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An assessment of the potential utility of interviewer observation variables for reducing non-response error in the National Survey for Wales

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A report prepared for the Welsh Government by

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EXECUTIVE SUMMARY

In recent years, survey agencies have increasingly employed a strategy of requiring interviewers to record a variety of different observations about all cases in their issued workload prior to first contact with the household. Because these observations are available for both responding and non-responding households they are, in theory, potentially useful for the development of weighting schemes. However, little is known about the utility of these variables for increasing the accuracy of survey estimates through non-response weighting.

In this report we identified all interviewer observation variables that have been included on major UK surveys in recent years. These can be broadly categorised as relating to characteristics of the area, of the household, and of the respondent.

Existing studies on interviewer observation variables show that they are not very effective in reducing non-response bias. This is because they tend to be weakly related to response propensity and even more weakly related to key survey outcomes. Additionally, they appear to suffer from problems relating to measurement validity.

An analysis of the innovation panel of the Understanding Society survey confirmed this general pattern. Only four variables from an extensive list of observations were found to be predictive of both response propensity and key survey outcomes. The power of even these variables in predicting survey outcomes was, however, weak.

Analysis of the ONS Census link study showed that interviewer observation variables were not effective in improving the accuracy of survey estimates via non-response weighting. Many estimates exhibited an increase in bias after weighting and, on average, mean squared error was somewhat higher for the weighted than for the unweighted estimates.

These findings suggest that interviewer observation variables should not be included on the National Survey for Wales. However, our recommendation is that observation variables should be included on the grounds that: there is no apparent cost saving from omitting them, it is possible that they may be of use in correcting for nonresponse bias in future rounds of the survey, and they have the potential to be of value for substantive as well as methodological analysis. The specific variables we recommend for inclusion are those that proved to be jointly predictive of response propensity and survey outcomes in our analysis of the Understanding Society Innovation Panel.

Additionally, we recommend innovation in the sorts of measures that are collected. While the measures that have been developed to date are primarily oriented toward predicting response propensity, new measures which are intended to be more strongly correlated with key survey outcomes, might be more effective in improving survey accuracy through weighting. Some tentative suggestions are made for the sorts of measures that might be included.

INTRODUCTION

Large, face-to-face probability surveys of the general population, such as the National Survey for Wales, invariably suffer from unit non-response - that is where some portion of the eligible sample is not contacted or refuses to participate in the survey - a problem which has been worsening in recent decades (De Leeuw and DeHeer, 2002). In addition to the loss of precision due to reduced sample size that non-response entails, there is a risk that survey estimates will be biased if the responding and non-responding units differ on the survey outcome(s) of interest. The magnitude of the bias in an outcome, *y*, due to non-response can be expressed as the ratio of the covariance between response propensity and the score on the survey outcome, $C_{y,\rho}$, to the mean of the response propensities, $\bar{\rho}$:

$$BIAS(\bar{y}_r) \approx \frac{C_{y,\rho}}{\bar{\rho}} \qquad (1)$$

Thus, if the probability of responding to a survey request is correlated with the outcome of interest, bias will increase as the response rate goes down, resulting in potentially sizeable differences between the survey estimate and true population value. A common strategy for mitigating bias in survey outcomes once a survey has been undertaken is to apply weighting adjustments as a part of data analysis, which compensates for differential selection probabilities among the responding units. If relevant assumptions are met, weighting is an effective strategy because it can serve both to reduce bias and to increase the precision of survey estimates. For a variable to be effective in reducing non-response bias, it must meet the following three criteria:

1. it must be predictive of response propensity for the survey in question;
2. it must be predictive of the survey variable of interest; and
3. it must be observed for both responding and non-responding units.

In practice, variables meeting criterion three are rare for surveys of the general population, being generally limited to auxiliary information attached to the sampling frame, such as aggregate Census form and administrative data. These variables have proven to be only weakly correlated with response propensity (criterion one) (Lynn 2003) and survey outcomes (criterion two) (Kreuter et al 2010).

In recent years, survey agencies have increasingly required interviewers to record a variety of different observations about all cases in their issued workload prior to first contact with the household. Because these observations are available for both responding and non-responding households (criterion 3) they are, in theory, potentially useful for the development of weighting schemes. However, there has to date been little in the way of systematic assessment of the extent to which these variables meet criteria one and two[1], let alone of their effectiveness in improving the accuracy of survey estimates. The objective of this report is to go some way toward addressing this gap by:

1. reviewing the existing literature on interviewer observation variables and compiling a list of variables that have been used on large, national probability samples in the UK to date.

2. Undertaking analyses of the Understanding Society Innovation Panel (www.understandingsociety.org.uk) interviewer observation variables in order to assess the extent to which they meet criteria two and three above.

3. Undertaking analyses of the Office for National Statistics (ONS) Census Link Study to assess whether weighting adjustments based on interviewer observations can improve the accuracy of survey estimates, compared to unweighted estimates and to weighted estimates where the weights are derived from aggregate Census variables.

[1] It is likely that such analyses have been conducted 'in-house' by survey agencies, although we have not come across any such 'grey literature' during the course of this research.

Based on the findings of these linked sections, we then draw conclusions about the utility and cost-effectiveness of collecting interviewer observation variables and make recommendations about which variables, if any, should be collected for the National Survey.

INTERVIEWER OBSERVATION VARIABLES ON EXISTING UK SURVEYS

In order to identify the list of all interviewer observation variables that have been used in the UK to date, we enumerated the variables that have been included on major, national, face-to-face probability surveys and which have been archived at the Economic and Social Data Service (ESDS). This strategy leaves open the possibility that some variables included on smaller, ad hoc surveys might have been missed. Nonetheless, we believe that we have been able to identify a near complete set. This search resulted in a large number of questions being identified and these are listed, survey-by-survey, at Appendix 3. Although Appendix 3 contains a large number of different questions, many clearly seek to measure the same characteristic using slightly different wording or response options so, in practice, the universe of questions is considerably smaller than the full list might suggest. Broadly, these measures can be categorised as falling under three different 'levels': 1. characteristics of the area or neighbourhood; 2. characteristics of the household or dwelling unit; and 3. characteristics of the respondent (or non-respondent). Examples of the questions falling under each of these three headings are listed below.

We do not have information on why these interviewer observation variables were originally chosen. However it would seem that they are intended to measure, albeit indirectly, the area, household, or respondent's level of economic affluence/deprivation (such as questions relating to the type, size and state of the property and possession of cars and motor vehicles) and degree of social cohesion or engagement in society (such as questions about barriers to entry, safety in the neighbourhood, and presence of graffiti and vandalism). These questions appear, then, to reflect implicit

theories about the role of economic and social position in society as underpinning survey non-response, a view that has some support in the theoretical and empirical literature (Groves and Couper 1999). However, it is also likely that some of the measures have been included without a great deal of reflection on the extent to which they might be predictive of non-response and survey outcomes. Because it is essential that the observations interviewers are asked to make should be relatively straightforward to undertake and applicable to all selected households, it is likely that some measures have been included simply because they meet these criteria.

Area/Neighbourhood level

- In the immediate area, how common is litter or rubbish lying around?
- In what physical state are the buildings of dwellings in this area?
- How common is vandalism, graffiti or deliberate damage to property?
- How common are homes in poor condition/run down?
- Are the houses in this area in a good or bad state of repair?
- How many boarded-up or uninhabitable buildings are there in this area?
- How safe would you feel walking along in this area after dark?
- Are most of the buildings in the area residential or commercial?
- Ethnic mix of area (Predominantly white, predominantly black/brown)

Dwelling/Household level

- Are any of these physical barriers to entry present at the house/flat/building? Locked common entrance, locked gates, security staff or other gatekeeper, entry phone access, none of these
- Which of these best describes the flat or house of the intended respondent? Detached house, semi-detached house, terraced house (including end of terrace), flat or maisonette - purpose built, flat or maisonette - conversion, other
- On what floor is the main part of the living accommodation? (Basement/semi-basement, ground floor/street level, 1st floor, 2nd floor, 3rd floor, 4th to 9th floor, 10th to 19th floor, 20th floor to higher)
- How is the external condition of the selected flat or house relative to other residential properties in the area?
- In what physical state is the sampled address, in comparison with the building and dwellings surrounding the sampled address? (In a much better condition than the dwellings nearby, in better condition than the dwellings nearby, more or less the same condition, worse condition than the dwellings nearby, much worse condition than the dwellings nearby)
- Is the dwelling in a neighbourhood watch area?
- Where is the dwelling located? (On main road, on side road, in cul de sac with no through access on foot, in cul de sac with through access on foot, on housing estate, above shops, other location)
- Does the address have an unkempt garden?
- Based on your observation, is it likely that this address has a car or van?
- Based on your observation, is it likely that this address contains one or more children aged under 10 (including babies)?
- Are any of the following present or within sight or hearing of the address? (Boarded houses/abandoned buildings/demolished houses or demolished buildings, trash/litter or junk in the street, heavy traffic on street/road, none)

Respondent level

- Record non-respondent's gender
- Record non-respondent's age

EXISTING STUDIES ON INTERVIEWER OBSERVATION VARIABLES

Given the widespread inclusion of interviewer observation variables on major surveys in the UK and internationally, there is a surprising dearth of published research on how effective they are, or might be, in diagnosing and reducing non-response bias. Lynn (2003) describes a study in which interviewers were instructed to collect a small number of key survey variables (the 'PEDAKSI' methods) from non-responding households as part of the British Crime Survey. Although the data collected in this way proved to be effective in diagnosing the direction and magnitude of non-response bias, the method is not suitable for deriving non-response weights because there remain a group of non-respondents for whom the key survey items are never observed. Blom (2009) uses European Social Survey (ESS) data for Poland, Finland and Slovakia (rounds 1-3) and finds interviewer observations of the physical state of the building and dwelling type to be predictive of response propensity. In combination with other information about the fieldwork process, such as the number of calls made at an address, she finds that applying weights based on these and other variables serves to shift estimates relative to unadjusted means (but because no criterion measures were available in this study it was not possible to determine whether these shifts were serving to reduce bias). However, the overall effect of incorporating interviewer observations in this study was small and limited compared to weights derived using frame data only.

Kaminska and Lynn (2009) focus on the accuracy of measurement of interviewer observations, noting that interviewers may feel uncomfortable being asked to 'guess' about respondent or household characteristics. This, they argue, may result in interviewers 'correcting' their initial guesses for responding households after the interview has taken place. This practice, if it

is prevalent, would be bad for weighting adjustments because it would artificially inflate the predictive power of the observational measures for the responding relative to the non-responding households. These authors suggest that interviewer observation questions should be worded in a way which emphasises that responses should be based on direct observation rather than guess-work. For instance, we should ask, '*based on your observation*, is it likely that this address has a car or van?' rather than 'does this address have a car or van?'. Kaminska and Lynn provide experimental evidence to support the hypothesis that framing the questions as observations rather than guesses reduces the amount of post-hoc correction by interviewers.

West (2011) is also concerned with the measurement accuracy of interviewer observation data. He analyses the American National Survey of Family Growth (NSFG), in which interviewers were required, prior to first face-to-face contact, to record whether they thought there were children under the age of fifteen in the household. Once the household was enumerated and an individual respondent selected (but prior to the individual interview taking place), interviewers were asked to record whether they thought the selected respondent was sexually active or not. West identified a considerable amount of classification error in these observations and, while both measures proved to be predictive of response propensity and key survey variables, as with the Blom study, the derived weights resulted in only small shifts in the unweighted distributions.

The most comprehensive assessment of the utility of interviewer observations to date is provided by Kreuter et al (2010) who investigate the extent to which such variables, and other field paradata measures, are jointly predictive of non-response and survey outcomes across three different surveys (the ESS, the NSFG and the American National Election Study (ANES)). Although they find a number of significant associations between interviewer observations and both response propensity and survey outcomes, these were generally rather weak in magnitude, particularly for the survey outcomes, leading the authors to conclude that "overall the correlations are weak and do not show the strength that is needed for successful non-

response adjustment" (2010, p405). In a subsequent paper, Kreuter and Olson (2011) demonstrate that, even when auxiliary variables are strongly related to response propensity and survey outcomes, the effectiveness of any weighting adjustments depends crucially on the directions of the relationships of the two auxiliary variables with each other and with the response indicator and the survey variable of interest. They show that there are a number of situations in which it is possible for weighting adjustments based on auxiliary variables to *increase* rather than to reduce non-response bias.

To summarise, the existing evidence on interviewer observations, although admittedly somewhat sparse, suggests that the utility of these variables for reducing non-response bias via weighting adjustments appears to be rather limited, due to problems of measurement accuracy and the weak nature of their correlation with response propensity and, in particular, survey outcomes. Furthermore, even when correlations with response propensity and survey outcomes are substantial, weighting adjustments may increase rather than reduce non-response bias, depending on the pattern of covariance between response propensity, survey outcomes, and the auxiliary variables used to produce the weighting adjustments. In the next sections, we undertake our own analyses using data collected in the UK to shed further light on this issue.

ANALYSIS 1 – DO INTERVIEWER OBSERVATIONS PREDICT RESPONSE PROPENSITY AND SURVEY OUTCOMES?

In this section of the report we evaluate the extent to which a range of interviewer observation variables are a) predictive of response propensity and b) predictive of survey outcomes. We have selected the Innovation Panel of the Understanding Society survey for this purpose because it contains a large number of interviewer observation variables, is a household survey, and contains survey outcomes which are similar to the likely content of the individual questionnaire for the National Survey. Our analyses proceeded in two stages. First we estimated response propensity models, predicting

household response from the full range of interviewer observation variables on the survey. Tables presenting the estimated coefficients are presented in tables A1 and A2 in Appendix 1. The model in Table A1 contains all interviewer observation variables, the model in Table A2 uses a backward stepwise procedure to select the best-fitting model, omitting any non-significant predictors ($p<0.05$) from the final model. The latter (or similar) approach would seem to be more common in the practice of weight production, although the pattern of results is essentially the same if the full or the reduced model is employed.

These models demonstrate that only a relatively small number of these variables are predictive of response propensity when considered simultaneously. The variables which are significant predictors of response in the stepwise model were: where the accommodation is located, predominant ethnic group and dwelling type in the neighbourhood, condition of the dwelling relative to others, socio-economic status of the area, number of floors in the building, and presence of an unkempt garden. The Pseudo R-squared for this model is 0.15, which is low but in line with existing research which shows that response propensity models tend to explain only a small amount of the total variability. It is important to note that these models do not include any additional auxiliary variables, such as Census and administrative data, which would generally be available for weighting purposes and their inclusion would likely reduce the number and magnitude of significant predictors in these models (and the independent predictive power of the interviewer observation variables).

Next, we turn to models which examine the extent to which the interviewer observations are able to predict key survey variables. We estimate models for four different outcomes: general health, life satisfaction, whether the respondent feels they belong to their neighbourhood and satisfaction with income (full question wordings are provided in Appendix 1). For each measure we specify an Ordinary Least Squares (OLS) regression model using the interviewer observation variables as predictors. The results of these models are presented in tables A3-A6 in Appendix 1. As with the response

propensity models, it is important to remember that there are no additional auxiliary variables in these models, so these estimates should be considered as upper bounds.

For all four models, the pattern is quite consistent: only a small number of predictors is significantly related to the outcome and the explanatory power of the models is low, with adjusted R-squared values in the range .044 to .068. As Kreuter et al (2011) found for their US data, the predictive power of the interviewer observation variables is particularly weak for the survey outcomes, meaning they would likely be of limited value for the purposes of non-response adjustment. An important caveat to the inferences that can be drawn from these models is that we observe the survey outcomes for the respondents only and must, therefore, assume that the relationships between the interviewer observations and the survey outcomes are the same for the responding and non-responding households. This is a problem to which we turn in the next analysis section. Table 1, below, provides a summary of the extent to which the interviewer observation variables are jointly predictive of both response propensity *and* survey outcomes. The variables listed in the first column of Table 1 are those found to be significantly related to response propensity in the stepwise logistic regression model reported in Table A2 (Appendix 1). In the remaining columns, we indicate whether, and in which direction, the categories of these significant response predictors are also correlated with survey outcomes.

Table 1: Summary of Significant Effects on Non-Response and Outcome Variables

*Household Non-Response**	*General Health*	*Life satisfaction*	*Belong to Neighbourhood*	*Income Satisfaction*
Floor of main living area (Ref: ground				
Basement				
First Floor				
Second Floor				
Third Floor				-
Fourth Floor and above				
Missing (+)				
Predominant ethnic group (Ref:				
Non-white (+)				
Mixed		-	-	-
Missing (+)			-	
Building relative to others (Ref:				
Better (-)	+			+
Worse		-	-	
No other properties				
Missing				
Number of floors: (Ref: Two)				
One	-	+	+	
Two				
Three	+			+
Four				
Over Five (+)			+	
Missing (+)				
Describe area (Ref: Middle Class)				
Affluent		+	+	+
Poor	-	-		-
Very Poor	-			
Missing (-)				
Predominant housing type in area				
Terrace		-		
Detached				
Mixed				
Low rise flats				
High rise flats (-)			-	
Flats over commercial				
Flats mixed				
Mix of houses and flats				
Missing				
Unkempt Garden (+)				

***** (+) indicates increases probability of household non-response; (-) indicates reduces probability of household non-response

Although four of the variables are predictive of both response propensity and survey outcomes (predominant ethnic group, building relative to others, number of floors and economic status of neighbourhood), two are not (floor of main living area) and predominant housing type. Thus, if we were to use this analysis as the basis for selecting interviewer observation variables for the National Survey, it would suggest selecting the first four variables. There are, however, two caveats – first, the pattern of correlations may be different for other variables in the survey and, second, these analyses do not include Census variables as predictors. If measures of ethnic group and economic deprivation were included from Census and administrative sources, it is possible that some of these relationships could become non-significant.

ANALYSIS 2 – DOES WEIGHTING BY INTERVIEWER OBSERVATION VARIABLES IMPROVE THE ACCURACY OF ESTIMATES?

The analyses in the previous section were limited by the fact that we have information on respondents only. In this section of the report, we use data from the ONS Census link study, in which six ONS surveys undertaken in 2001 (Expenditure and Food Survey, Family Resources Survey, General Household Survey, Omnibus Survey, National Transport Survey, and Labour Force Survey) were linked to Census records for responding and non-responding households (see Durrant et al 2010 for details of the linking procedures). Although the data available to us in this study contains no survey outcomes, we are able to identify non-response bias by taking the difference between the full sample (responding + non-responding households) and the responding households only on variables from the Census form. The following 12 variables were available, all relate to the household reference person:

- Single – respondent identified as single
- Widow – respondent identified as a widow
- Health – self rated health (good/not good)
- Carer – respondent acts as a carer for family
- Ill – respondent has a long term limiting illness

- Migrant – respondent identified as a migrant
- Loneparent – respondent identified as lone parent
- Degree – respondent has a degree
- Noqual – respondent has no qualifications.

Restricted to workers only:

- Drivew – respondent drives to work
- Homew – respondent works from home
- NRfootw – respondent travels to work by foot

Additionally, the set of interviewer observation variables used by ONS on its surveys (listed in Appendix 3) are included on the Census link study. For each of the six surveys, we estimated binary logistic response propensity models using the interviewer observation variables only. These models were used to derive non-response weights by taking the inverse of the predicted probability of response, with weights capped at a maximum value of four. For each of the 12 variables, we were then able to examine:

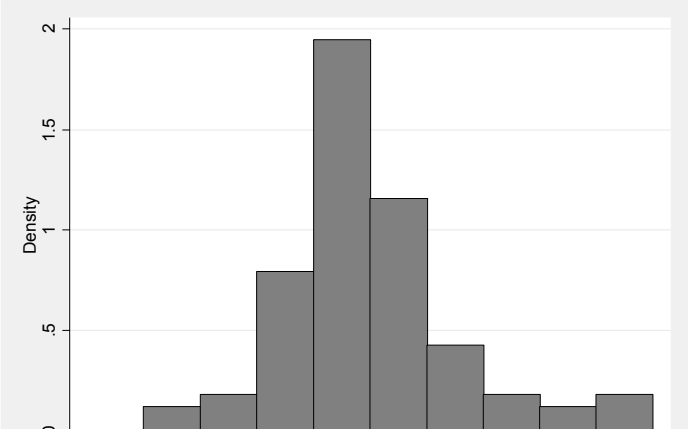
1. non-response bias, by taking the difference between the sample mean for the respondents only and the respondents and nonrespondents combined.
2. The effect of weighting on non-response bias by comparing the weighted and the unweighted mean for respondents only, relative to the mean for respondents and nonrespondents combined.
3. The increase in the variance of the weighted estimate of the mean relative to the unweighted estimate of the mean (the design effect, or DEFT)
4. The mean squared error of the weighted compared to the unweighted estimate (the sum of the square of the bias and the variance).

Clearly, this involved a large number of analyses, so we present only summary information here (full details of all analyses are included in Appendix 4, supplied as a MS Excel spreadsheet). First, with regard to bias, we found

that, across the 72 estimates (6 surveys * 12 variables), the effect of applying the weights derived from the interviewer observation variables, reduced the bias on 42 (58%) and increased the bias on 30 (42%). Thus, it is clear that weighting based on these auxiliary variables is not without risks; although in the majority of cases, the weights did serve to reduce non-response bias, in a substantial minority of cases, bias actually increased even if only by a small amount. Our analyses do not enable us to unequivocally identify the reasons why particular weighted estimates exhibited an increase in bias. However, it is likely to be the result of a combination of the factors identified by Kreuter and Olson (2011) relating to the pattern of correlation between the auxiliary variables and the survey outcome and the fact that, for many of the outcomes examined, the relationship between the interviewer observation variables and the outcome was different for the responding and non-responding households. It has been shown that this can result in an increase in non-response bias (Lessler and Kalsbeeck 1992). This was true for 13 (43%) of the items where an increase in bias was observed.

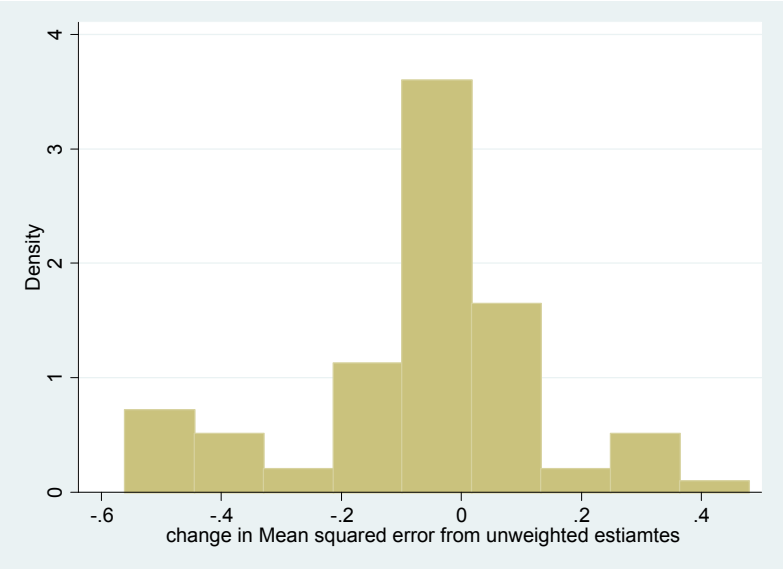
Even when weighting serves to reduce bias, it is well known that the overall effect can be to reduce the overall accuracy of an estimate, if the weights serve to increase the variance of estimates to a degree which outweighs any reduction in bias (Little and Vartivarian 2005). We therefore also examined the change in the mean squared error (variance + bias^2) between the weighted and unweighted estimates. Figure 1 plots the distribution of change scores for mean squared error (MSE) when the weights were derived using only the interviewer observation variables. A positive score indicates an increase in the mean squared error, a negative score a reduction.

Figure 1 change in Mean Squared Error from unweighted estimates using weights derived using interviewer observation variables only (mean = 0.006)



Although the design effects due to the weights were, in general, small (average = 1.0103), Figure 1 shows that the effect of the weights was somewhat more likely to increase the mean squared error than it was to decrease it, with a very slightly positive mean value of 0.006. On this evaluation, then, weighting by interviewer observation variables does not improve the accuracy of estimates and, in some cases, can substantially increase error. By way of contrast, Figure 2 shows the distribution of change in MSE score for weights produced using Census variables only. Although, there are still a large number of estimates where the effect of the weight is to increase mean squared error, the overall pattern shows an average reduction (mean = -0.07).

Figure 2 change in Mean Squared Error from unweighted estimates using weights derived using Census variables only (mean = -0.07)



To summarise, our analyses of the Census link data indicate that the interviewer observation variables do little or nothing to improve the accuracy

of survey estimates when they are used to produce non-response weights. On the variables we examined, they were as likely to *increase* as to reduce the bias relative to unweighted estimates and, additionally, to lead to small increases in the variance of estimates. We have also shown that a likely cause of these increases in bias, in addition to the factors identified by Kreuter and Olson (2011), is that the relationships between the interviewer observation variables and survey outcomes are different for the responding and non-responding households.

CONCLUSIONS AND RECOMMENDATIONS

With response rates declining throughout the world, survey commissioners are increasingly concerned about the consequences of non-response on the accuracy of survey estimates. In addition to the range of measures that can be taken to minimise non-response during data collection, post-survey weighting is frequently employed as a means of correcting bias and, potentially, of increasing precision. For effective non-response weighting, it is necessary to have access to variables which are observed for both responding and non-responding units and, for face-to-face general population surveys, such variables are rare.

In recent years, survey designers have increasingly required interviewers to record observations about the issued sample prior to making first contact. Such observations are potentially useful for developing weighting schemes because they are observed for the full issued sample. A wide variety of such observations have been collected, relating to characteristics of the immediate area, the dwelling or household, or the individual respondent. Little, however, is known about the properties of these variables for detecting and mitigating non-response bias. The purpose of this report has been to advance our understanding in this area in order to inform the design of the National Survey.

Our research comprised three main sections. In section 1, we reviewed the existing literature relating to interviewer observation data. It is unlikely that the material considered in this section is entirely complete because many analyses undertaken on interviewer observations are likely to have been conducted 'in-house' by survey agencies but not been published. However, informal discussions with colleagues in UK agencies suggest that their experiences chime with those reported in published accounts. In section 2, we undertook new analyses of data from the Innovation Panel of the Understanding Society survey, in order to evaluate the extent to which interviewer observations are able to jointly predict both response propensity and key survey outcomes. In section 3, we analysed data from the ONS Census link study, which enabled us to evaluate the extent to which interviewer observation variables are effective in improving the accuracy of survey estimates when used to produce inverse probability weights.

The results of our investigations are not favourable about the performance and utility of interviewer observation variables. Our review of the literature showed that existing studies have found little or no evidence that these variables are effective at reducing bias, over and above the effect that can be obtained from existing auxiliary variables, such as Census and administrative data. This is largely because these variables are weakly related to response propensity and even more weakly related to survey outcomes (cf. Kreuter et al 2010). There are additional problems, relating to the measurement validity of these variables which raise questions about their utility, in particular the apparent tendency of interviewers to complete (or alter) their observations for responding households, after the interview has been conducted.

The results of our own analyses supported this general conclusion. On the Innovation Panel, we established that the small number of interviewer observation variables that were predictive of response propensity on this survey were only patchily and weakly related to the 4 key survey outcomes that we examined. This pattern of results suggests that using these variables to produce non-response weights would have little or no effect, compared to

unweighted estimates. Our analyses of the Census link data, in which we were able to obtain estimates of bias and mean squared error, showed that using the interviewer observation variables to produce non-response weights was nearly as likely to lead to an increase in the bias of survey estimates as to a reduction. Considering the broader measure of mean squared error showed that weighted estimates had a very slightly *larger* error component than the unweighted estimates.

These findings would appear to suggest that interviewer observation variables should not be collected on the National Survey. However, the weak performance of these variables needs to be balanced against the fact that there appears to be no additional cost for including them (as reported by TNS-BMRB, the appointed data collection agency for the National Survey) and, therefore, no saving to be made from excluding them. Given that non-response bias is not just survey, but variable specific, it is certainly possible that interviewer observation variables could be useful in detecting/correcting for non-response bias on the National Survey. Additionally, it should be remembered that these variables can also be used by substantive analysts as well as for post-survey adjustment (e.g. Brunton-Smith and Sturgis 2011). In summary, despite the evidence to suggest that these variables are unlikely to be beneficial in increasing the accuracy of estimates for the National Survey, we still recommend that some be included, on the grounds that this comes at no additional cost and may have some analytical benefit, both methodological and substantive.

Which variables should be included? Our analyses of the broad range of observation variables on the Innovation Panel indicated that the following 4 would be the best candidates, in the sense of being predictive of both response propensity and key survey variables:

1. Predominant ethnic composition of the area
2. Condition of building relative to others in the area
3. Number of floors in the building
4. Socio-economic status of the area

However, given the low demonstrated utility of even these variables in predicting survey outcomes, there is perhaps an opportunity to innovate in the sorts of interviewer observation measures that are included in the National Survey. That is to say, the measures that have been included on surveys to date seem to have primarily been oriented toward predicting response propensity. However, as this report has demonstrated, the primary weakness of these variables is their ability to predict key survey outcomes. A potentially useful approach might, therefore, be to produce new measures which are devised so as to be more strongly correlated with key outcomes in the National Survey. Any new measures would need to be developed in conjunction with the data collection agency, taking into account the content of the main questionnaire. However, we might (for example) ask interviewers to rate the extent to which they believe people in the area are satisfied with services provided by the local council, or about the facilities that are available to the community.

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APPENDIX 1 REGRESSION MODELS - UNDERSTANDING SOCIETY INNOVATION PANEL

TABLE A1: PREDICTING HOUSEHOLD RESPONSE, FULL MODEL 2

	B	S.E.	OR	Sig.
Constant	0.88	0.36	2.41	0.02
Type of area				
Dense-Urban (ref: Innercity)	0.26	0.31	1.30	0.39
Suburb	0.26	0.29	1.30	0.37
Rural-village	0.29	0.31	1.34	0.34
Rural	0.52	0.42	1.68	0.22
Area Type DK/missing	-0.52	11798.47	0.60	1.00
Predominant housing in area				
Terrace (ref: Semi-detached)	0.13	0.21	1.13	0.56
Detached	-0.02	0.22	0.98	0.92
Mixed	0.01	0.15	1.01	0.97
Low rise flats	-0.17	0.32	0.84	0.59
High rise flats	1.44	0.79	4.22	0.07
Flats above commercial properties	-0.87	0.80	0.42	0.28
Flat mix	0.63	0.55	1.89	0.25
Mix of flats/houses	-0.35	0.31	0.71	0.27
DK/missing	17.61	11250.17	44450000.00	1.00
Predominant ethnicity in area				
Predominantly ethnic (ref: Predominantly white)	**-1.78*** **	0.45	0.17	0.00
Predominantly mixed	-0.16	0.18	0.86	0.39
Area ethnicity DK/missing	**-0.64*** **	0.15	0.53	0.00
Other area characteristics				
Boarded up houses	0.25	0.47	1.28	0.60
Abandoned cars	-1.18	0.98	0.31	0.23
Demolished housing	21.16	70412.52	1542000000.00	1.00
Trash in street	0.00	0.24	1.00	0.99
Trash in neighbourhood	-0.29	0.29	0.75	0.32
Factories in area	0.24	0.28	1.28	0.38
Retail outlets in area	-0.28	0.24	0.76	0.24
Heavy traffic in area	0.14	0.16	1.15	0.38
Type of accommodation				
Detached (ref: Semi-detached)	-0.02	0.18	0.99	0.93
End terrace	-0.03	0.23	0.97	0.89
Terrace	-0.11	0.19	0.90	0.58
Personal built flat (under 10 dwellings)	-0.07	0.29	0.93	0.81
Personal built flat (over 10 dwellings)	-0.22	0.36	0.80	0.54
Converted flat (under 10 dwellings)	-0.28	0.36	0.75	0.43
Converted flat (over 10 dwellings)	0.15	0.98	1.16	0.88
Development in business area	0.77	1.15	2.15	0.51
Bedsit	1.07	2.04	2.93	0.60
Sheltered accommodation	-0.67	0.64	0.51	0.30
Other	-1.28	0.75	0.28	0.09
DK/missing	4.68	19076.40	107.77	1.00
Number of floors in accommodation				
Zero (ref: Two floors)	-0.33	0.56	0.72	0.56
One floor	-0.07	0.13	0.93	0.58
Three floors	0.27	0.23	1.31	0.24
Four floors	-0.20	0.37	0.82	0.59
Five or more floors	-0.26	0.55	0.77	0.63
DK/missing	**-1.16** **	0.46	0.32	0.01
Floor of main living area				
Basement (ref: First floor)	-0.83	0.50	0.44	0.10
Ground floor	-0.45*	0.20	0.64	0.03
Second floor	0.01	0.36	1.01	0.97
Third floor	-0.56	0.48	0.57	0.24
Fourth floor and above	-0.69	0.72	0.50	0.34
DK/missing	**-4.47*** **	0.56	0.01	0.00
Accommodation comparison with surrounding area				
Better (ref: Same)	**0.82*** **	0.19	2.27	0.00
Worse	-0.25	0.19	0.78	0.18
No other properties in area	0.82	0.85	2.27	0.34
DK/missing	-38.31	11642.91	0.00	1.00
Describe area				
Well-off (re: middle-class)	0.04	0.18	1.04	0.83
Poor	0.04	0.12	1.05	0.72
Very poor	0.54	0.47	1.71	0.25
DK/missing	**1.21***	0.57	3.34	0.04
Other accommodation characteristics				
Locked entrance	-0.11	0.28	0.89	0.69
Locked gate	-0.69	0.43	0.50	0.11
Security staff	**1.62***	0.79	5.06	0.04
Entrance phone	-0.22	0.29	0.81	0.46
Bars on windows	1.37	1.15	3.94	0.24

Crime watch sticker	-0.38	0.57	0.68	0.50
No trespassers sticker	21.50	40192.97	2167000000.00	1.00
No soliciting sticker	-0.63	0.51	0.53	0.21
Beware of dog sticker	-0.39	0.74	0.68	0.60
Missing roof tiles	-20.21	27461.53	0.00	1.00
Boarded windows	-0.08	0.60	0.92	0.90
Broken windows	-0.08	0.70	0.93	0.92
Damaged walls	0.17	0.57	1.18	0.77
Graffiti	-0.28	0.51	0.76	0.58
Unkempt garden	-0.29	0.20	0.75	0.14
Nagelkerke R sq		0.243		
N		2523		

Source: Understanding Society Innovation Panel wave 1

TABLE A2: STEPWISE REGRESSION PREDICTING HOUSEHOLD SURVEY RESPONSE

Model		Unstandardized Coefficients	Std. Error	Sig.
1	Constant	0.642	0.01	**0.00**
	Where accom located: missing	**-0.618*** **	0.033	**0.00**
2	Constant	0.647	0.01	**0.00**
	Where accom located: missing	**-0.624*** **	0.033	**0.00**
	Predominant ethinic group: non-white	**-0.383*** **	0.079	**0.00**
3	Constant	0.636	0.01	**0.00**
	Where accom located: missing	**-0.621*** **	0.033	**0.00**
	Predominant ethinic group: non-white	**-0.371*** **	0.079	**0.00**
	Building relative to others: better	**0.140*** **	0.033	**0.00**
4	Constant	0.646	0.01	**0.00**
	Where accom located: missing	**-0.596*** **	0.034	**0.00**
	Predominant ethinic group: non-white	**-0.381*** **	0.079	**0.00**
	Building relative to others: better	**0.137*** **	0.033	**0.00**
	Predominant ethinic group missing	**-0.106*** **	0.029	**0.00**
5	Constant	0.649	0.01	**0.00**
	Where accom located: missing	**-0.589*** **	0.034	**0.00**
	Predominant ethinic group: non-white	**-0.349*** **	0.08	**0.00**
	Building relative to others: better	**0.141*** **	0.033	**0.00**
	Predominant ethinic group missing	**-0.112*** **	0.029	**0.00**
	Number of floors: over five	**-0.201*** **	0.066	**0.00**
6	Constant	0.657	0.011	**0.00**
	Where accom located: missing	**-0.589*** **	0.034	**0.00**
	Predominant ethinic group: non-white	**-0.342*** **	0.079	**0.00**
	Building relative to others: better	**0.135*** **	0.033	**0.00**
	Predominant ethinic group missing	**-0.112*** **	0.029	**0.00**
	Number of floors: over five	**-0.203*** **	0.066	**0.00**
	Unkempt garden	**-0.101*** **	0.035	**0.00**
7	Constant	0.657	0.011	**0.00**
	Where accom located: missing	**-0.618*** **	0.036	**0.00**
	Predominant ethinic group: non-white	**-0.343*** **	0.079	**0.00**
	Building relative to others: better	**0.137*** **	0.033	**0.00**
	Predominant ethinic group missing	**-0.128*** **	0.03	**0.00**
	Number of floors: over five	**-0.198*** **	0.066	**0.00**
	Unkempt garden	**-0.098** **	0.035	**0.01**
	Describe area: missing	**0.131***	0.059	**0.03**
8	Constant	0.658	0.011	**0.00**
	Where accom located: missing	**-0.573*** **	0.042	**0.00**
	Predominant ethinic group: non-white	**-0.35*** **	0.079	**0.00**
	Building relative to others: better	**0.134*** **	0.033	**0.00**
	Predominant ethinic group missing	**-0.124*** **	0.03	**0.00**
	Number of floors: over five	**-0.142***	0.071	**0.05**
	Unkempt garden	**-0.102*** **	0.035	**0.00**
	Describe area: missing	**0.166** **	0.061	**0.01**
	Number of floors missing	**-0.109***	0.052	**0.04**
9	Constant	0.657	0.011	**0.00**
	Where accom located: missing	**-0.569*** **	0.042	**0.00**
	Predominant ethinic group: non-white	**-0.352*** **	0.079	**0.00**
	Building relative to others: better	**0.137*** **	0.033	**0.00**
	Predominant ethinic group missing	**-0.125*** **	0.03	**0.00**

Number of floors: over five	**-0.186****	0.074	**0.01**
Unkempt garden	**-0.102*****	0.035	**0.00**
Comparison with surrounding area: missing	**0.189*****	0.062	**0.00**
Number of floors missing	**-0.149****	0.056	**0.01**
Predominant housing type in area: high rise flats	**0.196***	0.094	**0.04**

Source: Understanding Society Innovation Panel wave 1

QUESTION WORDINGS FOR SURVEY OUTCOMES

General health

"In general, would you say your health is...READ OUT...

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor"

Recoded so that: 1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent

Life satisfaction

"Here are some questions about how you feel about your life. Please tick the number which you feel best describes how dissatisfied or satisfied you are with the following aspects of your current situation…

…Your life overall"

11-point scale where:

0 = Not satisfied at all
10 = Completely satisfied

Belong to neighbourhood

"Next, here are some statements about neighbourhoods. Please tick the box that indicates how strongly you agree or disagree with each statement…

…I feel like I belong to this neighbourhood"

1. Strongly agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly disagree

Recoded so that: 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree, 5 = Strongly agree

Income satisfaction

"Here are some questions about how you feel about your life. Please tick the number which you feel best describes how dissatisfied or satisfied you are with the following aspects of your current situation….

…Your income"

11-point scale where:

0 = Not satisfied at all
10 = Completely satisfied

Table A3: Predicting general health, Full OLS model

	B	Std. Error	Sig.
Constant	3.423	0.2	0
Type of area: dense urban (Ref: innnercity)	0.011	0.174	0.95
Type of area: suburb	-0.026	0.17	0.879
Type of area: rural-village	-0.029	0.177	0.869
Type of area: rural	0.145	0.222	0.513
Type of area: missing	0.445	1.089	0.683
Predominant housing type in area: terrace (Ref: semi-detach)	0.006	0.108	0.959
Predominant housing type in area: detached	-0.13	0.107	0.227
Predominant housing type in area: mixed	-0.019	0.077	0.805
Predominant housing type in area: low rise flats	0.231	0.186	0.214
Predominant housing type in area: high rise flats	0.582	0.513	0.256
Predominant housing type in area: flats over commercial	0.374	0.474	0.43
Predominant housing type in area: flats mixed	-0.359	0.307	0.243
Predominant housing type in area: mix of houses and flats	0.079	0.183	0.665
Predominant housing type in area: missing	-0.025	0.736	0.973
Predominant ethnic group: non-white (Ref: white)	-0.202	0.309	0.514
Predominant ethnic group: mix	-0.035	0.098	0.719
Predominant ethnic group missing	0.042	0.091	0.647
Boarded up houses	-0.27	0.24	0.26
Abandoned cars	-0.072	0.914	0.937
Demolished houses	0.497	0.886	0.575
Trash in street	-0.196	0.133	0.14
Trash in neighbourhood	0.156	0.175	0.375
Factories in area	-0.056	0.132	0.673
Retail outlets in area	0.11	0.122	0.369
Heavy traffic	-0.06	0.079	0.443
Type of accommodation: detached (Ref: semi-detach)	0.144	0.088	0.101
Type of accommodation: end terraced	0.067	0.118	0.571
Type of accommodation: terraced	-0.062	0.101	0.538
Type of accommodation: purpose built flat under 10	-0.204	0.163	0.213
Type of accommodation: purpose built flat over 10	-0.4	0.223	0.072
Type of accommodation: converted flat under 10	0.077	0.215	0.719
Type of accommodation: converted flat over 10	-0.268	0.659	0.684
Type of accommodation: dwelling in business area	0.129	0.596	0.829
Type of accommodation: bedsit	0.065	1.185	0.957
Type of accommodation: sheltered accom	-0.451	0.431	0.295
Type of accommodation: other	-0.043	0.572	0.94
Number of floors: zero (Ref: two)	-0.012	0.297	0.968
Number of floors: one	**-0.349*** **	0.071	**0.00**
Number of floors: three	**0.336*** **	0.109	**0.002**
Number of floors: four	0.375	0.22	0.088

Number of floors: over five	-0.182	0.387	0.639
Number of floors missing	0.154	0.402	0.703
Where accom located: basement (Ref: first floor)	-0.046	0.351	0.895
Where accom located: ground floor	0.141	0.102	0.167
Where accom located: second floor	0.341	0.211	0.106
Where accom located: third floor	0.112	0.304	0.712
Where accom located: fourth floor	0.195	0.538	0.718
Where accom located: missing	-0.559	0.477	0.242
Building relative to others: better (Ref: same)	**0.202****	0.078	**0.01**
Building relative to others: worse	0.015	0.107	0.888
Building relative to others: no other properties	0.254	0.325	0.434
Describe area: well off, affluent (Ref: middle class)	0.1	0.085	0.24
Describe area: poor	**-0.376*****	0.064	**0.00**
Describe area: very poor	**-0.84*****	0.289	**0.004**
Describe area: missing	-0.234	0.21	0.265
Locked entrance	0.086	0.174	0.623
Locked gate	**0.525***	0.253	**0.038**
Security	-0.362	0.404	0.37
Entrance phone	-0.439	0.193	0.023
Bars on windows	-0.788	0.483	0.103
Crime watch sign	0.084	0.301	0.781
No trespassing sign	1.108	0.922	0.23
No soliciting sign	-0.422	0.315	0.181
Beware of dog	**-1.235*****	0.429	**0.004**
Boarded up windows	0.466	0.363	0.199
Broken windows	**1.005***	0.413	**0.015**
Walls damaged	-0.064	0.267	0.809
Graffiti	-0.395	0.363	0.277
Unkempt garden	0.207	0.116	0.073
R sq		0.048	
N		2167	

Source: Innovation Panel, wave 1

Table A4: Predicting Life Satisfaction, full OLS model

	B	Std. Error	Sig.
(Constant)	7.483	0.406	0
Type of area: dense urban (Ref: innercity)	-0.051	0.359	0.887
Type of area: suburb	-0.303	0.353	0.391
Type of area: rural-village	-0.129	0.367	0.725
Type of area: rural	0.144	0.46	0.754
Predominant housing type in area: terrace (Ref: semi-detach)	-0.274	0.216	0.205
Predominant housing type in area: detached	-0.103	0.213	0.629
Predominant housing type in area: mixed	0.069	0.152	0.651
Predominant housing type in area: low rise flats	0.09	0.368	0.806
Predominant housing type in area: high rise flats	-0.436	1	0.663
Predominant housing type in area: flats over commercial	1.321	1.736	0.447
Predominant housing type in area: flats mixed	-1.016	0.606	0.094
Predominant housing type in area: mix of houses and flats	-0.309	0.361	0.393
Predominant housing type in area: missing	0.396	1.661	0.812
Predominant ethnic group: non-white (Ref: white)	0.075	0.648	0.908
Predominant ethnic group: mix	**-0.59****	0.207	**0.004**
Predominant ethnic group missing	0.021	0.178	0.906
Boarded up houses	-0.802	0.498	0.108
Abandoned cars	-0.931	1.698	0.583
Demolished houses	2.433	1.664	0.144
Trash in street	0.432	0.276	0.118
Trash in neighbourhood	-0.373	0.361	0.302
Factories in area	0.004	0.264	0.989
Retail outlets in area	0.217	0.251	0.386
Heavy traffic	**-0.318***	0.158	**0.044**
Type of accommodation: detached (Ref: semi-detach)	0.069	0.175	0.696
Type of accommodation: end terraced	-0.057	0.235	0.807
Type of accommodation: terraced	-0.045	0.201	0.824
Type of accommodation: purpose built flat under 10	0.002	0.32	0.995
Type of accommodation: purpose built flat over 10	-0.757	0.442	0.087
Type of accommodation: converted flat under 10	0.192	0.449	0.669
Type of accommodation: converted flat over 10	-1.731	1.227	0.158
Type of accommodation: dwelling in business area	0.531	1.311	0.686
Type of accommodation: sheltered accom	-1.464	1.011	0.148
Type of accommodation: other	0.516	1.214	0.671
Type of accommodation: missing	0.316	2.573	0.902
Number of floors: zero (Ref: two)	0.819	0.586	0.162
Number of floors: one	**0.305***	0.142	**0.032**
Number of floors: three	0.301	0.223	0.176

Number of floors: four	**1.327****	0.456	**0.004**
Number of floors: over five	0.519	0.732	0.478
Number of floors missing	0.869	0.794	0.274
Where accom located: basement (Ref: first floor)	-0.433	0.708	0.54
Where accom located: ground floor	0.299	0.2	0.135
Where accom located: second floor	0.079	0.425	0.852
Where accom located: third floor	-0.811	0.578	0.161
Where accom located: fourth floor	-0.779	1.029	0.449
Where accom located: missing	-0.149	1.251	0.905
Building relative to others: better (Ref: same)	0.067	0.156	0.669
Building relative to others: worse	**-0.605****	0.228	**0.008**
Building relative to others: no other properties	0.79	0.716	0.27
Describe area: well off, affluent (Ref: middle class)	0.332	0.168	0.048
Describe area: poor	**-0.256***	0.13	**0.048**
Describe area: very poor	-0.326	0.594	0.583
Describe area: missing	0.275	0.44	0.533
Locked entrance	-0.402	0.349	0.249
Locked gate	0.34	0.482	0.481
Security	1.264	0.89	0.156
Entrance phone	0.117	0.382	0.759
Bars on windows	-0.187	0.902	0.836
Crime watch sign	0.16	0.627	0.799
No trespassing sign	1.417	1.724	0.411
No soliciting sign	-0.676	0.585	0.248
Beware of dog	-0.784	0.853	0.358
Boarded up windows	0.45	1.144	0.694
Broken windows	**-3.312*****	0.85	**0**
Walls damaged	0.86	0.54	0.111
Graffiti	0.524	0.836	0.531
Unkempt garden	-0.192	0.229	0.401
R sq		0.044	
N		2160	

Source: Innovation Panel, wave 1

Table A5: Predicting belong to neighbourhood, full OLS model

	B	Std. Error	Sig.
(Constant)	3.485	0.179	0
Type of area: dense urban (Ref: innercity)	**0.429****	0.159	**0.007**
Type of area: suburb	**0.442****	0.157	**0.005**
Type of area: rural-village	**0.511****	0.163	**0.002**
Type of area: rural	**0.626****	0.204	**0.002**
Predominant housing type in area: terrace (Ref: semi-detach)	0.02	0.095	0.835
Predominant housing type in area: detached	-0.049	0.094	0.602
Predominant housing type in area: mixed	0.016	0.067	0.81
Predominant housing type in area: low rise flats	-0.123	0.162	0.447
Predominant housing type in area: high rise flats	-0.412	0.442	0.351
Predominant housing type in area: flats over commercial	0.339	0.79	0.668
Predominant housing type in area: flats mixed	-0.057	0.268	0.831
Predominant housing type in area: mix of houses and flats	-0.123	0.156	0.43
Predominant housing type in area: missing	-0.19	0.734	0.796
Predominant ethnic group: non-white (Ref: white)	-0.105	0.287	0.713
Predominant ethnic group: mix	**-0.182***	0.092	**0.047**
Predominant ethnic group missing	-0.134	0.078	0.087
Boarded up houses	0.416	0.221	0.06
Abandoned cars	**-1.74***	0.751	**0.021**
Demolished houses	0.77	0.737	0.296
Trash in street	-0.067	0.123	0.586
Trash in neighbourhood	-0.098	0.159	0.539
Factories in area	-0.142	0.116	0.22
Retail outlets in area	**-0.233***	0.11	**0.034**
Heavy traffic	0.078	0.07	0.262
Type of accommodation: detached (Ref: semi-detach)	0.02	0.077	0.797
Type of accommodation: end terraced	-0.156	0.104	0.133
Type of accommodation: terraced	-0.079	0.089	0.372
Type of accommodation: purpose built flat under 10	-0.204	0.141	0.146
Type of accommodation: purpose built flat over 10	**-0.426***	0.193	**0.028**
Type of accommodation: converted flat under 10	-0.212	0.198	0.285
Type of accommodation: converted flat over 10	-0.366	0.542	0.5
Type of accommodation: dwelling in business area	-0.594	0.678	0.381
Type of accommodation: sheltered accom	-0.084	0.437	0.847
Type of accommodation: other	-0.969	0.537	0.071
Type of accommodation: missing	-0.619	1.137	0.586
Number of floors: zero (Ref: two)	0.382	0.259	0.14
Number of floors: one	**0.146***	0.062	**0.019**
Number of floors: three	0.103	0.097	0.293

Number of floors: four	-0.032	0.201	0.873
Number of floors: over five	**0.822***	0.324	**0.011**
Number of floors missing	0.041	0.351	0.908
Where accom located: basement (Ref: first floor)	-0.161	0.313	0.607
Where accom located: ground floor	-0.049	0.088	0.576
Where accom located: second floor	-0.294	0.187	0.116
Where accom located: third floor	-0.489	0.255	0.055
Where accom located: fourth floor	-0.848	0.454	0.062
Where accom located: missing	0.662	0.553	0.231
Building relative to others: better (Ref: same)	-0.069	0.068	0.313
Building relative to others: worse	**-0.325*****	0.101	**0.001**
Building relative to others: no other properties	0.475	0.316	0.133
Describe area: well off, affluent (Ref: middle class)	0.121	0.074	0.101
Describe area: poor	0.011	0.057	0.849
Describe area: very poor	-0.275	0.266	0.301
Describe area: missing	0.281	0.195	0.149
Locked entrance	-0.229	0.154	0.137
Locked gate	**-0.426***	0.215	**0.048**
Security	0.105	0.389	0.786
Entrance phone	**0.435****	0.168	**0.01**
Bars on windows	0.586	0.427	0.17
Crime watch sign	**-0.683***	0.287	**0.017**
No trespassing sign	0.381	0.767	0.619
No soliciting sign	0.092	0.259	0.723
Beware of dog	0.127	0.377	0.736
Boarded up windows	0.444	0.506	0.38
Broken windows	-0.575	0.376	0.127
Walls damaged	0.095	0.239	0.69
Graffiti	0.603	0.37	0.103
Unkempt garden	0.033	0.102	0.748
R sq		0.052	
N		2167	

Source: Innovation panel, wave 1

Table A6: Predicting Income Satisfaction, full OLS model

	B	Std. Error	Sig.
(Constant)	5.48	0.516	0
Type of area: dense urban (Ref: innercity)	0.709	0.457	0.121
Type of area: suburb	0.425	0.45	0.345
Type of area: rural-village	0.394	0.468	0.399
Type of area: rural	0.616	0.589	0.296
Predominant housing type in area: terrace (Ref: semi-detach)	-0.201	0.276	0.467
Predominant housing type in area: detached	0.021	0.274	0.938
Predominant housing type in area: mixed	0.099	0.195	0.611
Predominant housing type in area: low rise flats	0.175	0.469	0.709
Predominant housing type in area: high rise flats	-1.634	1.274	0.2
Predominant housing type in area: flats over commercial	2.203	2.211	0.319
Predominant housing type in area: flats mixed	-0.793	0.772	0.305
Predominant housing type in area: mix of houses and flats	-0.137	0.456	0.764
Predominant housing type in area: missing	-3.129	2.116	0.139
Predominant ethnic group: non-white (Ref: white)	-1.294	0.826	0.117
Predominant ethnic group: mix	**-0.915**	0.265	**0.001**
Predominant ethnic group missing	-0.009	0.228	0.969
Boarded up houses	0.225	0.635	0.724
Abandoned cars	-0.199	2.163	0.927
Demolished houses	-3.284	2.119	0.121
Trash in street	0.138	0.351	0.694
Trash in neighbourhood	-0.325	0.46	0.48
Factories in area	0.004	0.338	0.99
Retail outlets in area	0.003	0.32	0.993
Heavy traffic	**-0.462**	0.203	**0.023**
Type of accommodation: detached (Ref: semi-detach)	0.191	0.225	0.397
Type of accommodation: end terraced	-0.034	0.301	0.911
Type of accommodation: terraced	0.009	0.257	0.971
Type of accommodation: purpose built flat under 10	-0.18	0.41	0.66
Type of accommodation: purpose built flat over 10	-0.182	0.564	0.748
Type of accommodation: converted flat under 10	0.359	0.572	0.531
Type of accommodation: converted flat over 10	-0.238	1.562	0.879
Type of accommodation: dwelling in business area	-0.814	1.671	0.626
Type of accommodation: sheltered accom	-0.688	1.289	0.594
Type of accommodation: other	1.774	1.547	0.251
Type of accommodation: missing	4.152	3.277	0.205
Number of floors: zero (Ref: two)	1.061	0.747	0.156
Number of floors: one	-0.036	0.183	0.845
Number of floors: three	**0.661**	0.285	**0.02**

Number of floors: four	1.051	0.581	0.071
Number of floors: over five	0.037	0.933	0.968
Number of floors missing	1.916	1.011	0.058
Where accom located: basement (Ref: first floor)	-0.932	0.902	0.302
Where accom located: ground floor	-0.028	0.255	0.911
Where accom located: second floor	0.373	0.546	0.495
Where accom located: third floor	-1.416	0.737	0.055
Where accom located: fourth floor	-1.023	1.31	0.435
Where accom located: missing	-2.302	1.593	0.149
Building relative to others: better (Ref: same)	**0.401**	0.199	**0.044**
Building relative to others: worse	-0.406	0.293	0.166
Building relative to others: no other properties	0.388	0.912	0.671
Describe area: well off, affluent (Ref: middle class)	**1.002**	0.215	**0**
Describe area: poor	**-0.551**	0.166	**0.001**
Describe area: very poor	-0.554	0.757	0.465
Describe area: missing	0.004	0.551	0.995
Locked entrance	-0.48	0.451	0.288
Locked gate	0.46	0.615	0.455
Security	**2.296**	1.134	**0.043**
Entrance phone	0.275	0.49	0.575
Bars on windows	-1.902	1.149	0.098
Crime watch sign	0.223	0.8	0.78
No trespassing sign	1.744	2.195	0.427
No soliciting sign	-0.364	0.746	0.626
Beware of dog	-0.112	1.087	0.918
Boarded up windows	2.296	1.457	0.115
Broken windows	**-3.039**	1.083	**0.005**
Walls damaged	0.936	0.688	0.174
Graffiti	-0.851	1.065	0.424
Unkempt garden	0.033	0.293	0.911
R sq		0.062	
N		2135	

Source: Innovation Panel, wave 1

APPENDIX 2 – ONS CENSUS LINK STUDY RESULTS

For a full list of the tables showing the ONS Census link study results comparing raw estimates with interviewer adjusted estimates, please see the attachment on the National Survey for Wales website www.wales.gov.uk/nationalsurvey.

APPENDIX 3 INTERVIEWER OBSERVATION VARIABLES USED ON MAJOR UK GENERAL POPULATION HOUSEHOLD SURVEYS

Scottish Social Attitudes Survey (Scottish Centre for Social Research)

Are any of these physical barriers to entry present at the house/flat/building?	Locked common entrance, locked gates, security staff or other gatekeeper, entry phone access, none of these
Which of these best describes the selected flat or house of the intended respondent?	Detached house, semi-detached house, terraced house (including end of terrace), flat or maisonette - purpose built, flat or maisonette - conversion, other
Which of these best describes the condition of residential properties in the area?	Mainly good, mainly fair, mainly bad, mainly very bad
How is the external condition of the selected flat or house relative to other residential properties in the area?	Better, about the same, worse

British Social Attitudes Survey (Natcen)

Are any of these physical barriers to entry present at the house/flat/building?	Locked common entrance, locked gates, security staff or other gatekeeper, entry phone access, none of these
Which of these best describes the selected flat or house of the intended respondent?	Detached house, semi-detached house, terraced house (including end of terrace), flat or maisonette - purpose built, flat or maisonette - conversion, other
Which of these best describes the condition of residential properties in the area?	Mainly good, mainly fair, mainly bad, mainly very bad
How is the external condition of the selected flat or house relative to other residential properties in the area?	Better, about the same, worse

British Crime Survey (Natcen, BMRB)

Which of the following are visible at the sampled address?	Security gate over front door, bars/grilles on any windows, other security device(s), estate/block security lodge/guards, entryphone, None of these
In the immediate area, how common is litter or rubbish lying around?	Very common, fairly common, not very common, not at all common

How common is vandalism, graffiti or deliberate damage to property?	Very common, fairly common, not very common, not at all common
How common are homes in poor condition/run down?	Very common, fairly common, not very common, not at all common
Sampled dwelling is?	Detached house, semi-detached house, mid terrace, end terrace, maisonette, flat - purpose built, flat - converted, rooms/bedsitter, caravan/mobile home
(for type of flat)	Self-contained, not self-contained
Building has	Common entrance: lockable, common entrance: not lockable, no common entrance
Is the sampled house/flat in good or poor physical condition?	Very good, fairly good, neither good nor bad, fairly bad, very bad
Is the sampled house/flat in a better or worse condition than the others in this area?	Better, worse, about the same
Is the dwelling in a neighbourhood watch area?	Yes, no
Where is the dwelling located?	On main road, on side road, in cul de sac with no through access on foot, in cul de sac with through access on foot, on housing estate, above shops, other location

Millenium Cohort Study (Natcen)

Are any of these physical barriers to entry present at cohort child's house/flat/building?	Locked common entrance, locked gates, security staff or other gatekeeper, entry phone access, none of these
Which of these best describes the accommodation the cohort child lives in?	Detached house, semi-detached house, terraced house (including end of terrace), flat or maisonette - purpose built, flat or maisonette - conversion, other
(Others from the contact sheet?)	

British Household Panel Study - wave 1 (Gfk NOP, ONS)

What tyoe of accommodation does household live in?	Detached house/bungalow, semi-detached house/bungalow, end terraced house/bungalow, terraced house/bungalow, purpose built flat/maisonette (under 10 dwellings), purpose built flat/maisonette (10+ dwellings), converted flat/maisonette (under 10 dwellings), converted flat/maisonette (10+ dwellings), dwelling with business premises, bedsitter in multiple occupation (under 10 dwellings), bedsitter in multiple occupation (10+ dwellings), bedsitter/single occupation, sheltered accommodation, institutional accommodation

On what floor is the main part of the living accommodation?	Basement/semi-basement, ground floor/street level, 1st floor, 2nd floor, 3rd floor, 4th to 9th floor, 10th to 19th floor, 20th floor to higher

British Household Panel Study - wave 18 (Gfk NOP, ONS)

What type of accommodation does household live in?	Detached house/bungalow, semi-detached house/bungalow, end terraced house/bungalow, terraced house/bungalow, purpose built flat/maisonette (under 10 dwellings), purpose built flat/maisonette (10+ dwellings), converted flat/maisonette (under 10 dwellings), converted flat/maisonette (10+ dwellings), dwelling with business premises, bedsitter in multiple occupation (under 10 dwellings), bedsitter in multiple occupation (10+ dwellings), bedsitter/single occupation, sheltered accommodation, institutional accommodation

European Social Survey

In what type of house does the respondent live?	Farm, detached house, semi-detached house, terraced house, the only housing unit in a building with another purpose (commercial property), multi-unit house/flat, student apartments/rooms, sheltered housing, house-trailer or boat, other
Which of the following is visible at the sampled address	Alarm system, intercom/entryphone, security lights, closed/open porch, 'beware of dog' sign, bars/grilles on any window, none of the above
In what physical state are the buildings of dwellings in this area?	In a very good state, in a good state, in a satisfactory state, bad state, very bad state
In what physical state is the sampled address, in comparison with the building and dwellings surrounding the	In a much better condition than the dwellings nearby, in better condition than the dwellings nearby, more or less the same condition, worse condition than the dwellings nearby, much worse condition than the dwellings nearby

sampled address?	
In the immediate area, how common is litter or rubbish lying around?	Very common, fairly common, not very common, not at all common
How common is vandalism, graffiti or deliberate damage to property?	Very common, fairly common, not very common, not at all common

National Survey of Sexual Attitudes and Lifestyles (Natcen)

Record nonrespondent's gender	Male, female, couldn't find out
Record nonrespondent's age	16-24, 25-34, 35-44, couldn't find out
Type of area	Urban/city centre, small country town centre, suburban residential, rural residential/village centre, rural (agricultural with isolated dwellings or small hamlets)
Predominant residential building type	Terraced houses, semi-detached houses, detached houses, mixed houses, low rise flats (5 storey blocks of less), high rise flats (blocks over 5 storeys), flats with commercial, flats mixed, mixed houses and flats
Household dwelling type	Detached house/bungalow, semi-detached house/bungalow, terraced house/bungalow, purpose built flat/maisonette (basement to 3rd floor), purpose built flat/maisonette (10+ dwellings), converted flat/maisonette (under 10 dwellings), converted flat/maisonette (10+ dwellings), dwelling with business premises, bedsitter in multiple occupation (fourth floor or higher), converted flat/maisonette part-house/rooms in house, dwelling with business premises, caravan/houseboat, other
Ethnic mix of area	Predominantly white, predominantly black/brown

ONS surveys	Expenditure and Food Survey, Family Resources Survey, General Household Survey, Omnibus Survey, National Travel Survey, Labour Force Survey

Type of accommodation	Detached house, semi-detached house, terraced house, block of flats, other
Is the house part of a council or housing association estate?	Yes, no
Is the house in a better or worse condition than the others in the area?	Better, worse, about the same
Are the houses in this area in a good or bad state of repair?	Very good, good, fair, bad, very bad
How many boarded-up or uninhabitable buildings are there in this area?	None, one two a few, several or many
How safe would you feel walking along in this area after dark?	Very safe, safe, unsafe, very unsafe
Are there any physical barriers to entry?	Yes, no
Are there any visible security devices?	Yes, no
Are most of the buildings in the area residential or commercial?	All residential, mainly residential with some commerical, mainly commercial with some residential

Northern Ireland Social Attitudes Survey (SCPR)

Is this address	Yes, no

traceable, residential, and occupied?	
Accommodation type	Detached house/bungalow, semi-detached house/bungalow, terraced house/bungalow, self-contained purpose built flat/maisonette, self-contained converted flat/maisonette, rooms not self contained
Is home part of a housing estate?	Part of estate, not part of estate
Building has	Common entrance lockable, common entrance not lockable, no common entrance
On what floor is the main part of the living accommodation?	Basement/semi-basement, ground floor/street level, 1st floor, 2nd floor, 3rd floor, 4th to 9th floor, 10th to 19th floor, 20th floor to higher
English Housing Survey (ONS)	
Score general condition of neighbourhood	Best (1)…, average (4)…, worst (7)
Score general condition of building containing sample address	Best (1)…, average (4)…, worst (7)
Address type	Detached house/bungalow, semi-detached house/bungalow, terraced house/bungalow, self-contained purpose built flat/maisonette, self-contained converted flat/maisonette, hostel or bed and breakfast, caravan/mobile home/chalet/houseboat or similar, other
How many floors does the building containing the sample address have…	Less than 6, 6 or more
Does the sample address contain any	Yes, no

non-residential (e.g business) units?	
English House Condition Survey (ONS)	
Score general condition of neighbourhood	
Score general condition of building containing sample address	
Address type	Detached house/bungalow, semi-detached house/bungalow, terraced house/bungalow, self-contained purpose built flat/maisonette, self-contained converted flat/maisonette, hostel or bed and breakfast, caravan/mobile home/chalet/houseboat or similar, other
How many floors does the building containing the sample address have…	Less than 6, 6 or more
Does the sample address contain any non-residential (e.g business) units?	Yes, no
Understanding Society (Natcen)	
Household dwelling type	Detached house/bungalow, semi-detached house/bungalow, end terraced house/bungalow, terraced house/bungalow, purpose built flat/maisonette (under 10 dwellings), purpose built flat/maisonette (10+ dwellings), converted flat/maisonette (under 10 dwellings), converted flat/maisonette (10+ dwellings), dwelling with business premises, bedsitter in multiple occupation (under 10 dwellings), bedsitter in multiple occupation (10+ dwellings), bedsitter/single occupation, sheltered accommodation, other
How many floors are there at the	Code number

address?	
On what floor of the building is the address's main entrance?	Basement/semi-basement, ground floor/street level, 1st floor, 2nd floor, 3rd floor, 4th to 9th floor, 10th to 19th floor, 20th floor to higher
Are any of these physical barriers to entry present at the address?	Locked common entrance, locked gates, security staff or other gatekeeper, entry phone access, none of these
Does the address have an unkempt garden?	Yes, no
Based on your observation, is it likely that this address has a car or van?	Definitely has a car/van, likely, unlikely, definitely doesn't have a car/van, cannot tell
Based on your observation, is it likely that this address contains one or more children aged under 10 (including babies)?	Definitely has a child/children under 10, likely, unlikely, definitely doesn't have a child/children under 10, cannot tell
Are any of the following present or within sight or hearing of the address?	Boarded houses/abandoned buildings/demolished houses or demolished buildings, trash/litter or junk in the street, heavy traffic on street/road, none
Which of these best describes the condition of	Mainly good, mainly fair, mainly bad, mainly very bad

residential properties in the area?	
How is the external condition of the address relative to other residential properties in the area?	Better, about the same, worse

Offending Crime and Justice Survey (Natcen, BMRB)

Observed security features	Lockable common entrance, locked gates, security or gatekeeper, entryphone access, none
In the immediate area, how common is litter or rubbish lying around?	Very common, fairly common, not very common, not at all common
How common is vandalism, graffiti or deliberate damage to property?	Very common, fairly common, not very common, not at all common
How common are homes in poor condition/run down?	Very common, fairly common, not very common, not at all common
Sampled dwelling is?	Detached house, semi-detached house, mid terrace, end terrace, maisonette, flat - purpose built, flat - converted, rooms/bedsitter, caravan/mobile home
Is the sampled house/flat in good or poor physical condition?	Very good, fairly good, neither good nor bad, fairly bad, very bad
Is the sampled house/flat in a better or worse condition	Better, worse, about the same

than the others in this area?	
Is the dwelling in a neighbourhood watch area?	Yes, no

European Quality of Life Survey (TNS opinion)

What kind of address is this?	Farm, detached house, semi-detached house, terraced house, multi-unit house/flat, other, address not found, non-residential, area dangerous