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Wave 14 Boost Sample Representativeness

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Non-Technical Summary

Wave 14 of *Understanding Society* introduced a boost sample of households known as GPS2. Approximately 5,800 households in the United Kingdom (UK) were selected in Great Britain and Northern Ireland, and an experimental design was employed for data collection, where households were randomly assigned to either a web-first or CAPI-first design.

The relatively low response rate obtained raised some questions about the quality of the data. This paper addresses one of these concerns, the representativeness of the sample of respondents, by comparing the characteristics of the people who responded to the wave 14 boost sample with national population figures from the Office for National Statistics. The aim is to understand how well the new sample reflects the UK population, and whether it helped improve the overall representativeness of *Understanding Society*.

Findings show that the wave 14 boost sample of household members is broadly similar to the population in terms of age and sex, but not in terms of region. The sample of adults completing the individual interview shows some departures from the population benchmarks – ethnic minorities, London residents, young adults, and men were underrepresented. Some of these gaps can be explained by selective nonresponse, i.e., some adults in participating households not completing the individual questionnaire. Furthermore, when the wave 14 boost sample is combined with the original GPS1 sample, the overall survey becomes more representative of the UK population, particularly in terms of ethnic background, country of birth, sex, and several age and region categories.

The results highlight that future sampling efforts could benefit from more targeted recruitment in areas with lower response rates, such as London, and among groups more likely to be underrepresented. The study also shows that the weights provided with the survey data are essential tools for correcting any remaining gaps in representation when analysing the data..

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Abstract: Wave 14 of *Understanding Society* includes a new household boost sample (GPS2), using an experimental approach with web-first and CAPI-first assignments. This study compares GPS2 respondents to national population figures to assess representativeness. Results show that, while the sample profile of household members was similar to that of the population in terms of age and sex, certain groups were underrepresented among adult respondents: ethnic minorities, London residents, men, and young adults. Combining GPS2 with the original sample (GPS1) improved overall representativeness. Based on the findings, we outline some recommendations for future boost samples and the future of *Understanding Society*.

Keywords: non-response, sample representativeness, response rates, refreshment sample.

JEL classification: C81, C83.

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1. Introduction

Wave 14 of *Understanding Society* includes a new boost sample, known as GPS2 (Second General Population Sample), designed to be representative of the household population of the United Kingdom. This new sample has been recruited using an experimental mixed-mode strategy, in which a random portion of the sample were initially invited to join the study online, with a CAPI follow-up for nonrespondents, while other households were CAPI-first with a web follow-up.

Approximately, 5,800 households were sampled, with different sampling methods used in Great Britain and Northern Ireland. In Great Britain, a clustered design using stratified systematic sampling was implemented, using postcode sectors as the primary sampling units. Whereas in Northern Ireland, a systematic equal probability sample was drawn based on an unclustered design, although they were selected with equal probability as for the Great Britain sample. Fieldwork started in January 2022 and response rates were impacted by the Covid-19 pandemic. There was a relatively low response rate, with 20% of households in the CAPI-first sample and 31% in the web-first sample who completed at least one adult individual interview. The conditional individual response rate, based on eligible individuals enumerated in respondent households, was 64% for the adult interviews and 38% for the youth interviews. For more information see the *Understanding Society: Wave 14 boost technical report* (Verian, 2024).

Due to the relatively low response rates, there might be biases present in the wave 14 boost sample data. Therefore, this report aims to provide a set of indicators to evaluate the extent to which the sample recruited is representative of the target population and to what extent the new sample has improved the representativeness of the existing samples of *Understanding Society*. These indicators result from comparing the boost sample estimates to a series of population estimates from the Office for National Statistics (ONS).

2. Methods

To assess the extent to which the sample mirrors the population it is intended to represent, we require a set of benchmark variables for which population figures from the Census or other high-quality survey estimates exist. This analysis uses a set of population estimates from the ONS covering some demographic characteristics such as sex, age, region of residency, ethnic background, country of birth and economic activity (Table 1).

There are three aspects to consider when using these sources as high-quality population benchmarks. First, the ONS figures used in this analysis are estimates based on surveys, such as the Annual Population Survey, sometimes in combination with the 2021/2022 Census, and are subject to error. Second, the ONS figures occasionally employ rounding to ease interpretation and certain cells will be suppressed in order to protect privacy and maintain confidentiality of the data. Lastly, the ONS estimates used in this analysis aim to cover the total resident population, including individuals from households and communal establishments, while *Understanding Society* only covers the household population. In the 2021 Census, the proportion of individuals living in communal establishments was approximately 2%. This circumstance could affect the differences observed between the ONS and the wave 14 boost sample estimates for groups more likely to reside in communal establishments, such as the oldest group of the sample.

The analysis was carried out for three groups: household members, adult household members and responding adults. Household members (of all ages) are all enumerated individuals in GPS2 responding households who automatically become panel members of *Understanding Society*. Here we differentiate between the complete set of enumerated individuals, “household members”, and the subsample of individuals aged 16 and over, “adult household members”. The responding adults are the adult household members (16+ year olds) completing the individual questionnaire.

In the results section, we first present a comparison of the population benchmarks and the unweighted survey estimates. The analysis is unweighted as the primary focus of the report is on the representativeness of the wave 14 boost sample compared to the general population of the United Kingdom. Second, GPS2 aimed to increase the sample size within the panel to improve the accuracy of survey estimates and enable longitudinal analyses. Also, GPS2 could help improve the representativeness of the existing samples of *Understanding Society* by including members

from the population who arrived in the country after wave 6 (2014-15) and persons from subgroups that are more likely to drop out of the study. To provide some indication of whether GPS2 helped improve the representativeness of the sample, we show a comparison of the population benchmarks, wave 14 respondents from GPS1¹, the first General Population Sample selected at the initial wave of Understanding Society (2009-11), and the combined sample of GPS1 and GPS2. This analysis uses sample-based estimates subject to random sampling variation. Therefore, small differences in the profiles might be due to random variations.

Table 1. Sources of the population benchmarks

Variables	Coverage	Source
Sex, age, and Government Office Region	UK residents (0 to 90+ years old)	ONS: Mid-2022 population estimates for the UK.
Ethnic background	England & Wales residents (16+ years old)	ONS: Population estimates by ethnic group England and Wales (2021) based on the 2021 Census population estimates.
Born in the UK	UK residents (16 to 64 years old)	ONS (NOMIS): Population estimates by country of birth and ethnic group (2022) based on the Annual Population Survey.
Economic activity	UK residents (16 to 64 years old)	ONS: Labour market statistics Q1 2022 from the Labour Force Survey.

¹ The GPS1 is a large representative sample of the household population in the United Kingdom, selected at the initial wave of Understanding Society (2009-11). This sample consists of an equal-probability sample of persons in England, Scotland and Wales, plus an overrepresentation of residents in Northern Ireland (for more information, see Lynn 2009). To address the overrepresentation of Northern Ireland in the analysis, we used the selection weight.

3. Results

Wave 14 Boost Sample Profile Analysis

This section presents the comparison between the population benchmarks from the ONS and the unweighted estimates from the wave 14 boost sample. The analysis of sex, age and Government Office Region (GOR) (Table 2 and 3) was carried out for three groups: the household members (N = 15,100), the adult household members (N = 12,365) and the responding adults (N = 7,920). The rest of the variables used in the analysis (Tables 4 – 6) are only presented for the adult interview respondents. A table of percentage point differences between the population benchmarks, household members and respondents for each variable is provided in Table 8 (see Appendix A).

The GPS2 sample at wave 14 has broadly similar characteristics to the population benchmark estimates. With just one exception, sex differences in responding adults, the differences observed between the population figures and the wave 14 boost estimates are all below four percentage points (p.p.). However, we should distinguish between the sample of household members, closer to the population benchmarks and the responding adults that tend to depart further from the reference points.

The sample of household members is balanced in terms of age, whereas there are some minor differences concerning sex and the GOR (Table 2 and Table 3). Regarding sex, females are overrepresented, whilst males are underrepresented by 1.4 p.p. Additionally, for GOR, South West (2.1 p.p) and Scotland (1.7 p.p) are over-represented, while London (3.6 p.p.) is underrepresented. Similar differences for both sex and GOR are observed in the subsample of adult household members.

Females were more likely to cooperate with the survey than males, and, as a result, they are overrepresented in the sample of responding adults by 4.7 p.p compared to the population benchmark. Likewise, younger household members were less likely to complete the individual interview than the oldest panel members. As a result, the sample of responding adults contains fewer young adults than the population benchmark (16-19 = 1.5 p.p., 20-29 = 2.9 p.p.), while the most senior groups (60-69 and 70+) are overrepresented by 1.9 and 0.7 p.p, respectively. Residents in the South West (2.4 p.p.) and Scotland (2.7 p.p.) are overrepresented in the sample of

respondents, while London is underrepresented (4.3 p.p.). However, unlike sex and age, the percentage of individuals in each region of residence is similar between adult household members and respondents, but both groups deviate from population benchmarks. Specifically, compared to the adult household members, respondents from London are underrepresented by only 0.9 p.p, and respondents from South West and Scotland are slightly overrepresented by 0.2 p.p and 0.8 p.p, respectively.

People with white ethnic origin (6 p.p.) are overrepresented amongst respondents compared to the population benchmark, whilst those with Asian or black origin are underrepresented (3.2 p.p and 1.3 p.p), as shown in Table 4. Additionally, respondents not born in the UK are underrepresented by 1.1 p.p compared to the population benchmark (Table 5). Regarding employment status, those unemployed are overrepresented (3.3 p.p.) and those employed are underrepresented (3.2 p.p), as shown in Table 6.

Although there is a deviation in the demographic characteristics of the respondents compared to the population benchmarks, for age and sex, the samples of all household members and adult household members closely align with these benchmarks. This indicates the presence of a selective nonresponse within the household, rather than an issue with coverage or household participation. However, for GOR, both household members and respondents differ from the benchmarks, showing evidence that households in London, in particular, are less likely to participate at all. While differences exist between the respondents and population benchmarks regarding ethnic background and employment status, as household members data could not be collected, it cannot definitively be discerned if this is due to nonresponse at the household or individual level. However, it is important to note that most of these differences are relatively small, excluding ethnic background, which shows considerable discrepancies from the population benchmarks.

Table 2. Wave 14 boost: Sex and Age

	Persons of all ages		Persons aged 16+		
	UK Population Benchmark	Survey (Household Members)	UK Population Benchmark	Survey (Household Members)	Survey (Respondents)
Sex					
Female	51.0	52.4	51.5	52.9	56.2
Male	49.0	47.6	48.5	47.1	43.8
Age					
0-9	11.1	10.8			
10-15	7.3	7.5			
16-19	4.6	4.7	5.6	5.8	4.1
20-29	12.5	12.0	15.3	14.7	12.4
30-39	13.6	14.7	16.7	17.9	18.1
40-49	12.5	13.3	15.3	16.2	16.1
50-59	13.6	13.0	16.7	15.9	16.2
60-69	11.1	11.6	13.6	14.2	15.5
70+	13.8	12.6	16.9	15.4	17.6

Note: Respondents excluded due to missing values – UK household members = 13 for sex and 142 for age, UK adult household members = 12 for sex and 142 for age, and UK adult respondents = 5 for sex and 25 for age.

Table 3. Wave 14 boost: Government Office Region

	Persons of all ages		Persons aged 16+		
	UK Population Benchmark	Survey (Household Members)	UK Population Benchmark	Survey (Household Members)	Survey (Respondents)
North East	4.0	4.3	4.0	4.2	3.9
North West	11.1	11.2	11.1	11.1	11.4
Yorkshire and the Humber	8.2	8.5	8.2	8.1	8.4
East Midlands	7.3	7.5	7.3	7.4	7.3
West Midlands	8.9	8.1	8.8	8.1	7.9
East	9.5	9.8	9.4	9.9	9.6
London	13.1	9.5	13.0	9.6	8.7
South East	13.9	13.8	13.8	13.6	13.2
South West	8.5	10.6	8.7	10.9	11.1
Wales	4.6	4.4	4.7	4.5	4.5
Scotland	8.1	9.8	8.3	10.2	11.0
Northern Ireland	2.8	2.6	2.8	2.6	3.0

Table 4. Wave 14 boost: Ethnic background

	UK Population Benchmark	Survey Respondents
White	83.5	89.5
Asian	8.7	5.5
Black	3.7	2.4
Mixed	2.0	1.6
Other	2.2	1.1

Note: Population of residents in England and Wales aged 16 and over. 249 respondents were excluded due to missing values (N = 7,671).

Table 5. Wave 14 boost: Born in the UK

	UK Population Benchmark	Survey Respondents
Born in the UK	81.1	82.2
Not born in the UK	18.9	17.8

Note: Population of UK residents aged 16 to 64 years old. 15 respondents were excluded due to missing values (N = 5,880).

Table 6. Wave 14 boost: Economic Activity

	UK Population Benchmark	Survey Respondents
Inactive	21.4	21.3
Employed	75.4	72.2
Unemployed	3.2	6.5

Notes: Population of UK residents aged 16 to 64 years old. 18 respondents were excluded due to missing values (N = 5,877). The Understanding Society 'Inactive' category includes those describing themselves as 'full-time students', who could have part-time jobs or be looking for one. The Q1 2022 LFS estimates show that 1-in-3 full-time students between 16 and 24 years old are active (i.e., employed or unemployed).

Comparing the sample profile of GPS1 with GPS1+GPS2

This section presents comparisons between wave 14 estimates from the GPS1 sample alone and the combination of the GPS1 and GPS2 samples, to examine whether the refreshment sample improves the representativeness of the *Understanding Society* responding sample with regard to the population of the United Kingdom (Table 7). At wave 14, there were 15,837 respondents from the GPS1 sample and 23,753 from the combined GPS1 and GPS2 samples.

An improvement indicator using a relative difference measure is included to assess whether the wave 14 boost sample improved the representativeness of the full sample from GPS1. The relative difference measure is the ratio of the deviation of sample estimate from population benchmark with the combined sample to the deviation with only the GPS1 sample. A positive number less than 1.0 represents an improvement in the sample composition brought about by the addition of the GPS2. A negative number between -1.0 and 0.0 would indicate a smaller deviation with the addition of the GPS2, but in the opposite direction. A number greater than 1.0 would indicate a higher divergence from the benchmark leading to a deterioration of the representativeness. Percentage point differences between the population benchmark, GPS1 sample, and the combined sample are presented in Table 9 (see Appendix A).

In most cases, the wave 14 boost helped improve the representativeness of the sample (relative differences between 0.39 and 0.95) compared to the GPS1. This is true for 25 of the 31 estimates presented in Table 7. That said, most absolute differences are small in magnitude - below one percentage point. The profile of the combined samples (GPS1 and GPS2) is closer to the population benchmarks regarding sex, ethnicity, whether the person was born in the UK, all age groups, except for those aged 16-19, and most regions. For instance, after adding the wave 14 boost sample, the age group 30-39 reduced its level of underrepresentation from 7.9 p.p. to 4.8 p.p. (relative difference of 0.61), the overrepresentation of white individuals was reduced by 1.2 p.p. (relative difference of 0.88), and the underrepresentation of those born outside of the UK was reduced by 3.5 p.p. (relative difference of 0.68).

However, in some cases, the wave 14 boost sample slightly increased the underrepresentation or overrepresentation of some subgroups. Specifically, 16–19-year-olds are slightly more underrepresented in the combined sample than in the GPS1 sample, although this difference is

only 0.04 p.p. (4.23% compared to 4.27%). Similarly, for South West residents, the inclusion of the wave 14 boost sample slightly increases the overrepresentation (relative difference of 1.90), whereas Scottish residents are underrepresented by 0.42 p.p. in the GPS1 sample, but overrepresented by 0.63 p.p. in the combined sample. Lastly, the overrepresentation of unemployed individuals increases in the combined sample by 0.81 p.p. (relative difference of 1.77) and the underrepresentation of employed individuals increases by 0.99 p.p. (relative difference of 3.24).

Overall, the inclusion of the wave 14 boost sample improved the representativeness of the *Understanding Society* sample for most age categories and government office regions, ethnic groups, sex, and country of birth groups. The results also show that although under-representation and over-representation of some groups are still present, in most cases the percentage point difference from the population benchmark after including the wave 14 boost is below 5 p.p. Three exceptions are sex, the white ethnic group and country of birth, which show absolute departures from the benchmarks of between 5 and 8 p.p. It is worth noting that 18.5% of GPS2 sample members were born outside the UK, very close to the population benchmark of 18.9%, so the boost sample could hardly have been more successful in that regard, though this only increases the overall proportion in the combined sample to 11.5%. However, *Understanding Society* has extensive experience in developing weights to mitigate non-response and attrition, which have been shown to be effective in restoring the sample profile in cross-sectional and longitudinal analyses (Cabrera-Álvarez et al., 2023; Cabrera-Álvarez & Lynn, 2023). The wave 14 released datasets include cross-sectional weights that should be used for estimation with all *Understanding Society* samples, which correct for unequal selection probabilities, non-response at the recruitment wave, and attrition.

Table 7. Wave 14 boost sample and GPS1 responding adults sample comparison

	UK Adult Population Benchmark	GPS1	GPS1 + GPS2	Relative difference¹
Sex				
Female	51.53	56.92	56.67	0.95
Male	48.47	43.08	43.33	0.95
Age				
16-19	5.62	4.27	4.23	1.03
20-29	15.27	10.34	11.03	0.86
30-39	16.67	8.77	11.85	0.61
40-49	15.28	14.13	14.77	0.44
50-59	16.70	19.18	18.18	0.60
60-69	13.58	19.85	18.41	0.77
70+	16.88	23.47	21.52	0.70
Government Office Region				
North East	4.01	4.77	4.48	0.62
North West	11.07	11.16	11.24	1.90
Yorkshire and the Humber	8.18	9.88	9.38	0.71
East Midlands	7.32	8.52	8.12	0.67
West Midlands	8.80	9.04	8.65	-0.65
East	9.41	10.33	10.10	0.75
London	13.00	6.99	7.56	0.91
South East	13.83	14.54	14.11	0.39
South West	8.68	10.38	10.62	1.14
Wales	4.68	4.24	4.32	0.82
Scotland	8.25	7.83	8.88	-1.47
Northern Ireland	2.76	2.32	2.54	0.49
Ethnic group				
White	83.45	93.09	91.91	0.88
Asian	8.65	3.85	4.38	0.89
Black	3.73	1.17	1.56	0.85
Mixed	1.99	1.22	1.33	0.85
Other	2.17	0.67	0.82	0.90

	UK Adult Population Benchmark	GPS1	GPS1 + GPS2	Relative difference¹
Country of birth				
Born in the UK	81.07	91.99	88.48	0.68
Not born in the UK	18.93	8.01	11.52	0.68
Economic activity				
Inactive	21.39	20.78	20.97	0.69
Employed	75.43	74.99	74.00	3.24
Unemployed	3.18	4.23	5.04	1.77

Notes: Respondents excluded due to missing values – GPS1 sample = 5 for GOR, 83 for ethnic group, 99 for country of birth, and 34 for economic activity. GPS1 + GPS2 sample = 5 for sex, 25 for age, 5 for GOR, 332 for ethnic group, 114 for country of birth, 52 for economic activity.

¹Relative difference = (GPS1 and GPS2 sample – adult population benchmark) / (GPS1 sample – adult population benchmark).

4. Lessons for the future

In conclusion, several tentative lessons have emerged from these analyses:

1. The analysis has shown that certain population subgroups were underrepresented in the wave 14 boost, including London residents and individuals from ethnic minority backgrounds. For future refreshment samples, London and areas with a higher concentration of ethnic minorities could be targeted to receive additional fieldwork efforts that increase the response rate. These additional efforts could take the form of an increased number of interviewer visits to the household or additional contact attempts using letters, for example.
2. The results indicate that some discrepancies in the age and sex profile of the adult sample compared to the population benchmarks are due to selective nonresponse within households. Therefore, interventions to increase within-household response rates, such as providing additional reminders for the web-first group or implementing a knock-to-nudge strategy, might be considered for future boost samples.
3. The analysis indicates that the wave 14 boost sample improved the representativeness of *Understanding Society* with regard to sex, ethnic origin, whether the person was born in the UK and most age groups and region categories. Thus, the refreshment sample was successful in recruiting new members from groups, such as individuals from ethnic minority origins or those born outside the UK, who tend to exhibit higher levels of panel attrition. Also, the improvement in the representation of those born abroad suggests that the wave 14 boost sample was effective in representing new entrants to the population since 2014-15, when the last boost sample of immigrants and ethnic minorities was selected. However, further analysis is required to confirm this.
4. This analysis also offers some insights for future waves of the study. Individuals from ethnic origins other than white, men, those born outside of the UK, and young adults are underrepresented in the panel due to nonresponse and attrition. The wide variety of information collected from the individuals in the successive waves of the panel can be used to implement targeted intervention in the future to mitigate panel attrition.

5. References

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Appendix A. Differences between population benchmarks and sample estimates

Table 8. Wave 14 boost: Percentage point differences between population benchmark, household members, and respondents.

	UK Population Benchmark ¹ vs. Household Members	UK Population Benchmark ² vs. Respondents	Household Members vs. Respondents
Sex			
Female	1.4	4.7	3.3
Age			
0-9	-0.3	-	-
10-15	0.2	-	-
16-19	0.1	-1.5	-1.7
20-29	-0.5	-2.9	-2.3
30-39	1.1	1.4	0.2
40-49	0.8	0.8	-0.1
50-59	-0.6	-0.5	0.3
60-69	0.5	1.9	1.3
70+	-1.2	0.7	2.2
Government Office Region			
North East	0.3	-0.1	-0.3
North West	0.1	0.3	0.3
Yorkshire and the Humber	0.3	0.2	0.3
East Midlands	0.2	0	-0.1
West Midlands	-0.8	-0.9	-0.2
East	0.3	0.2	-0.3
London	-3.6	-4.3	-0.9
South East	-0.1	-0.6	-0.4
South West	2.1	2.4	0.2
Wales	-0.2	-0.2	0

	UK Population Benchmark¹ vs. Household Members	UK Population Benchmark² vs. Respondents	Household Members vs. Respondents
Scotland	1.7	2.7	0.8
Northern Ireland	-0.2	0.2	0.4
Ethnic background			
White	-	6	-
Asian	-	-3.2	-
Black	-	-1.3	-
Mixed	-	-0.4	-
Other	-	-1.1	-
County of birth	-		-
Born in the UK	-	1.1	-
Economic activity	-		-
Inactive	-	-0.1	-
Employed	-	-3.2	-
Unemployed	-	3.3	-

Note: Percentage point differences from population benchmark/household members, calculated as: household members – population benchmark, respondent – population benchmark, and respondent – household members.

¹UK resident population (all ages).

²UK adult resident population (16+).

Table 9. Differences in percentage points between the adult population benchmark, GPS1 respondents, and GPS1 + GPS2 respondents.

	(1) GPS1 vs. UK Population Benchmark ¹	(2) GPS1 + GPS2 vs. UK Population Benchmark ¹	Diff.: (2) – (1)
Sex			
Female	5.39	5.14	-0.25
Male	-5.39	-5.14	0.25
Age			
0-9	-	-	-
10-15	-	-	-
16-19	-1.34	-1.39	-0.04
20-29	-4.93	-4.24	0.69
30-39	-7.91	-4.82	3.09
40-49	-1.15	-0.51	0.64
50-59	2.48	1.48	-1.00
60-69	6.27	4.83	-1.44
70+	6.59	4.64	-1.95
Government Office Region			
North East	0.76	0.47	-0.29
North West	0.09	0.17	0.08
Yorkshire and the Humber	1.70	1.20	-0.50
East Midlands	1.19	0.80	-0.40
West Midlands	0.24	-0.15	-0.39
East	0.92	0.69	-0.23
London	-6.00	-5.43	0.57
South East	0.71	0.28	-0.43
South West	1.70	1.94	0.24
Wales	-0.44	-0.36	0.08
Scotland	-0.42	0.62	1.05
Northern Ireland	-0.44	-0.21	0.23
Ethnic group			
White	9.64	8.46	-1.18
Asian	-4.80	-4.27	0.53

	(1) GPS1 vs. UK Population Benchmark ¹	(2) GPS1 + GPS2 vs. UK Population Benchmark ¹	Diff.: (2) – (1)
Black	-2.56	-2.17	0.38
Mixed	-0.77	-0.66	0.11
Other	-1.50	-1.35	0.15
Country of birth			
Born in the UK	10.92	7.41	-3.51
Not born in the UK	-10.92	-7.41	3.51
Economic activity			
Inactive	-0.61	-0.42	0.19
Employed	-0.44	-1.43	-0.99
Unemployed	1.05	1.86	0.81

Note: Percentage point differences from population benchmark, calculated as: (1) GPS1 respondents – population benchmark, (2) GPS1 + GPS2 respondents – population benchmark and the difference: (2) – (1).

¹UK adult resident population (16+).