, possibly partly due to

the COVID-19 pandemic, survey participants may be less likely to be comfortable with inviting interviewers into their homes (Charman et al. 2024; Durrant et al. 2024), though a corollary is participants adopting 'digital detox' strategies to improve their mental health (see Radtke et al. 2022 for a review of relevant clinical interventions). These changes may affect the relative benefits of web mode and follow-ups in other modes, possibly to the point where the latter are no longer improve dataset quality. Hence, the impacts of respondents to the different modes on datasets must be re-evaluated, with a focus on how they are changing over time.

1.2. Previous research relating to aims and research questions

There is limited previous research relating to our research questions, with most instead comparing the quality of combined web plus CAPI / CATI respondent datasets to those given CAPI or CATI only designs (e.g. Bianchi et al. 2017; Voorpostel et al. 2021). Concerning RQ1, work exists on the UKHLS COVID-19 Study, a survey of participants in the long running UKHLS main survey fielded during the 2020/21 pandemic, in which ca. 1/3 of web non-respondents were followed up by CATI at several waves (Moore et al. 2024; Moore & Durrant in prep). Whilst results may have been affected by the pandemic, respondents to CATI follow-ups increased dataset size by 3-4%. Regarding other surveys, in the 2015 Swiss Election Study respondents to CATI follow-ups increased dataset size by 25% (Lipps & Pekari (2021). In another study using 2019 German LPP employee panel survey data, respondents to CATI follow-ups increased dataset size by 85% (Mackeben & Sakshaug 2023; see also Dillman et al. 2009; Klausch et el. 2015; McGonagle & Sastry 2023 for similar findings). No information exists on how the contribution of respondents to follow-ups to dataset size has changed over time.

Concerning RQ2, respondents to CATI follow-ups improved the representativeness of web respondents compared to the eligible sample in the UKHLS COVID-19 Study (Moore et al.

2024; Moore & Durrant in prep.). Similar is found for the 2015 Swiss Election Study (Lipps & Pekari 2021) and the 2019 German LPP (Mackeben & Sakshaug 2023), but CAPI follow-ups did not improve 2011 Dutch Crime Victimization Survey dataset representativeness (Klausch et al. 2015). No information exists on whether the impact of follow-ups on dataset representativeness has changed over time.

Concerning RQ3, under-representation of hard-to-reach population subgroups is also an issue because they are often the focus of substantive analyses. In the UKHLS COVID-19 Study, respondents to CATI follow-ups improved the representativeness of web respondents compared to the eligible sample for some under-represented population subgroups, such as older adults and those with low education levels, but not others, for example young adults (Moore et al. 2024; Moore & Durrant in prep.). Similar is reported for the 2015 Swiss Election Study (Lipps & Pekari 2021) and the 2019 German LPP (Mackeben & Sakshaug 2023). No information exists on whether the impact of follow-ups on under-represented subgroups has changed over time.

Concerning RQ4, non-response weights seek to map respondents to the study population. The quality of datasets weighted in this way in terms of remaining non-response biases is important because it is they that are most often used in substantive analyses. The only relevant research we are aware of is on the UKHLS COVID-19 Study (Moore et al. 2024; Moore & Durrant in prep.). Comparisons of non-response weighted estimates of main survey measured respondent characteristics to benchmark eligible sample weighted equivalents (obtaining information on population values to use as benchmarks is often difficult: e.g. Hand 2018) showed that differences were smaller for datasets including respondents to CATI follow-ups than for web respondent only datasets. No information exists on whether the impact of follow-ups on non-response weighted dataset quality has changed over time.

2. Data

We use two datasets relating to Understanding Society: the UK Household Longitudinal Study (UKHLS). The first is the main survey sample. In the waves we use for our analyses, web non-respondents were followed up with CATI. The second is the Understanding Society Innovation Panel, which has a mixed mode design with randomised allocations that have remained constant over nine survey waves, enabling comparisons over time. In this survey web non-respondents were followed up with CAPI. The main survey sample is considered because it is larger than the IP datasets, allowing us to assess population sub-group representativeness with more precision (see section 4.1 for dataset sizes).

2.1. The main *Understanding Society* survey

The UKHLS main survey is a major social science investment that follows-up a sample of people living in the UK every year (Institute for Social and Economic Research 2024a). Interviews are sought from all adults aged 16 and over in eligible households. The survey began in 2009 and includes respondents from the preceding British Household Panel Survey, which began in 1991. The samples were selected from Royal Mail's Postcode Address File using a clustered and stratified design. All samples included are probability samples (Lynn 2009). The following rules are such that all individuals in sample households are followed if they move within the UK, but become ineligible if they emigrate or die. Households that do not respond in the first wave in which they are issued and households where all members stop responding for more than two waves are not issued at later waves. Research shows that the survey continues to support valid population inference (Benzeval et al. 2020).

The first waves of the survey were implemented in CAPI. From wave 7 (2017) onwards households were issued using a web-first design. Non-responding adults in web-first households were followed up in CAPI. At Wave 7 it was non-responding households from Wave 6 that were issued web-first. From Wave 8 onwards a proportion of the sample with high predicted probability of completing the survey online were issued to web-first, with non-respondents followed up in CAPI. The proportion issued to web-first increased over time, to include households with lower predicted probabilities of completing the survey online. A fixed random 20% of the sample was ring-fenced and always allocated to CAPI first. During the COVID-19 pandemic all CAPI interviewing was suspended and this ring-fenced random sub-sample was issued to web-first for the first time, with non-respondents followed up in CATI. As this is a random sub-set of the original sample, it is the sample we examine in our analyses. These data cover April to December 2020 (wave 11, quarters 6-8, and wave 12, quarters 2-4).

2.2. UKHLS Innovation Panel (IP)

The UKHLS Innovation Panel (IP) is an annual longitudinal survey of the UK population excluding Northern Ireland that is separate to the UKHLS main survey, and is designed for experimental and methodological research related to longitudinal surveys (Institute for Social and Economic Research 2024b). Its design, content and data collection procedures are as far as possible the same as in the main survey, but at the same time multiple experimental studies are conducted. The IP began in 2008, so that currently 16 waves of data have been released. In addition to the original wave 1 survey sample, five refreshment samples have been added, at waves 4, 7, 10, 11 and 14.

The IP was also first fielded as a CAPI survey, but since 2012 (wave 5) has used a sequential mixed mode design including web. Initially, sample members could only utilise web mode on

a PC or tablet, but from 2016 (wave 8) smartphones could also be used. At IP5 all issued households were randomly allocated to one of two treatments: one-third to CAPI-first with follow up in other modes, and two-thirds to web-first with follow-up in CAPI. These allocations have remained fixed over time, excluding a small number of households with very low propensity to respond online who are allocated to CAPI first and excluded from our analyses. The refreshment samples were similarly allocated to one of the two treatments, although at waves 7 and 10 initial interviews were CAPI only, with allocation to one of the treatments occurring at a subsequent wave. In 2012 (wave 12), one third of the sample was allocated to an experiment involving data collection by nurses, with only a third allocated to web-first, too small a dataset for analyses. In 2020 (wave 13) and 2021 (wave 14) CAPI interviews were suspended due to the COVID-19 pandemic and all sample members allocated to web-first with CATI follow-up. Given such differences, these three waves are excluded from our analyses.

2.3. Analysis samples

For the main survey, the analysis sample consists of all adults eligible for annual interviews in the ring-fenced CAPI sample, who were issued to field in the relevant months of waves 11 and 12 (see also Table 1 for datasets considered in the study). Sample members who have died or moved out of scope are removed and we retain only cases allocated to web-first mode. The resulting analysis sample includes one observation each on 6048 adults issued to annual interviews.

For the IP we use waves 5 to 11, 15, and 16. The analysis samples are constructed in the same way as for the main survey dataset (see section 3.1 for the treatment of refreshment samples). They include 18,926 observations on 4,943 sample members issued to annual interviews at least once.

2.4. Covariates used in analyses

Our analysis samples include all adults eligible for annual interviews whether they respond or not. This means we are limited to information known about all issued household members, and so cannot use the detailed information collected in the annual interviews because it only exists for survey respondents. Hence, instead we use the information from the household grid, which the first person in each household to start the survey is asked to complete, and the similarly collected household questionnaire. We use the following covariates: sex (male, female), age (16-34, 35-54, 55-74, 75+), activity last week (in work, not in work), housing tenure (owner occupied, mortgage, rented / other), household structure (1 adult; 1 adult, kids; couple, no kids; couple, kids; other), region (north, east, south, west), behind with paying bills (no, yes), behind with paying council tax (no, yes), household location (urban, rural), equivalised household income (quintiles) and number of rooms in household (continuous).

The item non-response rates for these covariates can be high, up to ~35%, due to household non-response and a lack of household grid / questionnaire information for the wave. However, we could reduce these rates to 0% to ~13% by using values from household grids / questionnaires from previous or future waves. We then utilise imputation using values of other individuals with similar characteristics to replace the remaining missing values. We document these procedures in Appendix A1.

3. Methods

In our analyses, we use the samples issued to the field as the analysis samples. However, the composition of the issued samples over time is potentially altered by attrition. We therefore construct weights to adjust their composition for differential attrition. In the following sections we present how these weights are calculated, the methods used to assess the representativeness of respondent samples by modes, how non-response weights are constructed to adjust the respondent samples for sample member non-response to the survey at each wave, and the methods used to evaluate non-response biases remaining after non-response weighting.

3.1. Construction of sample inclusion weights

The sample inclusion weights are designed to adjust the issued sample at each wave to the composition of the study populations. The calculation of the weights is described in detail in Appendix A2, which also includes evaluations of weighted dataset quality. The following provides a brief overview. As a starting point we use the inclusion enumeration weights that are released with the publicly available data for each (refreshment) sample. These weights provide an inclusion weight for all sample members in households where at least one person completed the annual interview and the household grid enumerating all household members, at the wave the household first entered the survey. Hence, they serve as sample inclusion weights at the next wave. Given also that some refreshment samples were not allocated to web-first until a wave after the one at which they entered the survey, the wave 4 refreshment sample entered our analysis sample at wave 5, the wave 7 refreshment sample at wave 9, the wave 10 refreshment sample at wave 11, and, due to waves 12-14 not being considered (see section 2.2), the waves 11 and 14 refreshment samples at wave 15.

At each wave the sample inclusion weights are then adjusted for sample attrition: individuals in households in which nobody responds for two waves are excluded from the following wave's sample, as are individuals who ask to be removed from the study or request an interview mode different from what they were allocated to. This adjustment is based on estimating the probability of inclusion in the issued sample using the covariates listed in section 2.2, calculating the inverse predicted probabilities of inclusion, and multiplying this with the original enumeration weight. There are, however, some sample members for whom the sample inclusion weights cannot be calculated in this way, because they moved into the household after the wave in which it was first included in the survey. Therefore, if other household members have an adjusted weight, at the next stage the calculated weights are shared with such individuals so that they also have a valid weight. Following this, to weight the remaining unweighted individuals (i.e. those in households where nobody has an adjusted weight), the weights of individuals with similar covariate values are shared with them. In the final stage, the weights are post-stratified to the cross-tabulation of sex (2 categories), age (5 categories), and region (4 categories) of estimated population totals for the given year. Note that sample inclusion weights are produced for all individuals in samples including under 16s (by including an additional age 0-15 years category), so that individuals that reach 16 and are interviewed for the first time as adults at analysis waves are weighted.

3.2. Methods to evaluate the representativeness of respondent samples

Representativeness indicators (R-indicators and Coefficients of Variation of response propensities (CVs): see Schouten et al. 2012) are used to evaluate the representativeness of respondent samples. These indicators quantify variation in response propensities that are estimated by regression using auxiliary covariates available for all sample members. If

covariates and survey variables are correlated, low propensity variation (representativeness) implies low non-response bias risk. Overall indicators quantify dataset representativeness. Partial variants consider propensity variation associated with auxiliary covariates. Unconditional forms quantify deviations from representativeness, conditional forms quantify deviations from conditional representativeness (a random sample after stratifying by the other covariates). Statistical inference is possible. Supporting indicator use, Schouten et al. (2016) reported that high representativeness reduces biases, though Nishimura et al. (2017) found that performance depends on auxiliary covariate - survey variable correlations.

To quantify overall dataset representativeness, we calculate the overall CV, for sample size *n* and auxiliary covariate set ***x***, producing the propensity vector $p_{\boldsymbol{x}}$,

$$\widehat{CV}(p_{\boldsymbol{x}}) = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\hat{p}_i-\hat{\bar{p}})^2}}{\hat{\bar{p}}}, \quad (1)$$

where $\hat{p}_i$ is the response propensity of subject *i* and $\hat{\bar{p}}$ average response propensity. The numerator term is the response propensity standard deviation, *SD*. Weights can be applied when estimating propensities to map sample members to the population. The less propensities differ between sample members, the smaller the overall CV and the greater dataset representativeness. The overall R-indicator, $\hat{R}(p_{\boldsymbol{x}}) = 1 - 2SD$, is the *SD* scaled to between 0 and 1 (larger values imply greater dataset representativeness). Both indicators are comparable across datasets, but Schouten et al. (2009: see also Moore et al. 2018) advise using CVs when response rates differ because dividing *SD* by $\hat{\bar{p}}$ means they are less likely to falsely suggest high representativeness at very low or very high response rates due to low propensity variation. In addition, overall CVs predict maximal absolute survey variable standardised non-response biases (Schouten et al. 2011). As evaluated dataset response rates differ (see 'Results'), we use CVs in this paper. Partial unconditional and conditional CV (CV_us

and CV_cs) computation, sampling bias adjustments and CV standard errors (which can be converted into 95% confidence intervals for statistical inference), are described in Appendix A3.

In our analyses, we use eight of the covariates listed in section 2.2 in the regression models estimating response propensities. These are: Sex, Age, Activity last week, Housing tenure, Household structure, Region, Behind with paying bills and Household income. To quantify overall dataset representativeness, we compute overall CVs and their 95% confidence intervals (CIs) for web and web plus CAPI / CATI respondent datasets. To quantify the impacts of follow-ups on under-represented population subgroups, for the eight covariates we compute covariate category unconditional and conditional CVs and their 95% CIs. To compute CVs, we use the R code of de Heij et al. (2015). This code allows survey strata, but not primary sampling unit (PSU), to be accounted for in analyses.

3.3. Construction of non-response weights

The non-response weights are designed to adjust the sample inclusion weights for non-response at the wave in question. The methods used to construct these weights are analogous to those used to construct the sample inclusion weights (see section 3.1), with the covariates listed in section 2.2 used to calculate predicted probabilities of response, then the inverse of these probabilities multiplied with the sample inclusion weight. Note that all respondents are weighted using these methods, so that the weight sharing techniques used to construct sample inclusion weights for otherwise un-weighted individuals are not used. We construct weights for both web and web plus CAPI / CATI datasets.

3.4. Methods to evaluate remaining non-response biases after non-response weighting

We evaluate non-response biases remaining after non-response weighting by quantifying differences in non-response weighted estimates of respondent characteristics as measured by the variables listed in section 2.2 to equivalent benchmark sample inclusion weighted estimates for issued sample members. These methods are analogous to those used to evaluate the sample inclusion weights (see Appendix A2). Given partial dependencies between datasets (web respondents are a subset of web plus CAPI / CATI respondents), to statistically compare estimates we use the test of Moore et al. (2024: see Appendix A3 for details). Survey strata and PSU are accounted for in analyses, with the average of the variances for the other strata used for strata with only a single PSU (which occur in some IP analysis samples: see Stata Corp. 2023). In addition, as overall quality measures, we report means of absolute differences between estimates standardised by benchmark estimate standard deviations. These means are the primary focus in the paper. We evaluate web and web plus CAPI / CATI datasets.

4. Results

4.1. RQ1: Are CAPI / CATI follow-ups of web non-respondents required to maximise respondent dataset size, and how has this changed over time?

In the 2020 main survey sample, 6,048 individuals were issued to the field. 68% responded overall by web or CATI (4,125 individuals). 51% of the sample responded by web (3,111 individuals) and 17% by CATI (1,014 individuals). CATI follow-up therefore increased respondent dataset size by nearly a third.

For the IP data the issued sample and respondent dataset sizes and response rates at each wave are reported in Table 2. Issued sample sizes range from ca.1,500 (at wave 8) to c.3,000 (at wave 15). Sample sizes were larger in waves when refreshment samples entered our analysis datasets (see section 3.1 for details), then decrease at following waves due to members attriting from the issued sample. Overall (i.e. web plus CAPI) percentages responding ranged from 59% (at wave 15) to 81% (at wave 9). They tend to be lowest at waves when refreshment samples enter the analysis datasets, then increase at following waves. This reflects the usual pattern in longitudinal surveys, that attrition rates are highest in the first few waves and then level out. The percentages responding by web (mostly) increase across waves, from 32% at wave 5 to 59% at wave 16, corresponding to 643 and 1,735 respondents respectively. The percentages responding by CAPI decrease across waves, from 32% at wave 5 to 4% at wave 16, corresponding to 650 and 132 respondents respectively. That is, while the CAPI follow-up of web non-respondents does increase response rates, the additional gains have diminished over time, increasing respondent dataset size by only around 8% in the last observed wave.

4.2. RQ2: Are CAPI / CATI follow-ups required to maximise respondent dataset representativeness, and how has this changed over time?

In the 2020 main survey sample, the overall representativeness of web respondents as estimated by the overall CV is 0.28 (95% CI 0.25 – 0.30). Given that indicator 95% CIs do not overlap zero, this implies that such respondents are not representative of the issued sample. The web plus CATI respondent CV is statistically significantly (95% CIs do not overlap) smaller than for the web dataset at 0.21 (95% CI 0.19 – 0.22), implying that follow-ups improve dataset representativeness.

IP dataset respondent representativeness at each wave as measured by overall CVs is reported in Figure 1 (see Appendix A4 Table 1 for tabulated values and 95% CIs). Web respondent CVs all differ significantly from zero, implying non-representativeness. They tend to decline across waves, from 0.46 at wave 5 to 0.18 at wave 16. Web plus CAPI respondent CVs are also all significant. They are broadly similar across waves, ranging from 0.16 (wave 10) to 0.24 (wave 7), with 95% CIs that often overlap. At waves 11 (just), 15 and 16, their 95% CIs overlap those of web respondents, i.e. the representativeness of the two datasets does not differ. Note that this trend is due to increases in web dataset representativeness, with the ability of CAPI to impact on datasets at later waves reduced because there are fewer respondents by the mode (see section 4.1). Hence, whilst CAPI is needed at waves 5 to 10 to maximise dataset representativeness, from wave 11 on it has no impact on datasets.

4.3. RQ3: Are CAPI / CATI follow-ups required to maximise response by under-represented population subgroups, and how has this changed over time?

For the 2020 main survey sample, the covariate category unconditional CVs (CV_us) are reported in Figure 2a (see Appendix A4 Table 2 for tabulated values and 95% CIs). 11 of the 27

categories considered are significantly under-represented in the web dataset, i.e. their CV_us are negative, with 95% CIs that do not overlap zero. These are: Age: 75+; Activity last week: Not in work; Housing tenure: Rented / Other; Household Structure: 1 adult; Region: north; Household income: 1st quintile; Sex: Male; Age: 16-34; Household Structure: 1 adult, kids; Household Structure: Other; and Behind with bills: Yes. The CATI follow-up significantly reduces under-representation of the first six of these categories, i.e. the web plus CATI dataset CV_u is smaller in magnitude than for the web dataset, and indicator 95% CIs do not overlap. In fact, Household Structure: 1 adult and Household income: 1st quintile become significantly over-represented i.e. have positive CV_us with 95% CIs that do not overlap zero. The CATI follow-up does not significantly (i.e. CV_u 95% CIs overlap) reduce under-representation of the other five categories, though Region: north 95% CIs do overlap zero, i.e. the category becomes representative. Moreover, it leads to significant under-representation of the previously representative category Household income: 5th quintile.

The above category CV_us may identify largely separate population subgroups, or a smaller number of subgroups with combinations of the mentioned characteristics. Partial conditional category CVs (CV_cs) enabling this question to be addressed are reported in Figure 2b (see Appendix A4 Table 3 for tabulated values and 95% CIs). A significant CV_c (i.e. with 95% CIs that do not overlap zero; note also that CV_cs are only positive) given a significant CV_u implies an impact not correlated with other covariates, i.e. one that it not due to a subgroup with a combination of the CV_u identified characteristics (see section 3.2). Although generally slightly smaller in magnitude, in most instances CV_c equivalents of the mentioned significant CV_us are also significant, the exceptions being web respondent Behind with Bills: Yes and web plus CAPI respondent Activity Last week: Not in work (see Appendix A4 Figure 1 and Appendix A4 Table 3 for tabulated values and 95% CIs). Hence, under-representation of largely separate

population subgroups among respondents is reduced by CATI for some subgroups but not others, and it causes under-representation in one subgroup.

For the IP datasets, the category CV_us are reported in Figure 3 (see Appendix A4 Tables 4 and 6 for tabulated values and 95% CIs). To save space, we discuss only instances where consistent under-representation exists across waves (9 of the 27 categories considered), and not cases where it occurs at odd waves. Categories identified are similar to those identified for the main survey 2020 sample. The CAPI follow-up significantly reduces (i.e. the web plus CAPI dataset CV_u is smaller in magnitude, with 95% CIs that do not overlap those for the web dataset CV_u) significant under-representation in web datasets for the categories: Age: 75+ (from waves 5 to 11, but not at later waves); Activity last week: Not in work (from waves 5 to 8, with the category becoming significantly overrepresented, but not at later waves); Housing tenure: Rented / Other (waves 5 to 10, but not at later waves); Household structure: 1 adult (from waves 5 to 7, but not at later waves); and Household income: 1st quintile (waves 5 to 10, but not at later waves). Note again that these trends are due to category under-representation decreasing across waves in web datasets, with the ability of CAPI to impact on datasets at later waves reduced because there are fewer respondents by the mode. CAPI does not significantly improve representation in web datasets for the categories: Behind with bills: Yes; Household income: 2nd quintile (although CV_us for these two categories become mostly not significantly different from zero); Sex: Male; and Age: 16-34.

The above category CV_us again identify largely separate population subgroups (Fig. 4: see Appendix A4 Tables 5 & 7 for tabulated values and 95% CIs). Category CV_cs are only consistently non-significant at waves for which category CV_us are significant for Activity last week: Not in work and Behind with bills: Yes, although for the other mentioned categories they may be smaller in magnitude than CV_us. Hence, CAPI reduces under-representation in

datasets for some population subgroups but not others, with the likelihood of doing so less at later waves.

4.4. RQ4: Are CAPI / CATI follow-ups required to minimise non-response biases remaining after non-response weighting, and how has this changed over time?

We now consider non-response biases remaining after non-response weighting. For the 2020 main survey sample, the web dataset standardised mean of absolute biases in non-response weighted estimates of survey measured characteristics compared to sample inclusion weighted benchmarks across considered characteristics is 0.006 (95% CI = 0.004 – 0.008). The mean for the web plus CATI dataset, though very slightly smaller, is not statistically significantly different (i.e. 95% CIs overlap) at 0.004 (95% CI 0.003 – 0.005). Biases are reported for each characteristic separately in Appendix A4 Table 8. All estimates are prevalences, so can be multiplied by 100 to give percentages. No web dataset biases are significant (i.e. have 95% CIs that do not overlap zero) or above 1 percentage point. Similar holds for the web plus CATI dataset. Hence, the CATI follow-up has no impact on non-response biases remaining after non-response weighting.

IP dataset non-response biases remaining after non-response weighting are reported in Table 3. The web dataset standardised mean of absolute biases in weighted estimates of survey measured characteristics compared to sample inclusion weighted benchmarks across considered characteristics is 0.024 at wave 5. The means then (mostly) decrease across waves, to 0.004 at wave 16. Similar web plus CAPI dataset mean biases are all below 0.01, with no trend across waves, and are significantly smaller (their 95% CIs do not overlap) than for web datasets at waves 5 to 9, but no different from wave 10 on. Concerning biases for each characteristic, for the web dataset none are significant or above 3 percentage points at any

wave, though they are often smaller at later waves (Appendix A4 Tables 9 & 10). Similar web plus CAPI dataset biases are all below one percentage point and non-significant, with no trends across waves (Appendix A4 Tables 11 & 12). Note that, analogous to with dataset representativeness, these trends are due to declines in biases across waves in web datasets, with the ability of CAPI to impact on datasets at later waves reduced because there are fewer respondents by the mode. Hence, whilst CAPI is needed at waves 5 to 9 to minimise non-response biases remaining after non-response weighting, from wave 10 on it has no impact on datasets.

5. Conclusions and implications for survey practice

Summary: We examined the impact on dataset quality (i.e. response rates and dataset size, dataset representativeness and non-response biases remaining after non-response weighting) of CATI and CAPI follow-ups of web non-respondents in web-first sequential mixed mode survey designs, and how it has changed over time. We considered two datasets from Understanding Society: the UK Household Longitudinal Study (UKHLS), a main survey dataset from 2020 with CATI follow-ups, and Innovation Panel (IP) datasets spanning the period 2012-2023, with CAPI follow-ups. The main survey dataset was considered because it was larger than the IP datasets, allowing us to assess the representativeness of population sub-groups with greater precision.

Key findings: Our analyses of **the 2020 main survey dataset** show that CATI follow-ups of web non-respondents improved dataset size and overall respondent dataset representativeness compared to the (weighted) issued sample. In addition, they showed that such follow-ups improved representation of *some* under-represented population subgroups but not others, and for one subgroup even worsened under-representation. However, analyses also showed that follow-ups *did not* help to reduce non-response biases remaining after non-response weighting of datasets: remaining biases were similar for web-only and web plus CATI datasets. These findings are broadly comparable to those of previous research (Dillman et al. 2009; Klausch et el. 2015; Lipps & Pekari 2021; Mackeben & Sakshaug 2023; McGonagle et al. 2023; Moore et al. 2024; Moore & Durrant in prep; see also Introduction).

Our **analyses of the 2012-2023 IP datasets** showed that increases in dataset size due to CAPI follow-ups *declined* to 8% by the end of the study period. Overall dataset representativeness compared to the issued sample was *improved* by follow-ups at survey waves 5 to 10 (2012-2017), but *not* at later waves. Similar under-represented population subgroups were identified

to those identified in the main survey dataset (note that further comparisons between main survey and IP datasets are difficult because of differences in the length of time respondents were presented with web mode and the use of different follow-up modes). The representation of some was *improved* by follow-ups until wave 11 (2018), but *not* at later waves (no improvements occurred for other such subgroups at any waves). Non-response weighted dataset quality in terms of remaining non-response biases was *improved* by follow-ups from waves 5 to 10, but *not* at later waves. Both the patterns in dataset representativeness and in non-response weighted dataset quality were due to improvements in web datasets across waves, with the ability of CAPI to impact on datasets at later waves reduced because there were fewer respondents by the mode. These findings are to our knowledge the first concerning how the impact of CAPI / CATI follow-ups of web non-respondents on dataset quality in web-first sequential mixed mode survey designs has changed over time.

Implications of findings for survey practice: Our findings concerning how the impact on dataset quality of CAPI or CATI follow-ups of web non-respondents has changed over time imply that such follow-ups are still needed to maximise quality, but that their impacts are declining over time. They further imply - assuming internet access levels in the UK continue to increase as they have done in recent years (see Ofcom 2023, 2024) and a correlation between them and web dataset quality - that at some point soon follow-ups may no longer be needed to maximise quality. If this occurs, consideration can be given to discontinuing follow-ups, thereby offering an opportunity to reduce survey costs (though with government surveys at least, aspects such as accessibility and inclusiveness will also need to be considered). We hence recommend that other surveys, if they do not do so already, should begin to continuously evaluate the impact of non-response follow-ups on dataset quality.

Limitations: One limitation of our research is that the non-response weighted estimates of respondent characteristics were not compared to actual population values. This is because, as in many studies (see Hand 2018), population values for most were not available. Instead, we compared them to similar benchmark estimates calculated using the weighted issued samples: see Benzeval et al. (2020) for evidence that similar estimates approximate population values. The characteristics we could consider were also limited to the mainly sociodemographic and often HH level characteristics measured in the household grid and questionnaire elements of the survey, which were available for all sample members whether they responded or not. A second limitation is that we studied a longitudinal survey in which sample members were repeatedly interviewed and may have become accustomed to web mode. To an extent, this was mitigated by refreshment samples regularly entering the IP datasets, but findings may differ in cross-sectional surveys that only interview individuals once. A third limitation is the study period itself. The COVID-19 pandemic led to survey agencies losing many experienced interviewers, a loss that is still to be made up for. Hence, even though our findings showing declines in the impact of CAPI / CATI follow-ups on datasets seem to be due to web datasets improving, less effective CAPI / CATI interviewing (particularly following the pandemic with its impact on interviewer recruitment and retention, at least in the short- and intermediate-term) may also have been involved.

Future research: Our findings indicate three questions that should be pursued in future research on this topic. The first is to repeat our analyses on *future UKHLS datasets*, to assess whether a point where web-only designs produce datasets of similar quality to those produced by also following up non-respondents by CAPI or CATI is reached. The second is to investigate whether findings are comparable in *other surveys*. This work should consider both other UK surveys and surveys in other countries: different results in the latter especially may

be expected due to differences in levels of internet access (e.g. Eurostat 2024). In addition, it should consider cross-sectional surveys, surveys where web non-respondents are followed up in modes other than CATI or CAPI, such as paper (a common design: see Olson et al. 2021), and surveys where 'knock-to-nudge' approaches in which non-respondents are contacted to encourage completion by web are used (e.g. Kastberg & Siegler 2022; Kunz et al. 2024). This work would also benefit if it could consider a wider range of individual level characteristics than was possible in this paper. Third, the final question is to investigate in more depth whether findings are similar for *population subgroups* such as young and old adults and ethnic minorities. These are often the focus of substantive analyses, and also form 'populations' themselves, with, as in general populations, individuals possessing differing (other) characteristics that may be correlated with response probabilities and hence should be considered when evaluating dataset quality. This can be undertaken by repeating the analyses reported here on relevant individuals alone and comparing findings, and will be a focus in our future research.

6. References

Baker, R., Blumberg, S., Brick, M.J., Couper, M.P., Courtright, M., Dennis, M., Dillman, M., Frankel, M.R., Garland, P., Groves, R.M., Kennedy, C., Krosnick, J., Lee, S., Lavrakas, P.J., Link, M., Piekarski, L., Rao, K., Rivers, D., Thomas, R.K. & Zahs, D. (2010) *AAPOR report on online panels.* American Association for Public Opinion Research.

Benzeval, M., Bollinger, C. R., Burton, J., Crossley, T.F. & Lynn, P. (2020) *The representativeness of Understanding Society.* Understanding Society Working Paper Series 2020–08, Institute for Social and Economic Research.

Bianchi, A., Biffignandi, S. & Lynn, P. (2017) Web-face-to-face mixed-mode design in a longitudinal survey: effects on participation rates, sample composition, and costs. *Journal of Official Statistics*, 33: 385-408.

Brown, M. & Calderwood, L. (2020) *Mixing modes in longitudinal surveys: an overview*. Centre for Longitudinal Studies.

Burton, J. & Jäckle, A. (2020) *Mode Effects*, Understanding Society Working Paper 2020- 05. Colchester: University of Essex.

Carpenter, J.R. & Kenward, M.G. (2013) *Multiple Imputation and Its Application.* John Wiley & Sons, Ltd., Chichester. https://doi.org/10.1002/9781119942283

Charman, C., Mesplie-Cowan, S. & Collins, D. (2024) The post-pandemic role of face-to-face fieldworkers. https://surveyfutures.net/wp-content/uploads/2024/03/report-1-post-pandemic-role-face-to-face-fieldworkers.pdf

Cornesse, C. & Bosnjak, M. (2018) Is there an association between survey characteristics and representativeness? A meta-analysis. *Surv. Res. Meth.*, 12: 1-13. https://doi.org/10.18148/srm/2018.v12i1.7205

Couper, M. P., Kapteyn, A., Schonlau, M. & Winter, J. (2007) Noncoverage and nonresponse in an Internet survey. *Soc. Sci. Res.* 36: 131–148. https://doi.org/10.1016/j.ssresearch.2005.10.002

Daikeler, J., Bosnjak, M., & Lozar Manfreda, K. (2020). Web versus other survey modes: An updated and extended meta-analysis comparing response rates. *J. Surv. Stat. Meth.,* **8**, 513–539. https://doi.org/10.1093/jssam/smz008

De Heer, W., & De Leeuw, E. (2002). Trends in household survey nonresponse: A longitudinal and international comparison. *Survey nonresponse*, *41*, 41-54.

de Heij, V., Schouten, B. and Shlomo, N. (2015) RISQ Manual 2.1: Tools in SAS and R for the computation of R indicators and partial R indicators. Available from: www.risq-project.eu.

de Leeuw, E. (2018), Mixed-Mode: Past, Present, and Future. *Survey Research Methods*, 12: 75 – 89.

Dillman, D. A., Phelps, G., Tortora, R., Swift, K., Kohrell, J., Berck, J. & Messer, B. L. (2009) Response rate and measurement differences in mixed-mode surveys using mail, telephone, interactive voice response (IVR) and the Internet. Soc. Sci. Res 38: 1-18.

Dillman, D.A., Smyth, J.D. & Christian, L.M. (2014) *Internet, phone, mail, and mixed-mode surveys: the tailored design method*. Hoboken, New Jersey: John Wiley & Sons.

Durrant, G., Kocar, S., Brown, M., Hanson, T., Sanchez, C., Wood, M., Taylor, K., Tsantani, M. & Huskinson, T. (2024) *Live video interviewing: evidence of opportunities and challenges across seven major UK Social Surveys*. https://surveyfutures.net/wp-content/uploads/2024/06/working-paper-01-live-video-interviewing

Eurostat (2024) *Digital economy and society statistics - households and individuals.* https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Digital_economy_and_society_statistics_-_households_and_individuals#:~:text=In%20the%20EU%2C%20the%20share,or%20goods%20online%20in%202024.

Fricker, S., Galesic, M., Tourangeau, R. & Yan, T. (2005) An Experimental Comparison of Web and Telephone Surveys. *POQ*, **69**, 370–392. https://doi.org/10.1093/poq/nfi027

Groves, R. M., Dillman, D. A., Eltinge, J. L., & Little, R. J. (eds.) (2001) *Survey Nonresponse*. Wiley Series in Survey Methodology.

Groves, R. M. & Heeringa, S. (2006) Responsive design for household surveys: tools for actively controlling survey errors and costs*. J. Roy. Stat. Soc. A.*, **169**, 439-457. https://doi.org/10.1111/j.1467-985X.2006.00423.x

Hand, D. J. (20180 Statistical Challenges of Administrative and Transaction Data, *Journal of the Royal Statistical Society Series A: Statistics in Society*, 181, 555–605, https://doi.org/10.1111/rssa.12315

Institute for Social and Economic Research (2021) *Understanding Society COVID-19 User Guide. Version 10.0.* Colchester: University of Essex.

Institute for Social and Economic Research (2024) *Understanding Society – The UK Household Longitudinal Study, Innovation Panel, Waves 1-16, User Manual.* Colchester: University of Essex.

Institute for Social and Economic Research (2024b) *Understanding Society: Waves 1-14, 2009-2023 and Harmonised BHPS: Waves 1-18, 1991-2009, User Guide*, Colchester: University of Essex.

Jäckle, A., Lynn, P. & Burton, J. (2015) Going Online with a Face-to-Face Household Panel: Effects of a Mixed Mode Design on Item and Unit Non-Response, *Surv. Res. Meth.* 9: 57-70. https://doi.org/10.18148/srm/2015.v9i1.5475

Kastberg, S. & Siegler, V. (2022) *Impact of COVID-19 on ONS social survey data collection*. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/methodologies/impactofcovid19ononssocialsurveydatacollection

Kirchner, A. & Felderer, B. (2016) The Effect of Nonresponse and Measurement Error on Wage Regression across Survey Modes: A Validation Study. In: *Total Survey Error in Practice* (eds. Biemer, P. P., De Leeuw, E., Eckman, S., Edwards, B., Kreuter, F., Lyberg, L. E., Tucker, N. C. & West, B. T.), pp. 531–556, Hoboken: John Wiley & Sons. https://doi.org/10.1002/9781119041702

Klausch, T., Hox, J. & Schouten, B. (2015) *Assessing the mode dependency of sample selectivity across the survey response process.* Statistics Netherlands, The Hague.

Kunz, T., Daikeler, J. & Ackermann-Piek, D. (2024) 'Interviewer-observed paradata in mixed-mode and innovative data collection', *International Journal of Market Research*, 66: 14-26.

Lipps, O. & Pekari, N. (2021) Sequentially mixing modes in an election survey. *Survey Methods: Insights from the Field.* Retrieved from https://surveyinsights.org/?p=15281

Little, R. J., & Rubin, D. B. (2014) *Statistical analysis with missing data*, Wiley: New York. https://doi.org/10.1002/9781119013563

Lundquist, P. & Sarndal, C.-E. (2013) Aspects of responsive design with applications to the Swedish Living Conditions Survey. *J. Off. Stat.* **29**, 557–582. https://doi.org/10.2478/jos-2013-0040

Luiten, A., Hox, J., & de Leeuw, E. (2020) Survey Nonresponse Trends and Fieldwork Effort in the 21st Century: Results of an International Study across Countries and Surveys. *Journal of Official Statistics*, *36*, 469-487. https://doi.org/10.2478/jos-2020-0025

Lynn, P. (2009) *Sample Design for Understanding Society.* Understanding Society Working Paper Series, 2009–01, Institute for Social and Economic Research.

Mackeben J. & Sakshaug J.W. (2023) Transitioning an employee panel survey from telephone to online and mixed-mode data collection. *Stat. J. IAOS*. 39: 213-232. https://doi.org/10.3233/SJI-220088

McGonagle K.A. & Sastry N. (2023) Transitioning to a Mixed-Mode Study Design in a National Household Panel Study: Effects on Fieldwork Outcomes, Sample Composition and Costs. *Surv Res Methods*. 17: 411-427. https://doi.org/10.18148/srm/2023.v17i4.8172

Moore, J.C., Durrant, G.B. & Smith, P.W. (2018) Data set representativeness during data collection in three UK social surveys: generalizability and the effects of auxiliary covariate choice. *J. Roy. Stat. Soc. Ser. A,* 181: 229-248. https://doi.org/0964–1998/18/181229

Moore, J.C., Burton, J., Crossley, T. F., Fisher, P., Gardiner, C., Jäckle, A., & Benzeval, M. (2024) *Assessing Bias Prevention and Bias Adjustment in a Sub-Annual Online Panel Survey*. Understanding Society Working Papers Series 2024-04.

Nishimura, R., Wagner, J. & Elliott, M. (2016). Alternative indicators for the risk of non-response bias: a simulation study. *Int. Stat. Rev.,* 84, 43-62. https://doi.org/10.1111/insr.12100

Ofcom (2023) Ofcom technology tracker 2023.
https://www.ofcom.org.uk/siteassets/resources/documents/research-and-data/data/statistics/2023/technology-tracker/technology-tracker-2023-data-tables?v=329770

Ofcom (2024) Ofcom technology tracker 2024.
https://www.ofcom.org.uk/siteassets/resources/documents/research-and-data/data/statistics/2024/technology-tracker/technology-tracker-2024-data-tables.pdf?v=374153

Office for National Statistics (2023) *Transformed Labour Force Survey background user guide.* https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/methodologies/transformedlabourforcesurveyuserguidance

Olson, K., Smyth, J.D., Horwitz, R., Keeter, S., Lesser, V., Marken, S., Mathiowetz, N.A., McCarthy, J.S., O'Brien, E., Opsomer, J.D. & Steiger, D. (2021) Transitions from telephone surveys to self-administered and mixed-mode surveys: AAPOR task force report. *J. Surv. Stat. Meth.* 9: 381-411. https://doi.org/10.1093/jssam/smz062

Peytchev, A., Pratt, D. & Duprey, M. (2022) Responsive and adaptive survey design: Use of bias propensity during data collection to reduce nonresponse bias. *J. Surv. Stat. Meth.* **10**, 131-148. https://doi.org/10.1093/jssam/smaa013

Pew Research Center (2024) *Internet/Broadband fact sheet.* https://www.pewresearch.org/internet/fact-sheet/internet-broadband/

Radtke, T., Apel, T., Schenkel, K., Keller, J. & von Lindern, E. (2022) Digital detox: An effective solution in the smartphone era? A systematic literature review. *Mobile Media & Communication* 10: 189-215.

Sarndal, C.-E. and Lundquist, P. (2014a) Balancing the response and adjusting estimates for nonresponse bias: complementary activities. *J. Soc. Statist.*, **155**, 28–50. http://www.numdam.org/item/JSFS_2014__155_4_28_0/

Sarndal, C.-E. and Lundquist, P. (2014b) Accuracy in estimation with nonresponse: a function of the degree of imbalance and degree of explanation. *J. Surv. Stat. Meth.* **2**, 361–387. https://doi.org/10.1093/jssam/smu014

Schonlau, M., Soest, A. van, Kapteyn, A. & Couper, M. (2009) Selection Bias in Web Surveys and the Use of Propensity Scores: *Soc. Meth. Res.* 37: 291-318. https://doi.org/10.1177/0049124108327128

Schouten, B., Cobben, F. and Bethlehem, J. (2009) Indicators for the representativeness of survey response. *Survey Methodology,* 35, 101-113.

Schouten, B., Shlomo, N. and Skinner, C. (2011) Indicators for monitoring and improving representativeness of response. *Journal of Official Statistics*, 27, 231-253.

Schouten, B., Bethlehem, J., Beullens, K., Kleven, Ø., Loosveldt, G., Luiten, A., Rutar, K., Shlomo, N. and Skinner, C. (2012) Evaluating, comparing, monitoring, and improving representativeness of survey response through R-indicators and partial R-indicators. *Int. Statist. Rev.*, 80, 382-399. https://doi.org/10.1111/j.1751-5823.2012.00189.x

Schouten, B., Cobben, F., Lundquist, P. & Wagner, J. (2016) Does more balanced survey response imply less non-response bias? *J. Roy. Stat. Soc. A,* **179**, 727-748. https://doi.org/10.1111/rssa.12152

Valliant, R., Dever, J. A., & Kreuter, F. (2013). *Practical tools for designing and weighting survey samples (Vol. 1)*. New York: Springer. https://doi.org/10.1007/978-1-4614-6449-5

van Berkel, K., van der Doef, S., & Schouten, B. (2020) Implementing adaptive survey design with an application to the Dutch health survey. *J. Off. Stat.*, **36**, 609-629. https://doi.org/10.2478/jos-2020-0031

van Berkel, K., van Den Brakel, J., Groffen, D., & Burger, J. (2024) Experiences with mixed-mode surveys in times of COVID-19 at Statistics Netherlands. *Stat. J. IAOS*, **40**, 361-373. https://doi.org/10.3233/SJI-230092

Voorpostel, M., Lipps, O., & Roberts, C. (2021). Mixing modes in household panel surveys: Recent developments and new findings. In: *Advances in longitudinal survey methodology* (ed. P. Lynn), pp. 204-226. Wiley.

Wagner, J. R. (2008) *Adaptive Survey Design to Reduce Nonresponse Bias.* PhD diss., University of Michigan, Michigan.

Wu M-J., Zhao, K. & Fils-Aime, F. (2022) Response rates of online surveys in published research: A meta-analysis. *Comp. Human Behav. Rep.*, **7**, 100206. https://doi.org/10.1016/j.chbr.2022.100206.

Table 1: UKHLS main survey (ringfenced sample) and IP datasets used in this research and the years in which they were collected. Note that data for two main survey waves are collected each year, though individuals are surveyed annually.

	Year											
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
UKHLS main survey:												
Wave(s)	3 / 4	4 /5	5 / 6	6 / 7	7 / 8	8 / 9	9 / 10	10 / 11	11 / 12	12 / 13	13 / 14	14 / 15
Used?	N	N	N	N	N	N	N	N	Y	N	N	N
UKHLS IP:												
Wave	5	6	7	8	9	10	11	12	13	14	15	16
Used?	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	Y

Table 2: IP dataset issued sample sizes, respondent numbers and percentages of samples responding overall and by web and CAPI modes at each wave.

	IP dataset wave								
	5 (2012)	6 (2013)	7 (2014)	8 (2015)	9 (2016)	10 (2017)	11 (2018)	15 (2022)	16 (2023)
Issued Sample N	2018	1825	1699	1496	1790	1889	2207	3064	2938
Web + CAPI response N	1293	1337	1126	1093	1449	1318	1438	1801	1867
% responding by web + CAPI	64	73	66	73	81	70	65	59	64
Web response N	643	809	727	758	1077	978	1156	1654	1735
% responding by web	32	44	43	51	60	52	52	54	59
CAPI response N	650	528	399	335	372	340	282	147	132
% responding by CAPI	32	29	23	22	21	18	13	5	4

Table 3: IP non-response weighted web and web plus CAPI dataset mean absolute standardised biases (MASBs) compared to eligible sample inclusion weighted benchmarks and their 95% CIs at each wave.

	Web			Web + CAPI		
		95% CIs			95% CIs	
Wave	MASB	CI -	CI +	MASB	CI -	CI +
5	0.024	0.018	0.030	0.005	0.004	0.006
6	0.013	0.008	0.018	0.005	0.003	0.006
7	0.015	0.011	0.020	0.007	0.004	0.009
8	0.014	0.010	0.018	0.004	0.003	0.005
9	0.012	0.009	0.014	0.005	0.004	0.006
10	0.009	0.006	0.012	0.006	0.004	0.008
11	0.007	0.006	0.009	0.004	0.003	0.005
15	0.003	0.002	0.005	0.003	0.002	0.004
16	0.004	0.003	0.006	0.004	0.003	0.006

Figure 1: IP dataset overall CVs at each wave for web respondents (black), and web plus CAPI respondents (blue).

Figure 2: Main survey 2020 ringfenced sample unconditional covariate category a) CV_us, and b) CV_cs. Web respondents are represented by black circles, and web plus CAPI respondents by white circles. Error bars indicate 95% CIs.

Figure 3: IP dataset unconditional covariate category CV_us at each wave for web respondents (a, c, e, g, i, k, m & o) and web plus CAPI respondents (b, d, f, h, j, l, n & p).

Figure 4: IP dataset unconditional covariate category CV_cs at each wave for web respondents (a, c, e, g, i, k, m & o) and web plus CAPI respondents (b, d, f, h, j, l, n & p).

Fig 1

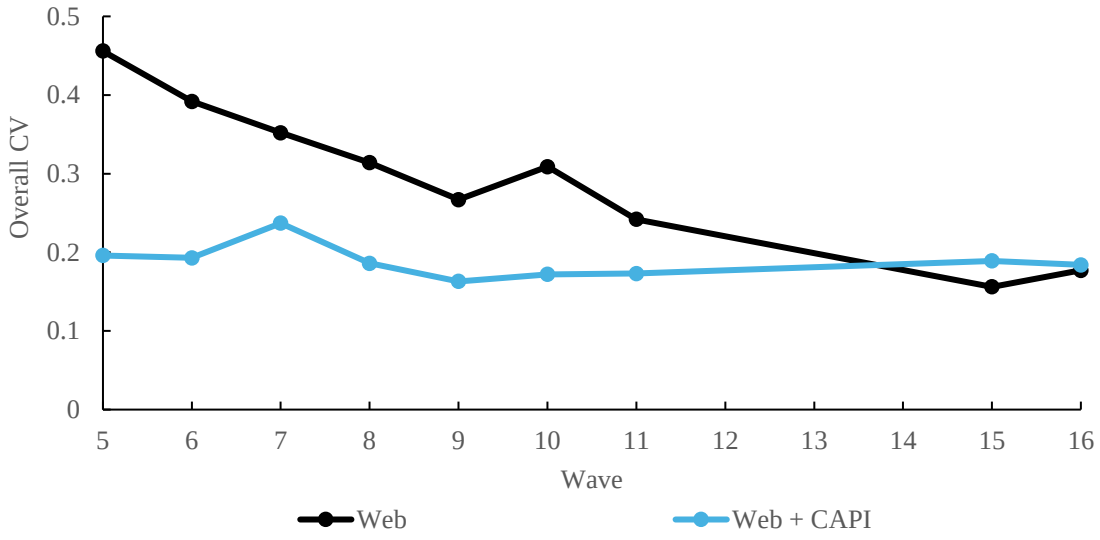

0.5
0.4
0.3
0.2
0.1
0
Overall CV
5
6
7
8
9
10
11
12
13
14
15
16
Wave
Web
Web + CAPI

Fig. 2.

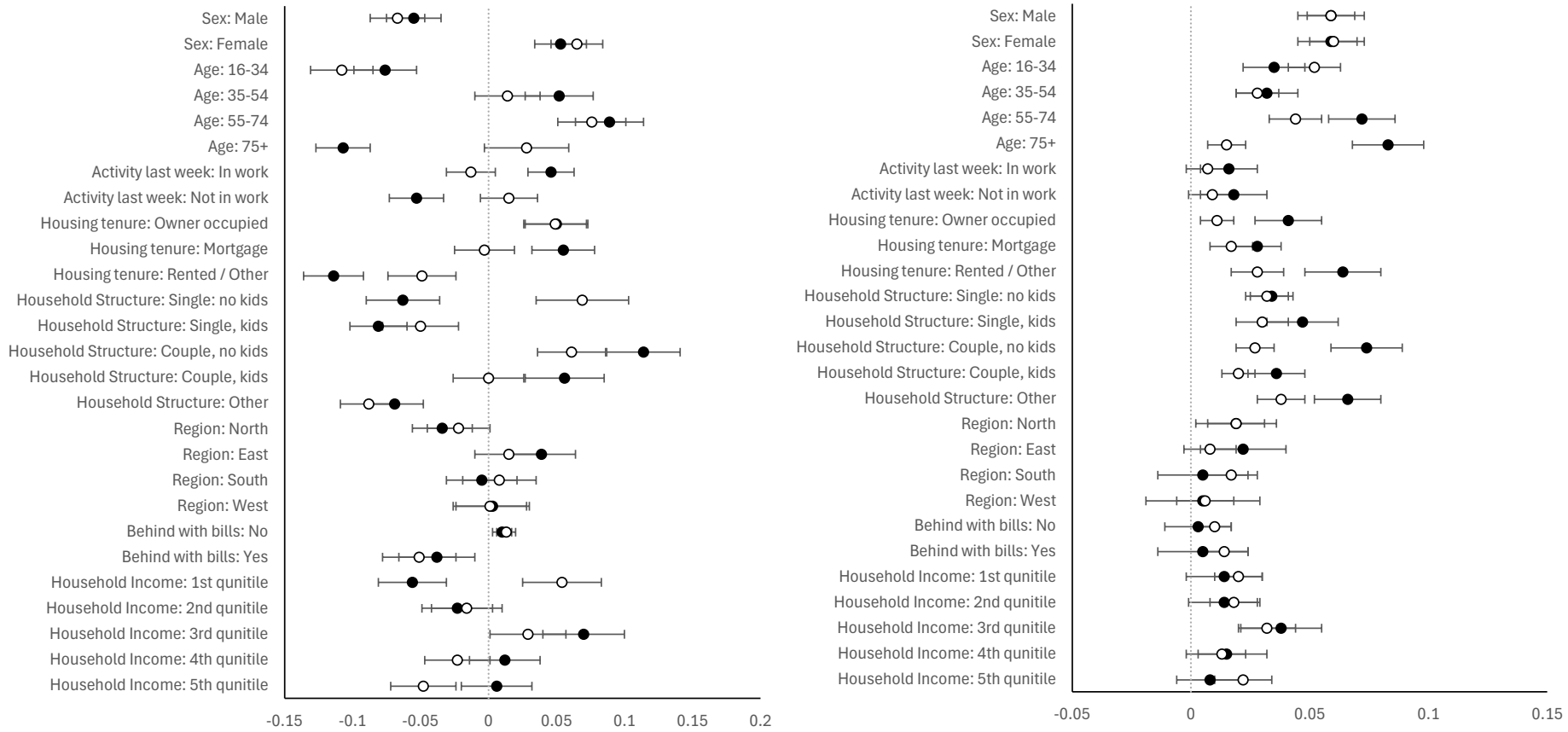

Sex: Male
Sex: Female
Age: 16-34
Age: 35-54
Age: 55-74
Age: 75+
Activity last week: In work
Activity last week: Not in work
Housing tenure: Owner occupied
Housing tenure: Mortgage
Housing tenure: Rented / Other
Household Structure: Single: no kids
Household Structure: Single, kids
Household Structure: Couple, no kids
Household Structure: Couple, kids
Household Structure: Other
Region: North
Region: East
Region: South
Region: West
Behind with bills: No
Behind with bills: Yes
Household Income: 1st qunitile
Household Income: 2nd qunitile
Household Income: 3rd qunitile
Household Income: 4th qunitile
Household Income: 5th qunitile
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2
Sex: Male
Sex: Female
Age: 16-34
Age: 35-54
Age: 55-74
Age: 75+
Activity last week: In work
Activity last week: Not in work
Housing tenure: Owner occupied
Housing tenure: Mortgage
Housing tenure: Rented / Other
Household Structure: Single: no kids
Household Structure: Single, kids
Household Structure: Couple, no kids
Household Structure: Couple, kids
Household Structure: Other
Region: North
Region: East
Region: South
Region: West
Behind with bills: No
Behind with bills: Yes
Household Income: 1st qunitile
Household Income: 2nd qunitile
Household Income: 3rd qunitile
Household Income: 4th qunitile
Household Income: 5th qunitile
-0.05
0
0.05
0.1
0.15

Fig 3

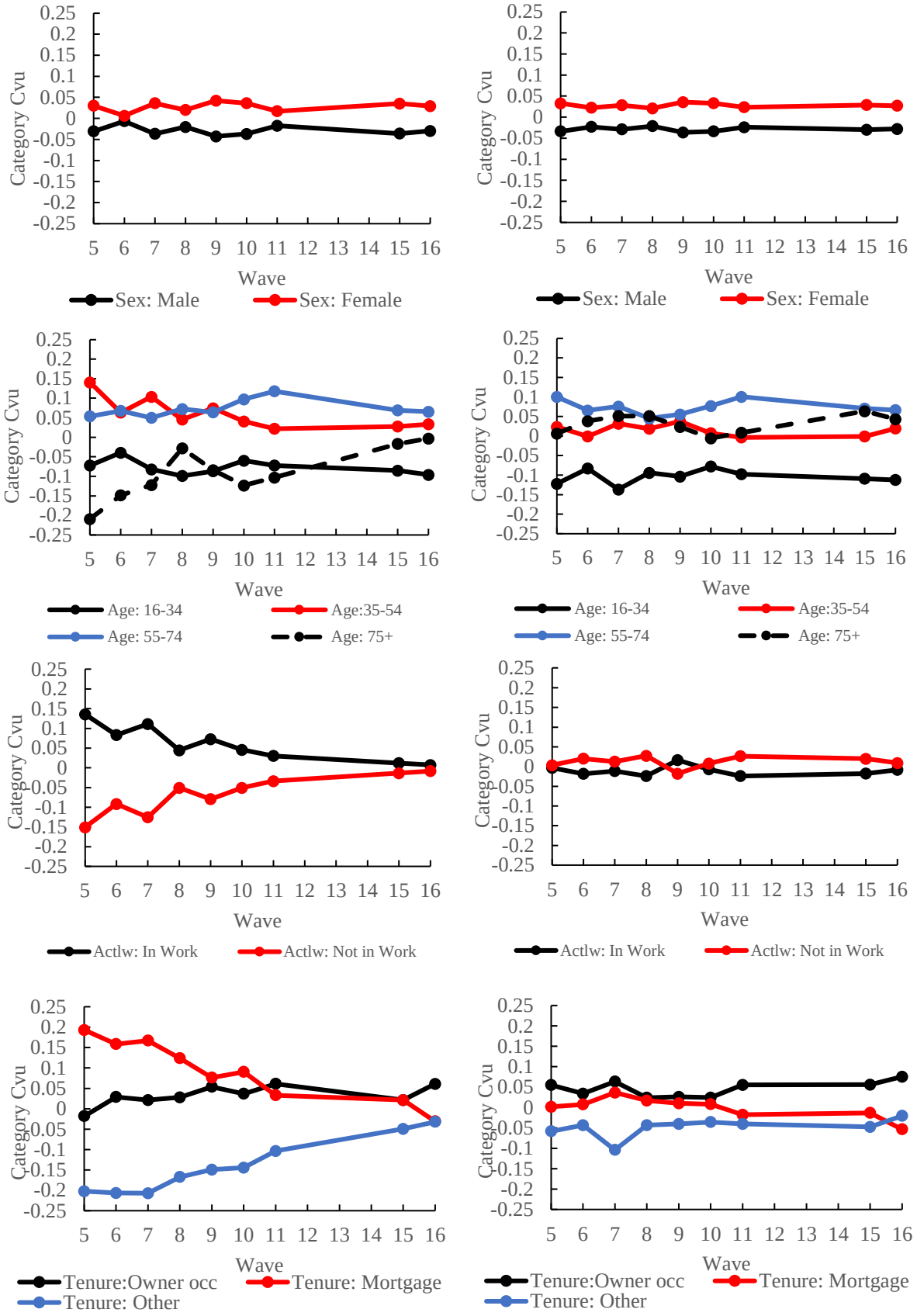

Category Cvu
Wave
Sex: Male
Sex: Female
Age: 16-34
Age:35-54
Age: 55-74
Age: 75+
Actlw: In Work
Actlw: Not in Work
Tenure:Owner occ
Tenure: Mortgage
Tenure: Other

Fig 3 cont.

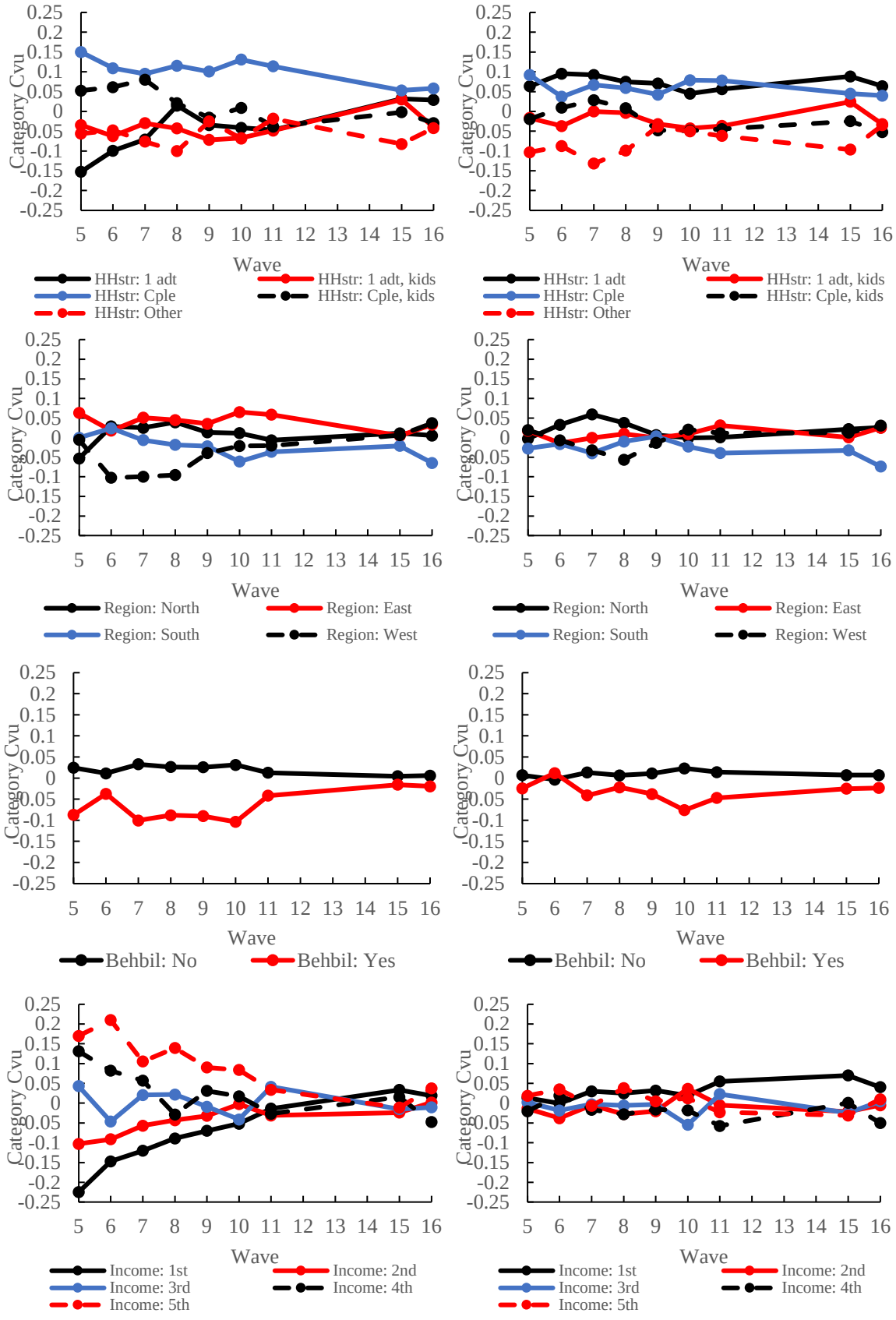

Category Cvu
Wave
HHstr: 1 adt
HHstr: Cple
HHstr: Other
HHstr: 1 adt, kids
HHstr: Cple, kids
Region: North
Region: South
Region: East
Region: West
Behbil: No
Behbil: Yes
Income: 1st
Income: 3rd
Income: 5th
Income: 2nd
Income: 4th

Fig 4

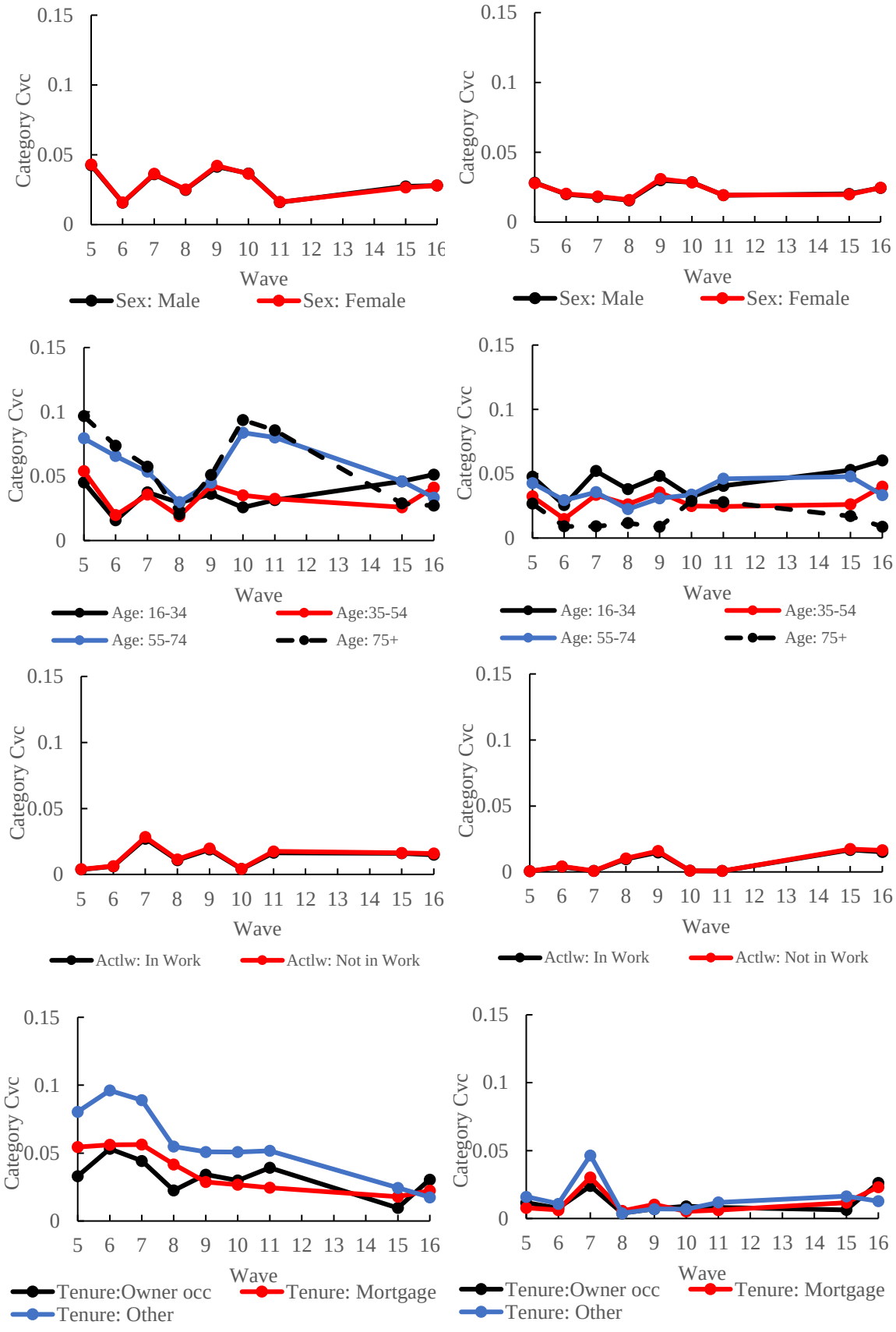
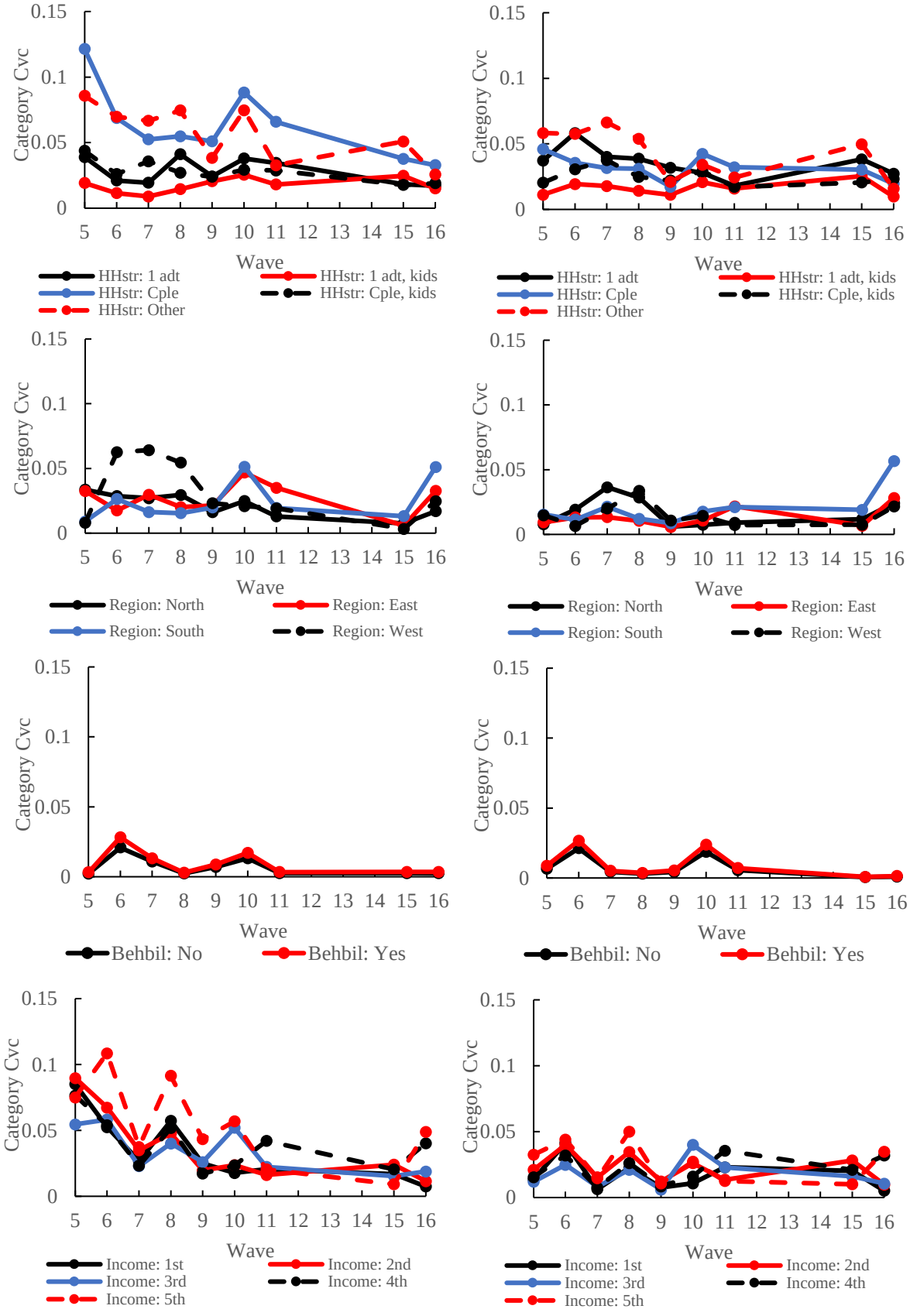

0.15
0.1
0.05
0
Category Cvc
5 6 7 8 9 10 11 12 13 14 15 16
Wave
Sex: Male
Sex: Female
Age: 16-34
Age:35-54
Age: 55-74
Age: 75+
Actlw: In Work
Actlw: Not in Work
Tenure:Owner occ
Tenure: Mortgage
Tenure: Other

Fig 4 cont.


Category Cvc
0.15
0.1
0.05
0
5 6 7 8 9 10 11 12 13 14 15 16
Wave
HHstr: 1 adt
HHstr: Cple
HHstr: Other
HHstr: 1 adt, kids
HHstr: Cple, kids
Region: North
Region: South
Region: East
Region: West
Behbil: No
Behbil: Yes
Income: 1st
Income: 3rd
Income: 5th
Income: 2nd
Income: 4th

Appendix A1. Missing values and imputation strategy

This appendix provides a detailed description of the missing data in the datasets used for the analysis from the UKHLS main survey and the Innovation Panel. We also document the imputation process using information from previous and following waves and a chained equation imputation model for the remaining missingness.

A1 1 Pre-imputation datasets

This section documents the generation of the initial datasets prior to the imputation. The following paragraphs detail the exclusion of ineligible cases and other individuals not issued to the field from the sample for each relevant wave of the UKHLS main survey and the Innovation Panel. Although the analysis of the paper is based on the adults, i.e., sample members aged 16 and over, who were invited to complete the individual questionnaire, the tables provided in this appendix include all sample members regardless of their age or whether they were issued to web-first or not. This is because the datasets with all sample members were required to compute the sample inclusion weights (see Appendix A2).

For each wave to be used in the weighting or analysis, we excluded from the sample the individuals who had become ineligible and those who could not be issued to the field or were not assigned to a household. The ineligible sample members were those found to have died before the fieldwork or moved out of scope, i.e., relocated abroad or, in the case of the Innovation Panel samples, moved to Northern Ireland. In addition, some individuals, primarily the households participating online, who had not provided a valid address could not be issued to the interviewers and were excluded. Finally, a small group of sample members were not assigned to a household and were dropped from the datasets.

Table A1 1 shows the number of individuals excluded because they were ineligible or because they could not be issued to the field in the main survey.

Table A1 1. UKHLS main survey: Exclusion of sample members of the analysis by wave

	Initial sample (n)	Ineligible[1]		Not issued/no household assigned	
		n	%	n	%
Wave 7 (2015-17)	90,021	786	0.9	6,815	7.6
Wave 11 (2019-21)	58,499	469	0.8	2,485	4.2
Wave 12 (2020-22)	55,891	446	0.8	2,479	4.4

Note: [1]Sample members ineligible for an interview are those who died before the fieldwork or moved abroad. [2]Not issued includes households for which there was no address and could not be issued to the interviewers, plus the individuals who were not assigned to a household.

Table A1 2 shows the number of individuals excluded from the initial sample for all relevant waves of the Innovation Panel.

Table A1 2. UKHLS Innovation Panel: Exclusion of sample members of the analysis by wave

	Initial sample (n)	Ineligible[1]		Not issued/no household assigned[2]	
		n	%	n	%
Wave 2 (2009)	3720	42	1.1	7	0.2
Wave 5 (2012)	3861	26	0.7	3	0.1
Wave 6 (2013)	3528	22	0.6	22	0.6
Wave 7 (2014)	4602	25	0.5	245	5.3
Wave 8 (2015)	4147	35	0.8	58	1.4
Wave 9 (2016)	3768	29	0.8	62	1.6
Wave 10 (2017)	4489	28	0.6	148	3.3
Wave 11 (2018)	5629	38	0.7	178	3.2
Wave 12 (2019)	5566	50	0.9	321	5.8
Wave 15 (2022)	6796	31	0.5	577	8.5
Wave 16 (2023)	6720	48	0.7	749	11.1

Note: [1]Sample members ineligible for an interview are those who died before the fieldwork or moved abroad. [2]Not issued includes households for which there was no address and could not be issued to the interviewers plus the individuals who were not assigned to a household.

A1 2 Missing values and imputation strategy

Auxiliary information from respondents and non-respondents is necessary to compute the survey weights and conduct the representativeness analysis. *Understanding Society* is a household survey where household members are invited to complete a household grid and a questionnaire, and each adult is asked to complete an individual questionnaire at each wave. Therefore, for each wave, we have some information available from all household members from responding households, i.e., households that completed the household grid and questionnaire. However, for sample members at a given wave there is no information available if no one in the household participated in the survey. In

addition, survey respondents can refuse to answer a particular question in the household questionnaire (item non-response).

Table A1 3 (column 2) shows the percentage of missing values (item non-response) for the variables for each wave of the main survey involved in the weights and analysis. The level of missingness varies between 15.5% of sex at wave 11 and 33.7% of being behind with council tax bills at wave 7. The percentage of sample members with all the information missing is 27.3% at wave 7, 15.4% at wave 11, and 17.8% at wave 12.

Table A1 4 (column 2) shows the same information for each wave of the Innovation Panel. The level of missing information at each wave oscillates between 15.6%—sex at wave 6—and 40.9%—households behind with bills at wave 12. The percentage of non-respondents from non-responding households, i.e., sample members with all variables missing in that wave, varied from 15.6% at wave 10 and 36.4% at wave 12.

We developed a two-step strategy to impute the missing values. This strategy consisted of 1) an imputation based on information from the previous and following waves (IPFW), and 2) a model-based imputation using a multivariate imputation chained equations (MICE) model for the remaining missing values.

A1 3 Imputation from previous and following waves (IPFW)

An advantage of working with a longitudinal survey is the availability of information for those who are part of the panel but do not participate in a wave. Missing values can be imputed using a last observation carried forward, or baseline observation carried forward. However, this method assumes that the state of sample members has not changed between the observation and the wave with a missing value, which can introduce some bias into estimates (Kenward & Molenberghs, 2009; Saha & Jones, 2009). We limited the number of previous and following waves used in the imputation to

enhance the use of panel information while minimising the risks associated with this method. For sex, ethnicity and age, we used the information from the previous or following six waves since these characteristics will not change or are perfectly correlated with time. For the rest of the household and individual level characteristics, we limited the range of values used for the imputation to the previous and following two waves.

Table A1 3 (columns 3 to 8) and Table A1 4 present the remaining missing values if the information is imputed using the previous and following waves for the datasets of the main survey and Innovation Panel, respectively. The tables show that the level of missingness decreases substantially when information from the previous and following waves is considered. For a comparison of the distribution of the observed and the imputed values using the IPFW, see Table A1 9 and Table A1 8.

Table A1 4. UKHLS Innovation Panel: Percentage of missing values for each variable as observed (Obs.) and after the imputation from previous and following waves (IPFW) by wave

	Wave 2		Wave 5		Wave 6		Wave 7		Wave 8		Wave 9	
	Obs.	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**
All variables missing	26.8	0.0	21.6	0.0	15.6	0.0	16.3	0.0	18.8	0.0	15.3	0.0
Sex	26.8	0.0	21.6	0.0	15.6	0.1	16.5	0.0	18.9	0.1	15.3	0.0
Age	26.8	0.0	21.6	0.0	15.6	0.0	17.3	0.6	19.1	0.7	15.4	0.2
Region (GOR)	27.0	0.1	21.6	1.9	15.9	0.6	16.9	0.3	19.1	0.4	15.3	0.3
Urbanicity	27.0	0.1	21.6	1.9	15.9	0.6	16.9	0.3	19.1	0.4	15.3	0.3
Employment status	27.0	0.3	21.9	2.1	15.9	0.9	17.6	1.1	19.3	1.1	15.9	0.5
Household income			23.3	1.9	15.9	0.5	22.2	1.3	21.1	1.4	17.8	1.0
Behind with bills	26.9	0.1	23.9	1.9	16.7	0.6	22.7	1.5	21.4	1.5	18.2	1.1
Behind with council tax	27.3	0.2	24.0	1.9	17.0	0.6	23.5	1.5	21.6	1.6	18.7	1.4
Household type	26.8	0.0	23.3	1.9	15.9	0.5	22.2	1.3	21.1	1.4	17.8	1.0
Tenure status	26.8	0.0	23.5	2.0	17.0	0.7	22.8	1.5	21.3	1.6	18.1	1.1
Number of rooms	26.8	0.0	23.5	1.9	16.3	0.5	22.6	1.5	21.1	1.5	17.9	1.0
Base (n)	3671	3671	3832	3832	3484	3484	4332	4332	4054	4054	3677	3677

	Wave 10		Wave 11		Wave 12		Wave 15		Wave 16	
	Obs.	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**	**Obs.**	**IPFW**
All variables missing	15.6	0.0	16.9	0.0	36.4	0.0	32.2	0.7	28.9	0.8
Sex	15.6	0.0	16.9	0.0	36.4	0.0	32.2	0.7	29.0	0.8
Age	16.1	0.3	17.2	0.3	36.4	0.1	32.3	0.9	29.0	1.0
Region (GOR)	15.7	2.6	17.0	1.7	36.5	2.8	32.3	8.4	28.9	9.0
Urbanicity	15.7	2.6	17.0	1.7	36.5	2.8	32.3	8.4	28.9	9.0
Employment status	16.5	3.1	17.5	2.3	36.7	3.3	32.4	8.9	29.3	9.6
Household income	18.9	3.0	20.0	2.6	40.2	4.0	36.7	11.9	32.2	12.2
Behind with bills	19.2	3.1	20.7	3.1	40.9	4.5	37.1	12.1	32.5	12.6
Behind with council tax	19.5	3.3	20.9	3.3	40.8	4.7	37.1	12.4	32.8	12.9
Household type	18.9	3.0	20.0	2.6	40.2	4.0	36.7	11.9	32.2	12.2
Tenure status	21.6	4.1	20.6	3.9	40.4	5.2	36.8	12.1	32.4	12.5
Number of rooms	19.1	3.1	20.5	3.0	40.4	4.4	36.7	12.1	32.3	12.5
Base (n)	4313	4313	5413	5413	5195	5195	6188	6188	5923	5923

After the first imputation stage, sample members for whom all the information remained missing were excluded from the analysis and, therefore, were not included in the model-based imputation. Table A1 6 presents the number of sample members excluded by wave in the main survey datasets, and Table A1 5 shows the analogous information for the Innovation Panel datasets.

Table A1 5. UKHLS main survey: Sample members for whom no information was available

		No information	
Wave	**Base (n)**	**n**	***%***
Wave 7	82420	356	0.4
Wave 11	55545	16	0.0
Wave 12	52966	15	0.0

Table A1 6. UKHLS IP: Sample members for whom no information was available

		No information	
Wave	**Base (n)**	**n**	***%***
Wave 2	3671	0	0.0
Wave 5	3832	0	0.0
Wave 6	3484	1	0.0
Wave 7	4332	0	0.0
Wave 8	4054	1	0.0
Wave 9	3677	1	0.0
Wave 10	4313	1	0.0
Wave 11	5413	0	0.0
Wave 12	5195	0	0.0
Wave 15	6188	46	0.7
Wave 16	5923	49	0.8

A1 4 Model-based imputation strategy

The remaining missing cases were imputed using a model-based strategy. Given the relatively low level of missing information after the first stage of imputation at most waves, a single imputation using multivariate imputation by chained equations (MICE) was considered. The imputation strategy accounted for the multilevel structure of the data that involves sample members (level-1) nested in households (level-2). This is because using a single-level imputation method that ignores the hierarchical structure of the data can result in a conceptual problem where sample members from the same household exhibit different household characteristics (Van Buuren, 2018). Thus, we implemented a two-step imputation to produce a consistent imputation that considered the multilevel

data structure (Grund et al., 2018). First, a dataset at the household level that included the household characteristics and an average of the level-1 predictors (i.e., sex, age, employment status and ethnic background) was used to impute the missing values of the household variables. Second, we produced an individual-level dataset that included the individual-level predictors and the household-level variables imputed in the household-level dataset. This dataset was used to impute the individual-level variables. Table A1 7 presents the variables used in the imputation models. We used a propensity mean matching technique for the imputation of continuous, semi-continuous, and dummy variables (Austin & van Buuren, 2023; Vink et al., 2014). The categorical variables were imputed using multinomial logistic regression models.

Table A1 7. Specification of the MICE models

Household-level dataset imputation	
Variables	**Role and model**
Average of individual characteristics: female, age, being employed, white[1], Asian[1] and black[1].	**Imputed** using a propensity mean matching technique with 10 donors (nearest neighbor).
Urbanicity, household income[2], being behind with bills, being behind with council tax and number of rooms.	**Imputed** using a multinomial logistic regression model.
Region (GOR), household type and tenure status.	**Regular**. Not imputed but included as a predictor in the models.
Cluster size.	
Individual-level dataset imputation	
Variables	**Role and Model**
Sex and age	**Imputed** using a propensity mean matching technique with 10 donors (nearest neighbor).
Ethnic background[1]	**Imputed** using a multinomial logistic regression model.
From the household-level dataset imputation: urbanicity, household income, being behind with bills, being behind with council tax, number of rooms, region (GOR), household type and tenure status.	**Regular.** Not imputed but included as a predictor in the models.

[1]Ethnic background was only used in the UKHLS main survey datasets. [2]Household income was not available for wave 2 of the UKHLS Innovation Panel.

Finally, we provide a summary of the differences between the observed and imputed values at the different stages of the imputation. For this purpose, Table A1 9 and Table A1 8 present the distribution of the variables involved in the imputation at the different stages of the process for the main survey and the Innovation Panel, respectively. In most cases, the imputation, both the IPFW and the model-

based, had a minimal impact on the distribution of the variables. The difference between the observed and complete distribution of the variables results in less than a percentage point. However, there are a few exceptions. At waves that registered a higher level of missingness (e.g., Innovation panel waves 15 and 16, or wave 7 from the main study), the variables tenure status and household type showed some differences. Regarding tenure status, the distribution of imputed, both IPFW and MICE, exhibit a higher proportion of individuals renting their accommodation and a lower prevalence of people who own their houses compared to the observed distribution. In terms of household type, the imputed values show a lower proportion of one couple with no children households and a higher proportion of other households. Finally, in the main survey datasets, the imputed values show a higher proportion of persons with an ethnic minority background compared to the observed ones. These differences indicate that, in some instances, the imputation has increased the presence of sub-groups that are usually affected by attrition to a greater extent (Cabrera-Álvarez et al., 2023), suggesting that the imputation might have improved the overall representativeness of the datasets.

Table A1 8. UKHLS main survey: Distributions of the imputed variables by wave.

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Wave 7 (2015-17)					
Sex					
Male	48.2	49.4	48.6	48.1	48.6
Female	51.8	50.6	51.4	51.9	51.4
Base (n)	59,934	22,103	82,037	27	82,064
Age					
16-24	32.9	34.4	33.3	45.3	33.3
25-44	24.2	34.6	27.0	29.1	27.0
45-64	26.5	21.4	25.1	17.9	25.1
65+	16.3	9.6	14.5	7.7	14.5
Base (n)	59,871	22,076	81,947	117	82,064
Ethnic background					
White	75.8	64.1	72.7	70.6	72.6
Asian	13.9	19.2	15.3	17.1	15.4
Black	5.4	9.8	6.6	7.7	6.6
Mixed & Other	4.8	6.9	5.4	4.6	5.4
Base (n)	58,755	21,526	80,281	1,783	82,064
Region (GOR)					
North East	3.3	2.4	3.2	3.0	3.2
North West	10.4	9.8	10.3	9.2	10.2
Yorkshire and the Humber	8.8	7.0	8.5	9.5	8.6
East Midlands	6.7	6.8	6.7	6.4	6.7
West Midlands	8.9	8.8	8.9	8.8	8.9
East of England	8.0	7.1	7.8	7.8	7.8
London	15.1	27.7	17.1	20.8	17.6
South East	11.4	9.9	11.1	10.7	11.1
South West	7.2	5.6	7.0	6.5	6.9
Wales	6.2	8.1	6.5	6.1	6.4
Scotland	7.7	6.8	7.6	7.0	7.5
Northern Ireland	6.1	0.0	5.2	4.1	5.0
Base (n)	59,921	11,017	70,938	11,126	82,064
Urbanicity					
Urban	78.0	83.8	79.0	81.3	79.2
Rural	22.0	16.2	21.0	18.7	20.8
Base (n)	59,921	11,763	71,684	10,380	82,064
Employment status					
Yes	45.6	47.8	45.9	43.8	45.7
No	54.4	52.2	54.1	56.2	54.3
Base (n)	59,661	11,680	71,341	10,723	82,064
Income					
Up to £1,999	25.0	28.1	25.6	29.4	26.1
£2,000-£2,999	24.7	24.7	24.7	24.5	24.7
£3,000-£4,999	33.0	30.5	32.6	29.4	32.1
£5,000 and over	17.3	16.7	17.2	16.7	17.1
Base (n)	58,655	12,414	71,069	10,995	82,064
Behind with bills					
Up to date with bills	94.7	90.6	94.0	92.4	93.7
Behind with some bills	5.3	9.4	6.0	7.6	6.3
Base (n)	58,382	12,546	70,928	11,136	82,064
Behind with Council Tax					
Yes	6.9	11.6	7.8	8.1	7.8
No	93.1	88.4	92.2	91.9	92.2
Base (n)	54,642	11,775	66,417	15,647	82,064
Household type					
1 adult, no children	10.2	8.2	9.8	15.9	10.6
1 adult, children	6.0	8.8	6.5	5.9	6.4
Couple, no children	20.6	13.5	19.4	12.3	18.4

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Couple with children	32.0	30.5	31.7	30.6	31.6
Other households	31.2	39.0	32.6	35.3	33.0
Base (n)	58,658	12,420	71,078	10,986	82,064
Tenure status					
Owned outright	28.2	17.9	26.3	20.9	25.6
Owned on mortgage	40.0	36.4	39.4	39.7	39.4
Rented and others	31.8	45.7	34.3	39.3	35.0
Base (n)	58,248	12,560	70,808	11,256	82,064
Number of rooms					
1	41.4	48.1	42.6	47.5	43.3
2	36.3	32.5	35.6	33.4	35.3
3	15.5	12.9	15.0	13.6	14.8
4	4.7	4.9	4.8	3.7	4.6
5 or more	2.1	1.6	2.0	1.8	2.0
Base (n)	58,579	12,360	70,939	11,125	82,064
Wave 11 (2019-21)					
Sex					
Male	47.8	49.0	48.0	60.0	48.0
Female	52.2	51.0	52.0	40.0	52.0
Base (n)	46,961	8,563	55,524	5	55,529
Age					
16-24	29.8	37.3	30.9	50.0	30.9
25-44	22.6	28.7	23.6	22.7	23.6
45-64	28.3	21.7	27.3	13.6	27.3
65+	19.3	12.3	18.2	13.6	18.2
Base (n)	46,944	8,563	55,507	22	55,529
Ethnic background					
White	78.4	64.4	76.2	75.0	76.2
Asian	12.9	19.0	13.9	13.9	13.9
Black	4.0	9.9	4.9	6.3	5.0
Mixed & Other	4.7	6.7	5.0	4.8	5.0
Base (n)	45,918	8,249	54,167	1,362	55,529
Region (GOR)					
North East	3.5	3.0	3.4	3.2	3.4
North West	10.3	10.7	10.4	8.9	10.3
Yorkshire and the Humber	8.8	10.1	9.0	8.7	9.0
East Midlands	7.1	6.0	6.9	8.7	6.9
West Midlands	8.8	11.4	9.1	6.6	9.1
East of England	8.6	7.8	8.5	9.9	8.5
London	13.3	18.7	14.0	14.3	14.0
South East	11.6	11.4	11.6	11.7	11.6
South West	7.7	6.4	7.5	5.9	7.5
Wales	6.2	6.8	6.3	5.6	6.3
Scotland	8.0	7.7	8.0	7.6	7.9
Northern Ireland	6.2	0.0	5.4	9.0	5.5
Base (n)	46,936	7,443	54,379	1,150	55,529
Urbanicity					
Urban	77.0	72.7	76.3	79.9	76.3
Rural	23.0	27.3	23.7	20.1	23.7
Base (n)	45,982	8,844	54,826	703	55,529
Employment status					
Yes	46.7	45.9	46.6	44.3	46.6
No	53.3	54.1	53.4	55.7	53.4
Base (n)	46,746	7,918	54,664	865	55,529
Income					
Up to £1,999	21.2	23.7	21.7	24.1	21.7
£2,000-£2,999	21.0	23.1	21.3	17.8	21.2
£3,000-£4,999	34.7	31.4	34.2	30.0	34.0
£5,000 and over	23.0	21.8	22.8	28.1	23.0

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Base (n)	44,610	9,271	53,881	1,648	55,529
Behind with bills					
Yes	93.2	87.6	92.2	90.9	92.2
No	6.8	12.4	7.8	9.1	7.8
Base (n)	44,384	9,378	53,762	1,767	55,529
Behind with Council Tax					
Yes	6.7	12.4	7.7	5.4	7.5
No	93.3	87.6	92.3	94.6	92.5
Base (n)	41,468	8,987	50,455	5,074	55,529
Household type					
1 adult, no children	11.2	8.9	10.8	13.5	10.9
1 adult, children	4.4	8.5	5.1	5.7	5.1
Couple, no children	22.8	11.2	20.8	11.0	20.5
Couple with children	28.6	30.6	28.9	32.7	29.1
Other households	32.9	40.8	34.3	37.0	34.4
Base (n)	44,612	9,271	53,883	1,646	55,529
Tenure status					
Owned outright	32.6	20.8	30.4	22.8	30.2
Owned on mortgage	40.7	38.5	40.3	47.3	40.6
Rented and others	26.7	40.7	29.2	29.8	29.3
Base (n)	44,071	9,709	53,780	1,749	55,529
Number of rooms					
1	38.4	44.7	39.5	43.7	39.6
2	36.4	35.5	36.3	34.0	36.2
3	16.7	14.0	16.2	14.6	16.2
4	5.8	3.6	5.5	6.7	5.5
5 or more	2.6	2.1	2.5	1.0	2.5
Base (n)	44,527	9,307	53,834	1,695	55,529
Wave 12 (2020-22)					
Sex					
Male	47.8	48.9	48.0	40.0	48.0
Female	52.2	51.1	52.0	60.0	52.0
Base (n)	43,552	9,394	52,946	5	52,951
Age					
16-24	28.9	36.0	30.2	36.4	30.2
25-44	22.6	27.7	23.5	36.4	23.5
45-64	28.7	21.9	27.5	24.2	27.5
65+	19.8	14.4	18.8	3.0	18.8
Base (n)	43,529	9,389	52,918	33	52,951
Ethnic background					
White	79.4	62.3	76.4	76.8	76.4
Asian	12.3	20.9	13.8	13.2	13.8
Black	3.8	9.7	4.8	4.8	4.8
Mixed & Other	4.5	7.0	5.0	5.2	5.0
Base (n)	42,467	9,067	51,534	1,417	52,951
Region (GOR)					
North East	3.5	2.8	3.4	2.2	3.4
North West	9.9	14.3	10.6	7.9	10.5
Yorkshire and the Humber	8.7	11.1	9.0	10.4	9.1
East Midlands	7.2	6.3	7.0	9.0	7.1
West Midlands	8.8	10.6	9.1	9.3	9.1
East of England	8.8	7.1	8.5	8.3	8.5
London	12.7	18.5	13.6	15.5	13.6
South East	12.0	9.9	11.7	11.2	11.6
South West	7.9	5.8	7.6	7.4	7.6
Wales	6.3	6.3	6.3	6.1	6.3
Scotland	8.1	7.4	8.0	5.7	7.9
Northern Ireland	6.2	0.0	5.3	6.9	5.3
Base (n)	43,537	7,787	51,324	1,627	52,951

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Urbanicity					
Urban	75.2	81.9	76.3	83.9	76.5
Rural	24.8	18.1	23.7	16.1	23.5
Base (n)	43,537	8,275	51,812	1,139	52,951
Employment status					
Yes	46.6	44.1	46.2	44.9	46.1
No	53.4	55.9	53.8	55.1	53.9
Base (n)	43,356	8,279	51,635	1,316	52,951
Income					
Up to £1,999	19.7	24.0	20.5	21.7	20.6
£2,000-£2,999	19.9	20.9	20.1	16.1	19.9
£3,000-£4,999	34.5	32.3	34.0	32.4	34.0
£5,000 and over	#N/A	#N/A	#N/A	#N/A	#N/A
Base (n)	#N/A	#N/A	#N/A	#N/A	#N/A
Behind with bills					
Yes	93.5	86.7	92.2	90.4	92.1
No	6.5	13.3	7.8	9.6	7.9
Base (n)	40,732	10,063	50,795	2,156	52,951
Behind with Council Tax					
Yes	6.0	13.3	7.4	4.5	7.2
No	94.0	86.7	92.6	95.5	92.8
Base (n)	38,117	9,533	47,650	5,301	52,951
Household type					
1 adult, no children	11.4	9.7	11.1	12.2	11.1
1 adult, children	4.1	7.8	4.8	5.5	4.8
Couple, no children	23.6	12.4	21.4	10.1	20.9
Couple with children	27.5	30.1	28.0	29.1	28.0
Other households	33.4	40.1	34.7	43.1	35.0
Base (n)	40,992	9,910	50,902	2,049	52,951
Tenure status					
Owned outright	33.8	21.7	31.4	24.8	31.1
Owned on mortgage	41.0	36.9	40.2	46.2	40.4
Rented and others	25.2	41.4	28.4	29.0	28.5
Base (n)	40,717	10,032	50,749	2,202	52,951
Number of rooms					
1	37.4	43.1	38.5	44.1	38.7
2	36.3	36.8	36.4	30.8	36.2
3	17.6	12.9	16.6	17.3	16.7
4	6.1	5.0	5.9	6.0	5.9
5 or more	2.7	2.2	2.6	1.9	2.5
Base (n)	40,894	9,947	50,841	2,110	52,951

Table A1 9. UKHLS Innovation Panel: Distributions of the imputed variables by wave

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Wave 2 (2009)					
Sex					
Male	48.7	48.6	48.7	0.0	48.7
Female	51.3	51.4	51.3	0.0	51.3
Base (n)	2,688	983	3,671	0	3,671
Age					
16-24	29.8	35.3	31.3	0.0	31.2
25-44	25.6	26.9	25.9	0.0	25.9
45-64	27.6	21.5	26.0	100.0	26.0
65+	17.0	16.3	16.8	0.0	16.8
Base (n)	2,688	982	3,670	1	3,671
Region (GOR)					
North East	4.1	4.1	4.1	0.0	4.1
North West	12.4	14.0	12.8	0.0	12.8
Yorkshire and the Humber	10.0	6.1	9.0	75.0	9.0
East Midlands	8.8	6.2	8.1	0.0	8.1
West Midlands	6.9	12.0	8.3	0.0	8.3
East of England	10.1	9.0	9.8	0.0	9.8
London	10.8	13.5	11.5	0.0	11.5
South East	13.9	13.2	13.7	0.0	13.7
South West	9.8	9.4	9.7	25.0	9.7
Wales	4.9	4.3	4.7	0.0	4.7
Scotland	8.1	8.3	8.1	0.0	8.1
Base (n)	2,679	988	3,667	4	3,671
Urbanicity					
Urban	76.2	82.4	77.9	100.0	77.9
Rural	23.8	17.6	22.1	0.0	22.1
Base (n)	2,679	988	3,667	4	3,671
Employment status					
Yes	45.5	43.4	44.9	30.0	44.9
No	54.5	56.6	55.1	70.0	55.1
Base (n)	2,681	980	3,661	10	3,671
Behind with bills					
Up to date with bills	92.1	89.3	91.4	100.0	91.4
Behind with some bills	7.9	10.7	8.6	0.0	8.6
Base (n)	2,682	984	3,666	5	3,671
Behind with Council Tax					
Yes	7.8	12.1	9.0	0.0	8.9
No	92.2	87.9	91.0	100.0	91.1
Base (n)	2,667	996	3,663	8	3,671
Household type					
1 adult, no children	11.3	11.7	11.4	0.0	11.4
1 adult, children	7.1	7.8	7.3	0.0	7.3
Couple, no children	25.3	20.2	23.9	0.0	23.9
Couple with children	31.1	31.5	31.2	0.0	31.2
Other households	25.3	28.8	26.2	0.0	26.2
Base (n)	2,689	982	3,671	0	3,671
Tenure status					
Owned outright	29.2	21.2	27.0	0.0	27.0
Owned on mortgage	44.5	42.1	43.8	0.0	43.8
Rented and others	26.4	36.8	29.1	0.0	29.1
Base (n)	2,689	982	3,671	0	3,671
Number of rooms					
1	37.2	46.3	39.6	0.0	39.6
2	37.4	31.8	35.9	0.0	35.9
3	17.2	13.9	16.3	100.0	16.3

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
4	5.7	5.1	5.5	0.0	5.5
5 or more	2.5	3.0	2.6	0.0	2.6
Base (n)	2,689	981	3,670	1	3,671
Wave 5 (2012)					
Sex					
Male	48.9	46.9	48.4	0.0	48.4
Female	51.1	53.1	51.6	0.0	51.6
Base (n)	3,004	828	3,832	0	3,832
Age					
16-24	30.8	37.7	32.3	0.0	32.3
25-44	22.2	26.0	23.0	0.0	23.0
45-64	29.6	20.0	27.5	0.0	27.5
65+	17.4	16.3	17.2	0.0	17.2
Base (n)	3,004	828	3,832	0	3,832
Region (GOR)					
North East	4.4	4.0	4.3	0.0	4.2
North West	11.6	15.2	12.3	15.1	12.3
Yorkshire and the Humber	11.2	6.8	10.3	8.2	10.3
East Midlands	9.4	7.7	9.1	6.8	9.0
West Midlands	8.5	6.8	8.2	11.0	8.2
East of England	9.1	10.2	9.3	13.7	9.4
London	8.6	13.9	9.6	2.7	9.5
South East	13.9	15.1	14.2	20.5	14.3
South West	10.2	7.2	9.6	8.2	9.6
Wales	5.6	3.7	5.2	6.8	5.2
Scotland	7.6	9.5	8.0	6.8	8.0
Base (n)	3,004	755	3,759	73	3,832
Urbanicity					
Urban	76.0	79.6	76.7	72.6	76.7
Rural	24.0	20.4	23.3	27.4	23.3
Base (n)	3,004	755	3,759	73	3,832
Employment status					
Yes	45.9	41.9	45.1	47.6	45.1
No	54.1	58.1	54.9	52.4	54.9
Base (n)	2,991	759	3,750	82	3,832
Income					
Up to £1,999	27.0	28.7	27.3	37.5	27.5
£2,000-£2,999	25.4	22.5	24.7	34.7	24.9
£3,000-£4,999	29.5	29.0	29.4	15.3	29.1
£5,000 and over	18.2	19.8	18.6	12.5	18.4
Base (n)	2,938	822	3,760	72	3,832
Behind with bills					
Up to date with bills	92.4	90.5	92.0	86.1	91.9
Behind with some bills	7.6	9.5	8.0	13.9	8.1
Base (n)	2,918	842	3,760	72	3,832
Behind with Council Tax					
Yes	7.7	9.8	8.2	4.1	8.1
No	92.3	90.2	91.8	95.9	91.9
Base (n)	2,914	844	3,758	74	3,832
Household type					
1 adult, no children	10.3	10.1	10.3	16.7	10.4
1 adult, children	6.4	7.4	6.6	11.1	6.7
Couple, no children	25.1	15.1	22.9	20.8	22.8
Couple with children	28.8	30.3	29.1	26.4	29.0
Other households	29.4	37.1	31.1	25.0	31.0
Base (n)	2,938	822	3,760	72	3,832
Tenure status					
Owned outright	29.0	21.7	27.4	26.0	27.4

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Owned on mortgage	42.7	41.4	42.5	32.5	42.2
Rented and others	28.3	36.8	30.1	41.6	30.4
Base (n)	2,932	823	3,755	77	3,832
Number of rooms					
1	36.0	43.0	37.5	38.4	37.5
2	40.1	33.3	38.6	38.4	38.6
3	14.5	17.4	15.1	12.3	15.1
4	6.9	3.7	6.2	4.1	6.2
5 or more	2.6	2.5	2.6	6.8	2.7
Base (n)	2,931	828	3,759	73	3,832
Wave 6 (2013)					
Sex					
Male	48.4	49.7	48.6	0.0	48.6
Female	51.6	50.3	51.4	100.0	51.4
Base (n)	2,939	543	3,482	1	3,483
Age					
16-24	31.2	39.2	32.5	0.0	32.5
25-44	22.1	26.7	22.8	0.0	22.8
45-64	28.8	22.7	27.8	0.0	27.8
65+	17.9	11.4	16.9	0.0	16.9
Base (n)	2,940	543	3,483	0	3,483
Region (GOR)					
North East	4.8	3.4	4.6	9.5	4.7
North West	11.8	12.2	11.9	4.8	11.8
Yorkshire and the Humber	11.4	7.0	10.7	28.6	10.8
East Midlands	9.0	9.2	9.0	4.8	9.0
West Midlands	8.5	7.0	8.3	0.0	8.2
East of England	9.5	7.5	9.2	9.5	9.2
London	9.0	11.1	9.3	14.3	9.4
South East	13.3	18.1	14.0	9.5	14.0
South West	9.8	10.0	9.8	14.3	9.8
Wales	5.1	6.0	5.2	0.0	5.2
Scotland	7.8	8.5	7.9	4.8	7.9
Base (n)	2,931	531	3,462	21	3,483
Urbanicity					
Urban	76.2	78.5	76.5	90.5	76.6
Rural	23.8	21.5	23.5	9.5	23.4
Base (n)	2,931	531	3,462	21	3,483
Employment status					
Yes	45.7	48.1	46.1	29.0	45.9
No	54.3	51.9	53.9	71.0	54.1
Base (n)	2,930	522	3,452	31	3,483
Income					
Up to £1,999	19.2	27.2	20.4	11.1	20.4
£2,000-£2,999	23.2	33.5	24.8	44.4	24.9
£3,000-£4,999	34.2	21.3	32.2	44.4	32.2
£5,000 and over	23.5	18.0	22.6	0.0	22.5
Base (n)	2,931	534	3,465	18	3,483
Behind with bills					
Up to date with bills	91.0	91.1	91.0	95.0	91.0
Behind with some bills	9.0	8.9	9.0	5.0	9.0
Base (n)	2,902	561	3,463	20	3,483
Behind with Council Tax					
Yes	9.7	11.2	10.0	20.0	10.0
No	90.3	88.8	90.0	80.0	90.0
Base (n)	2,893	570	3,463	20	3,483
Household type					
1 adult, no children	10.5	5.8	9.8	16.7	9.8

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
1 adult, children	5.7	11.2	6.6	11.1	6.6
Couple, no children	23.1	17.6	22.3	16.7	22.3
Couple with children	28.8	27.7	28.7	33.3	28.7
Other households	31.9	37.6	32.8	22.2	32.7
Base (n)	2,931	534	3,465	18	3,483
Tenure status					
Owned outright	29.0	20.9	27.7	27.3	27.7
Owned on mortgage	42.0	39.0	41.5	40.9	41.5
Rented and others	28.9	40.1	30.8	31.8	30.8
Base (n)	2,892	569	3,461	22	3,483
Number of rooms					
1	36.4	42.2	37.3	27.8	37.3
2	38.8	36.7	38.5	61.1	38.6
3	15.1	15.3	15.2	11.1	15.1
4	7.0	3.5	6.4	0.0	6.4
5 or more	2.7	2.4	2.6	0.0	2.6
Base (n)	2,917	548	3,465	18	3,483
Wave 7 (2014)					
Sex					
Male	48.3	47.5	48.2	100.0	48.2
Female	51.7	52.5	51.8	0.0	51.8
Base (n)	3,619	711	4,330	2	4,332
Age					
16-24	29.7	34.7	30.5	17.9	30.4
25-44	22.1	27.8	23.0	21.4	23.0
45-64	29.8	23.1	28.7	46.4	28.8
65+	18.4	14.4	17.8	14.3	17.7
Base (n)	3,581	723	4,304	28	4,332
Region (GOR)					
North East	4.6	1.7	4.1	0.0	4.1
North West	13.1	9.2	12.4	6.7	12.4
Yorkshire and the Humber	11.5	11.6	11.5	26.7	11.5
East Midlands	8.8	9.1	8.8	26.7	8.9
West Midlands	9.0	6.3	8.5	13.3	8.5
East of England	8.4	10.2	8.7	6.7	8.7
London	10.1	12.3	10.5	0.0	10.4
South East	13.7	13.7	13.7	0.0	13.7
South West	8.8	12.8	9.5	6.7	9.5
Wales	4.5	7.0	4.9	0.0	4.9
Scotland	7.6	6.1	7.4	13.3	7.4
Base (n)	3,601	716	4,317	15	4,332
Urbanicity					
Urban	77.7	77.9	77.8	100.0	77.8
Rural	22.3	22.1	22.2	0.0	22.2
Base (n)	3,601	716	4,317	15	4,332
Employment status					
Yes	45.6	46.6	45.8	46.8	45.8
No	54.4	53.4	54.2	53.2	54.2
Base (n)	3,571	714	4,285	47	4,332
Income					
Up to £1,999	21.5	21.4	21.5	17.2	21.4
£2,000-£2,999	23.1	28.4	24.2	36.2	24.4
£3,000-£4,999	33.9	28.6	32.8	43.1	32.9
£5,000 and over	21.5	21.5	21.5	3.4	21.3
Base (n)	3,369	905	4,274	58	4,332
Behind with bills					
Up to date with bills	91.9	88.7	91.2	87.5	91.2
Behind with some bills	8.1	11.3	8.8	12.5	8.8

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Base (n)	3,347	921	4,268	64	4,332
Behind with Council Tax					
Yes	10.1	12.5	10.6	4.5	10.5
No	89.9	87.5	89.4	95.5	89.5
Base (n)	3,313	952	4,265	67	4,332
Household type					
1 adult, no children	10.9	7.6	10.2	15.5	10.3
1 adult, children	6.0	6.0	6.0	3.4	6.0
Couple, no children	25.8	15.6	23.7	27.6	23.7
Couple with children	27.7	30.9	28.4	25.9	28.3
Other households	29.6	39.9	31.8	27.6	31.7
Base (n)	3,369	905	4,274	58	4,332
Tenure status					
Owned outright	31.0	21.6	28.9	10.8	28.7
Owned on mortgage	41.5	39.5	41.1	43.1	41.1
Rented and others	27.6	38.9	30.0	46.2	30.2
Base (n)	3,346	921	4,267	65	4,332
Number of rooms					
1	37.1	41.3	38.0	41.3	38.1
2	37.6	37.8	37.6	34.9	37.6
3	15.5	13.1	15.0	19.0	15.1
4	6.8	5.9	6.6	1.6	6.6
5 or more	3.0	2.0	2.7	3.2	2.7
Base (n)	3,351	918	4,269	63	4,332
Wave 8 (2015)					
Sex					
Male	48.3	47.0	48.0	50.0	48.0
Female	51.7	53.0	52.0	50.0	52.0
Base (n)	3,289	762	4,051	2	4,053
Age					
16-24	30.5	31.8	30.8	33.3	30.8
25-44	21.5	27.2	22.5	22.2	22.5
45-64	29.8	26.7	29.2	25.9	29.2
65+	18.2	14.3	17.5	18.5	17.5
Base (n)	3,280	746	4,026	27	4,053
Region (GOR)					
North East	4.5	3.2	4.3	0.0	4.3
North West	12.3	13.2	12.5	28.6	12.5
Yorkshire and the Humber	11.8	9.7	11.4	0.0	11.4
East Midlands	8.4	11.2	8.9	0.0	8.9
West Midlands	9.5	6.7	9.0	0.0	8.9
East of England	8.8	8.2	8.7	0.0	8.7
London	10.8	9.9	10.6	14.3	10.6
South East	14.0	12.4	13.7	21.4	13.7
South West	8.4	11.6	9.0	14.3	9.0
Wales	4.0	7.1	4.6	0.0	4.5
Scotland	7.5	7.0	7.4	21.4	7.4
Base (n)	3,279	760	4,039	14	4,053
Urbanicity					
Urban	78.5	78.7	78.5	42.9	78.4
Rural	21.5	21.3	21.5	57.1	21.6
Base (n)	3,279	760	4,039	14	4,053
Employment status					
Yes	46.2	50.1	46.9	30.2	46.7
No	53.8	49.9	53.1	69.8	53.3
Base (n)	3,271	739	4,010	43	4,053
Income					
Up to £1,999	21.8	23.1	22.0	50.9	22.5

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
£2,000-£2,999	18.3	23.6	19.4	17.5	19.4
£3,000-£4,999	34.1	34.4	34.2	24.6	34.0
£5,000 and over	25.8	18.9	24.4	7.0	24.2
Base (n)	3,199	797	3,996	57	4,053
Behind with bills					
Up to date with bills	93.5	91.4	93.1	96.7	93.1
Behind with some bills	6.5	8.6	6.9	3.3	6.9
Base (n)	3,187	805	3,992	61	4,053
Behind with Council Tax					
Yes	7.4	13.1	8.6	6.5	8.5
No	92.6	86.9	91.4	93.5	91.5
Base (n)	3,179	812	3,991	62	4,053
Household type					
1 adult, no children	10.7	9.5	10.5	21.1	10.6
1 adult, children	6.1	5.3	5.9	24.6	6.2
Couple, no children	24.4	18.6	23.2	21.1	23.2
Couple with children	27.8	27.1	27.6	17.5	27.5
Other households	31.1	39.5	32.8	15.8	32.5
Base (n)	3,199	797	3,996	57	4,053
Tenure status					
Owned outright	29.9	24.4	28.8	19.4	28.6
Owned on mortgage	42.7	36.2	41.4	38.7	41.4
Rented and others	27.4	39.4	29.8	41.9	30.0
Base (n)	3,189	802	3,991	62	4,053
Number of rooms					
1	36.8	42.0	37.8	41.7	37.9
2	37.1	38.8	37.4	43.3	37.5
3	16.4	10.8	15.3	8.3	15.1
4	6.7	6.5	6.7	3.3	6.6
5 or more	3.0	1.9	2.8	3.3	2.8
Base (n)	3,197	796	3,993	60	4,053
Wave 9 (2016)					
Sex					
Male	48.1	49.3	48.3	0.0	48.3
Female	51.9	50.7	51.7	0.0	51.7
Base (n)	3,114	562	3,676	0	3,676
Age					
16-24	29.9	35.5	30.8	50.0	30.8
25-44	21.2	27.0	22.1	16.7	22.1
45-64	30.4	22.0	29.1	16.7	29.1
65+	18.6	15.5	18.1	16.7	18.1
Base (n)	3,110	560	3,670	6	3,676
Region (GOR)					
North East	4.8	2.2	4.4	0.0	4.4
North West	11.8	14.5	12.2	20.0	12.2
Yorkshire and the Humber	12.1	10.7	11.9	30.0	12.0
East Midlands	8.4	9.6	8.6	0.0	8.6
West Midlands	9.7	7.1	9.3	0.0	9.3
East of England	8.3	9.8	8.5	0.0	8.5
London	10.8	9.9	10.6	0.0	10.6
South East	13.4	16.1	13.8	20.0	13.8
South West	8.8	9.4	8.9	20.0	8.9
Wales	4.8	4.3	4.7	0.0	4.7
Scotland	7.3	6.5	7.1	10.0	7.2
Base (n)	3,113	553	3,666	10	3,676
Urbanicity					
Urban	78.4	79.6	78.6	90.0	78.6
Rural	21.6	20.4	21.4	10.0	21.4

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Base (n)	3,113	553	3,666	10	3,676
Employment status					
Yes	47.1	47.0	47.1	41.2	47.1
No	52.9	53.0	52.9	58.8	52.9
Base (n)	3,091	568	3,659	17	3,676
Income					
Up to £1,999	18.2	20.6	18.6	27.0	18.7
£2,000-£2,999	20.9	18.5	20.5	32.4	20.6
£3,000-£4,999	33.3	36.6	33.9	24.3	33.8
£5,000 and over	27.6	24.3	27.1	16.2	27.0
Base (n)	3,022	617	3,639	37	3,676
Behind with bills					
Up to date with bills	92.2	90.8	91.9	100.0	92.0
Behind with some bills	7.8	9.2	8.1	0.0	8.0
Base (n)	3,008	629	3,637	39	3,676
Behind with Council Tax					
Yes	7.8	14.7	9.0	19.2	9.2
No	92.2	85.3	91.0	80.8	90.8
Base (n)	2,990	634	3,624	52	3,676
Household type					
1 adult, no children	11.0	7.3	10.4	8.1	10.3
1 adult, children	5.0	5.5	5.1	10.8	5.1
Couple, no children	23.8	15.7	22.4	16.2	22.3
Couple with children	26.5	34.0	27.8	40.5	27.9
Other households	33.7	37.4	34.4	24.3	34.2
Base (n)	3,022	617	3,639	37	3,676
Tenure status					
Owned outright	29.8	22.4	28.6	15.4	28.4
Owned on mortgage	43.4	36.5	42.2	43.6	42.2
Rented and others	26.8	41.0	29.2	41.0	29.3
Base (n)	3,013	624	3,637	39	3,676
Number of rooms					
1	37.5	39.9	37.9	54.1	38.1
2	37.0	33.0	36.3	37.8	36.3
3	16.4	19.4	16.9	8.1	16.8
4	6.4	3.2	5.8	0.0	5.8
5 or more	2.7	4.5	3.1	0.0	3.0
Base (n)	3,020	619	3,639	37	3,676
Wave 10 (2017)					
Sex					
Male	49.1	47.8	48.9	0.0	48.9
Female	50.9	52.2	51.1	0.0	51.1
Base (n)	3,640	672	4,312	0	4,312
Age					
16-24	29.6	33.5	30.2	42.9	30.3
25-44	21.5	24.9	22.1	14.3	22.1
45-64	30.0	24.9	29.2	14.3	29.2
65+	18.8	16.7	18.5	28.6	18.5
Base (n)	3,620	678	4,298	14	4,312
Region (GOR)					
North East	4.2	3.9	4.1	4.5	4.2
North West	12.3	11.5	12.2	15.5	12.2
Yorkshire and the Humber	11.6	14.0	11.9	6.4	11.8
East Midlands	9.0	5.5	8.5	8.2	8.5
West Midlands	8.2	8.5	8.2	5.5	8.1
East of England	8.6	10.4	8.9	18.2	9.1
London	11.7	13.1	11.9	12.7	11.9
South East	13.6	14.9	13.8	11.8	13.7

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
South West	9.5	7.4	9.2	4.5	9.1
Wales	4.4	5.3	4.5	5.5	4.5
Scotland	7.1	5.5	6.9	7.3	6.9
Base (n)	3,637	565	4,202	110	4,312
Urbanicity					
Urban	78.0	79.1	78.2	72.7	78.0
Rural	22.0	20.9	21.8	27.3	22.0
Base (n)	3,637	565	4,202	110	4,312
Employment status					
Yes	47.0	49.7	47.4	51.1	47.5
No	53.0	50.3	52.6	48.9	52.5
Base (n)	3,601	580	4,181	131	4,312
Income					
Up to £1,999	21.0	23.3	21.4	14.7	21.2
£2,000-£2,999	18.6	17.2	18.4	14.0	18.2
£3,000-£4,999	32.9	34.6	33.2	38.0	33.3
£5,000 and over	27.5	24.9	27.1	33.3	27.3
Base (n)	3,496	687	4,183	129	4,312
Behind with bills					
Up to date with bills	93.1	86.0	91.9	91.0	91.9
Behind with some bills	6.9	14.0	8.1	9.0	8.1
Base (n)	3,485	694	4,179	133	4,312
Behind with Council Tax					
Yes	7.3	12.0	8.1	7.1	8.0
No	92.7	88.0	91.9	92.9	92.0
Base (n)	3,473	699	4,172	140	4,312
Household type					
1 adult, no children	11.5	10.8	11.4	8.5	11.3
1 adult, children	4.7	7.9	5.2	10.1	5.4
Couple, no children	23.7	13.7	22.1	19.4	22.0
Couple with children	25.9	29.3	26.5	21.7	26.3
Other households	34.2	38.4	34.9	40.3	35.0
Base (n)	3,496	687	4,183	129	4,312
Tenure status					
Owned outright	31.1	22.7	29.6	39.5	30.0
Owned on mortgage	40.3	39.1	40.1	36.7	40.0
Rented and others	28.5	38.2	30.3	23.7	30.0
Base (n)	3,383	752	4,135	177	4,312
Number of rooms					
1	38.7	46.2	39.9	32.1	39.7
2	38.2	29.1	36.7	39.7	36.8
3	16.1	12.2	15.5	18.3	15.5
4	5.3	7.7	5.7	6.1	5.7
5 or more	1.7	4.8	2.2	3.8	2.2
Base (n)	3,491	690	4,181	131	4,312
Wave 11 (2018)					
Sex					
Male	48.4	48.7	48.4	0.0	48.4
Female	51.6	51.3	51.6	0.0	51.6
Base (n)	4,497	916	5,413	0	5,413
Age					
16-24	28.4	33.3	29.2	18.8	29.2
25-44	22.0	26.6	22.8	18.8	22.8
45-64	29.8	25.5	29.0	56.3	29.1
65+	19.8	14.6	19.0	6.3	18.9
Base (n)	4,484	913	5,397	16	5,413
Region (GOR)					
North East	4.6	2.8	4.3	6.5	4.3

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
North West	11.2	12.2	11.3	2.2	11.2
Yorkshire and the Humber	10.5	14.5	11.1	8.7	11.1
East Midlands	9.6	6.9	9.2	13.0	9.2
West Midlands	8.9	5.1	8.3	4.3	8.2
East of England	9.1	9.4	9.1	15.2	9.2
London	11.2	12.5	11.4	15.2	11.5
South East	13.2	14.8	13.5	5.4	13.3
South West	9.8	9.2	9.7	6.5	9.7
Wales	5.0	4.7	4.9	9.8	5.0
Scotland	7.0	7.9	7.1	13.0	7.2
Base (n)	4,495	826	5,321	92	5,413
Urbanicity					
Urban	76.8	78.2	77.0	79.3	77.1
Rural	23.2	21.8	23.0	20.7	22.9
Base (n)	4,495	826	5,321	92	5,413
Employment status					
Yes	46.3	49.9	46.9	54.8	47.0
No	53.7	50.1	53.1	45.2	53.0
Base (n)	4,465	822	5,287	126	5,413
Income					
Up to £1,999	21.0	20.8	20.9	26.8	21.1
£2,000-£2,999	18.5	17.1	18.3	19.0	18.3
£3,000-£4,999	32.0	35.5	32.6	26.8	32.5
£5,000 and over	28.5	26.6	28.2	27.5	28.2
Base (n)	4,329	942	5,271	142	5,413
Behind with bills					
Up to date with bills	92.7	89.2	92.1	98.8	92.3
Behind with some bills	7.3	10.8	7.9	1.2	7.7
Base (n)	4,291	955	5,246	167	5,413
Behind with Council Tax					
Yes	8.1	11.4	8.7	5.6	8.6
No	91.9	88.6	91.3	94.4	91.4
Base (n)	4,280	956	5,236	177	5,413
Household type					
1 adult, no children	12.5	9.4	12.0	15.5	12.1
1 adult, children	5.1	8.9	5.7	3.5	5.7
Couple, no children	24.6	14.6	22.8	12.7	22.6
Couple with children	26.9	28.2	27.2	26.1	27.1
Other households	30.9	38.7	32.3	42.3	32.5
Base (n)	4,329	942	5,271	142	5,413
Tenure status					
Owned outright	32.0	23.7	30.6	30.5	30.6
Owned on mortgage	39.3	37.7	39.0	34.3	38.8
Rented and others	28.7	38.7	30.4	35.2	30.6
Base (n)	4,300	900	5,200	213	5,413
Number of rooms					
1	38.8	45.0	39.9	46.3	40.1
2	37.7	34.6	37.2	28.8	36.9
3	16.1	12.0	15.4	22.5	15.6
4	5.3	5.6	5.3	2.5	5.2
5 or more	2.1	2.7	2.2	0.0	2.1
Base (n)	4,306	947	5,253	160	5,413
Wave 12 (2019)					
Sex					
Male	48.9	47.5	48.4	0.0	48.4
Female	51.1	52.5	51.6	0.0	51.6
Base (n)	3,306	1,889	5,195	0	5,195
Age					

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
16-24	26.9	30.3	28.1	50.0	28.2
25-44	21.2	26.3	23.0	0.0	23.0
45-64	29.6	28.0	29.0	50.0	29.0
65+	22.3	15.4	19.8	0.0	19.8
Base (n)	3,306	1,885	5,191	4	5,195
Region (GOR)					
North East	4.2	4.4	4.3	6.1	4.4
North West	11.8	10.9	11.5	5.4	11.3
Yorkshire and the Humber	11.1	11.1	11.1	12.2	11.1
East Midlands	9.4	8.9	9.2	8.8	9.2
West Midlands	9.0	6.9	8.2	10.8	8.3
East of England	9.6	8.5	9.2	6.8	9.1
London	9.1	15.5	11.3	12.2	11.4
South East	14.6	11.2	13.4	18.2	13.6
South West	9.9	9.3	9.7	9.5	9.7
Wales	4.9	5.0	5.0	4.1	4.9
Scotland	6.4	8.3	7.1	6.1	7.0
Base (n)	3,300	1,747	5,047	148	5,195
Urbanicity					
Urban	76.0	79.0	77.0	80.4	77.1
Rural	24.0	21.0	23.0	19.6	22.9
Base (n)	3,300	1,747	5,047	148	5,195
Employment status					
Yes	45.8	49.4	47.0	48.5	47.1
No	54.2	50.6	53.0	51.5	52.9
Base (n)	3,288	1,738	5,026	169	5,195
Income					
Up to £1,999	17.3	20.6	18.5	9.5	18.2
£2,000-£2,999	18.4	16.5	17.7	21.0	17.8
£3,000-£4,999	32.9	32.2	32.7	41.4	33.0
£5,000 and over	31.4	30.7	31.1	28.1	31.0
Base (n)	3,109	1,876	4,985	210	5,195
Behind with bills					
Up to date with bills	94.5	90.3	92.9	92.3	92.9
Behind with some bills	5.5	9.7	7.1	7.7	7.1
Base (n)	3,070	1,890	4,960	235	5,195
Behind with Council Tax					
Yes	6.6	10.2	8.0	7.4	8.0
No	93.4	89.8	92.0	92.6	92.0
Base (n)	3,077	1,876	4,953	242	5,195
Household type					
1 adult, no children	12.3	10.7	11.7	12.9	11.7
1 adult, children	5.6	5.8	5.6	6.2	5.7
Couple, no children	26.8	18.6	23.7	20.5	23.5
Couple with children	24.8	26.8	25.5	20.0	25.3
Other households	30.6	38.3	33.5	40.5	33.8
Base (n)	3,109	1,876	4,985	210	5,195
Tenure status					
Owned outright	35.6	24.3	31.4	22.0	30.9
Owned on mortgage	37.6	39.7	38.4	42.9	38.6
Rented and others	26.8	36.0	30.2	35.1	30.5
Base (n)	3,095	1,832	4,927	268	5,195
Number of rooms					
1	38.9	40.1	39.3	40.8	39.4
2	34.7	39.6	36.5	33.3	36.4
3	17.9	12.4	15.8	17.1	15.9
4	6.2	6.3	6.3	7.9	6.3
5 or more	2.3	1.6	2.1	0.9	2.0

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Base (n)	3,098	1,869	4,967	228	5,195
Wave 15 (2022)					
Sex					
Male	48.0	48.1	48.0	0.0	48.0
Female	52.0	51.9	52.0	0.0	52.0
Base (n)	4,197	1,945	6,142	0	6,142
Age					
16-24	26.4	31.1	27.9	40.0	27.9
25-44	24.2	29.5	25.9	40.0	25.9
45-64	27.5	26.8	27.3	20.0	27.3
65+	21.9	12.6	19.0	0.0	19.0
Base (n)	4,192	1,940	6,132	10	6,142
Region (GOR)					
North East	4.3	3.4	4.1	1.3	3.8
North West	12.6	10.3	12.0	12.8	12.0
Yorkshire and the Humber	10.9	10.2	10.7	8.2	10.5
East Midlands	7.8	8.4	8.0	8.2	8.0
West Midlands	9.2	9.2	9.2	6.7	9.0
East of England	9.7	9.5	9.7	14.3	10.0
London	10.9	10.0	10.6	12.4	10.8
South East	15.0	17.0	15.5	12.4	15.3
South West	9.5	9.3	9.4	13.9	9.8
Wales	4.1	5.8	4.5	2.9	4.4
Scotland	6.1	6.9	6.3	6.9	6.4
Base (n)	4,192	1,474	5,666	476	6,142
Urbanicity					
Urban	78.7	81.6	79.5	84.5	79.8
Rural	21.3	18.4	20.5	15.5	20.2
Base (n)	4,192	1,474	5,666	476	6,142
Employment status					
Yes	47.1	51.1	48.1	50.6	48.3
No	52.9	48.9	51.9	49.4	51.7
Base (n)	4,185	1,453	5,638	504	6,142
Income					
Up to £1,999	15.6	15.4	15.5	17.6	15.8
£2,000-£2,999	15.4	17.8	16.1	12.5	15.7
£3,000-£4,999	30.8	33.4	31.5	25.0	30.8
£5,000 and over	38.2	33.4	36.8	44.9	37.7
Base (n)	3,916	1,538	5,454	688	6,142
Behind with bills					
Up to date with bills	93.1	87.6	91.6	89.5	91.3
Behind with some bills	6.9	12.4	8.4	10.5	8.7
Base (n)	3,894	1,543	5,437	705	6,142
Behind with Council Tax					
Yes	6.1	9.2	7.0	9.1	7.2
No	93.9	90.8	93.0	90.9	92.8
Base (n)	3,890	1,530	5,420	722	6,142
Household type					
1 adult, no children	11.5	11.1	11.3	11.5	11.4
1 adult, children	6.1	5.5	5.9	6.4	6.0
Couple, no children	29.7	20.9	27.2	20.1	26.4
Couple with children	23.1	26.3	24.0	27.2	24.4
Other households	29.7	36.2	31.5	34.9	31.9
Base (n)	3,916	1,538	5,454	688	6,142
Tenure status					
Owned outright	33.7	23.0	30.7	19.6	29.4
Owned on mortgage	41.5	41.4	41.4	45.4	41.9
Rented and others	24.8	35.6	27.9	35.0	28.7

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Base (n)	3,909	1,530	5,439	703	6,142
Number of rooms					
1	37.6	41.2	38.6	47.7	39.6
2	34.0	32.7	33.7	31.6	33.4
3	18.2	15.1	17.4	11.2	16.7
4	7.4	7.2	7.4	6.5	7.3
5 or more	2.7	3.7	3.0	3.0	3.0
Base (n)	3,915	1,522	5,437	705	6,142
Wave 16 (2023)					
Sex					
Male	48.2	47.4	48.0	0.0	48.0
Female	51.8	52.6	52.0	0.0	52.0
Base (n)	4,208	1,666	5,874	0	5,874
Age					
16-24	26.6	31.4	28.0	20.0	28.0
25-44	23.8	29.0	25.3	30.0	25.3
45-64	27.6	26.5	27.3	30.0	27.3
65+	22.0	13.0	19.5	20.0	19.5
Base (n)	4,204	1,660	5,864	10	5,874
Region (GOR)					
North East	4.9	1.9	4.2	4.3	4.2
North West	12.2	12.4	12.3	14.4	12.4
Yorkshire and the Humber	11.3	9.3	10.9	15.0	11.2
East Midlands	8.5	6.6	8.1	7.0	8.0
West Midlands	8.9	9.8	9.1	6.4	8.9
East of England	9.5	9.8	9.6	4.7	9.2
London	9.9	13.4	10.7	16.0	11.1
South East	15.4	15.2	15.4	16.0	15.4
South West	8.6	11.5	9.3	3.7	8.8
Wales	4.1	5.9	4.5	4.7	4.5
Scotland	6.6	4.2	6.0	7.8	6.2
Base (n)	4,209	1,178	5,387	487	5,874
Urbanicity					
Urban	78.7	80.8	79.2	75.8	78.9
Rural	21.3	19.2	20.8	24.2	21.1
Base (n)	4,209	1,178	5,387	487	5,874
Employment status					
Yes	47.6	51.6	48.5	51.1	48.7
No	52.4	48.4	51.5	48.9	51.3
Base (n)	4,186	1,166	5,352	522	5,874
Income					
Up to £1,999	13.3	14.3	13.5	10.1	13.1
£2,000-£2,999	15.3	18.8	16.1	16.8	16.2
£3,000-£4,999	31.2	29.9	30.9	19.6	29.6
£5,000 and over	40.2	37.0	39.5	53.5	41.1
Base (n)	4,016	1,185	5,201	673	5,874
Behind with bills					
Up to date with bills	91.5	90.1	91.2	88.2	90.9
Behind with some bills	8.5	9.9	8.8	11.8	9.1
Base (n)	3,998	1,179	5,177	697	5,874
Behind with Council Tax					
Yes	7.6	8.3	7.8	6.0	7.6
No	92.4	91.7	92.2	94.0	92.4
Base (n)	3,979	1,179	5,158	716	5,874
Household type					
1 adult, no children	11.6	10.0	11.2	11.3	11.3
1 adult, children	5.2	5.6	5.3	9.1	5.7
Couple, no children	29.2	21.3	27.4	17.2	26.2

	(a) Observed	(b) IPFW	(a) + (b)	(c) MICE	Complete (a) + (b) + (c)
Couple with children	24.3	25.6	24.6	27.3	24.9
Other households	29.7	37.6	31.5	35.1	31.9
Base (n)	4,016	1,185	5,201	673	5,874
Tenure status					
Owned outright	33.7	22.2	31.0	22.1	30.0
Owned on mortgage	41.4	42.6	41.7	54.8	43.2
Rented and others	24.9	35.2	27.3	23.0	26.8
Base (n)	4,002	1,181	5,183	691	5,874
Number of rooms					
1	35.7	44.8	37.7	37.6	37.7
2	36.5	27.7	34.5	34.5	34.5
3	17.5	16.4	17.3	16.3	17.1
4	7.7	6.5	7.4	8.4	7.5
5 or more	2.6	4.6	3.1	3.2	3.1
Base (n)	4,012	1,173	5,185	689	5,874

A1. 5 References

Austin, P. C., & van Buuren, S. (2023) Logistic regression vs. Predictive mean matchingfor imputing binary covariates. *Stat. Meth. Med. Res.*, 32, 2172–2183. https://doi.org/10.1177/09622802231198795

Cabrera-Álvarez, P., James, N., & Lynn, P. (2023) *Panel attrition in the General Population Sample and the Immigrant and Ethnic Minority Boost of Understanding Society.* Understanding Society Working Papers, 2023–03, 37. https://doi.org/10.5255/UKDA-SN-6614-15

Grund, S., Lüdtke, O., & Robitzsch, A. (2018) Multiple Imputation of Missing Data at Level 2: A Comparison of Fully Conditional and Joint Modeling in Multilevel Designs. *J. Educ. Behav. Stats.,* 43, 316–353. https://doi.org/10.3102/1076998617738087

Kenward, M. G., & Molenberghs, G. (2009) Last Observation Carried Forward: A Crystal Ball? *J. Biopharm. Stat.,* 19, 872–888. https://doi.org/10.1080/10543400903105406

Saha, C., & Jones, M. P. (2009) Bias in the last observation carried forward method under informative dropout. *J. Stat. Plan. Inf.*, 139, 246–255. https://doi.org/10.1016/j.jspi.2008.04.017

Van Buuren, S. (2018). *Flexible imputation of missing data (Second edition)*. CRC Press, Taylor & Francis Group.

Vink, G., Frank, L. E., Pannekoek, J., & van Buuren, S. (2014) Predictive mean matching imputation of semicontinuous variables. *Stat. Neerl.*, 68, 61–90. https://doi.org/10.1111/stan.12023

Appendix A2: Estimation and evaluation of analysis dataset sample inclusion weights

Sample inclusion weights for each wave are not released with the UKHLS datasets, nor are weights for web mode first sample members. Hence, sets of customised weights were created for use in the substantive analyses in the paper. These weights, termed cross-sectional (see below) sample inclusion weights, adjust the released sample inclusion enumeration weights for attrition from the sample (HHs not responding for two waves are not issued, nor are individuals who ask to be removed from the survey: see also main paper section 3.1). They also adjust for selection into the web-first sample (individuals can request another mode). HH weight-sharing methods are then used to share these weights with unweighted HH members (those who enter HHs at waves after the inclusion enumeration weight was constructed), split (divide) these shared weights with remaining unweighted sample members (those in HHs where there is no weight to be shared) with similar characteristics, and post-stratify the split weights to relevant population estimates. The procedure is complex, so in the sections below is described first for the main survey dataset and then wave by wave for the IP datasets (an additional complexity with the later weights is that the survey refreshment samples must also be incorporated: see main paper section 2.2 for details). Following this, evaluations of weight performance are reported.

A2 1 Weight estimation

A2 1.1 Main survey 2020 dataset

The main survey dataset of interest consists of some ex-CAPI ring-fenced sample members offered web-first interviewing at wave 11 or 12 during COVID-19 pandemic in 2020. The input to this weight is the released main survey wave 6 inclusion enumeration weight. Since only those enumerated at wave 6 have this weight, and only these individuals are included in the sample at wave 7, it is also the wave 7 sample inclusion weight for these individuals. For each of the wave 11 and wave 12 samples,

this weight is adjusted for wave 11 / 12 sample non-inclusion, i.e. multiplied by 1 / the estimated probability of wave 11 / 12 sample inclusion given inclusion in the wave 7 sample, with inclusion probabilities estimated using regression modelling with 11 survey-measured, auxiliary covariates (see Table 1 for covariates, and section A1.2. for details of methods used to select final models and estimate inclusion probabilities). The estimated weights are then adjusted for selection into the ring-fenced sample, i.e. multiplied by 1 / the estimated probability of selection into the ring-fenced sample given inclusion in the wave 11 / 12 sample, with sample inclusion probabilities estimated using the same regression methods as for the sample inclusion adjustment.

To produce the final weight to be used in the substantive analyses, the post-stratified cross-sectional sample inclusion weight, four further steps are then undertaken. First, the weights estimated above are shared with unweighted wave 11/12 web-first HH members, i.e. (final) weights in HH including unweighted web-first members equal the sum of existing weights across web-first HH members divided by the number of web-first HH members with or without existing weights. This method provides unbiased estimates from HH probability samples and is used in a number of panel surveys (Ernst 1983; Lavallee 1995, 2007; Schonlau et al. 2013; Zhang 2021).

Second, each of these shared weights is split with remaining unweighted sample members (those in HHs without a sample inclusion weight to share) with similar survey measured characteristics using the procedure of Moore & Clarke (submitted). This procedure: 1) uses regression modelling of existing weights to predict 'synthetic' weights for unweighted individuals given their survey measured characteristics; 2) matches / clusters existing and synthetic weights; and 3) splits (divides) the existing weights in each cluster with the unweighted individuals in the cluster. It will produce unbiased estimates of the population estimated by the shared weights assuming that shared weighted and unweighted sample members are exchangeable given the same characteristics, and that clusters of sample members with similar characteristics are identified adequately.

Third, these two split weights are combined, rescaled to have a mean of one, and then post-stratified to Great Britain population estimates for 2020 (Office for National Statistics 2024; National Records of Scotland 2024; Northern Ireland Statistics and Research Agency 2024). Population estimates for the cross tabulation of Region (4 categories), Sex (2 categories) and Age (5 categories) are used in the post-stratification (a total of 40 strata). Fourth, in the final step, the post-stratified weights are again rescaled to have a mean of one.

A2 1.2. IP datasets

Wave 5

The first IP wave of interest is wave 5, the wave at which web-first interviewing was introduced. The weight for use in substantive analyses, the cross-sectional (see below) wave 5 web-first sample inclusion weight, has two components. The first is the weight for wave 1 sample members. The input to this weight is the wave 1 enumeration weight for all wave 1 sample members, which is then adjusted for their non-inclusion in the wave 5 sample, and for selection into the web-first sample. The non-inclusion adjustment is computed as 1 / the estimated probability of inclusion in the wave 5 sample given inclusion in the wave 1 sample, with inclusion probabilities estimated in the same way as with the main survey weights. The selection adjustment is computed as 1 / the estimated probability of selection into web-first given inclusion in the wave 5 sample, with selection probabilities also estimated using similar regression modelling. The wave 1 enumeration weight is then multiplied by these adjustments.

The other component is the released wave 4 enumeration inclusion weight for all wave 4 refreshment sample members. Since only those enumerated at wave 4 have this weight, and only these individuals are included in the sample at wave 5, it is also the wave 5 sample inclusion weight for these individuals. This weight is adjusted for selection into the web-first sample in similar fashion to the weight for wave

1 sample members, i.e. it is multiplied by 1 / the estimated probability of selection into web-first given inclusion in the wave 5 sample, with selection probabilities using regression modelling as before. Each of the two sets of weights is then rescaled so that they have a mean of 1. Next, they are combined to produce the wave 5 longitudinal web-first sample inclusion weight. This weight is used in the production of weights for following waves (see below). To produce the final weight to be used in the substantive analyses, the wave 5 post-stratified cross-sectional sample inclusion weight, in a process analogous to that for the main survey weights the longitudinal sample inclusion weight, is shared with unweighted HH members. This shared weight is split with remaining unweighted sample members. The split weight is post-stratified to estimated Great Britain excluding Northern Ireland (the IP datasets did not include individuals from the latter country: see main paper, section 2.2) population totals for the given year, and the post-stratified weight re-scaled to have a mean of one.

Waves 6, 7, 8, 10 and 16

The weights for these waves are constructed in the same way. The wave *t* longitudinal web-first sample inclusion weight is the wave *t-1* (wave 5 in the case of wave *t* = 6) longitudinal web-first sample inclusion weight adjusted for wave *t* web-first sample non-inclusion, i.e. multiplied by 1 / the estimated probability of wave *t* web-first sample inclusion given inclusion in the wave *t - 1* web-first sample, with sample inclusion probabilities estimated as above. This weight is then rescaled to have a mean of one. Analogous to the wave 5 equivalent, the wave *t* cross-sectional web-first sample inclusion weight to be used in substantive analyses is the wave *t* longitudinal web-first sample inclusion weight shared with unweighted wave *t* HH members, split with remaining unweighted sample members, post-stratified to estimated population totals, then re-scaled to have a mean of one. Note that a refreshment sample also enters the survey at wave *t* = 7. However, members are not offered web-first mode until wave *t* = 9, which is the wave at which they enter the analysis datasets considered here

(see below). In addition, another refreshment sample enters the survey at wave 10, but members are not offered web-first mode until wave 11, which is the wave at which they enter the analysis datasets.

Wave 9

Weights for this wave have two components. The first is the weight for waves 1 and 4 (refreshment) sample members, which is the wave 8 longitudinal web-first sample inclusion weight adjusted for wave 9 web-first sample non-inclusion, i.e. multiplied by 1 / the estimated probability of wave 8 web-first sample inclusion given inclusion in the wave 7 web-first sample, with sample inclusion probabilities estimated as above. This weight is then rescaled to have a mean of one.

The second component is the weight for wave 7 refreshment sample members. The input to this weight is the released wave 7 enumeration weight (which is the wave 8 sample inclusion weight for such individuals). This is adjusted for wave 9 sample non-inclusion by multiplying it by 1 / the estimated probability of wave 9 sample inclusion given inclusion in the wave 7 sample, with sample inclusion probabilities estimated as before. Then, the resulting weight is adjusted for selection into the web-first sample by multiplying it by 1 / the estimated probability of wave 9 web-first sample inclusion given inclusion in the wave 9 sample, with sample inclusion probabilities estimated as before. Next, this weight is rescaled to have a mean of one. Finally, the weights from the two components are combined to produce the wave 9 longitudinal web-first sample inclusion weight. The wave 9 cross-sectional web-first sample inclusion weight used in substantive analyses is the wave 9 longitudinal web-first sample inclusion weight shared with unweighted wave 9 HH members, split with remaining unweighted sample members, post-stratified to estimated population totals, then re-scaled to have a mean of one.

Wave 11

Weights for this wave have two components. The first is the weight for web-first waves 1, 4 and 7 (refreshment) sample members. This is the wave 10 longitudinal web-first sample inclusion weight estimated above adjusted for wave 11 web-first sample non-inclusion, i.e. multiplied by 1 / the estimated probability of wave 11 web-first sample inclusion given inclusion in the wave 10 web-first sample, with sample inclusion probabilities estimated as above. This weight is then rescaled to have a mean of one.

The second component is the released wave 10 enumeration weight for all wave 10 refreshment sample members. This is also the wave 11 sample inclusion weight for these individuals as all are included in the sample at wave 11. This weight is adjusted for selection into the web-first sample by multiplying it by 1 / the estimated probability of wave 11 web-first sample inclusion given inclusion in the wave 11 sample, with sample inclusion probabilities estimated as before. Then, the resulting weight is rescaled so that it has a mean of 1. Next, the weights from the two components are combined to produce the wave 11 longitudinal web-first sample inclusion weight. The wave 11 cross-sectional web-first sample inclusion weight used in substantive analyses is the wave 11 longitudinal web-first sample inclusion weight shared with unweighted wave 11 HH members, split with remaining unweighted sample members, post-stratified to estimated population totals, then re-scaled to have a mean of one. Note that a refreshment sample also entered the survey at wave 11. Some members were allocated to web-first mode at the wave, but the only released weight available for them, the wave 11 enumeration weight, cannot be used as a sample inclusion weight at the wave because it includes an adjustment for wave 11 non-enumeration. Hence, they only enter our analysis samples at wave 14 (see below).

Wave 15

Waves 12, 13 and 14 are not included in our analyses. At wave 12, one third of the sample was allocated to an experiment that involved data collection by nurses, with only a third allocated to web-first, too small a dataset for analyses. Waves 13 and 14 took place during the COVID-19 pandemic, which led to all IP sample members being allocated to web interviewing with telephone follow up. Note that a refreshment sample also entered the survey at wave 14. At wave 15, a newly chosen subset of sample members was allocated to web-first. Hence, the weights for this wave have two components. The first is the weight for all waves 1, 4, 7 and 10 (refreshment) sample members. The input to this weight is the wave 11 longitudinal weight, estimated using the procedures described previously but for all sample members rather just the web-first sample. This weight is then adjusted for non-sample inclusion at wave 15, i.e. multiplied by 1 / the estimated probability of wave 15 web-first sample inclusion given enumeration at wave 11, with sample inclusion probabilities estimated as above. Next, the resulting weight is adjusted for selection into the web-first sample by multiplying it by 1 / the estimated probability of wave 15 web-first sample inclusion given inclusion in the wave 15 sample, with sample inclusion probabilities estimated as before. Finally, this weight is rescaled to have a mean of 1.

The second component is the released wave 14 enumeration weight for all wave 14 refreshment sample members, which is also their wave 15 sample inclusion weight since all enumerated are issued at the wave. This weight is restricted to wave 15 web-first individuals, Then, the resulting weight is rescaled so that it has a mean of 1. Next, the weights from the two components are combined to produce the wave 15 longitudinal web-first sample inclusion weight. The wave 15 cross-sectional web-first sample inclusion weight used in substantive analyses is the wave 15 longitudinal web-first sample inclusion weight shared with unweighted wave 15 HH members, split with remaining unweighted sample members, post-stratified to estimated population totals, then re-scaled to have a mean of one.

A2 1.3. Regression model selection methods

To identify the final regression models used to estimate inclusion / selection probabilities, Lasso procedures are used. Lasso procedures (Tibshirani 1996; Steyerberg et al. 2001) are regularised regression methods. As with other regularised regression methods for binary data (i.e. 0 = sample non-inclusion, 1 = sample inclusion), they maximise the joint probability of the model parameters given the observed data similar to maximum likelihood methods, but in addition impose a regularisation penalty on model complexity (Ahrens et al. 2020). Due to the imposition of this penalty, such methods tend to outperform maximum likelihood methods in terms of out of sample prediction, as reducing model complexity and inducing shrinkage bias decreases prediction error. In doing so, they also address the problem of model overfitting: high in-sample fit, but poor prediction performance on unseen data.

Regularised regression methods incorporate tuning parameters that determine the amount and form of regularisation penalty. Several techniques exist to choose the value of these parameters. The first is cross-validation, which explicitly evaluates out of sample prediction performance. The data are split into training and validation datasets. The models for different values of the tuning parameters are then estimated and variables selected using the training dataset. Next, they are applied to the validation dataset, and performance quantified (Ahrens et al. 2020). The second technique is the use of information criteria. These are interpretable as likelihood methods that penalise the number of parameters in models. Again, models for different tuning parameters are estimated and variables selected, then the best performing is chosen based on information criteria value. When producing the sample inclusion weights, we use information criteria techniques to choose tuning parameter values and identify models for estimating inclusion probabilities. Specifically, we utilise the Extended Bayesian Information Criterion (EBIC: Chen & Chen 2008), because simulations show that in the majority of scenarios they perform better than other similar options in terms of model identification (see Ahrens et al. 2020). We do not use cross validation methods because the size of analysis datasets prevents

their division into training and validation datasets (see Moore et al. 2024 for further justification of these methods in the current context). We use the Stata 18 package 'lassologit' (Ahrens et al. 2020) to perform analyses.

The above techniques require that predictors are standardised so that they have unit variance. Hence, when modelling inclusion probabilities for weight estimation we first convert all multi-category predictors into dummy variables. Once the selected model is identified, we then extend it to all selected covariate categories whether they were selected or not: in previous work, we have found that this approach reduces biases (relative to benchmarks) in weighted estimates (unpublished results). After final model identification, we use post-Lasso estimation to estimate inclusion / selection probabilities for weight estimation, because Lasso estimated coefficients are subject to attenuation bias (Ahrens et al. 2020). Specifically, we use probit models, with inclusion probabilities predicted using model coefficients and sample member characteristics.

A2 2. Evaluations of weight performance

A2 2.1. Evaluation methods

The customised sample inclusion weights are evaluated in two ways. First, they are evaluated against internal benchmarks. This approach involves using weighted estimates of survey measured characteristics for the sample from a given survey wave as benchmarks and evaluating the performance of equivalent weighted estimates from a comparator dataset (from the same or following waves) in recovering them (see Moore et al. 2024 for an example of this approach). Note that in this instance the types of comparisons possible are restricted because different weighted datasets often represent different populations. We cannot evaluate cross-sectional sample inclusion weights from a given wave using the previous wave sample and its equivalent weights as the benchmark due to HH joiners and refreshment samples entering the former dataset. Similarly, concerning interim weights

estimated in the course of final weight estimation, shared weight datasets cannot be compared to unshared weight (i.e. longitudinal sample inclusion weight) datasets due to the former including HH joiners. However, two sets of comparisons of interim weights are possible. Longitudinal sample inclusion-weighted datasets can be compared to previous wave equivalent benchmarks because they only include sample members who were similarly weighted at the previous wave. Note that this type of comparison can only be undertaken when the previous benchmark wave has a longitudinal sample inclusion weight. Hence, it cannot be undertaken for the main survey 2020 dataset or IP dataset wave 15, though with the latter datasets an evaluation of wave 5 weights for enumerated wave 1 sample members is included.

In addition, split weighted datasets can be compared to shared weight dataset benchmarks from the same wave because the weight splitting procedure divides the shared weights with unweighted sample members with similar characteristics, so such weights produce estimates for the same population as the benchmarks. This latter type of evaluation can be undertaken for both the main survey 2020 dataset and all IP dataset waves. In these evaluations, weighted estimates of incidence in the dataset for each of the categories of the 11 covariates included in models estimating the sample inclusion / selection probabilities underlying weight estimation (see Table 1) are computed for benchmark and comparator datasets and compared. For the evaluations of the longitudinal sample inclusion weights, the test of Moore et al. (2024: see Appendix A3 for details), which accounts for partial dependencies between datasets (comparator datasets are a subset of benchmark datasets), is used. For the shared vs. split weight evaluation, independent samples T tests are instead used because in this scenario (where benchmark datasets are a subset of comparator datasets) use of Moore et al.'s (2024) test cannot be justified with a design-based framework. Note that these latter tests will be anti-conservative as they do not account for partial dependencies between datasets. Survey design (Primary Sampling Unit and Strata) is accounted for in estimation and testing. In addition, as overall performance measures, we report means across all considered covariate categories of absolute

differences between comparator and benchmark estimates standardised by benchmark estimate standard deviations (MASBs) and their 95% CIs.

The second approach to evaluating weight performance involves comparing weighted estimates of survey measured characteristics to external benchmarks. In these evaluations, as external benchmarks the Region × Sex × Age cross-tabulation of UK population estimates for the given year that are utilised to post stratify the (split) cross-sectional sample inclusion weights to produce the final weight used in substantive analyses (see previously) are used. The population totals in each of the cells are converted to incidences (= cell total / overall population total) and compared to equivalent incidences computed using survey measured characteristics for (split) cross-sectional sample inclusion weighted and final post-stratified weighted comparator datasets. One sample T tests are used for statistical inference, with survey design (Primary Sampling Unit and Strata for each weight) accounted for in estimation and testing. As overall performance measures, we also report the means of absolute differences (MABs) across all crosstabulation cells and their 95% confidence intervals (CIs).

A2 2. Evaluation results

A2 2.1. Main survey 2020 dataset

The evaluations of split, cross-sectional sample inclusion weighted estimates compared to shared cross-sectional weighted benchmarks indicate that the means of the absolute biases standardised by benchmark estimate standard deviations (MASB) is 0.002 (95% CI 0.001 – 0.002). No significant differences between estimates for individual characteristics are observed (Table A2 2). Hence, the split weights perform well at recovering same wave shared weight benchmarks.

The evaluations of the split, cross-sectional sample inclusion weights compared to external population estimate benchmarks indicate that the mean absolute difference (MAB) is 0.004 (95% CI 0.004 – 0.005). 21 significant differences between estimates are observed, but the largest is 0.012 (Table A2

3). Note also that significant differences are to be expected given the number of tests and the likelihood of type 1 errors. The evaluations of the post-stratified, split, cross-sectional sample inclusion weights compared to external population estimate benchmarks indicate that the MAB is 0.001 (95% CI 0.001 – 0.001). No significant differences found between estimates are observed (Table A2 3). Hence, both the split, cross-sectional sample inclusion weights and the final post-stratified weights used in substantive analyses perform well at recovering relevant external population estimate benchmarks.

A2 2.2 IP datasets

The evaluations of longitudinal sample inclusion-weighted estimates from each survey wave compared to equivalently weighted previous wave benchmarks indicate that means of the absolute biases standardised by benchmark estimate standard deviations (MASBs) are below 1% of estimate standard deviations at all waves, though they are slightly higher at waves 5 and 16 than other waves (Table A2 4). Regarding biases for individual characteristics, no significant differences between estimates exist at waves 5 to 11, but 22 of the 27 are significant at wave 16 (Table A2 5). Hence, the longitudinal sample inclusion weights perform well at recovering previous wave equivalent benchmarks. We suggest that the larger differences between benchmark and comparator estimates at waves 5 and 16 are due to more covariate values being imputed using multiple imputation methods at these waves (there is less opportunity to instead use values from respectively earlier and later waves than at the other evaluated waves: see Appendix A1). That many differences were significant at wave 16 probably reflects the larger sample size (c. 1/3 larger) at this wave compared to the other waves, along with the probability of type 1 errors given the number of tests performed (see also section 2.2.1).

The evaluations of split-weighted estimates from each survey wave compared to same wave shared-weighted benchmarks indicate that MASBs are below 1% of benchmark estimate standard deviations at all waves (Table A2 6). Regarding individual biases, no significant differences between estimates

exist (Tables A2 7 and A2 8). Hence, the split weights perform well at recovering same wave shared weight benchmarks.

The evaluations of the split, cross-sectional sample inclusion weights compared to external population estimate benchmarks indicate that mean absolute biases (MABs) are smaller than 0.007 at all waves (Table A2 9), although some significant differences between estimates are observed, with numbers increasing across waves (Table A2 10). The evaluations of the post-stratified, split, cross-sectional sample inclusion weights compared to external population estimate benchmarks indicate that MABs are a maximum of 0.001 (Table A2 11). No significant differences exist between estimates at any wave (Table A2 12). Hence, both the split, cross-sectional sample inclusion weights and the final post-stratified weights used in substantive analyses perform well at recovering relevant external population estimate benchmarks.

A2 3. References

Ahrens, A., Hansen, C. B., & Schaffer, M. E. (2020) lassopack: Model selection and prediction with regularized regression in Stata. *The Stata Journal*, 20*:* 176-235.

Chen, J. & Chen, Z. (2008) Extended Bayesian information criteria for model selection with large model spaces. *Biometrika*, 95: 759–771. DOI: 10.1093/biomet/asn034

Ernst, L.R. (1989) Weighting issues for longitudinal household and family estimates. In *Panel Surveys* (Kasprzyk, D., Duncan, G., Kalton, G. & Singh, M.P. (eds), p. 135–159. Wiley & Sons, New York,

Lavallee, P. (1995) Cross-sectional weighting of longitudinal surveys of individuals and households using the weight share method*. Survey Methodology*, 21:25–32.

Lavallée, P. (2007) *Indirect Sampling,* New York: Springer

Moore, J.C., Burton, J., Crossley, T. F., Fisher, P., Gardiner, C., Jäckle, A., & Benzeval, M. (2024) *Assessing Bias Prevention and Bias Adjustment in a Sub-Annual Online Panel Survey*. Understanding Society Working Papers Series ??

Moore, J.C. & Clarke, P. (in prep.) Two new solutions to the zero survey weights problem.

National Records of Scotland (2024) *Mid Year Population Estimates Time Series Data*. https://www.nrscotland.gov.uk/publications/population-estimates-time-series-data/

Northern Ireland Statistics and Research Agency (2024) *2023 Mid-year Population Estimates for Northern Ireland*. https://www.nisra.gov.uk/system/files/statistics/MYE23-bulletin_1.pdf

Office for National Statistics (2024) *Mid 2011 to mid-2023 detailed time series edition of population estimates for England and Wales.*

https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/estimatesofthepopulationforenglandandwales

Schonlau, M., Kroh, M., & Watson, N. (2013) The implementation of cross-sectional weights in household panel surveys. *Statistics Surveys*, 7: 37-57.

StataCorp (2023) Stata Lasso Reference Manual Release 18. StataCorp LLC, College Station, Texas.

Steyerberg, E.W., Eijkemans, M.J.C. & Habbema, J.D.F. (2001) Application of shrinkage techniques in Logistic regression analysis: a case study. *Statistica Neerlandica,* 55: 76–88. DOI: 10.1111/1467-9574.00157.

Tibshirani, R. (1996) Regression and shrinkage via the Lasso, *Journal of the Royal Statistical Society, Series B*, 58, 267-288.

Zhang, L. C. (2021). *Graph sampling*. Chapman and Hall/CRC.

Table A2 1: Auxiliary covariates used in weight estimation and evaluations of weight performance their categorisations.

	Categorisation
Sex	1) Male; 2) Female
Age	1) 16-34; 2) 35-54; 3) 55-74; 4) 75+
Activity last week	1) In work; 2) Not in Work
Tenure	1) Owner occupied; 2) Mortgage; 3) Rented / Other.
HH Structure	1) 1 adult; 2) 1 adult, kids; 3) Couple, no kids; 4) Couple, kids; 5) Other
Region	1) North; 2) East; 3) South; 4) West.
Behind with bills	1) No; 2) Yes
HH income	1) 1st quintile; 2) 2nd quintile; 3) 3rd quintile; 4) 4th quintile; 5) 5th quintile
Behind with Council Tax	1) Yes; 2) No
Urban	1) Urban; 2) Rural
Nos. rooms in HH	Continuous

Table A2 2: Main survey 2020 dataset split cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent shared cross-sectional sample inclusion weighted benchmarks. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the sample inclusion weighted estimate and the benchmark estimate. * equals $P<0.05$.

Variable	Bch. (se)	Diff
Sex: Male	0.488	-0.002
	(0.006)	
Age: 0-15	0.135	0.000
	(0.004)	
Age: 16-34	0.224	-0.001
	(0.005)	
Age: 35-54	0.247	0.001
	(0.005)	
Age: 55-74	0.268	0.001
	(0.005)	
Age: 75+	0.126	-0.001
	(0.004)	
Activity Last Week: In work	0.452	-0.002
	(0.006)	
Housing tenure: Owner occupied	0.339	0.001
	(0.006)	
Housing tenure: Mortgage	0.356	-0.000
	(0.006)	
Housing tenure: Rented/Other	0.305	-0.001
	(0.006)	
Household Structure: 1 adult	0.162	-0.001
	(0.005)	
Household Structure: 1 adult, kids	0.048	0.000
	(0.003)	
Household Structure: Couple	0.245	0.000
	(0.005)	
Household Structure: Couple, kids	0.233	-0.000
	(0.005)	
Household Structure: Other	0.312	0.000
	(0.006)	
Region: North	0.327	0.000
	(0.006)	
Region: South	0.261	-0.001
	(0.005)	
Region: East	0.249	-0.001
	(0.005)	
Region: West	0.163	0.002
	(0.005)	
Household Location: Urban	0.749	-0.000
	(0.005)	
Behind with bills: No	0.931	-0.000
	(0.003)	
Behind Council Tax: Yes	0.065	0.000
	(0.003)	
Household income: 1st quintile	0.228	0.001
	(0.005)	
Household income: 2nd quintile	0.220	-0.000
	(0.005)	
Household income: 3rd quintile	0.187	-0.001
	(0.005)	
Household income: 4th quintile	0.184	-0.000
	(0.005)	
Household income: 5th quintile	0.180	0.000
	(0.005)	

Table A2 3: Main survey 2020 dataset split ('SP') and post-stratified (PS) cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent UK estimated population incidence benchmarks. 'Bch.' is the benchmark population estimate. 'SP. diff' is the difference between the split weight estimate and the benchmark estimate. 'PS. diff' is the difference between the split weight estimate and the benchmark estimate. * equals *P*<0.05.

Strata	Bch.	SP. diff	PS. Diff
Region1_Sex1_Age1	0.030	-0.008*	-0.001
Region1_Sex1_Age2	0.036	0.002	-0.001
Region1_Sex1_Age3	0.037	0.003	-0.001
Region1_Sex1_Age4	0.035	0.009*	-0.001
Region1_Sex2_Age5	0.016	-0.001	-0.000
Region1_Sex2_Age1	0.029	-0.006*	-0.001
Region1_Sex2_Age2	0.036	-0.001	-0.001
Region1_Sex2_Age3	0.039	0.004	-0.001
Region1_Sex2_Age4	0.036	0.008*	-0.001
Region1_Sex2_Age5	0.019	0.003	-0.001
Region2_Sex1_Age1	0.026	-0.009*	-0.001
Region2_Sex1_Age2	0.031	-0.001	-0.001
Region2_Sex1_Age3	0.034	-0.003	-0.001
Region2_Sex1_Age4	0.030	0.006*	-0.001
Region2_Sex2_Age5	0.010	0.004*	-0.000
Region2_Sex2_Age1	0.025	-0.006*	-0.001
Region2_Sex2_Age2	0.031	-0.003	-0.001
Region2_Sex2_Age3	0.035	-0.001	-0.001
Region2_Sex2_Age4	0.031	0.003	-0.001
Region2_Sex2_Age5	0.014	0.005*	-0.000
Region3_Sex1_Age1	0.028	-0.012*	-0.001
Region3_Sex1_Age2	0.036	-0.003	-0.001
Region3_Sex1_Age3	0.039	-0.010*	-0.001
Region3_Sex1_Age4	0.027	0.005*	-0.001
Region3_Sex2_Age5	0.009	0.007*	-0.000
Region3_Sex2_Age1	0.026	-0.011*	-0.001
Region3_Sex2_Age2	0.037	-0.006*	-0.001
Region3_Sex2_Age3	0.040	-0.009*	-0.001
Region3_Sex2_Age4	0.029	0.002	-0.001
Region3_Sex2_Age5	0.012	0.004*	-0.000
Region4_Sex1_Age1	0.015	-0.004*	-0.000
Region4_Sex1_Age2	0.019	-0.003*	-0.001
Region4_Sex1_Age3	0.021	-0.002	-0.001
Region4_Sex1_Age4	0.020	0.003	-0.001
Region4_Sex2_Age5	0.007	0.002*	-0.000
Region4_Sex2_Age1	0.015	-0.002	-0.000
Region4_Sex2_Age2	0.019	-0.002	-0.001
Region4_Sex2_Age3	0.021	-0.001	-0.001
Region4_Sex2_Age4	0.021	0.001	-0.001
Region4_Sex2_Age5	0.009	0.004*	-0.000

Table A2 4: IP dataset mean absolute standardised biases (MASBs) in longitudinal sample inclusion weighted estimates of survey measured characteristics for sample members compared to equivalent previous wave sample inclusion weighted benchmarks and their 95% CIs at each wave.

		95% CIs	
Wave	MASB	CI -	CI +
5	0.009	0.005	0.012
6	0.002	0.001	0.002
7	0.001	0.001	0.002
8	0.005	0.003	0.006
9	0.002	0.001	0.003
10	0.002	0.001	0.002
11	0.003	0.002	0.004
16	0.007	0.005	0.008

Table A2 5: IP dataset longitudinal sample inclusion weighted estimates of survey measured characteristics compared to equivalent previous wave sample inclusion weighted benchmarks at each wave. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the sample inclusion weighted estimate and the benchmark estimate. * equals *P*>0.05.

	IP dataset wave															
	5		6		7		8		9		10		11		16	
Variable	Bch. (se)	Diff.	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.493	0.002	0.491	0.001	0.490	-0.000	0.490	-0.000	0.491	0.001	0.491	0.000	0.490	-0.001	0.494	0.006*
	(0.008)		(0.010)		(0.011)		(0.012)		(0.013)		(0.011)		(0.011)		(0.010)	
Age: 0-15	0.161	0.001	0.133	0.001	0.125	0.000	0.112	0.000	0.102	0.000	0.110	0.001	0.095	-0.000	0.091	-0.002*
	(0.006)		(0.007)		(0.007)		(0.007)		(0.008)		(0.007)		(0.007)		(0.006)	
Age: 16-34	0.264	0.003	0.264	0.001	0.261	-0.001	0.258	-0.002	0.255	0.002	0.252	0.001	0.251	0.000	0.258	0.004*
	(0.007)		(0.009)		(0.010)		(0.010)		(0.011)		(0.010)		(0.010)		(0.009)	
Age: 35-54	0.290	0.001	0.282	-0.000	0.283	0.001	0.274	-0.002	0.275	-0.001	0.274	-0.000	0.274	0.000	0.260	-0.003*
	(0.008)		(0.009)		(0.010)		(0.010)		(0.011)		(0.010)		(0.010)		(0.009)	
Age: 55-74	0.204	-0.003	0.227	-0.000	0.229	-0.000	0.239	0.000	0.248	-0.001	0.258	-0.001	0.266	0.000	0.262	-0.004*
	(0.007)		(0.009)		(0.009)		(0.010)		(0.011)		(0.010)		(0.010)		(0.009)	
Age: 75+	0.081	-0.002	0.094	-0.001	0.102	0.000	0.117	0.003	0.120	-0.001	0.108	-0.002	0.114	-0.000	0.129	0.005*
	(0.005)		(0.006)		(0.007)		(0.008)		(0.008)		(0.007)		(0.007)		(0.007)	
Activity Last Week: In work	0.469	0.007	0.471	0.001	0.470	-0.001	0.473	-0.002	0.480	0.001	0.479	0.001	0.482	0.005	0.498	-0.001
	(0.008)		(0.010)		(0.011)		(0.012)		(0.013)		(0.011)		(0.011)		(0.010)	
HH tenure: Owner occupied	0.265	-0.006	0.280	-0.001	0.289	-0.000	0.291	0.004	0.292	-0.000	0.301	-0.002	0.318	-0.004	0.332	0.004*
	(0.007)		(0.009)		(0.010)		(0.011)		(0.012)		(0.010)		(0.011)		(0.009)	
HH tenure: Mortgage	0.428	0.007	0.400	0.001	0.387	-0.000	0.382	0.001	0.382	-0.002	0.389	0.001	0.386	-0.000	0.412	-0.003*
	(0.008)		(0.010)		(0.011)		(0.011)		(0.012)		(0.011)		(0.011)		(0.010)	
HH tenure: Rented/Other	0.307	-0.001	0.319	-0.000	0.324	0.000	0.327	-0.004	0.326	0.002	0.310	0.001	0.295	0.004	0.257	-0.000
	(0.008)		(0.010)		(0.010)		(0.011)		(0.012)		(0.010)		(0.010)		(0.009)	
HH Structure: 1 adult	0.125	0.000	0.129	-0.002	0.135	-0.000	0.140	0.004	0.150	-0.000	0.144	0.000	0.151	0.001	0.142	0.006*
	(0.006)		(0.007)		(0.008)		(0.008)		(0.009)		(0.008)		(0.008)		(0.007)	
HH Structure: 1 adult, kids	0.071	-0.005	0.066	-0.000	0.063	0.000	0.060	-0.000	0.059	0.000	0.051	0.000	0.048	-0.001	0.044	-0.001*
	(0.004)		(0.005)		(0.005)		(0.006)		(0.006)		(0.005)		(0.005)		(0.004)	
HH Structure: Couple	0.236	0.012	0.231	0.000	0.225	-0.001	0.230	-0.000	0.227	-0.001	0.227	-0.002	0.245	0.000	0.284	-0.003*
	(0.007)		(0.009)		(0.009)		(0.010)		(0.011)		(0.009)		(0.010)		(0.009)	
HH Structure: Couple, kids	0.293	-0.006	0.254	0.002	0.242	0.000	0.230	0.000	0.215	-0.002	0.236	0.002	0.218	0.000	0.221	-0.004*
	(0.008)		(0.009)		(0.010)		(0.010)		(0.010)		(0.009)		(0.009)		(0.008)	
HH Structure: Other	0.276	-0.001	0.319	-0.000	0.334	0.001	0.340	-0.004	0.349	0.002	0.341	-0.001	0.338	-0.000	0.309	0.003*
	(0.008)		(0.010)		(0.010)		(0.011)		(0.012)		(0.010)		(0.011)		(0.009)	
Region: North	0.339	0.001	0.333	-0.001	0.336	0.000	0.336	0.005	0.335	0.000	0.339	-0.000	0.336	0.002	0.333	0.000
	(0.008)		(0.010)		(0.011)		(0.011)		(0.012)		(0.010)		(0.011)		(0.009)	
Region: South	0.269	-0.001	0.270	0.002	0.266	0.001	0.264	-0.002	0.265	0.001	0.263	0.000	0.266	-0.002	0.267	-0.002*
	(0.007)		(0.009)		(0.010)		(0.010)		(0.011)		(0.010)		(0.010)		(0.009)	
Region: East	0.253	0.002	0.254	-0.000	0.256	-0.000	0.257	0.000	0.254	-0.000	0.252	-0.000	0.253	0.000	0.264	0.002*

	(0.007)		(0.009)		(0.010)		(0.010)		(0.011)		(0.010)		(0.010)		(0.009)	
Region: West	0.139	-0.002	0.143	-0.001	0.141	-0.001	0.142	-0.004	0.146	-0.001	0.147	0.000	0.145	-0.000	0.137	-0.000
	(0.006)		(0.007)		(0.008)		(0.008)		(0.009)		(0.008)		(0.008)		(0.007)	
HH Location: Urban	0.795	-0.005	0.795	0.001	0.794	0.001	0.802	0.002	0.799	-0.001	0.804	0.001	0.800	0.002	0.799	0.004*
	(0.007)		(0.008)		(0.009)		(0.009)		(0.010)		(0.009)		(0.009)		(0.008)	
Behind with bills: No	0.913	-0.009	0.917	-0.000	0.901	-0.001	0.894	0.000	0.912	0.001	0.913	0.000	0.912	0.002	0.909	0.002
	(0.005)		(0.006)		(0.007)		(0.007)		(0.007)		(0.006)		(0.006)		(0.006)	
Behind Council Tax: Yes	0.098	-0.001	0.080	0.000	0.105	0.001	0.099	-0.000	0.092	-0.001	0.092	0.001	0.090	-0.001	0.082	-0.002*
	(0.005)		(0.006)		(0.007)		(0.007)		(0.007)		(0.006)		(0.007)		(0.005)	
HH income: 1st quintile			0.213	-0.001	0.227	-0.001	0.216	0.004	0.201	-0.000	0.252	-0.001	0.229	0.001	0.202	0.002*
			(0.009)		(0.009)		(0.010)		(0.010)		(0.010)		(0.010)		(0.008)	
HH income: 2nd quintile			0.207	0.000	0.183	0.000	0.200	-0.003	0.217	0.000	0.211	0.001	0.221	-0.001	0.218	-0.001*
			(0.008)		(0.009)		(0.009)		(0.010)		(0.009)		(0.009)		(0.008)	
HH income: 3rd quintile			0.184	0.001	0.196	0.001	0.186	0.001	0.193	-0.000	0.184	-0.000	0.196	-0.001	0.199	-0.002*
			(0.008)		(0.009)		(0.009)		(0.010)		(0.009)		(0.009)		(0.008)	
HH income: 4th quintile			0.208	0.001	0.211	0.000	0.208	-0.002	0.196	0.001	0.179	0.001	0.190	0.000	0.191	-0.002*
			(0.008)		(0.009)		(0.010)		(0.010)		(0.008)		(0.009)		(0.008)	
HH income: 5th quintile			0.189	-0.001	0.184	-0.000	0.190	0.000	0.193	-0.001	0.173	0.000	0.165	0.001	0.190	0.003*
			(0.008)		(0.009)		(0.009)		(0.010)		(0.008)		(0.008)		(0.008)	

Table A2 6: IP dataset mean absolute standardised biases (MASBs) in split cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent shared cross-sectional sample inclusion weighted benchmarks and their 95% CIs at each wave.

		95% CIs	
Wave	MASB	CI -	CI +
5	0.001	0.000	0.001
6	0.001	0.001	0.001
7	0.001	0.001	0.001
8	0.002	0.001	0.002
9	0.001	0.001	0.001
10	0.001	0.001	0.001
11	0.008	0.005	0.011
15	0.003	0.002	0.004
16	0.003	0.002	0.004

Table A2 7: IP dataset split cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent shared cross-sectional sample inclusion weighted benchmarks at waves 5, 6, 7, 8 and 9. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the sample inclusion weighted estimate and the benchmark estimate. * equals *P*<0.05.

	IP dataset wave									
	5		6		7		8		9	
Variable	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.488	-0.000	0.487	0.000	0.487	0.000	0.491	0.001	0.495	-0.001
	(0.010)		(0.011)		(0.011)		(0.012)		(0.010)	
Age: 0-15	0.158	-0.000	0.157	0.000	0.148	-0.000	0.144	0.000	0.144	0.000
	(0.007)		(0.008)		(0.008)		(0.008)		(0.007)	
Age: 16-34	0.252	-0.000	0.247	0.000	0.243	-0.000	0.237	-0.000	0.240	-0.000
	(0.009)		(0.009)		(0.009)		(0.010)		(0.009)	
Age: 35-54	0.271	0.000	0.268	-0.001	0.257	-0.000	0.255	-0.001	0.256	0.000
	(0.009)		(0.009)		(0.010)		(0.010)		(0.009)	
Age: 55-74	0.224	0.000	0.225	-0.000	0.235	0.001	0.246	0.002	0.255	0.000
	(0.008)		(0.009)		(0.009)		(0.010)		(0.009)	
Age: 75+	0.094	0.000	0.103	-0.000	0.117	-0.000	0.117	-0.001	0.105	-0.001
	(0.006)		(0.006)		(0.007)		(0.008)		(0.006)	
Activity Last Week: In work	0.452	-0.000	0.447	-0.000	0.446	0.000	0.453	-0.001	0.454	0.000
	(0.010)		(0.010)		(0.011)		(0.012)		(0.010)	
HH tenure: Owner occupied	0.280	0.000	0.289	0.001	0.291	0.001	0.292	0.001	0.301	-0.000
	(0.009)		(0.010)		(0.010)		(0.011)		(0.009)	
HH tenure: Mortgage	0.400	0.000	0.387	-0.000	0.383	-0.001	0.382	0.000	0.389	0.001
	(0.010)		(0.010)		(0.011)		(0.011)		(0.010)	
HH tenure: Rented/Other	0.320	-0.000	0.324	-0.000	0.326	-0.000	0.326	-0.001	0.309	-0.000
	(0.009)		(0.010)		(0.010)		(0.011)		(0.010)	
HH Structure: 1 adult	0.129	0.000	0.135	-0.001	0.140	0.000	0.150	-0.001	0.144	-0.000
	(0.007)		(0.007)		(0.008)		(0.008)		(0.007)	
HH Structure: 1 adult, kids	0.066	-0.000	0.063	-0.000	0.060	-0.000	0.059	-0.000	0.051	-0.000
	(0.005)		(0.005)		(0.005)		(0.005)		(0.005)	
HH Structure: Couple	0.231	0.000	0.225	0.000	0.229	0.000	0.227	0.001	0.227	0.000
	(0.008)		(0.009)		(0.009)		(0.010)		(0.009)	
HH Structure: Couple, kids	0.254	-0.001	0.242	0.000	0.231	-0.001	0.215	0.000	0.236	0.000
	(0.009)		(0.009)		(0.009)		(0.010)		(0.009)	
HH Structure: Other	0.319	-0.000	0.334	0.001	0.340	0.001	0.349	0.000	0.342	-0.000
	(0.009)		(0.010)		(0.010)		(0.011)		(0.010)	
Region: North	0.333	0.000	0.337	0.001	0.336	0.000	0.335	0.001	0.339	0.001
	(0.009)		(0.010)		(0.010)		(0.011)		(0.010)	
Region: South	0.270	-0.000	0.266	-0.000	0.265	-0.001	0.265	0.000	0.263	-0.001
	(0.009)		(0.009)		(0.010)		(0.010)		(0.009)	
Region: East	0.254	0.000	0.256	-0.000	0.257	0.000	0.255	-0.001	0.252	0.000

	(0.009)		(0.009)		(0.010)		(0.010)		(0.009)	
Region: West	0.143	-0.000	0.142	-0.000	0.142	0.001	0.146	-0.001	0.147	0.000
	(0.007)		(0.007)		(0.008)		(0.008)		(0.007)	
HH Location: Urban	0.795	0.000	0.795	-0.000	0.802	-0.001	0.799	-0.002	0.804	0.000
	(0.008)		(0.008)		(0.009)		(0.009)		(0.008)	
Behind with bills: No	0.917	-0.000	0.901	-0.001	0.894	-0.000	0.912	0.000	0.912	-0.000
	(0.005)		(0.006)		(0.007)		(0.007)		(0.006)	
Behind Council Tax: Yes	0.079	-0.000	0.105	-0.000	0.099	-0.000	0.092	-0.000	0.092	0.000
	(0.005)		(0.006)		(0.007)		(0.007)		(0.006)	
HH income: 1st quintile	0.213	0.000	0.227	-0.001	0.215	-0.000	0.200	-0.000	0.252	-0.001
	(0.008)		(0.009)		(0.009)		(0.009)		(0.009)	
HH income: 2nd quintile	0.206	-0.000	0.183	0.001	0.200	-0.000	0.218	-0.001	0.211	0.000
	(0.008)		(0.008)		(0.009)		(0.010)		(0.008)	
HH income: 3rd quintile	0.184	-0.001	0.196	-0.000	0.187	0.000	0.193	-0.000	0.182	0.001
	(0.008)		(0.008)		(0.009)		(0.009)		(0.008)	
HH income: 4th quintile	0.208	0.000	0.211	0.000	0.208	0.000	0.196	0.001	0.181	-0.000
	(0.008)		(0.009)		(0.009)		(0.009)		(0.008)	
HH income: 5th quintile	0.189	-0.000	0.184	0.000	0.190	0.000	0.193	0.000	0.174	0.000
	(0.008)		(0.008)		(0.009)		(0.009)		(0.008)	

Table A2 8: IP dataset split cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent shared cross-sectional sample inclusion weighted benchmarks at waves 10, 11, 15 and 16. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the sample inclusion weighted estimate and the benchmark estimate. * equals *P*<0.05.

	IP dataset wave							
	10		11		15		16	
Variable	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.499	0.000	0.500	-0.003	0.497	0.001	0.495	-0.000
	(0.011)		(0.011)		(0.009)		(0.009)	
Age: 0-15	0.132	0.000	0.127	-0.007	0.130	-0.003	0.134	-0.001
	(0.007)		(0.007)		(0.006)		(0.006)	
Age: 16-34	0.241	0.000	0.241	-0.002	0.246	0.001	0.255	-0.001
	(0.009)		(0.009)		(0.008)		(0.008)	
Age: 35-54	0.253	0.000	0.245	0.004	0.239	-0.000	0.242	0.000
	(0.009)		(0.009)		(0.008)		(0.008)	
Age: 55-74	0.260	-0.000	0.266	0.011	0.257	0.003	0.256	0.004
	(0.009)		(0.010)		(0.008)		(0.008)	
Age: 75+	0.113	-0.000	0.121	-0.005	0.127	-0.001	0.114	-0.002
	(0.007)		(0.007)		(0.006)		(0.006)	
Activity Last Week: In work	0.453	0.001	0.455	0.006	0.467	0.004	0.461	0.001
	(0.011)		(0.011)		(0.009)		(0.009)	
HH tenure: Owner occupied	0.319	0.000	0.342	0.005	0.332	-0.001	0.324	0.001
	(0.010)		(0.010)		(0.008)		(0.008)	
HH tenure: Mortgage	0.387	0.001	0.379	-0.001	0.412	0.001	0.401	0.001
	(0.010)		(0.011)		(0.009)		(0.009)	
HH tenure: Rented/Other	0.294	-0.001	0.279	-0.004	0.257	0.000	0.275	-0.002
	(0.010)		(0.010)		(0.008)		(0.008)	
HH Structure: 1 adult	0.150	-0.000	0.162	-0.006	0.142	-0.002	0.143	0.001
	(0.008)		(0.008)		(0.006)		(0.006)	
HH Structure: 1 adult, kids	0.048	0.000	0.048	0.001	0.043	0.001	0.049	0.000
	(0.005)		(0.005)		(0.004)		(0.004)	
HH Structure: Couple	0.245	-0.000	0.242	0.012	0.284	0.004	0.286	0.001
	(0.009)		(0.009)		(0.008)		(0.008)	
HH Structure: Couple, kids	0.218	-0.000	0.218	-0.008	0.222	-0.002	0.225	-0.002
	(0.009)		(0.009)		(0.007)		(0.007)	
HH Structure: Other	0.338	0.001	0.330	0.002	0.309	-0.001	0.297	0.001
	(0.010)		(0.010)		(0.008)		(0.008)	
Region: North	0.336	0.001	0.343	0.001	0.333	0.001	0.331	0.002
	(0.010)		(0.010)		(0.008)		(0.008)	
Region: South	0.266	-0.000	0.272	0.002	0.267	0.000	0.274	-0.002
	(0.009)		(0.010)		(0.008)		(0.008)	
Region: East	0.253	-0.000	0.240	-0.002	0.264	-0.001	0.252	0.002
	(0.009)		(0.009)		(0.008)		(0.008)	
Region: West	0.145	-0.001	0.146	-0.001	0.137	-0.001	0.143	-0.001
	(0.007)		(0.008)		(0.006)		(0.006)	
HH Location: Urban	0.800	-0.001	0.789	0.000	0.799	-0.001	0.817	-0.000
	(0.008)		(0.009)		(0.007)		(0.007)	
Behind with bills: No	0.910	0.000	0.908	0.001	0.909	-0.000	0.924	-0.001
	(0.006)		(0.006)		(0.005)		(0.005)	
Behind Council Tax: Yes	0.090	-0.000	0.081	-0.000	0.082	0.001	0.069	0.000
	(0.006)		(0.006)		(0.005)		(0.004)	
HH income: 1st quintile	0.228	-0.000	0.239	-0.001	0.202	-0.000	0.236	0.002
	(0.009)		(0.009)		(0.007)		(0.007)	
HH income: 2nd quintile	0.223	-0.000	0.225	0.002	0.218	0.000	0.217	-0.003
	(0.009)		(0.009)		(0.007)		(0.007)	
HH income: 3rd quintile	0.194	-0.001	0.182	0.000	0.199	0.001	0.192	0.001
	(0.008)		(0.008)		(0.007)		(0.007)	
HH income: 4th quintile	0.190	0.000	0.166	-0.000	0.191	-0.001	0.182	0.001
	(0.008)		(0.008)		(0.007)		(0.007)	
HH income: 5th quintile	0.166	0.001	0.188	-0.001	0.190	0.000	0.173	-0.001
	(0.008)		(0.009)		(0.007)		(0.007)	

Table A2 9: IP dataset mean absolute biases (MABs) in split cross-sectional sample inclusion weighted estimate of member survey measured characteristics compared to equivalent UK estimated population incidence benchmarks for the given year and their 95% CIs at each wave.

		95% CIs	
Wave	MAB	CI -	CI +
5	0.003	0.002	0.004
6	0.003	0.003	0.004
7	0.004	0.003	0.005
8	0.005	0.004	0.006
9	0.005	0.004	0.006
10	0.005	0.004	0.007
11	0.006	0.005	0.007
15	0.005	0.004	0.006
16	0.005	0.004	0.006

Table A2 10: IP dataset split cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent UK estimated population incidence benchmarks for the given year at each wave. 'Bch.' is the benchmark population estimate. 'Diff' is the difference between the split weighted estimate and the benchmark estimate. * equals *P*<0.05.

	IP dataset wave																	
	5		6		7		8		9		10		11		15		16	
Strata	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff
Region1_Sex1_Age1	0.032	-0.006	0.031	-0.006	0.031	-0.007*	0.031	-0.007*	0.031	-0.003	0.031	-0.006	0.031	-0.005	0.031	-0.004	0.031	-0.004
Region1_Sex1_Age2	0.039	0.003	0.039	0.002	0.039	-0.003	0.038	0.001	0.038	0.005	0.037	0.008	0.037	0.005	0.037	0.002	0.037	-0.002
Region1_Sex1_Age3	0.042	0.001	0.041	0.002	0.041	0.002	0.040	0.001	0.040	-0.001	0.040	-0.004	0.039	-0.000	0.038	0.007*	0.038	0.009*
Region1_Sex1_Age4	0.034	-0.001	0.034	0.000	0.034	0.001	0.034	0.005	0.035	0.009*	0.035	0.012*	0.035	0.009*	0.036	0.006	0.036	0.007*
Region1_Sex2_Age5	0.016	-0.002	0.016	-0.002	0.016	0.001	0.016	-0.001	0.016	-0.002	0.016	-0.001	0.016	0.001	0.017	-0.002	0.017	0.002
Region1_Sex2_Age1	0.031	-0.008*	0.031	-0.008*	0.031	-0.009*	0.030	-0.010*	0.030	-0.010*	0.030	-0.014*	0.030	-0.012*	0.030	-0.011*	0.030	-0.011*
Region1_Sex2_Age2	0.039	0.005	0.039	0.005	0.039	0.007	0.039	0.004	0.038	0.005	0.038	0.002	0.038	0.006	0.037	0.008*	0.038	0.004
Region1_Sex2_Age3	0.043	0.008	0.042	0.007	0.042	0.006	0.041	0.007	0.041	0.005	0.041	0.006	0.040	0.003	0.039	-0.001	0.040	-0.001
Region1_Sex2_Age4	0.035	0.006	0.035	0.005	0.036	0.006	0.036	0.009	0.036	0.012*	0.036	0.014*	0.037	0.012*	0.037	0.012*	0.037	0.014*
Region1_Sex2_Age5	0.020	-0.003	0.020	0.000	0.020	0.004	0.020	0.001	0.020	-0.005*	0.020	-0.006*	0.020	-0.006*	0.021	-0.012*	0.021	-0.008*
Region2_Sex1_Age1	0.026	-0.002	0.026	-0.004	0.026	-0.005	0.027	-0.008*	0.027	-0.007*	0.027	-0.009*	0.027	-0.010*	0.026	-0.007*	0.026	-0.008*
Region2_Sex1_Age2	0.033	0.002	0.033	0.003	0.033	0.004	0.033	0.005	0.033	0.004	0.033	0.004	0.032	0.004	0.032	0.009*	0.032	0.009*
Region2_Sex1_Age3	0.037	0.002	0.037	-0.000	0.037	-0.002	0.037	-0.005	0.036	-0.003	0.036	-0.002	0.036	-0.002	0.035	-0.002	0.035	-0.002
Region2_Sex1_Age4	0.028	0.002	0.029	0.004	0.029	0.005	0.029	0.007	0.029	0.004	0.030	0.006	0.030	0.007	0.031	-0.001	0.031	-0.003
Region2_Sex2_Age5	0.009	-0.001	0.009	-0.001	0.010	0.001	0.010	0.006*	0.010	0.007*	0.010	0.008*	0.010	0.012*	0.012	0.010*	0.012	0.008*
Region2_Sex2_Age1	0.025	-0.003	0.025	-0.004	0.025	-0.006	0.025	-0.005	0.025	-0.007*	0.025	-0.008*	0.025	-0.009*	0.025	-0.008*	0.025	-0.010*
Region2_Sex2_Age2	0.032	-0.002	0.033	-0.001	0.033	0.001	0.032	-0.005	0.032	-0.006	0.032	-0.008*	0.032	-0.008*	0.032	0.002	0.032	-0.004
Region2_Sex2_Age3	0.038	-0.001	0.037	-0.001	0.037	-0.007	0.037	-0.005	0.037	-0.008*	0.037	-0.007	0.037	-0.011*	0.036	-0.005	0.036	-0.005
Region2_Sex2_Age4	0.030	0.003	0.030	0.000	0.030	0.004	0.030	0.005	0.031	0.010*	0.031	0.007	0.031	0.006	0.032	0.001	0.032	-0.001
Region2_Sex2_Age5	0.013	-0.001	0.013	-0.002	0.013	-0.002	0.013	-0.004	0.013	-0.003	0.013	-0.001	0.014	0.006*	0.015	0.004	0.015	0.006*
Region3_Sex1_Age1	0.029	-0.002	0.029	-0.002	0.029	-0.001	0.029	0.000	0.029	-0.006*	0.029	-0.007*	0.029	-0.007*	0.028	-0.012*	0.028	-0.012*
Region3_Sex1_Age2	0.040	-0.001	0.039	-0.004	0.039	-0.005	0.039	-0.006	0.038	-0.010*	0.038	-0.009*	0.037	-0.013*	0.037	-0.005	0.037	-0.005
Region3_Sex1_Age3	0.040	-0.008*	0.041	-0.007	0.041	-0.007	0.041	-0.008*	0.041	-0.005	0.041	-0.005	0.041	-0.005	0.039	-0.008*	0.039	-0.007*
Region3_Sex1_Age4	0.025	-0.000	0.025	0.001	0.025	0.001	0.026	-0.002	0.026	-0.003	0.027	-0.001	0.027	-0.001	0.028	0.001	0.028	0.003
Region3_Sex2_Age5	0.008	0.000	0.008	-0.000	0.008	0.003	0.008	0.004	0.008	0.003	0.009	0.003	0.009	0.005*	0.010	0.004*	0.010	0.004*
Region3_Sex2_Age1	0.027	-0.010*	0.027	-0.009*	0.027	-0.011*	0.028	-0.013*	0.028	-0.010*	0.028	-0.011*	0.027	-0.013*	0.027	-0.010*	0.027	-0.009*
Region3_Sex2_Age2	0.040	-0.009*	0.040	-0.010*	0.040	-0.009*	0.040	-0.011*	0.040	-0.010*	0.039	-0.008*	0.039	-0.006	0.038	-0.006*	0.038	-0.001
Region3_Sex2_Age3	0.041	-0.005	0.041	-0.004	0.041	-0.007	0.042	-0.007	0.042	-0.005	0.042	-0.005	0.042	-0.009*	0.041	-0.009*	0.041	-0.009*
Region3_Sex2_Age4	0.027	0.003	0.027	0.001	0.027	0.002	0.027	0.003	0.028	0.005	0.028	0.003	0.029	0.001	0.030	-0.001	0.030	0.004
Region3_Sex2_Age5	0.012	-0.003	0.012	0.001	0.012	0.001	0.012	0.003	0.012	0.002	0.012	0.004	0.012	0.001	0.013	0.006*	0.013	0.006*
Region4_Sex1_Age1	0.013	-0.005*	0.013	-0.005*	0.013	-0.004*	0.013	-0.004	0.013	-0.004*	0.013	-0.003	0.013	-0.006*	0.012	-0.005*	0.012	-0.004*
Region4_Sex1_Age2	0.017	-0.001	0.017	-0.004	0.017	-0.003	0.016	-0.004	0.016	-0.000	0.016	-0.000	0.016	0.002	0.016	0.001	0.016	0.000
Region4_Sex1_Age3	0.019	-0.004	0.018	-0.004	0.018	-0.004	0.018	-0.003	0.018	0.000	0.018	-0.002	0.018	-0.003	0.017	-0.004*	0.017	-0.006*
Region4_Sex1_Age4	0.016	-0.002	0.016	-0.002	0.016	-0.001	0.016	-0.000	0.016	-0.001	0.017	-0.000	0.017	0.000	0.017	0.000	0.017	-0.000
Region4_Sex2_Age5	0.005	0.007*	0.005	0.008*	0.006	0.007*	0.006	0.003	0.006	0.003	0.006	0.002	0.006	0.005*	0.007	0.001	0.007	0.002

Region4_Sex2_Age1	0.012	-0.002	0.012	-0.002	0.012	-0.002	0.012	-0.005*	0.012	-0.003	0.012	-0.005*	0.012	-0.005*	0.012	-0.001	0.012	-0.001
Region4_Sex2_Age2	0.016	0.002	0.016	0.001	0.016	-0.000	0.016	0.004	0.016	0.005	0.016	0.004	0.016	0.002	0.016	0.002	0.016	-0.001
Region4_Sex2_Age3	0.019	0.001	0.019	-0.002	0.019	-0.001	0.019	0.001	0.019	-0.002	0.018	-0.003	0.018	-0.002	0.018	-0.002	0.018	-0.003
Region4_Sex2_Age4	0.017	0.000	0.017	0.002	0.017	0.000	0.017	0.000	0.017	0.000	0.018	-0.000	0.018	0.002	0.018	0.005*	0.018	0.002
Region4_Sex2_Age5	0.008	0.005*	0.008	0.007*	0.008	0.010*	0.008	0.014*	0.008	0.010*	0.008	0.011*	0.008	0.012*	0.009	0.005*	0.009	0.007*

Table A2 11: IP dataset mean absolute biases (MABs) in post-stratified cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent UK estimated population incidence benchmarks for the given year and their 95% CIs at each wave.

		95% CIs	
Wave	MAB	CI -	CI +
5	0.001	0.001	0.001
6	0.001	0.001	0.001
7	0.001	0.001	0.001
8	0.001	0.001	0.001
9	0.001	0.001	0.001
10	0.001	0.001	0.001
11	0.001	0.001	0.001
15	0.001	0.001	0.001
16	0.001	0.001	0.001

Table A2 12: IP dataset post-stratified cross-sectional sample inclusion weighted estimates of member survey measured characteristics compared to equivalent UK estimated population incidence benchmarks for the given year at each wave. 'Bch' is the benchmark population estimate. 'Diff' is the difference between the post-stratified weighted estimate and the benchmark estimate. * equals *P*<0.05.

	IP dataset wave																	
	5		6		7		8		9		10		11		15		16	
Strata	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff	Bch.	Diff
Region1_Sex1_Age1	0.032	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001
Region1_Sex1_Age2	0.039	-0.001	0.039	-0.001	0.039	-0.001	0.038	-0.001	0.038	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001
Region1_Sex1_Age3	0.042	-0.001	0.041	-0.001	0.041	-0.001	0.040	-0.001	0.040	-0.001	0.040	-0.001	0.039	-0.001	0.038	-0.001	0.038	-0.001
Region1_Sex1_Age4	0.034	-0.001	0.034	-0.001	0.034	-0.001	0.034	-0.001	0.035	-0.001	0.035	-0.001	0.035	-0.001	0.036	-0.001	0.036	-0.001
Region1_Sex2_Age5	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.017	-0.001	0.017	-0.001
Region1_Sex2_Age1	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.030	-0.001	0.030	-0.001	0.030	-0.001	0.030	-0.001	0.030	-0.001	0.030	-0.001
Region1_Sex2_Age2	0.039	-0.001	0.039	-0.001	0.039	-0.001	0.039	-0.001	0.038	-0.001	0.038	-0.001	0.038	-0.001	0.037	-0.001	0.038	-0.001
Region1_Sex2_Age3	0.043	-0.001	0.042	-0.001	0.042	-0.001	0.041	-0.001	0.041	-0.001	0.041	-0.001	0.040	-0.001	0.039	-0.001	0.040	-0.001
Region1_Sex2_Age4	0.035	-0.001	0.035	-0.001	0.036	-0.001	0.036	-0.001	0.036	-0.001	0.036	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001
Region1_Sex2_Age5	0.020	-0.001	0.020	-0.001	0.020	-0.001	0.020	-0.001	0.020	-0.001	0.020	-0.001	0.020	-0.001	0.021	-0.001	0.021	-0.001
Region2_Sex1_Age1	0.026	-0.001	0.026	-0.001	0.026	-0.001	0.027	-0.001	0.027	-0.001	0.027	-0.001	0.027	-0.001	0.026	-0.001	0.026	-0.001
Region2_Sex1_Age2	0.033	-0.001	0.033	-0.001	0.033	-0.001	0.033	-0.001	0.033	-0.001	0.033	-0.001	0.032	-0.001	0.032	-0.001	0.032	-0.001
Region2_Sex1_Age3	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.036	-0.001	0.036	-0.001	0.036	-0.001	0.035	-0.001	0.035	-0.001
Region2_Sex1_Age4	0.028	-0.001	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.030	-0.001	0.030	-0.001	0.031	-0.001	0.031	-0.001
Region2_Sex2_Age5	0.009	-0.000	0.009	-0.000	0.010	-0.000	0.010	-0.000	0.010	-0.000	0.010	-0.000	0.010	-0.000	0.012	-0.000	0.012	-0.000
Region2_Sex2_Age1	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.025	-0.001
Region2_Sex2_Age2	0.032	-0.001	0.033	-0.001	0.033	-0.001	0.032	-0.001	0.032	-0.001	0.032	-0.001	0.032	-0.001	0.032	-0.001	0.032	-0.001
Region2_Sex2_Age3	0.038	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001	0.036	-0.001	0.036	-0.001
Region2_Sex2_Age4	0.030	-0.001	0.030	-0.001	0.030	-0.001	0.030	-0.001	0.031	-0.001	0.031	-0.001	0.031	-0.001	0.032	-0.001	0.032	-0.001
Region2_Sex2_Age5	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.014	-0.000	0.015	-0.000	0.015	-0.000
Region3_Sex1_Age1	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.029	-0.001	0.028	-0.001	0.028	-0.001
Region3_Sex1_Age2	0.040	-0.001	0.039	-0.001	0.039	-0.001	0.039	-0.001	0.038	-0.001	0.038	-0.001	0.037	-0.001	0.037	-0.001	0.037	-0.001
Region3_Sex1_Age3	0.040	-0.001	0.041	-0.001	0.041	-0.001	0.041	-0.001	0.041	-0.001	0.041	-0.001	0.041	-0.001	0.039	-0.001	0.039	-0.001
Region3_Sex1_Age4	0.025	-0.001	0.025	-0.001	0.025	-0.001	0.026	-0.001	0.026	-0.001	0.027	-0.001	0.027	-0.001	0.028	-0.001	0.028	-0.001
Region3_Sex2_Age5	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.009	-0.000	0.009	-0.000	0.010	-0.000	0.010	-0.000
Region3_Sex2_Age1	0.027	-0.001	0.027	-0.001	0.027	-0.001	0.028	-0.001	0.028	-0.001	0.028	-0.001	0.027	-0.001	0.027	-0.001	0.027	-0.001
Region3_Sex2_Age2	0.040	-0.001	0.040	-0.001	0.040	-0.001	0.040	-0.001	0.040	-0.001	0.039	-0.001	0.039	-0.001	0.038	-0.001	0.038	-0.001
Region3_Sex2_Age3	0.041	-0.001	0.041	-0.001	0.041	-0.001	0.042	-0.001	0.042	-0.001	0.042	-0.001	0.042	-0.001	0.041	-0.001	0.041	-0.001
Region3_Sex2_Age4	0.027	-0.001	0.027	-0.001	0.027	-0.001	0.027	-0.001	0.028	-0.001	0.028	-0.001	0.029	-0.001	0.030	-0.001	0.030	-0.001
Region3_Sex2_Age5	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.013	-0.000	0.013	-0.000
Region4_Sex1_Age1	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.013	-0.000	0.012	-0.000	0.012	-0.000
Region4_Sex1_Age2	0.017	-0.001	0.017	-0.001	0.017	-0.001	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000
Region4_Sex1_Age3	0.019	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001	0.017	-0.001	0.017	-0.001
Region4_Sex1_Age4	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.017	-0.001	0.017	-0.001	0.017	-0.001	0.017	-0.001
Region4_Sex2_Age5	0.005	-0.000	0.005	-0.000	0.006	-0.000	0.006	-0.000	0.006	-0.000	0.006	-0.000	0.006	-0.000	0.007	-0.000	0.007	-0.000

Region4_Sex2_Age1	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000	0.012	-0.000
Region4_Sex2_Age2	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000	0.016	-0.000
Region4_Sex2_Age3	0.019	-0.001	0.019	-0.001	0.019	-0.001	0.019	-0.001	0.019	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001
Region4_Sex2_Age4	0.017	-0.001	0.017	-0.001	0.017	-0.001	0.017	-0.001	0.017	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001	0.018	-0.001
Region4_Sex2_Age5	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.008	-0.000	0.009	-0.000	0.009	-0.000

Appendix A3. Partial CVs and weight test

A3 1.1 Partial unconditional and conditional CVs (CV_us and CV_cs) derivation

CV_us and CV_cs are derived from, respectively, the between and within ANOVA variance decomposition components, and bounded by the overall CV. CV_us quantify univariate associations with propensity variation. Using the same notation as in the main text, the CV_u for covariate Z with *K* categories is

$$\widehat{CV}_u(Z, p_x) = \frac{\sqrt{\frac{1}{n}\sum_{k=1}^{K} n_k(\hat{\bar{p}}_k - \hat{\bar{p}})^2}}{\hat{\bar{p}}}, \quad (1)$$

where n_k is the number of observations and $\hat{\bar{p}}_k$ is the mean response propensity in covariate category k. Large values suggest substantial between category variability and non-representativeness associated with Z. Category CVs decompose and are bounded by covariate CVs. The CV_u for category *k* of Z is

$$\widehat{CV}_u(Z_k, p_x) = \frac{\sqrt{\frac{n_k}{n}}(\hat{\bar{p}}_k - \hat{\bar{p}})}{\hat{\bar{p}}}. \quad (2)$$

Values can be positive or negative, implying respectively over- or under-representation. CV_cs quantify associations conditional on the other auxiliary covariates.

The CV_c for covariate Z is

$$\widehat{CV}_c(Z, p_x) = \frac{\sqrt{\frac{1}{n}\sum_{l=1}^{L}\sum_{i\in l}(p_i - \hat{\bar{p}}_l)^2}}{\hat{\bar{p}}}, \quad (3)$$

where $\hat{\bar{p}}_l$ is the mean propensity of the *l*th of *L* cells resulting from cross-classifying ***x*** excluding Z and propensity modelling given this covariate subset. The CV_c for category *k* of Z is

$$\widehat{CV}_c(Z_k, p_x) = \frac{\sqrt{\frac{1}{n}\sum_{l=1}^{L}\sum_{i\in l} h_i(p_i - \hat{\bar{p}}_l)^2}}{\hat{\bar{p}}}, \quad (4)$$

where h_i indicates whether subject *i* is in category *k*. Large CV_cs imply substantial solely attributed non-representativeness. In addition, adjustments to correct biases caused by estimating propensities exist, as do approximate standard errors that when converted into 95% confidence intervals (CV ± 1.96 × SE) enable inference regarding (comparative) representativeness or otherwise (de Heij et al. 2015). Population level analysis is also possible by applying sample weights.

A3 1.2. CV inferences about non-response biases

Overall CVs predict the maximum absolute standardised bias of survey covariate means when non-response correlates maximally to the auxiliary covariates. Given an unknown covariate set explaining response behaviour (ℵ), the Horvitz-Thompson estimate of a covariate bias is approximated by the covariance between sample response propensities and covariate values divided by mean propensity (Bethlehem 1988). This value can be standardised by dividing by the covariate sample standard deviation ($S(y)$, for covariate y with response mean $\hat{\bar{y}}_r$). By replacing the numerator covariance with its absolute maxima, which by the Cauchy Schwartz inequality is the product of involved covariate standard deviations, the survey maximum absolute standardised bias is estimated. This value is approximated by the overall CV if the covariates ℵ are replaceable by utilised set $\boldsymbol{x}$ (Schouten et al. 2011; de Heij et al. 2015), e.g.

$$\frac{Bias(\hat{\bar{y}}_r)}{S(y)} = \frac{Cov(y,p_{\aleph})}{\hat{\bar{p}}_{\aleph}\, S(y)} = \frac{Cov(y,p_x)}{\hat{\bar{p}}\, S(y)} \leq \frac{SD\; S(y)}{\hat{\bar{p}}\, S(y)} = \frac{SD}{\hat{\bar{p}}}. \qquad (5)$$

The assumption that set $\boldsymbol{x}$ can be used in estimation is untestable. In practice, including correlates of both propensities and survey covariates is essential. Moore et al. (2021) also describe partial CV predictions about auxiliary covariate (analogue) biases. Equations (2) and (4) indicate that, like overall CVs, partial covariate CVs consider all subjects, but use weighted category mean deviations from average propensity or subject predictions as expected values. In terms of (5), propensity – covariate covariance is maximal, so for two-category covariates the absolute standardised (conditional) category mean bias is predicted, a value independent of focal category. With multi-category covariates, K biases (focal category vs. others or the reverse) exist. For these, covariate CVs predict the bias when other deviations are identical (its maxima), because squaring over-emphasises larger values. Equations (3) and (4) indicate that partial category CVs only consider focal category deviations. Hence, they under-estimate category (absolute with CV_cs) biases, with discrepancies smaller when, due to category size or deviation, contributions to covariate inequalities are large, i.e. they predict bias minima.

A3 1.3 References

Bethlehem, J. G. (1988) Reduction of nonresponse bias through regression estimation. *Journal of Official Statistics*, 4, 251-260.

de Heij, V., Schouten, B. and Shlomo, N. (2015) RISQ Manual 2.1: Tools in SAS and R for the computation of R indicators and partial R indicators. Available from: www.risq-project.eu.

Moore, J.C., Durrant, G.B. & Smith, P.W. (2021) Do coefficients of variation of response propensities approximate non-response biases during survey data collection? *J. Roy. Stat. Soc. Ser. A,* 184: 301-323.

Schouten, B., Shlomo, N. and Skinner, C. (2011) Indicators for monitoring and improving representativeness of response. *Journal of Official Statistics*, 27, 231-253.

A3 2. Derivation of Moore et al's. (2024) test of the equality of weighted survey means

Moore et al. (2024) proposed a test that enables the equality of weighted survey estimate means to be evaluated when there are partial dependencies between benchmark and comparator datasets. This test can also be utilized to compare a weighted issued sample to a benchmark weighted issued sample, or weighted non-respondents to a weighted issued sample, assuming that the comparator sample is a subset of the benchmark sample (see also Appendix A2). To formalize this test, consider a "quasi-randomization" setup (Valliant and Dever, 2018). Let $I_i = 1$ indicate that individual i is in the survey sample, and $I_i = 0$ if not. Let $R_i^t = 1$ indicate that individual i is in the issued sample at the benchmark wave, and $R_i^t = 0$ if not, conditional on being in the survey sample. Denote the probability that individual i is in the survey sample by $\Pr(I_i = 1) = \pi_i$ and probability that individual i is issued at wave *t*, given they are in the survey sample, by $\Pr\left(R_i^t = 1 \middle| I_i = 1\right) = \phi_i^t$. Let U be the set of individuals in the population and r^t be the set of issued sample members at wave t (that is, the set of individuals for whom $R_i^t I_i = 1$).

A1. Assume that $\pi_i > 0 \; \forall i$, $\phi_i^t > 0 \; \forall i$, and weights for wave t, w_i^t are available such that $w_i^t = \left(\pi_i \phi_i^t\right)^{-1}$.

For a quantity, y^t, observed at wave t, an estimator of the population total is

$$\hat{T}(y^t) = \sum_{i \in r^t} w_i^t y_i^t = \sum_{i \in U} R_i^t I_i w_i^t y_i^t. \tag{4}$$

Again, in the applications in this paper wave *t* is the benchmark issued sample wave, so this is just the weighted total using sample members and the associated issued sample weights. It is a standard result that $\hat{T}(y^t)$ is unbiased under **A1** (see, e.g., Valliant and Dever, 2018, Chapter 3). To see this take expectations over both the sampling and selection into the benchmark issued sample processes:

$$E_I E_{R^t}\left[\sum_{i \in U} R_i^t I_i w_i^t y_i^t\right] = \sum_{i \in U} w_i^t y_i^t E_I E_{R^t}\left[R_i^t I_i\right] = \sum_{i \in U} y_i^t. \tag{5}$$

The last equality uses the fact that $E_I E_{R^t}\left[R_i^t I_i\right] = E_I\left[I_i\left[E_{R^t}\left[R_i^t | I_i\right]\right]\right] = \pi_i \phi_i^t$, and **A1**.

Now consider response to the survey (being selected into the comparator issued sample), which is treated simply as a subsequent wave, $t + k$ of the panel. Let $R_i^{t+k} = 1$ indicate that individual i

responds (is issued) to panel wave $t+k$, and $R_i^{t+k}=0$ if not, conditional on being in the survey sample *and* responding (being issued) to wave t. This is termed *retention.* Let r^{t+k} be the set of respondents (issued sample members) retained at wave $t+k$.

The probability that individual i responds (is issued) at wave $t+k$, given they are in the survey sample and were selected into the issued sample at time t (that is they are retained) is $\Pr\left(R_i^{t+k}=1\middle|I_i=1,R_i^t=1\right)=\theta_i^{t+k}$. Thus, the probability that they respond (were issued) to wave $t+k$ is $\pi_i\phi_i^t\theta_i^{t+k}$.

A2. Assume that $\pi_i>0\ \forall i,\ \ \phi_i^t>0\ \forall i, \theta_i^{t+k}>0\ \forall i$, and weights for wave $t+k,\ w_i^{t+k}$, are available, such that $w_i^{t+k}=\left(\pi_i\phi_i^t\theta_i^{t+k}\right)^{-1}$.

Consider an alternative estimator of population total of y^t, the quantity of interest at wave t:

$$\tilde{T}(y^t)=\sum_{i\in r^{t+k}}w_i^{t+k}y_i^t=\sum_{i\in U}R_i^{t+k}R_i^tI_iw_i^{t+k}y_i^t. \tag{5}$$

By similar arguments to those above, $\tilde{T}(y^t)$ is unbiased under **A2**. To see this take expectations of the sampling, response (issued at relevant wave) *and* retention processes:

$$E_IE_{R^t}E_{R^{T+k}}\left[\sum_{i\in U}R_i^{t+k}R_i^tI_iw_i^ty_i^t\right]=\sum_{i\in U}w_i^ty_i^tE_IE_{R^t}E_{R^{T+k}}\left[R_i^{t+k}R_i^tI_i\right]=\sum_{i\in U}y_i^t. \tag{6}$$

The last equality uses the fact that $E_IE_{R^t}E_{R^{T+k}}\left[R_i^{t+k}R_i^tI_i\right]=E_I\left[I_i\left[E_{R^t}\left[R_i^tE[R_i^{t+k}|R_i^t,I_i]|I_i\right]\right]\right]=\pi_i\phi_i^t\theta_i^{t+k}$, and **A2**. This result simply says that under **A2** the population total of y^t can alternatively be estimated using the subset of wave t respondents (issued sample members) who are retained at wave $t+k$, and the appropriate wave $t+k$ weights.

Note that $\hat{T}(y^t)$ is unaffected by the retention process, so that $E_IE_{R^t}E_{R^{T+k}}\left[\hat{T}(y^t)\right]=E_IE_{R^t}\left[\hat{T}(y^t)\right]=\sum_{i\in U}y_i^t$, and together these results imply

$$E_IE_{R^t}E_{R^{T+k}}\left[\hat{T}(y^t)-\tilde{T}(y^t)\right]=0. \tag{7}$$

This is the joint implication of **A1** and **A2** that the test evaluates.

Note that

$$\tilde{T}(y^t)=\sum_{i\in r^{t+k}}w_i^{t+k}y_i^t=\sum_{i\in s^t}R_i^{t+k}w_i^{t+k}y_i^t. \tag{8}$$

This allows one to proceed as follows:

$$\hat{T}(y^t) - \tilde{T}(y^t) = \left(\sum_{i \in s^t} w_i^t y_i^t - \sum_{i \in s^t} R_i^{t+k} w_i^{t+k} y_i^t\right) = \sum_{i \in s^t} y_i^t \left(w_i^t - R_i^{t+k} w_i^{t+k}\right)$$

$$= \sum_{i \in s^t} y_i^t \omega_i. \quad (9)$$

where the composite weight ω_i is observed for all $i \in s^t$ because $R_i^{t+k} w_i^{t+k} = 0$ when $R_i^{t+k} = 0$. This means that there is no need to observe w_i^{t+k} for attritors (those not retained from wave t to $t + k$), although in practice it often is.

This formulation of $\hat{T}(y^t) - \tilde{T}(y^t)$ takes advantage of the fact that each retained individual (wave *t+k* respondent or issued sample member) is also a wave t issued sample member and so their weights can be "paired." Working with $\hat{T}(y^t) - \tilde{T}(y^t) = \sum_{i \in s^t} y_i^t \omega_i$ means that inferences only need to be made about a weighted total, which is done using standard methods for inference with complex survey samples. The null that $\hat{T}(y^t) - \tilde{T}(y^t) = 0$ is tested. A rejection of the null would suggest either A1 or A2 (or both) do not hold. As the survey weights have been extensively evaluated in previous work, a rejection of this null would lead one to doubt A2, that is, the adequacy of the non-response (issued sample) weights.

A3 3. References

Crossley, T. F., Fisher, P. & Low, H. (2021) The Heterogeneous and Regressive Consequences of COVID-19: Evidence from High Quality Panel Data. *J. Pub. Econ.* **193**, 104344. https://doi.org/10.1016/j.jpubeco.2020.104334

Deaton, A. (1997). *The analysis of household surveys: a microeconometric approach to development policy*. World Bank Publications.

DuMouchel, W. H., & Duncan, G. J. (1983). Using sample survey weights in multiple regression analyses of stratified samples. *J. Amer. Statist. Assoc.*, **78**, 535-543. https://doi.org/10.1080/01621459.1983.10478006

Moore, J.C., Burton, J., Crossley, T. F., Fisher, P., Gardiner, C., Jäckle, A., & Benzeval, M. (2024) *Assessing Bias Prevention and Bias Adjustment in a Sub-Annual Online Panel Survey*. Understanding Society Working Papers Series 2024-04.

Valliant, R., Dever, J. A., & Kreuter, F. (2013) *Practical tools for designing and weighting survey samples*. New York: Springer.

Wooldridge, J. M. (2002). Inverse probability weighted M-estimators for sample selection, attrition, and stratification. *Portuguese economic journal*, **1**, 117-139. https://doi.org/10.1007/s10258-002-0008-x

Wooldridge, J. M. (2007). Inverse probability weighted estimation for general missing data problems. *J. Econometrics*, **141**, 1281-1301. https://doi.org/10.1016/j.jeconom.2007.02.002

Appendix A4. Tables and Figures

Table A4 1: Weighted IP web and web plus CAPI respondent dataset overall CVs and 95% CIs. * indicates denote significance.

	Web			Web + CAPI		
		95% CIs			95% CIs	
Wave	Overall CV	CI -	CI +	Overall CV	CI -	CI +
5	0.456*	0.394	0.517	0.196*	0.164	0.229
6	0.392*	0.343	0.441	0.193*	0.164	0.222
7	0.352*	0.298	0.406	0.237*	0.203	0.272
8	0.314*	0.266	0.361	0.186*	0.154	0.218
9	0.267*	0.229	0.305	0.163*	0.138	0.189
10	0.309*	0.265	0.352	0.172*	0.141	0.203
11	0.242*	0.203	0.282	0.173*	0.144	0.203
15	0.156*	0.122	0.190	0.189*	0.159	0.218
16	0.177*	0.146	0.208	0.184*	0.156	0.213

Table A4 2: Main survey 2020 web and web plus CATI respondent dataset covariate category CV_us and 95% CIs. * indicates significance.

Variable	Web			Web + CATI		
		95% CIs			95% CIs	
	CV_u	CI -	CI +	CV_u	CI -	CI +
Sex: Male	-0.067*	-0.087	-0.047	-0.055*	-0.074	-0.035
Sex: Female	0.065*	0.046	0.084	0.053*	0.034	0.072
Age: 16-34	-0.108*	-0.131	-0.085	-0.076*	-0.099	-0.053
Age: 35-54	0.014	-0.011	0.038	0.052*	0.027	0.077
Age: 55-74	0.076*	0.051	0.100	0.089*	0.065	0.114
Age: 75+	0.028	-0.003	0.059	-0.107*	-0.127	-0.087
Activity Last Week: In work	-0.013	-0.031	0.006	0.046*	0.029	0.064
Activity Last Week: Not in work	0.015	-0.006	0.036	-0.053*	-0.074	-0.033
Housing tenure: Owner occupied	0.049*	0.026	0.072	0.050*	0.027	0.073
Housing tenure: Mortgage	-0.003	-0.026	0.019	0.055*	0.032	0.079
Housing tenure: Rented/Other	-0.049*	-0.074	-0.024	-0.114*	-0.136	-0.092
Household Structure: 1 adult	0.069*	0.035	0.103	-0.063*	-0.090	-0.037
Household Structure: 1 adult, kids	-0.050*	-0.077	-0.022	-0.081*	-0.102	-0.061
Household Structure: Couple	0.061*	0.035	0.086	0.114*	0.087	0.142
Household Structure: Couple, kids	0.000	-0.025	0.026	0.056*	0.027	0.084
Household Structure: Other	-0.088*	-0.109	-0.067	-0.069*	-0.090	-0.048
Region: North	-0.022	-0.044	0.001	-0.034*	-0.056	-0.012
Region: South	0.015	-0.010	0.039	0.039*	0.014	0.065
Region: East	0.008	-0.019	0.035	-0.005	-0.031	0.022
Region: West	0.001	-0.026	0.028	0.003	-0.024	0.031
Behind with bills: No	0.013*	0.006	0.020	0.010*	0.003	0.017
Behind with bills: Yes	-0.051*	-0.077	-0.024	-0.038*	-0.066	-0.011
Household income: 1st quintile	0.054*	0.025	0.084	-0.056*	-0.081	-0.032
Household income: 2nd quintile	-0.016	-0.042	0.010	-0.023	-0.049	0.003
Household income: 3rd quintile	0.029*	0.001	0.057	0.070*	0.040	0.100
Household income: 4th quintile	-0.023	-0.047	0.001	0.012	-0.014	0.038
Household income: 5th quintile	-0.048*	-0.072	-0.025	0.006	-0.020	0.032

Table A4 3: Main survey 2020 web and web plus CATI respondent dataset covariate category CV_cs and 95% CIs. * indicates significance.

Variable	Web			Web + CATI		
		95% CIs			95% CIs	
	CV_c	CI -	CI +	CV_c	CI -	CI +
Sex: Male	0.059*	0.050	0.069	0.059*	0.044	0.073
Sex: Female	0.060*	0.050	0.070	0.059*	0.045	0.073
Age: 16-34	0.052*	0.041	0.062	0.035*	0.021	0.048
Age: 35-54	0.028*	0.019	0.037	0.032*	0.018	0.045
Age: 55-74	0.044*	0.033	0.054	0.072*	0.058	0.085
Age: 75+	0.015*	0.008	0.023	0.083*	0.067	0.098
Activity Last Week: In work	0.007	-0.001	0.016	0.016*	0.004	0.028
Activity Last Week: Not in work	0.009	-0.002	0.019	0.018*	0.004	0.031
Housing tenure: Owner occupied	0.011*	0.004	0.019	0.041*	0.027	0.055
Housing tenure: Mortgage	0.017*	0.009	0.026	0.028*	0.018	0.038
Housing tenure: Rented/Other	0.028*	0.017	0.039	0.064*	0.048	0.080
Household Structure: 1 adult	0.032*	0.022	0.041	0.034*	0.025	0.044
Household Structure: 1 adult, kids	0.030*	0.019	0.041	0.047*	0.032	0.062
Household Structure: Couple	0.027*	0.019	0.036	0.074*	0.059	0.089
Household Structure: Couple, kids	0.020*	0.013	0.027	0.036*	0.023	0.048
Household Structure: Other	0.038*	0.029	0.048	0.066*	0.052	0.080
Region: North	0.019*	0.008	0.031	0.019*	0.002	0.036
Region: South	0.008	-0.003	0.019	0.022*	0.004	0.039
Region: East	0.017*	0.005	0.028	0.005	-0.014	0.024
Region: West	0.006	-0.006	0.019	0.005	-0.019	0.029
Behind with bills: No	0.010*	0.003	0.017	0.003	-0.010	0.017
Behind with bills: Yes	0.014*	0.004	0.024	0.005	-0.015	0.024
Household income: 1st quintile	0.020*	0.010	0.030	0.014	-0.001	0.030
Household income: 2nd quintile	0.018*	0.009	0.028	0.014	-0.001	0.030
Household income: 3rd quintile	0.032*	0.020	0.043	0.038*	0.020	0.055
Household income: 4th quintile	0.013*	0.004	0.023	0.015	-0.002	0.033
Household income: 5th quintile	0.022*	0.010	0.033	0.008	-0.007	0.022

Table A4 4: IP web respondent dataset covariate category CV_us and 95% CIs. * indicates denote significance.

	Sex: Male			Sex: Female			Age: 16 to 34			Age: 35 to 54			Age: 55 to 74			Age: 75+		
Wave	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.031*	-0.061	-0.000	0.030*	0.000	0.060	-0.072*	-0.107	-0.037	0.140*	0.100	0.181	0.054*	0.016	0.092	-0.209*	-0.230	-0.188
6	-0.006	-0.038	0.025	0.006	-0.024	0.036	-0.039*	-0.078	-0.001	0.063*	0.025	0.102	0.068*	0.028	0.107	-0.149*	-0.180	-0.117
7	-0.037*	-0.069	-0.005	0.036*	0.005	0.067	-0.082*	-0.119	-0.045	0.104*	0.061	0.146	0.050*	0.011	0.089	-0.122*	-0.156	-0.089
8	-0.020	-0.055	0.014	0.020	-0.014	0.054	-0.099*	-0.136	-0.061	0.045*	0.003	0.088	0.072*	0.030	0.115	-0.028	-0.092	0.035
9	-0.043*	-0.073	-0.013	0.042*	0.013	0.071	-0.087*	-0.121	-0.052	0.074*	0.037	0.112	0.064*	0.026	0.102	-0.084*	-0.131	-0.037
10	-0.037*	-0.067	-0.007	0.036*	0.007	0.065	-0.060*	-0.095	-0.024	0.041*	0.005	0.076	0.097*	0.058	0.137	-0.124*	-0.165	-0.082
11	-0.017	-0.049	0.014	0.017	-0.014	0.048	-0.072*	-0.107	-0.037	0.022	-0.014	0.058	0.118*	0.077	0.159	-0.103*	-0.157	-0.049
15	-0.036*	-0.062	-0.011	0.035*	0.010	0.060	-0.085*	-0.113	-0.058	0.028	-0.003	0.059	0.069*	0.038	0.100	-0.017	-0.065	0.031
16	-0.030*	-0.056	-0.004	0.029*	0.004	0.054	-0.096*	-0.124	-0.068	0.033*	0.001	0.066	0.065*	0.034	0.097	-0.003	-0.051	0.045
	Act. last week: In Work			Act. last week: Not in Work			Tenure: Owner occupied			Tenure: Mortgage			Tenure: Rented / Other			HH Str.: 1 adult		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	0.136*	0.109	0.163	-0.151*	-0.181	-0.121	-0.018	-0.054	0.018	0.193*	0.156	0.230	-0.202*	-0.230	-0.174	-0.153*	-0.183	-0.123
6	0.083*	0.055	0.111	-0.092*	-0.123	-0.060	0.029	-0.008	0.065	0.159*	0.120	0.197	-0.206*	-0.235	-0.177	-0.099*	-0.136	-0.063
7	0.111*	0.083	0.139	-0.125*	-0.157	-0.094	0.021	-0.016	0.059	0.167*	0.128	0.207	-0.207*	-0.238	-0.176	-0.071*	-0.111	-0.031
8	0.045*	0.013	0.076	-0.051*	-0.087	-0.015	0.028	-0.014	0.070	0.124*	0.083	0.164	-0.167*	-0.203	-0.132	0.015	-0.045	0.074
9	0.073*	0.045	0.101	-0.079*	-0.110	-0.049	0.054*	0.016	0.091	0.076*	0.043	0.110	-0.149*	-0.182	-0.117	-0.035	-0.084	0.015
10	0.046*	0.018	0.073	-0.051*	-0.082	-0.020	0.037*	0.000	0.073	0.090*	0.056	0.124	-0.144*	-0.177	-0.112	-0.041	-0.087	0.005
11	0.030*	0.001	0.059	-0.034*	-0.066	-0.001	0.061*	0.022	0.100	0.033	-0.002	0.068	-0.104*	-0.138	-0.070	-0.047*	-0.093	-0.001
15	0.012	-0.012	0.036	-0.013	-0.040	0.013	0.021	-0.010	0.052	0.021	-0.007	0.050	-0.049*	-0.078	-0.020	0.032	-0.011	0.074
16	0.007	-0.017	0.032	-0.008	-0.036	0.019	0.061*	0.028	0.093	-0.031*	-0.058	-0.003	-0.032*	-0.064	-0.000	0.029	-0.015	0.073
	HH Str.: 1 adult, kids			HH Str.: Couple			HH Str.: Couple, kids			HH Str.: Other			Region: North			Region: East		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.035	-0.076	0.007	0.150*	0.105	0.195	0.052*	0.008	0.096	-0.056*	-0.090	-0.023	-0.053*	-0.085	-0.021	0.063*	0.021	0.105
6	-0.063*	-0.097	-0.028	0.109*	0.065	0.153	0.061*	0.013	0.109	-0.048*	-0.082	-0.014	0.029	-0.006	0.064	0.018	-0.023	0.059
7	-0.030	-0.080	0.020	0.095*	0.050	0.140	0.080*	0.027	0.133	-0.076*	-0.110	-0.042	0.025	-0.011	0.061	0.051*	0.007	0.095
8	-0.043	-0.091	0.006	0.115*	0.066	0.165	0.021	-0.027	0.068	-0.100*	-0.136	-0.065	0.039	-0.001	0.079	0.045	-0.002	0.091
9	-0.072*	-0.104	-0.040	0.101*	0.059	0.142	-0.016	-0.054	0.023	-0.025	-0.058	0.008	0.013	-0.022	0.049	0.035	-0.004	0.075
10	-0.067*	-0.096	-0.038	0.131*	0.087	0.174	0.009	-0.031	0.049	-0.069*	-0.100	-0.037	0.011	-0.023	0.046	0.065*	0.024	0.106
11	-0.049*	-0.082	-0.015	0.114*	0.067	0.161	-0.039*	-0.077	-0.001	-0.019	-0.052	0.015	-0.007	-0.045	0.032	0.059*	0.018	0.099
15	0.030	-0.014	0.074	0.053*	0.022	0.084	-0.002	-0.036	0.032	-0.082*	-0.110	-0.054	0.011	-0.020	0.042	0.005	-0.026	0.036
16	-0.040*	-0.071	-0.009	0.058*	0.026	0.090	-0.029	-0.063	0.004	-0.042*	-0.071	-0.013	0.005	-0.026	0.037	0.033*	0.000	0.066
	Region: South.			Region: West			Behind Bills: No			Behind Bills: Yes			HH income: 1st quintile			HH income: 2nd quintile		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.000	-0.042	0.042	-0.006	-0.048	0.036	0.025*	0.016	0.033	-0.087*	-0.118	-0.057	-0.225*	-0.250	-0.199	-0.103*	-0.135	-0.070
6	0.024	-0.020	0.068	-0.103*	-0.136	-0.069	0.011	-0.001	0.024	-0.037	-0.078	0.004	-0.147*	-0.178	-0.116	-0.091*	-0.126	-0.056
7	-0.006	-0.050	0.038	-0.099*	-0.134	-0.065	0.033*	0.021	0.044	-0.101*	-0.136	-0.065	-0.120*	-0.154	-0.086	-0.057*	-0.095	-0.019
8	-0.019	-0.064	0.027	-0.095*	-0.134	-0.057	0.026*	0.015	0.037	-0.088*	-0.124	-0.052	-0.089*	-0.134	-0.044	-0.043*	-0.086	-0.000
9	-0.022	-0.061	0.017	-0.039	-0.079	0.000	0.025*	0.016	0.035	-0.090*	-0.122	-0.058	-0.070*	-0.109	-0.031	-0.032	-0.072	0.008
10	-0.061*	-0.098	-0.024	-0.021	-0.063	0.021	0.031*	0.022	0.040	-0.104*	-0.135	-0.073	-0.052*	-0.092	-0.012	-0.002	-0.043	0.038
11	-0.036	-0.074	0.002	-0.020	-0.060	0.020	0.012*	0.001	0.024	-0.042*	-0.081	-0.002	-0.014	-0.057	0.029	-0.031	-0.075	0.013

15	-0.021	-0.053	0.011	0.006	-0.031	0.043	0.004	-0.006	0.015	-0.016	-0.051	0.020	0.033	-0.004	0.071	-0.024	-0.056	0.008
16	-0.065*	-0.095	-0.034	0.037	-0.005	0.079	0.006	-0.005	0.017	-0.020	-0.055	0.016	0.019	-0.018	0.056	0.002	-0.034	0.038

	HH income: 3rd quintile			HH income: 4th quintile			HH income: 5th quintile		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	0.043	-0.003	0.089	0.131*	0.083	0.180	0.170*	0.118	0.222
6	-0.047*	-0.086	-0.007	0.082*	0.037	0.127	0.210*	0.152	0.268
7	0.021	-0.028	0.069	0.057*	0.010	0.104	0.105*	0.054	0.157
8	0.022	-0.026	0.070	-0.028	-0.072	0.015	0.139*	0.083	0.196
9	-0.009	-0.049	0.031	0.031	-0.010	0.072	0.090*	0.043	0.137
10	-0.041*	-0.079	-0.003	0.017	-0.022	0.057	0.084*	0.038	0.130
11	0.041	-0.003	0.086	-0.027	-0.064	0.010	0.034	-0.006	0.074
15	-0.015	-0.047	0.017	0.016	-0.020	0.051	-0.011	-0.045	0.023
16	-0.011	-0.044	0.023	-0.048*	-0.079	-0.017	0.038	-0.001	0.076

Table A4 5: IP web respondent dataset covariate category CV_cs and 95% CIs. * indicates significance.

	Sex: Male			Sex: Female			Age: 16 to 34			Age: 35 to 54			Age: 55 to 74			Age: 75+		
Wave	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.042*	0.003	0.082	0.043*	0.003	0.083	0.045*	0.012	0.079	0.054*	0.019	0.089	0.079*	0.052	0.107	0.097*	0.063	0.131
6	0.016	-0.018	0.050	0.016	-0.019	0.050	0.016	-0.004	0.035	0.020	-0.002	0.042	0.066*	0.039	0.092	0.074*	0.046	0.102
7	0.036*	0.004	0.068	0.036*	0.004	0.069	0.038*	0.006	0.069	0.036*	0.006	0.065	0.054*	0.024	0.083	0.057*	0.026	0.089
8	0.025	-0.003	0.053	0.025	-0.003	0.054	0.029*	0.002	0.057	0.019	-0.007	0.044	0.030	-0.000	0.060	0.020	-0.008	0.049
9	0.041*	0.020	0.063	0.042*	0.020	0.064	0.036*	0.018	0.054	0.043*	0.023	0.063	0.045*	0.027	0.063	0.051*	0.029	0.073
10	0.037*	0.010	0.063	0.036*	0.010	0.062	0.026*	0.010	0.041	0.035*	0.013	0.057	0.084*	0.060	0.108	0.094*	0.067	0.121
11	0.016	-0.009	0.041	0.016	-0.009	0.041	0.031*	0.011	0.052	0.032*	0.014	0.051	0.080*	0.057	0.103	0.086*	0.062	0.109
15	0.027*	0.007	0.048	0.027*	0.007	0.047	0.046*	0.026	0.066	0.026*	0.010	0.042	0.046*	0.025	0.067	0.029*	0.008	0.050
16	0.028*	0.010	0.046	0.028*	0.010	0.046	0.051*	0.033	0.070	0.041*	0.024	0.058	0.033*	0.015	0.051	0.027*	0.008	0.046
	Act. last week: In Work			Act. last week: Not in Work			Tenure: Owner occupied			Tenure: Mortgage			Tenure: Rented / Other			HH Str.: 1 adult		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.004	-0.094	0.101	0.004	-0.098	0.106	0.033*	0.011	0.055	0.054*	0.024	0.085	0.081*	0.045	0.116	0.039*	0.015	0.063
6	0.006	-0.035	0.047	0.006	-0.036	0.048	0.053*	0.030	0.076	0.056*	0.035	0.077	0.096*	0.068	0.125	0.021*	0.003	0.040
7	0.027	-0.001	0.055	0.028	-0.001	0.057	0.044*	0.022	0.067	0.056*	0.032	0.081	0.089*	0.059	0.119	0.019	-0.004	0.043
8	0.011	-0.016	0.038	0.011	-0.017	0.040	0.022*	0.007	0.038	0.042*	0.018	0.066	0.055*	0.028	0.082	0.041*	0.017	0.065
9	0.019*	0.002	0.036	0.020*	0.001	0.038	0.034*	0.016	0.053	0.029*	0.015	0.042	0.051*	0.030	0.072	0.024*	0.013	0.036
10	0.004	-0.039	0.047	0.004	-0.040	0.049	0.030*	0.007	0.053	0.027*	0.008	0.045	0.051*	0.025	0.077	0.038*	0.024	0.052
11	0.016	-0.003	0.036	0.017	-0.004	0.039	0.039*	0.018	0.061	0.024*	0.012	0.037	0.052*	0.029	0.075	0.035*	0.016	0.053
15	0.016	-0.002	0.034	0.016	-0.002	0.035	0.010	-0.008	0.027	0.018	-0.000	0.036	0.024*	0.003	0.046	0.018*	0.002	0.035
16	0.015	-0.001	0.030	0.016	-0.001	0.032	0.030*	0.013	0.048	0.022*	0.007	0.038	0.017*	0.003	0.032	0.017*	0.002	0.032
	HH Str.: 1 adult, kids			HH Str.: Couple			HH Str.: Couple, kids			HH Str.: Other			Region: North			Region: East		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_u	CI-	CI+
5	0.019	-0.011	0.050	0.121*	0.080	0.163	0.044*	0.014	0.073	0.086*	0.052	0.120	0.034	-0.013	0.080	0.033	-0.015	0.080
6	0.011	-0.018	0.040	0.069*	0.040	0.098	0.026*	0.004	0.048	0.070*	0.042	0.097	0.029	-0.000	0.058	0.018	-0.007	0.042
7	0.009	-0.024	0.041	0.052*	0.021	0.084	0.036*	0.004	0.067	0.067*	0.036	0.097	0.027	-0.004	0.058	0.030	-0.005	0.065
8	0.014	-0.005	0.034	0.055*	0.032	0.078	0.027*	0.010	0.044	0.075*	0.049	0.100	0.030*	0.001	0.058	0.020	-0.009	0.050
9	0.020	-0.001	0.041	0.051*	0.031	0.071	0.024*	0.007	0.040	0.038*	0.022	0.055	0.016	-0.007	0.040	0.021	-0.004	0.046
10	0.025*	0.001	0.050	0.088*	0.063	0.113	0.029*	0.017	0.042	0.075*	0.051	0.098	0.025*	0.001	0.048	0.047*	0.018	0.076
11	0.018	-0.004	0.040	0.066*	0.043	0.089	0.029*	0.008	0.050	0.033*	0.019	0.046	0.013	-0.009	0.035	0.035*	0.009	0.061
15	0.025*	0.004	0.046	0.038*	0.019	0.056	0.018*	0.006	0.029	0.051*	0.031	0.071	0.007	-0.025	0.039	0.006	-0.033	0.045
16	0.015	-0.004	0.034	0.033*	0.015	0.051	0.019*	0.001	0.037	0.026*	0.009	0.042	0.017*	0.005	0.029	0.033*	0.012	0.053
	Region: South.			Region: West			Behind Bills: No			Behind Bills: Yes			HH income: 1st quintile			HH income: 2nd quintile		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.009	-0.059	0.077	0.008	-0.084	0.100	0.002	-0.073	0.077	0.003	-0.104	0.110	0.085*	0.048	0.122	0.090*	0.053	0.127
6	0.026	-0.004	0.056	0.063*	0.027	0.098	0.021*	0.002	0.040	0.028*	0.003	0.054	0.053*	0.024	0.081	0.067*	0.037	0.098
7	0.016	-0.012	0.045	0.064*	0.027	0.101	0.011	-0.010	0.032	0.013	-0.012	0.039	0.027	-0.007	0.061	0.035*	0.000	0.070
8	0.015	-0.007	0.038	0.054*	0.021	0.088	0.002	-0.050	0.055	0.003	-0.061	0.067	0.057*	0.029	0.086	0.048*	0.025	0.070
9	0.020	-0.005	0.044	0.023	-0.004	0.050	0.007	-0.009	0.023	0.009	-0.011	0.029	0.025*	0.003	0.046	0.020*	0.001	0.038
10	0.051*	0.023	0.080	0.021	-0.010	0.052	0.013	-0.003	0.030	0.017	-0.005	0.039	0.018	-0.008	0.043	0.024*	0.006	0.041
11	0.019	-0.005	0.044	0.019	-0.010	0.048	0.003	-0.028	0.034	0.003	-0.037	0.044	0.021	-0.003	0.044	0.016	-0.006	0.038

15	0.013	-0.013	0.039	0.003	-0.064	0.070	0.003	-0.024	0.029	0.003	-0.031	0.038	0.017	-0.004	0.038	0.024*	0.001	0.047
16	0.051*	0.030	0.072	0.025*	0.004	0.045	0.002	-0.019	0.024	0.003	-0.026	0.033	0.008	-0.011	0.026	0.012	-0.002	0.025

	HH income: 3rd quintile			HH income: 4th quintile			HH income: 5th quintile		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.055*	0.033	0.077	0.077*	0.037	0.116	0.075*	0.035	0.115
6	0.058*	0.031	0.085	0.054*	0.036	0.072	0.109*	0.075	0.142
7	0.023	-0.005	0.050	0.023	-0.005	0.052	0.037*	0.001	0.074
8	0.040*	0.024	0.056	0.052*	0.028	0.076	0.092*	0.061	0.122
9	0.026*	0.003	0.049	0.017*	0.001	0.034	0.043*	0.020	0.067
10	0.052*	0.023	0.081	0.024*	0.005	0.042	0.057*	0.028	0.086
11	0.022	-0.003	0.048	0.042*	0.015	0.070	0.020	-0.003	0.044
15	0.015	-0.009	0.040	0.021	-0.004	0.045	0.009	-0.016	0.034
16	0.019*	0.001	0.037	0.040*	0.019	0.061	0.049*	0.028	0.069

Table A4 6: IP web respondent plus CAPI dataset covariate category CV_us and 95% CIs. * indicates denote significance.

	Sex: Male			Sex: Female			Age: 16 to 34			Age: 35 to 54			Age: 55 to 74			Age: 75+		
Wave	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.034*	-0.060	-0.007	0.033*	0.007	0.059	-0.122*	-0.151	-0.094	0.023	-0.009	0.056	0.100*	0.063	0.137	0.006	-0.039	0.052
6	-0.023	-0.053	0.006	0.022	-0.006	0.051	-0.083*	-0.116	-0.050	-0.001	-0.035	0.033	0.066*	0.027	0.104	0.038	-0.018	0.094
7	-0.029	-0.059	0.002	0.028	-0.001	0.058	-0.137*	-0.169	-0.105	0.032	-0.006	0.070	0.076*	0.037	0.115	0.051	-0.005	0.107
8	-0.021	-0.057	0.014	0.021	-0.014	0.055	-0.094*	-0.132	-0.056	0.019	-0.022	0.060	0.045*	0.004	0.087	0.051	-0.028	0.131
9	-0.037*	-0.068	-0.005	0.036*	0.004	0.067	-0.104*	-0.139	-0.068	0.037*	0.000	0.075	0.055*	0.017	0.094	0.023	-0.047	0.094
10	-0.034*	-0.065	-0.003	0.033*	0.003	0.063	-0.078*	-0.113	-0.043	0.007	-0.028	0.043	0.077*	0.038	0.116	-0.006	-0.070	0.059
11	-0.024	-0.057	0.009	0.024	-0.009	0.056	-0.098*	-0.133	-0.062	-0.004	-0.041	0.033	0.100*	0.059	0.141	0.009	-0.067	0.084
15	-0.030*	-0.056	-0.003	0.029*	0.003	0.055	-0.109*	-0.136	-0.082	-0.001	-0.032	0.030	0.071*	0.039	0.102	0.063*	0.004	0.123
16	-0.028*	-0.055	-0.001	0.027*	0.001	0.053	-0.112*	-0.140	-0.085	0.019	-0.013	0.052	0.067*	0.035	0.098	0.043	-0.012	0.098
	Act. last week: In Work			Act. last week: Not in Work			Tenure: Owner occupied			Tenure: Mortgage			Tenure: Rented / Other			HH Str.: 1 adult		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.003	-0.028	0.022	0.003	-0.024	0.031	0.055*	0.021	0.089	0.002	-0.028	0.031	-0.058*	-0.090	-0.027	0.063*	0.018	0.109
6	-0.018	-0.046	0.010	0.020	-0.010	0.051	0.034	-0.001	0.070	0.007	-0.025	0.040	-0.043*	-0.079	-0.008	0.095*	0.040	0.150
7	-0.011	-0.040	0.017	0.013	-0.019	0.045	0.064*	0.026	0.102	0.037*	0.002	0.071	-0.104*	-0.139	-0.069	0.092*	0.036	0.148
8	-0.024	-0.058	0.010	0.027	-0.011	0.066	0.024	-0.019	0.067	0.017	-0.021	0.055	-0.043	-0.088	0.001	0.075*	0.005	0.145
9	0.017	-0.014	0.047	-0.018	-0.052	0.016	0.026	-0.013	0.065	0.010	-0.023	0.044	-0.040	-0.083	0.002	0.071*	0.005	0.137
10	-0.007	-0.037	0.023	0.008	-0.025	0.041	0.024	-0.014	0.062	0.008	-0.025	0.042	-0.036	-0.076	0.005	0.045	-0.014	0.104
11	-0.024	-0.056	0.008	0.027	-0.009	0.062	0.055*	0.013	0.097	-0.018	-0.053	0.017	-0.040*	-0.080	-0.000	0.056	-0.003	0.116
15	-0.018	-0.043	0.008	0.020	-0.009	0.048	0.056*	0.022	0.090	-0.013	-0.042	0.015	-0.047*	-0.078	-0.017	0.088*	0.039	0.138
16	-0.008	-0.033	0.017	0.009	-0.019	0.038	0.075*	0.042	0.109	-0.053*	-0.081	-0.026	-0.021	-0.053	0.012	0.064*	0.016	0.112
	HH Str.: 1 adult, kids			HH Str.: Couple			HH Str.: Couple, kids			HH Str.: Other			Region: North			Region: East		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.017	-0.060	0.026	0.092*	0.055	0.129	-0.019	-0.055	0.016	-0.103*	-0.131	-0.075	-0.003	-0.033	0.027	0.018	-0.018	0.053
6	-0.037	-0.077	0.003	0.037	-0.001	0.075	0.009	-0.031	0.050	-0.088*	-0.118	-0.057	0.033	-0.002	0.067	-0.014	-0.051	0.022
7	-0.000	-0.056	0.056	0.067*	0.026	0.108	0.028	-0.017	0.074	-0.132*	-0.162	-0.101	0.059*	0.023	0.096	-0.000	-0.040	0.039
8	-0.004	-0.063	0.056	0.059*	0.013	0.105	0.008	-0.038	0.054	-0.099*	-0.135	-0.064	0.038	-0.003	0.078	0.010	-0.035	0.054
9	-0.032	-0.075	0.010	0.042*	0.002	0.082	-0.048*	-0.085	-0.011	-0.038*	-0.072	-0.005	0.007	-0.031	0.044	-0.001	-0.040	0.038
10	-0.043*	-0.079	-0.006	0.079*	0.037	0.121	-0.049*	-0.084	-0.013	-0.050*	-0.083	-0.018	-0.001	-0.037	0.036	0.009	-0.029	0.048
11	-0.037	-0.073	0.000	0.078*	0.030	0.126	-0.045*	-0.083	-0.007	-0.062*	-0.095	-0.028	0.001	-0.042	0.043	0.031	-0.009	0.072
15	0.024	-0.019	0.068	0.045*	0.013	0.076	-0.025	-0.058	0.008	-0.096*	-0.125	-0.068	0.022	-0.012	0.055	0.001	-0.031	0.033
16	-0.032*	-0.065	-0.000	0.040*	0.008	0.071	-0.052*	-0.084	-0.021	-0.035*	-0.065	-0.005	0.026	-0.007	0.059	0.025	-0.008	0.058
	Region: South.			Region: West			Behind Bills: No			Behind Bills: Yes			HH income: 1st quintile			HH income: 2nd quintile		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	-0.028	-0.063	0.008	0.019	-0.022	0.060	0.007	-0.004	0.018	-0.024	-0.064	0.015	0.013	-0.024	0.051	-0.014	-0.051	0.023
6	-0.016	-0.055	0.023	-0.007	-0.047	0.033	-0.004	-0.018	0.011	0.012	-0.037	0.061	-0.001	-0.042	0.040	-0.038	-0.077	0.000
7	-0.040	-0.080	0.000	-0.032	-0.071	0.007	0.013	-0.001	0.028	-0.041	-0.085	0.003	0.030	-0.014	0.074	-0.005	-0.047	0.037
8	-0.010	-0.057	0.038	-0.056*	-0.103	-0.010	0.007	-0.007	0.020	-0.022	-0.069	0.025	0.025	-0.036	0.085	-0.028	-0.072	0.017
9	0.003	-0.039	0.046	-0.013	-0.061	0.034	0.011	-0.001	0.022	-0.038	-0.079	0.004	0.032	-0.017	0.081	-0.020	-0.065	0.024
10	-0.023	-0.063	0.017	0.021	-0.028	0.070	0.023*	0.012	0.033	-0.076*	-0.111	-0.041	0.019	-0.029	0.067	0.036	-0.009	0.081
11	-0.039	-0.079	0.001	0.011	-0.033	0.056	0.014*	0.002	0.026	-0.047*	-0.087	-0.007	0.055*	0.004	0.106	-0.005	-0.054	0.043

15	-0.032*	-0.064	-0.001	0.013	-0.026	0.052	0.007	-0.003	0.017	-0.025	-0.061	0.010	0.070*	0.029	0.111	-0.021	-0.055	0.012
16	-0.074*	-0.104	-0.044	0.030	-0.012	0.073	0.007	-0.004	0.018	-0.023	-0.059	0.012	0.041*	0.001	0.080	-0.005	-0.042	0.031

	HH income: 3rd quintile			HH income: 4th quintile			HH income: 5th quintile		
	CV_u	CI-	CI+	CV_u	CI-	CI+	CV_u	CI-	CI+
5	0.002	-0.037	0.041	-0.020	-0.056	0.015	0.019	-0.019	0.057
6	-0.018	-0.058	0.021	0.019	-0.020	0.059	0.035	-0.007	0.077
7	-0.003	-0.046	0.041	-0.017	-0.056	0.023	-0.007	-0.048	0.034
8	-0.006	-0.050	0.039	-0.028	-0.071	0.015	0.038	-0.010	0.085
9	-0.003	-0.044	0.038	-0.016	-0.054	0.022	0.005	-0.036	0.046
10	-0.055*	-0.093	-0.017	-0.018	-0.055	0.019	0.012	-0.028	0.053
11	0.023	-0.021	0.066	-0.058*	-0.093	-0.023	-0.023	-0.060	0.014
15	-0.025	-0.057	0.007	0.001	-0.035	0.037	-0.031	-0.064	0.001
16	0.004	-0.031	0.040	-0.050*	-0.081	-0.019	0.010	-0.027	0.047

Table A4 7: IP web plus CAPI respondent dataset covariate category CV_cs and 95% CIs. * indicates significance.

	Sex: Male			Sex: Female			Age: 16 to 34			Age: 35 to 54			Age: 55 to 74			Age: 75+		
Wave	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.028*	0.009	0.047	0.028*	0.009	0.047	0.048*	0.029	0.067	0.032*	0.016	0.049	0.043*	0.024	0.062	0.027*	0.009	0.045
6	0.020*	0.004	0.036	0.020*	0.004	0.036	0.026*	0.011	0.040	0.015*	0.005	0.025	0.029*	0.014	0.045	0.009	-0.001	0.019
7	0.018	-0.001	0.037	0.018	-0.001	0.038	0.052*	0.032	0.072	0.034*	0.017	0.050	0.036*	0.016	0.055	0.009	-0.006	0.024
8	0.016	-0.002	0.033	0.016	-0.002	0.034	0.038*	0.020	0.056	0.026*	0.010	0.042	0.022*	0.008	0.037	0.012	-0.002	0.025
9	0.030*	0.017	0.043	0.031*	0.017	0.045	0.048*	0.035	0.061	0.036*	0.024	0.047	0.031*	0.019	0.043	0.009*	0.000	0.017
10	0.029*	0.011	0.046	0.028*	0.011	0.046	0.032*	0.015	0.049	0.025*	0.010	0.040	0.034*	0.017	0.051	0.029*	0.012	0.045
11	0.019*	0.002	0.036	0.019*	0.002	0.036	0.041*	0.024	0.057	0.025*	0.012	0.038	0.046*	0.029	0.063	0.028*	0.012	0.044
15	0.020*	0.002	0.039	0.020*	0.002	0.038	0.053*	0.035	0.070	0.026*	0.015	0.037	0.048*	0.031	0.065	0.017*	0.001	0.033
16	0.025*	0.008	0.041	0.025*	0.008	0.041	0.060*	0.043	0.077	0.040*	0.025	0.055	0.033*	0.017	0.050	0.009	-0.003	0.021
	Act. last week: In Work			Act. last week: Not in Work			Tenure: Owner occupied			Tenure: Mortgage			Tenure: Rented / Other			HH Str.: 1 adult		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.001	-0.153	0.154	0.001	-0.162	0.163	0.012	-0.008	0.031	0.008	-0.009	0.024	0.016	-0.004	0.036	0.037*	0.020	0.054
6	0.004	-0.016	0.024	0.004	-0.016	0.025	0.008	-0.011	0.026	0.006	-0.010	0.022	0.011	-0.006	0.028	0.058*	0.044	0.072
7	0.001	-0.104	0.106	0.001	-0.113	0.115	0.024*	0.010	0.038	0.030*	0.015	0.045	0.046*	0.028	0.065	0.040*	0.024	0.057
8	0.010	-0.006	0.026	0.010	-0.006	0.027	0.004	-0.024	0.032	0.006	-0.018	0.029	0.004	-0.024	0.032	0.039*	0.025	0.053
9	0.015*	0.004	0.026	0.016*	0.004	0.028	0.007	-0.008	0.022	0.010	-0.003	0.024	0.007	-0.007	0.021	0.032*	0.021	0.042
10	0.001	-0.071	0.073	0.001	-0.078	0.080	0.009	-0.012	0.030	0.005	-0.017	0.027	0.007	-0.014	0.028	0.028*	0.015	0.041
11	0.001	-0.090	0.091	0.001	-0.098	0.100	0.008	-0.012	0.028	0.006	-0.011	0.023	0.012	-0.007	0.030	0.018*	0.005	0.030
15	0.017*	0.001	0.032	0.017*	0.001	0.034	0.006	-0.014	0.026	0.012	-0.005	0.029	0.016	-0.003	0.036	0.038*	0.021	0.055
16	0.015*	0.001	0.029	0.016*	0.001	0.031	0.026*	0.010	0.042	0.023*	0.008	0.038	0.013*	0.002	0.023	0.027*	0.012	0.043
	HH Str.: 1 adult, kids			HH Str.: Couple			HH Str.: Couple, kids			HH Str.: Other			Region: North			Region: East		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_u	CI-	CI+
5	0.011*	0.000	0.022	0.046*	0.029	0.063	0.020*	0.011	0.029	0.058*	0.039	0.077	0.008	-0.016	0.031	0.009	-0.015	0.034
6	0.019*	0.009	0.030	0.036*	0.027	0.044	0.031*	0.020	0.041	0.058*	0.041	0.074	0.019*	0.001	0.037	0.013	-0.006	0.032
7	0.018*	0.005	0.031	0.031*	0.019	0.043	0.037*	0.020	0.055	0.066*	0.047	0.085	0.036*	0.016	0.057	0.013	-0.003	0.030
8	0.014*	0.004	0.024	0.031*	0.020	0.042	0.025*	0.012	0.038	0.054*	0.037	0.071	0.028*	0.011	0.046	0.010	-0.003	0.024
9	0.011	-0.000	0.022	0.017*	0.010	0.025	0.022*	0.010	0.034	0.021*	0.013	0.029	0.006	-0.010	0.022	0.006	-0.013	0.025
10	0.021*	0.003	0.039	0.042*	0.027	0.058	0.029*	0.013	0.045	0.034*	0.021	0.047	0.007	-0.012	0.027	0.011	-0.010	0.031
11	0.016	-0.001	0.033	0.032*	0.016	0.049	0.017*	0.002	0.032	0.024*	0.011	0.037	0.009	-0.007	0.025	0.022*	0.002	0.041
15	0.025*	0.007	0.043	0.030*	0.018	0.043	0.021*	0.011	0.030	0.050*	0.032	0.068	0.012	-0.010	0.034	0.007	-0.019	0.033
16	0.010	-0.007	0.027	0.020*	0.007	0.032	0.023*	0.006	0.041	0.016*	0.005	0.027	0.024*	0.009	0.039	0.028*	0.011	0.045
	Region: South.			Region: West			Behind Bills: No			Behind Bills: Yes			HH income: 1st quintile			HH income: 2nd quintile		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.015	-0.006	0.036	0.015	-0.009	0.038	0.007	-0.009	0.022	0.009	-0.012	0.029	0.014	-0.006	0.034	0.021*	0.001	0.041
6	0.011	-0.007	0.029	0.006	-0.017	0.029	0.021*	0.010	0.033	0.027*	0.013	0.041	0.041*	0.023	0.059	0.040*	0.022	0.058
7	0.021*	0.002	0.041	0.020	-0.003	0.043	0.004	-0.013	0.021	0.005	-0.015	0.025	0.006	-0.020	0.033	0.015	-0.008	0.039
8	0.012*	0.000	0.024	0.034*	0.013	0.055	0.003	-0.018	0.024	0.004	-0.020	0.028	0.022*	0.005	0.040	0.035*	0.016	0.053
9	0.009	-0.007	0.024	0.011	-0.007	0.028	0.004	-0.007	0.015	0.005	-0.008	0.019	0.008	-0.006	0.021	0.012	-0.004	0.028
10	0.018	-0.002	0.038	0.014	-0.008	0.036	0.019*	0.007	0.030	0.024*	0.009	0.039	0.011	-0.003	0.024	0.026*	0.008	0.044
11	0.021*	0.002	0.040	0.007	-0.016	0.030	0.006	-0.008	0.019	0.007	-0.010	0.024	0.023*	0.006	0.040	0.013*	0.001	0.026

15	0.019	-0.002	0.040	0.007	-0.021	0.036	0.001	-0.078	0.080	0.001	-0.103	0.104	0.020*	0.002	0.038	0.028*	0.008	0.048
16	0.057*	0.038	0.076	0.022*	0.004	0.039	0.001	-0.037	0.039	0.001	-0.051	0.054	0.005	-0.016	0.026	0.010	-0.006	0.026

	HH income: 3rd quintile			HH income: 4th quintile			HH income: 5th quintile		
	CV_c	CI-	CI+	CV_c	CI-	CI+	CV_c	CI-	CI+
5	0.012	-0.005	0.029	0.016	-0.002	0.033	0.033*	0.011	0.054
6	0.025*	0.015	0.035	0.032*	0.019	0.045	0.044*	0.027	0.061
7	0.008	-0.017	0.034	0.008	-0.017	0.032	0.015	-0.009	0.039
8	0.021*	0.011	0.031	0.026*	0.012	0.041	0.050*	0.031	0.069
9	0.006	-0.011	0.023	0.009	-0.009	0.026	0.011	-0.006	0.027
10	0.040*	0.019	0.061	0.016*	0.001	0.031	0.027*	0.008	0.046
11	0.023*	0.004	0.042	0.036*	0.015	0.056	0.013	-0.000	0.026
15	0.016	-0.004	0.036	0.021	-0.000	0.042	0.010	-0.010	0.030
16	0.011	-0.004	0.025	0.032*	0.013	0.051	0.035*	0.016	0.054

Table A4 8: Main survey 2020 web and web plus CATI respondent non-response weighted dataset biases in survey measured characteristics compared to issued sample weighted benchmark equivalents. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the non-response weighted estimate and the benchmark estimate. * equals *P*<0.05.

		Web	Web + CATI
Variable	Bch. (se)	Comp. diff	Comp. diff
Sex: Male	0.486	-0.007	0.001
	(0.006)		
Age: 16-34	0.281	0.004	0.002
	(0.006)		
Age: 35-54	0.324	0.000	0.001
	(0.006)		
Age: 55-74	0.277	-0.001	-0.001
	(0.006)		
Age: 75+	0.118	-0.004	-0.001
	(0.004)		
Activity Last Week: In work	0.570	0.002	0.003
	(0.006)		
Housing tenure: Owner occupied	0.343	-0.001	-0.002
	(0.006)		
Housing tenure: Mortgage	0.358	-0.001	0.001
	(0.006)		
Housing tenure: Rented/Other	0.299	0.002	0.002
	(0.006)		
Household Structure: 1 adult	0.179	-0.005	-0.000
	(0.005)		
Household Structure: 1 adult, kids	0.032	0.003	0.001
	(0.002)		
Household Structure: Couple	0.264	-0.004	-0.002
	(0.006)		
Household Structure: Couple, kids	0.177	-0.001	-0.000
	(0.005)		
Household Structure: Other	0.347	0.007	0.001
	(0.006)		
Region: North	0.305	-0.001	0.000
	(0.006)		
Region: South	0.255	0.002	0.001
	(0.006)		
Region: East	0.274	-0.003	-0.003
	(0.006)		
Region: West	0.165	0.001	0.002
	(0.005)		
Household Location: Urban	0.758	0.007	0.002
	(0.006)		
Behind with bills: No	0.938	0.000	0.001
	(0.003)		
Behind Council Tax: Yes	0.059	-0.000	-0.002
	(0.003)		
Household income: 1st quintile	0.230	0.001	-0.000
	(0.005)		
Household income: 2nd quintile	0.215	-0.003	-0.003
	(0.005)		
Household income: 3rd quintile	0.182	-0.001	0.001
	(0.005)		
Household income: 4th quintile	0.182	0.001	0.000
	(0.005)		
Household income: 5th quintile	0.190	0.002	0.002
	(0.005)		

Table A4 9: IP web dataset non-response weighted estimates of survey measured characteristics compared to equivalent eligible sample inclusion weighted benchmarks at waves 5, 6, 7, 8 and 9. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the comparator estimate and benchmark estimate. * equals *P*<0.05.

	IP dataset wave									
	5		6		7		8		9	
Variable	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.486	-0.014	0.484	-0.010	0.488	-0.001	0.487	-0.014	0.489	0.001
	(0.011)		(0.012)		(0.012)		(0.013)		(0.012)	
Age: 16-34	0.295	-0.002	0.298	-0.009	0.294	0.002	0.294	0.008	0.306	0.002
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Age: 35-54	0.338	-0.008	0.334	-0.008	0.334	-0.016	0.332	-0.016	0.324	-0.003
	(0.011)		(0.011)		(0.011)		(0.012)		(0.011)	
Age: 55-74	0.257	-0.011	0.257	-0.002	0.260	0.003	0.261	0.001	0.265	-0.004
	(0.010)		(0.010)		(0.011)		(0.011)		(0.010)	
Age: 75+	0.111	0.020	0.111	0.018	0.112	0.011	0.112	0.006	0.105	0.005
	(0.007)		(0.007)		(0.008)		(0.008)		(0.007)	
Activity Last Week: In work	0.553	-0.017	0.548	-0.008	0.559	-0.023	0.565	-0.004	0.543	-0.012
	(0.011)		(0.012)		(0.012)		(0.013)		(0.012)	
Housing tenure: Owner occupied	0.312	-0.011	0.318	0.011	0.307	-0.002	0.311	-0.003	0.318	-0.003
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Housing tenure: Mortgage	0.390	-0.010	0.378	-0.005	0.383	-0.012	0.385	-0.001	0.404	-0.004
	(0.011)		(0.011)		(0.012)		(0.013)		(0.012)	
Housing tenure: Rented/Other	0.297	0.020	0.304	-0.006	0.310	0.013	0.305	0.004	0.278	0.007
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Household Structure: 1 adult	0.155	0.012	0.158	0.002	0.153	0.005	0.163	-0.001	0.166	0.005
	(0.008)		(0.009)		(0.009)		(0.010)		(0.009)	
Household Structure: 1 adult, kids	0.043	0.001	0.042	-0.000	0.041	0.002	0.042	-0.002	0.035	-0.001
	(0.004)		(0.005)		(0.005)		(0.005)		(0.004)	
Household Structure: Couple	0.269	-0.012	0.259	-0.004	0.259	-0.007	0.251	-0.005	0.245	-0.004
	(0.010)		(0.010)		(0.011)		(0.011)		(0.010)	
Household Structure: Couple, kids	0.186	-0.003	0.176	0.002	0.166	-0.004	0.152	-0.004	0.185	0.007
	(0.009)		(0.009)		(0.009)		(0.009)		(0.009)	
Household Structure: Other	0.348	0.002	0.365	0.001	0.381	0.004	0.392	0.011	0.368	-0.008
	(0.011)		(0.011)		(0.012)		(0.013)		(0.011)	
Region: North	0.322	0.021	0.318	0.001	0.317	0.005	0.319	-0.003	0.320	-0.011
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Region: South	0.265	-0.020	0.265	0.004	0.264	0.000	0.264	0.003	0.271	-0.005
	(0.010)		(0.010)		(0.011)		(0.011)		(0.011)	
Region: East	0.274	0.012	0.280	0.006	0.279	-0.001	0.279	0.006	0.272	0.010
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Region: West	0.140	-0.013	0.138	-0.011	0.140	-0.004	0.138	-0.005	0.138	0.006

	(0.008)		(0.008)		(0.008)		(0.009)		(0.008)	
Household Location: Urban	0.789	-0.005	0.792	-0.009	0.801	0.005	0.802	-0.004	0.803	-0.004
	(0.009)		(0.010)		(0.010)		(0.010)		(0.009)	
Behind with bills: No	0.927	0.002	0.916	-0.001	0.905	-0.001	0.920	0.014	0.926	0.000
	(0.006)		(0.006)		(0.007)		(0.007)		(0.006)	
Behind Council Tax: Yes	0.070	-0.001	0.093	-0.006	0.088	-0.005	0.081	-0.007	0.081	-0.006
	(0.006)		(0.007)		(0.007)		(0.007)		(0.006)	
Household income: 1st quintile	0.224	0.010	0.234	-0.002	0.219	0.014	0.195	-0.008	0.236	0.006
	(0.009)		(0.010)		(0.010)		(0.010)		(0.010)	
Household income: 2nd quintile	0.200	0.011	0.178	0.005	0.193	0.006	0.214	0.007	0.215	-0.002
	(0.009)		(0.009)		(0.010)		(0.011)		(0.010)	
Household income: 3rd quintile	0.178	-0.017	0.183	-0.001	0.184	-0.004	0.187	-0.003	0.178	-0.006
	(0.009)		(0.009)		(0.009)		(0.010)		(0.009)	
Household income: 4th quintile	0.200	0.001	0.216	0.001	0.213	-0.013	0.202	0.004	0.180	0.001
	(0.009)		(0.010)		(0.010)		(0.010)		(0.009)	
Household income: 5th quintile	0.198	-0.006	0.189	-0.003	0.191	-0.003	0.201	0.000	0.191	0.001
	(0.009)		(0.009)		(0.010)		(0.010)		(0.009)	

Table A4 10: IP web dataset non-response weighted estimates of survey measured characteristics compared to equivalent eligible sample inclusion weighted benchmarks at waves 10, 11, 15 and 16. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the non-response weighted estimate and the benchmark estimate. * equals *P*<0.05.

	IP dataset wave							
	10		11		15		16	
Variable	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.488	-0.006	0.489	0.003	0.485	0.001	0.484	0.004
	(0.012)		(0.011)		(0.009)		(0.009)	
Age: 16-34	0.291	-0.003	0.293	-0.003	0.288	0.000	0.292	0.002
	(0.010)		(0.010)		(0.008)		(0.008)	
Age: 35-54	0.329	-0.001	0.325	0.001	0.315	0.001	0.314	-0.000
	(0.011)		(0.010)		(0.008)		(0.009)	
Age: 55-74	0.267	0.001	0.269	-0.005	0.274	-0.000	0.273	0.000
	(0.010)		(0.009)		(0.008)		(0.008)	
Age: 75+	0.112	0.004	0.113	0.008	0.122	-0.001	0.121	-0.002
	(0.007)		(0.007)		(0.006)		(0.006)	
Activity Last Week: In work	0.553	-0.006	0.554	-0.006	0.553	0.001	0.561	0.002
	(0.011)		(0.011)		(0.009)		(0.009)	
Housing tenure: Owner occupied	0.332	0.004	0.346	-0.002	0.346	0.002	0.344	-0.001
	(0.011)		(0.010)		(0.009)		(0.009)	
Housing tenure: Mortgage	0.383	0.001	0.364	-0.003	0.381	0.002	0.400	0.002
	(0.011)		(0.010)		(0.009)		(0.009)	
Housing tenure: Rented/Other	0.285	-0.004	0.290	0.005	0.273	-0.003	0.256	-0.000
	(0.010)		(0.010)		(0.008)		(0.008)	
Household Structure: 1 adult	0.163	0.004	0.184	-0.000	0.163	-0.001	0.161	0.000
	(0.009)		(0.008)		(0.007)		(0.007)	
Household Structure: 1 adult, kids	0.031	0.000	0.030	0.000	0.033	0.001	0.029	0.002
	(0.004)		(0.004)		(0.003)		(0.003)	
Household Structure: Couple	0.261	-0.003	0.243	-0.005	0.313	-0.001	0.300	-0.001
	(0.010)		(0.009)		(0.008)		(0.008)	
Household Structure: Couple, kids	0.170	-0.013	0.178	0.002	0.165	0.001	0.169	0.002
	(0.009)		(0.008)		(0.007)		(0.007)	
Household Structure: Other	0.374	0.012	0.365	0.004	0.326	0.000	0.340	-0.003
	(0.011)		(0.010)		(0.008)		(0.009)	
Region: North	0.314	0.000	0.313	0.000	0.314	0.002	0.314	0.002
	(0.011)		(0.010)		(0.008)		(0.009)	
Region: South	0.267	-0.003	0.270	0.001	0.265	-0.001	0.271	-0.002
	(0.010)		(0.009)		(0.008)		(0.008)	
Region: East	0.281	-0.001	0.281	0.003	0.281	-0.000	0.277	-0.001
	(0.010)		(0.010)		(0.008)		(0.008)	
Region: West	0.138	0.004	0.136	-0.004	0.141	-0.000	0.139	0.000

	(0.008)		(0.007)		(0.006)		(0.006)	
Household Location: Urban	0.803	-0.003	0.781	0.003	0.818	-0.001	0.803	-0.000
	(0.009)		(0.009)		(0.007)		(0.007)	
Behind with bills: No	0.917	0.005	0.918	-0.002	0.926	0.003	0.917	-0.002
	(0.006)		(0.006)		(0.005)		(0.005)	
Behind Council Tax: Yes	0.084	-0.002	0.075	0.001	0.061	-0.002	0.074	-0.002
	(0.006)		(0.006)		(0.004)		(0.005)	
Household income: 1st quintile	0.217	-0.001	0.242	0.003	0.234	-0.002	0.201	0.002
	(0.009)		(0.009)		(0.008)		(0.007)	
Household income: 2nd quintile	0.231	-0.005	0.217	-0.004	0.225	-0.001	0.222	-0.003
	(0.010)		(0.009)		(0.008)		(0.008)	
Household income: 3rd quintile	0.184	0.002	0.171	-0.005	0.190	-0.000	0.196	-0.002
	(0.009)		(0.008)		(0.007)		(0.007)	
Household income: 4th quintile	0.192	0.002	0.170	0.004	0.171	-0.001	0.192	-0.002
	(0.009)		(0.008)		(0.007)		(0.007)	
Household income: 5th quintile	0.177	0.002	0.199	0.002	0.179	0.004	0.189	0.005
	(0.009)		(0.009)		(0.007)		(0.007)	

Table A4 11: IP web plus CAPI dataset non-response weighted estimates of survey measured characteristics compared to equivalent eligible sample inclusion weighted benchmarks at waves 5, 6, 7, 8 and 9. 'Bch.' is the benchmark estimate (standard error in brackets). 'Diff' is the difference between the non-response weighted estimate and the benchmark estimate. * equals *P*<0.05.

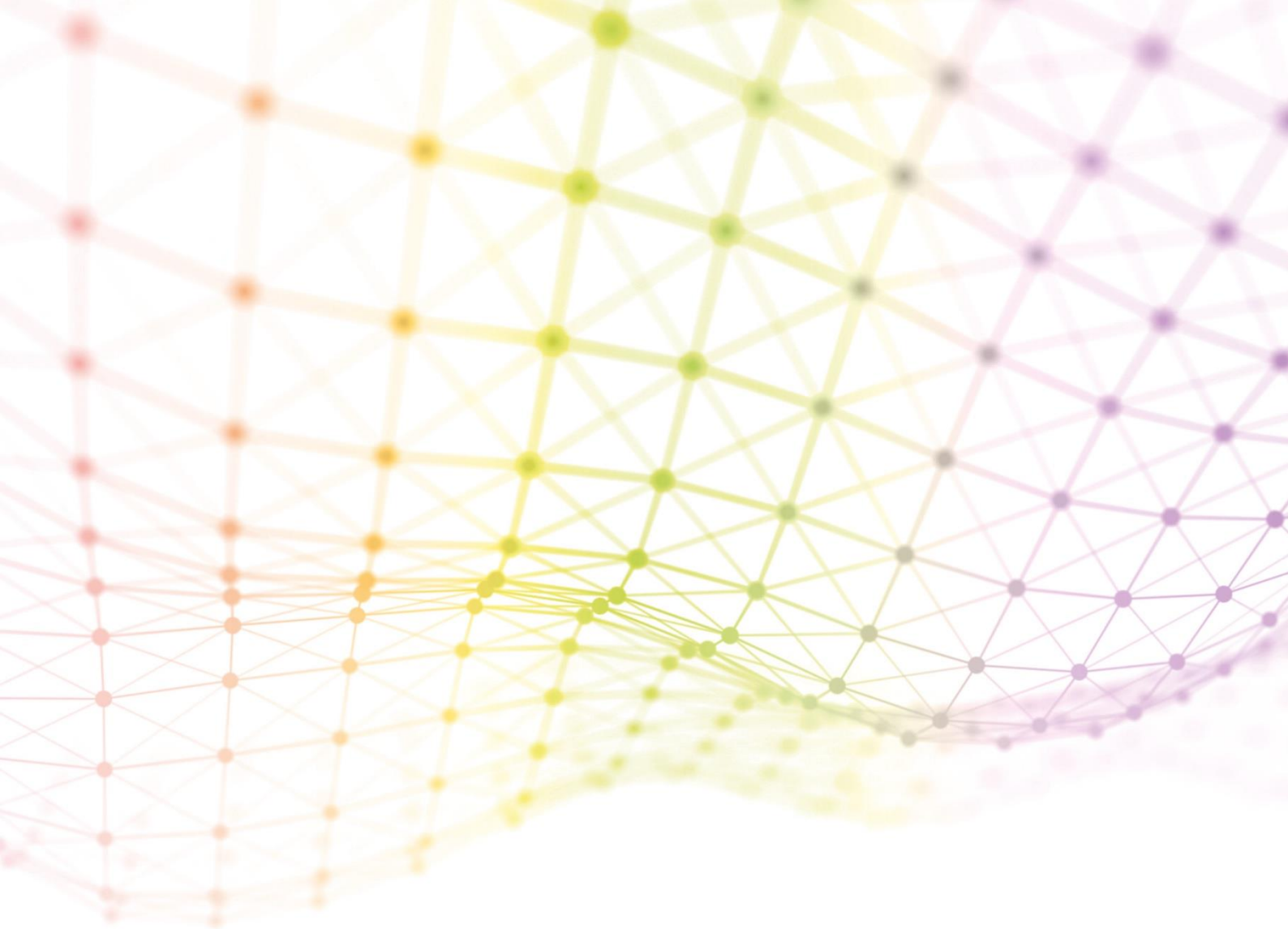
	IP dataset wave									
	5		6		7		8		9	
Variable	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.486	0.003	0.484	0.000	0.488	0.004	0.487	0.003	0.489	0.004
	(0.011)		(0.012)		(0.012)		(0.013)		(0.012)	
Age: 16-34	0.295	0.001	0.298	-0.000	0.294	-0.001	0.294	0.001	0.306	0.004
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Age: 35-54	0.338	0.001	0.334	-0.000	0.334	-0.000	0.332	-0.001	0.324	-0.001
	(0.011)		(0.011)		(0.011)		(0.012)		(0.011)	
Age: 55-74	0.257	-0.004	0.257	-0.001	0.260	0.001	0.261	-0.000	0.265	-0.002
	(0.010)		(0.010)		(0.011)		(0.011)		(0.010)	
Age: 75+	0.111	0.002	0.111	0.001	0.112	0.000	0.112	0.001	0.105	-0.002
	(0.007)		(0.007)		(0.008)		(0.008)		(0.007)	
Activity Last Week: In work	0.553	-0.004	0.548	-0.002	0.559	-0.006	0.565	-0.002	0.543	-0.006
	(0.011)		(0.012)		(0.012)		(0.013)		(0.012)	
Housing tenure: Owner occupied	0.312	-0.003	0.318	0.002	0.307	0.002	0.311	0.005	0.318	-0.002
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Housing tenure: Mortgage	0.390	0.002	0.378	-0.003	0.383	-0.002	0.385	-0.006	0.404	-0.001
	(0.011)		(0.011)		(0.012)		(0.013)		(0.012)	
Housing tenure: Rented/Other	0.297	0.002	0.304	0.001	0.310	0.000	0.305	0.000	0.278	0.003
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Household Structure: 1 adult	0.155	-0.001	0.158	-0.000	0.153	-0.000	0.163	-0.000	0.166	-0.001
	(0.008)		(0.009)		(0.009)		(0.010)		(0.009)	
Household Structure: 1 adult, kids	0.043	-0.000	0.042	-0.000	0.041	0.003	0.042	0.001	0.035	0.001
	(0.004)		(0.005)		(0.005)		(0.005)		(0.004)	
Household Structure: Couple	0.269	-0.003	0.259	0.001	0.259	-0.003	0.251	0.001	0.245	-0.002
	(0.010)		(0.010)		(0.011)		(0.011)		(0.010)	
Household Structure: Couple, kids	0.186	0.000	0.176	0.001	0.166	-0.001	0.152	-0.003	0.185	0.005
	(0.009)		(0.009)		(0.009)		(0.009)		(0.009)	
Household Structure: Other	0.348	0.004	0.365	-0.001	0.381	0.001	0.392	0.001	0.368	-0.003
	(0.011)		(0.011)		(0.012)		(0.013)		(0.011)	
Region: North	0.322	0.003	0.318	0.003	0.317	-0.002	0.319	-0.004	0.320	-0.003
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Region: South	0.265	-0.001	0.265	0.003	0.264	0.003	0.264	0.002	0.271	-0.001
	(0.010)		(0.010)		(0.011)		(0.011)		(0.011)	
Region: East	0.274	0.001	0.280	-0.003	0.279	-0.001	0.279	0.003	0.272	0.001
	(0.010)		(0.011)		(0.011)		(0.012)		(0.011)	
Region: West	0.140	-0.003	0.138	-0.003	0.140	-0.000	0.138	-0.001	0.138	0.002

	(0.008)		(0.008)		(0.008)		(0.009)		(0.008)	
Household Location: Urban	0.789	0.004	0.792	-0.001	0.801	0.003	0.802	0.002	0.803	-0.000
	(0.009)		(0.010)		(0.010)		(0.010)		(0.009)	
Behind with bills: No	0.927	-0.002	0.916	-0.002	0.905	0.001	0.920	-0.001	0.926	0.001
	(0.006)		(0.006)		(0.007)		(0.007)		(0.006)	
Behind Council Tax: Yes	0.070	0.000	0.093	0.003	0.088	0.002	0.081	0.001	0.081	0.002
	(0.006)		(0.007)		(0.007)		(0.007)		(0.006)	
Household income: 1st quintile	0.224	-0.003	0.234	0.004	0.219	0.005	0.195	0.000	0.236	0.000
	(0.009)		(0.010)		(0.010)		(0.010)		(0.010)	
Household income: 2nd quintile	0.200	0.004	0.178	-0.006	0.193	0.003	0.214	0.003	0.215	0.000
	(0.009)		(0.009)		(0.010)		(0.011)		(0.010)	
Household income: 3rd quintile	0.178	-0.000	0.183	0.001	0.184	0.004	0.187	-0.002	0.178	-0.002
	(0.009)		(0.009)		(0.009)		(0.010)		(0.009)	
Household income: 4th quintile	0.200	-0.001	0.216	-0.000	0.213	-0.015	0.202	-0.000	0.180	0.002
	(0.009)		(0.010)		(0.010)		(0.010)		(0.009)	
Household income: 5th quintile	0.198	-0.000	0.189	0.002	0.191	0.003	0.201	-0.001	0.191	-0.000
	(0.009)		(0.009)		(0.010)		(0.010)		(0.009)	

Table A4 12: IP web plus CAPI dataset non-response weighted estimates of survey measured characteristics compared to equivalent eligible sample inclusion weighted benchmarks at waves 10, 11, 15 and 16. 'Bch.' is benchmark estimate (standard error in brackets). 'Diff' is the difference between the non-response weighted estimate and the benchmark estimate. * equals *P*<0.05.

	IP dataset wave							
	10		11		15		16	
Variable	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff	Bch. (se)	Diff
Sex: Male	0.488	0.002	0.489	0.002	0.485	0.003	0.484	0.005
	(0.012)		(0.011)		(0.009)		(0.009)	
Age: 16-34	0.291	-0.001	0.293	-0.000	0.288	-0.001	0.292	0.002
	(0.010)		(0.010)		(0.008)		(0.008)	
Age: 35-54	0.329	-0.000	0.325	-0.001	0.315	0.001	0.314	-0.000
	(0.011)		(0.010)		(0.008)		(0.009)	
Age: 55-74	0.267	-0.000	0.269	0.000	0.274	-0.000	0.273	0.000
	(0.010)		(0.009)		(0.008)		(0.008)	
Age: 75+	0.112	0.001	0.113	0.001	0.122	0.000	0.121	-0.002
	(0.007)		(0.007)		(0.006)		(0.006)	
Activity Last Week: In work	0.553	0.005	0.554	-0.002	0.553	-0.000	0.561	0.001
	(0.011)		(0.011)		(0.009)		(0.009)	
Housing tenure: Owner occupied	0.332	0.004	0.346	-0.002	0.346	0.001	0.344	-0.002
	(0.011)		(0.010)		(0.009)		(0.009)	
Housing tenure: Mortgage	0.383	0.003	0.364	0.001	0.381	0.001	0.400	0.003
	(0.011)		(0.010)		(0.009)		(0.009)	
Housing tenure: Rented/Other	0.285	-0.007	0.290	0.000	0.273	-0.002	0.256	-0.000
	(0.010)		(0.010)		(0.008)		(0.008)	
Household Structure: 1 adult	0.163	-0.000	0.184	-0.000	0.163	0.001	0.161	-0.000
	(0.009)		(0.008)		(0.007)		(0.007)	
Household Structure: 1 adult, kids	0.031	-0.001	0.030	0.000	0.033	0.001	0.029	0.002
	(0.004)		(0.004)		(0.003)		(0.003)	
Household Structure: Couple	0.261	-0.001	0.243	-0.001	0.313	-0.001	0.300	-0.000
	(0.010)		(0.009)		(0.008)		(0.008)	
Household Structure: Couple, kids	0.170	-0.005	0.178	-0.003	0.165	0.001	0.169	0.002
	(0.009)		(0.008)		(0.007)		(0.007)	
Household Structure: Other	0.374	0.007	0.365	0.004	0.326	-0.001	0.340	-0.003
	(0.011)		(0.010)		(0.008)		(0.009)	
Region: North	0.314	0.000	0.313	0.001	0.314	0.002	0.314	0.001
	(0.011)		(0.010)		(0.008)		(0.009)	
Region: South	0.267	0.000	0.270	0.003	0.265	-0.001	0.271	-0.000
	(0.010)		(0.009)		(0.008)		(0.008)	
Region: East	0.281	-0.003	0.281	-0.001	0.281	-0.002	0.277	0.001
	(0.010)		(0.010)		(0.008)		(0.008)	
Region: West	0.138	0.002	0.136	-0.003	0.141	0.000	0.139	-0.001

	(0.008)		(0.007)		(0.006)		(0.006)	
Household Location: Urban	0.803	-0.002	0.781	0.000	0.818	-0.002	0.803	0.001
	(0.009)		(0.009)		(0.007)		(0.007)	
Behind with bills: No	0.917	0.005	0.918	-0.001	0.926	0.001	0.917	-0.001
	(0.006)		(0.006)		(0.005)		(0.005)	
Behind Council Tax: Yes	0.084	-0.003	0.075	0.001	0.061	-0.002	0.074	-0.001
	(0.006)		(0.006)		(0.004)		(0.005)	
Household income: 1st quintile	0.217	-0.005	0.242	-0.001	0.234	-0.001	0.201	0.003
	(0.009)		(0.009)		(0.008)		(0.007)	
Household income: 2nd quintile	0.231	-0.001	0.217	-0.004	0.225	-0.002	0.222	-0.003
	(0.010)		(0.009)		(0.008)		(0.008)	
Household income: 3rd quintile	0.184	0.003	0.171	0.002	0.190	0.001	0.196	-0.002
	(0.009)		(0.008)		(0.007)		(0.007)	
Household income: 4th quintile	0.192	0.002	0.170	0.001	0.171	-0.002	0.192	-0.002
	(0.009)		(0.008)		(0.007)		(0.007)	
Household income: 5th quintile	0.177	0.001	0.199	0.003	0.179	0.004	0.189	0.005
	(0.009)		(0.009)		(0.007)		(0.007)	



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Office for National Statistics

UCL

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