Table SM1. Imputed distance and GHG conversion factors used for emission estimates. Based on Alcock et al. (2017), Department for Environment, Food and Rural Affairs & Department of Energy and Climate Change (2015).

|  |  |  |
| --- | --- | --- |
| **Air travel destination** | **Imputed distance (km)** | **GHG conversion factor (kg CO2e per km)** |
| Within the UK | 857 | 0.37826 |
| To other European countries | 3,181 | 0.215939 |
| Outside of Europe  | 13,518 | 0.247076 |

Notes: Alcock et al. (2017) derive their estimates combining data on passenger traffic between airports and on the proportion of traffic flying for non-work reasons. UK Government GHG conversion factors (Department for Environment, Food and Rural Affairs & Department of Energy and Climate Change, 2015) on a passenger-km basis and are based on UK-specific loading factors. They include direct CO2, CH4 and N2O emissions, as well as indirect GHG emissions from production and distribution of fuels, and climate change effects of aviation known as ‘radiative forcing’ (e.g. contrails, water vapour, NOx), which account for a large share of the climate-forcing impact of aviation. The factors are presented as CO2 equivalents (CO2e) for global warming potential over a 100-year time horizon (GWP100).

**Table SM2.** Socio-economic control variables: group size and descriptive statistics for GHG emissions from air travel (N=16,696).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Value** | **Group size (%)** | **Zero flights (%)** | **GHG emissions (mean, kgCO2e)** |
| Income quintile | 1st  | 20.1 | 75.7 | 688 |
| 2nd  | 18.9 | 71.1 | 693 |
| 3rd  | 19.7 | 61.0 | 990 |
| 4th  | 19.7 | 48.3 | 1503 |
| 5th  | 20.6 | 31.3 | 2736 |
| Tertiary education | No | 64.5 | 64.2 | 1000 |
| Yes | 34.5 | 44.3 | 1967 |
| Employment status | In paid employment | 58.5 | 49.2 | 1630 |
| Retired | 21.2 | 67.2 | 937 |
| Other (non-employed, non-retired) | 19.2 | 70.6 | 889 |
| Age | 16-29 years old | 18.6 | 57.6 | 1165 |
| 30-59 years old | 51.7 | 54.1 | 1515 |
| 60-74 years old | 19.9 | 55.9 | 1382 |
| 75+ years old | 8.8 | 77.6 | 558 |
| In a cohabiting couple | No | 36.9 | 64.9 | 1039 |
| Yes | 62.1 | 52.7 | 1515 |
| Sex | Male | 47.3 | [57.1] | 1450 |
| Female | 51.7 | [57.4] | 1234 |
| Responsible for children | No | 83.4 | 56.4 | 1407 |
| Yes | 15.6 | 61.7 | 964 |
| Long-standing illness or disability | No | 64.6 | 52.8 | 1533 |
| Yes | 34.4 | 65.6 | 971 |

Notes: Values between square brackets indicate that there is no statistically significant difference between the categories of the independent value (Chi-square and t-tests at p<0.05).

**Table SM3.** Parameter estimates OLS regression models of GHG emissions (kgCO2e) from air travel.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Model 1** | **Model 2** | **Model 3** | **Model 4** |
|  | Coef. (b) [in kg] | Coef. (b) [in kg] | Coef. (b)[in kg] | Coef. (b)[in kg] |
| **Rural – urban classification (ref.cat.: C – Urban: City and town)** |  |  |  |  |
| A1 - Urban: Major Conurbation / London | 597 | 373 | 147 | 229 |
| A1 - Urban: Major Conurbation / Other | 35 | 37 | -24 | 15 |
| B1 - Minor Conurbation | -173 | -132 | -67 | -37 |
| D - Rural: Town and Fringe | -78 | -60 | -27 | -50 |
| E - Rural: Village | 82 | 98 | 155 | 115 |
| F - Rural: Hamlets and Isolated Dwellings | -94 | -93 | -45 | -85 |
| **Travel time to nearest town centre by public transport or walking (minutes)** | -2 | -1 | -1 | -1 |
| **Income quintile (ref. cat.: 1st)** |  |  |  |  |
| 2nd  | 3 | 51 | 26 | -1 |
| 3rd  | 210 | 296 | 261 | 215 |
| 4th  | 606 | 687 | 639 | 581 |
| 5th  | 1669 | 1752 | 1682 | 1610 |
| **Tertiary education qualification (dummy)** | 445 | 332 | 315 | 315 |
| **Employment status (ref. cat.: In employment)** |  |  |  |  |
| Retired | -207 | -184 | -177 | -142 |
| Other (non-employed, non-retired) | -110 | -106 | -97 | -69 |
| **Age (ref.cat. 16-29 years old)** |  |  |  |  |
| 30-59 years old | 68 | 37 | 41 | 64 |
| 60-74 years old | 111 | 135 | 134 | 168 |
| 75+ years old | -308 | -273 | -257 | -197 |
| **Cohabiting couple (dummy)** | 203 | 158 | 139 | 92 |
| **Female (dummy)** | -1 | 14 | 16 | 27 |
| **Responsible for children <16 years old (dummy)** | -465 | -484 | -488 | -491 |
| **Long-standing illness or disability (dummy)** | -380 | -345 | -339 | -330 |
| **Migration generation (ref. cat.: 4th+)** |  |  |  |  |
| 3rd |  | 32 | 15 | 18 |
| 2nd |  | 150 | 138 | 140 |
| 1st (5+ years) |  | 121 | 108 | 114 |
| 1st (less than 5 years) |  | 1278 | 1301 | 1343 |
| **Ethnic group (ref. cat.: White British)** |  |  |  |  |
| Other white |  | 74 | 60 | 63 |
| Asian or Asian British |  | 485 | 452 | 451 |
| Black or Black British |  | -285 | -252 | -221 |
| Other + Mixed |  | -73 | -75 | -57 |
| **Friends outside of local area (ref.cat.: none)** |  |  |  |  |
| half or less |  | 82 | 64 | 55 |
| more than half |  | 155 | 137 | 127 |
| **Best friends abroad (dummy)** |  | 548 | 543 | 545 |
| **Close family abroad (dummy)** |  | 767 | 762 | 776 |
| **Travel time to nearest large airport (hours)** |  |  | -70 | -37 |
| **No. of airports within 60 minutes travel time**  |  |  | 141 | 125 |
| **Annual passengers at nearest large airport (millions)** |  |  | 5 | 5 |
| **Cars in household (dummy)** |  |  |  | 146 |
| **Distance driven by car in last 12 months (household total) (thousand miles)** |  |  |  | 6 |
|  |  |  |  |  |
| Constant | 743 | 494 | 475 | 293 |
| N | 16696 | 16696 | 16696 | 16696 |
| R2 | 0.074 | 0.086 | 0.088 | 0.089 |
| AIC | 316801 | 316606 | 316573 | 316561 |

Notes: the table does not report significance levels.

**Table SM4.** Parameter estimates (raw coefficients) for the Heckman two-step regression of the natural log of GHG emissions (kgCO2e) from air travel, including selection equation (Logit – participation in air travel) and outcome equation (OLS – emissions of air travellers, log-transformed).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Model 1** | **Model 2** | **Model 3** | **Model 4** |
|  | **Probit selection equation** | **Outcome equation** | **Probit selection equation** | **Outcome equation** | **Probit selection equation** | **Outcome equation** | **Probit selection equation** | **Outcome equation** |
|  | Coef. (b) | Coef. (b)[in log(kg)] | Coef. (b) | Coef. (b)[in log(kg)] | Coef. (b) | Coef. (b)[in log(kg)] | Coef. (b) | Coef. (b)[in log(kg)] |
| **Rural – urban classification (ref.cat.: C – Urban: City and town)** |  |  |  |  |  |  |  |  |
| A1 - Urban: Major Conurbation / London | 0.22\*\*\* | 0.23\*\*\* | 0.19\*\*\* | 0.10\* | 0.07 | 0.06 | 0.17\*\*\* | 0.06 |
| A1 - Urban: Major Conurbation / Other | 0.03 | 0.03 | 0.06\* | 0.01 | -0.03 | 0.02 | 0.02 | 0.02 |
| B1 - Minor Conurbation | -0.05 | -0.06 | -0.02 | -0.06 | -0.03 | -0.03 | -0.01 | -0.02 |
| D - Rural: Town and Fringe | 0.00 | -0.04 | 0.00 | -0.02 | 0.02 | -0.02 | -0.00 | -0.02 |
| E - Rural: Village | -0.06 | 0.13\* | -0.06 | 0.14\*\* | -0.02 | 0.14\*\* | -0.05 | 0.14\*\* |
| F - Rural: Hamlets and Isolated Dwellings | -0.06 | 0.01 | -0.06 | 0.01 | -0.02 | 0.02 | -0.06 | 0.02 |
| **Travel time to nearest town centre by public transport or walking (minutes)** | 0.001 | -0.003\* | 0.001 | -0.002\* | 0.001 | -0.003 | 0.001 | -0.003\* |
| **Income quintile (ref. cat.: 1st)** |  |  |  |  |  |  |  |  |
| 2nd  | 0.12\*\*\* | -0.14\*\* | 0.13\*\*\* | -0.08 | 0.11\*\* | -0.07 | 0.08\* | -0.08 |
| 3rd  | 0.32\*\*\* | -0.19\*\* | 0.33\*\*\* | -0.04 | 0.31\*\*\* | -0.03 | 0.26\*\*\* | -0.04 |
| 4th  | 0.57\*\*\* | -0.21\* | 0.58\*\*\* | 0.02 | 0.55\*\*\* | 0.03 | 0.49\*\*\* | 0.01 |
| 5th  | 0.96\*\*\* | -0.08 | 0.97\*\*\* | 0.23\* | 0.94\*\*\* | 0.24\* | 0.87\*\*\* | 0.20 |
| **Tertiary education qualification (dummy)** | 0.21\*\*\* | 0.02 | 0.18\*\*\* | 0.02 | 0.17\*\*\* | 0.02 | 0.17\*\*\* | 0.02 |
| **Employment status (ref. cat.: In employment)** |  |  |  |  |  |  |  |  |
| Retired | -0.19\*\*\* | 0.03 | -0.18\*\*\* | -0.01 | -0.17\*\*\* | -0.02 | -0.14\*\* | -0.01 |
| Other (non-employed, non-retired) | -0.19\*\*\* | 0.16\*\*\* | -0.18\*\*\* | 0.09\* | -0.17\*\*\* | 0.09\* | -0.15\*\*\* | 0.10\* |
| **Age (ref.cat. 16-29 years old)** |  |  |  |  |  |  |  |  |
| 30-59 years old | -0.11\*\*\* | 0.13\*\* | -0.15\*\*\* | 0.10\* | -0.15\*\*\* | 0.09\* | -0.13\*\*\* | 0.10\*\* |
| 60-74 years old | -0.01 | 0.12\* | -0.04 | 0.15\*\* | -0.03 | 0.14\*\* | -0.01 | 0.16\*\* |
| 75+ years old | -0.36\*\*\* | 0.18 | -0.39\*\*\* | 0.11 | -0.37\*\*\* | 0.10 | -0.32\*\*\* | 0.13 |
| **Cohabiting couple (dummy)** | 0.19\*\*\* | -0.05 | 0.17\*\*\* | -0.02 | 0.16\*\*\* | -0.02 | 0.10\*\*\* | -0.03 |
| **Female (dummy)** | 0.09\*\*\* | -0.07\* | 0.09\*\*\* | -0.04 | 0.10\*\*\* | -0.04 | 0.11\*\*\* | -0.04 |
| **Responsible for children <16 years old (dummy)** | -0.20\*\*\* | -0.11\*\* | -0.21\*\*\* | -0.18\*\*\* | -0.21\*\*\* | -0.18\*\*\* | -0.22\*\*\* | -0.17\*\*\* |
| **Long-standing illness or disability (dummy)** | -0.21\*\*\* |  | -0.21\*\*\* |  | -0.20\*\*\* |  | -0.19\*\*\* |  |
| **Migration generation (ref. cat.: 4th+)** |  |  |  |  |  |  |  |  |
| 3rd |  |  | 0.02 | 0.05 | 0.02 | 0.05 | 0.02 | 0.05 |
| 2nd |  |  | 0.08\* | -0.00 | 0.08\* | -0.01 | 0.08\* | -0.01 |
| 1st (5+ years) |  |  | 0.17\*\*\* | 0.05 | 0.17\*\*\* | 0.05 | 0.18\*\*\* | 0.04 |
| 1st (less than 5 years) |  |  | -0.09 | 0.50\*\*\* | -0.08 | 0.50\*\*\* | -0.02 | 0.49\*\*\* |
| **Ethnic group (ref. cat.: White British)** |  |  |  |  |  |  |  |  |
| Other White |  |  | 0.21\*\* | -0.10 | 0.20\*\* | -0.09 | 0.20\*\* | -0.10 |
| Asian or Asian British |  |  | -0.16\*\* | 0.48\*\*\* | -0.18\*\*\* | 0.48\*\*\* | -0.18\*\*\* | 0.49\*\*\* |
| Black or Black British |  |  | -0.27\*\*\* | 0.27\*\*\* | -0.28\*\*\* | 0.29\*\*\* | -0.23\*\*\* | 0.30\*\*\* |
| Other + Mixed |  |  | -0.09 | 0.19\* | -0.10 | 0.19\* | -0.07 | 0.19\* |
| **Friends outside of local area (ref.cat.: none)** |  |  |  |  |  |  |  |  |
| half or less |  |  | 0.13\*\*\* | 0.00 | 0.12\*\*\* | 0.00 | 0.11\*\*\* | 0.00 |
| more than half |  |  | 0.05 | 0.05 | 0.04 | 0.05 | 0.03 | 0.04 |
| **Best friends abroad (dummy)** |  |  | 0.19\*\*\* | 0.11\* | 0.20\*\*\* | 0.11\*\* | 0.20\*\*\* | 0.11\* |
| **Close family abroad (dummy)** |  |  | 0.30\*\*\* | 0.23\*\*\* | 0.30\*\*\* | 0.24\*\*\* | 0.31\*\*\* | 0.22\*\*\* |
| **Travel time to nearest large airport (hours)** |  |  |  |  | -0.11\*\*\* | 0.01 | -0.07\*\* | 0.01 |
| **No. of airports within 60 minutes travel time**  |  |  |  |  | 0.06\*\* | 0.03 | 0.03 | 0.03 |
| **Annual passengers at nearest large airport (millions)** |  |  |  |  | 0.000 | 0.002\*\* | 0.000 | 0.002\*\* |
| **Cars in household (dummy)** |  |  |  |  |  |  | 0.30\*\*\* | -0.07 |
| **Distance driven by car in last 12 months (household total) (thousand miles)** |  |  |  |  |  |  | 0.004\*\*\* | 0.002\* |
|  |  |  |  |  |  |  |  |  |
| Constant | -0.58\*\*\* | 8.13\*\*\* | -0.68\*\*\* | 7.55\*\*\* | -0.55\*\*\* | 7.45\*\*\* | -0.82\*\*\* | 7.57\*\*\* |
| Lambda | -0.59\*\* |  | -0.23 |  | -0.20 |  | -0.28 |  |
| Squared correlation observed/fitted values | 0.03 |  | 0.09 |  | 0.09 |  | 0.09 |  |
| N | 16696 | 16696 | 16696 | 16696 | 16696 | 16696 | 16696 | 16696 |

Notes: i) by construction, the outcome equation should omit one predictor that is present in the selection models: we select ’long-standing illness or disability‘, as this is likely to affect participation in air travel more than travel distance for those who fly; ii) the analysis is unweighted; iii) \* p<0.05 \*\* p<0.01 \*\*\* p<0.001.

**Table SM5.** Parameter estimates for two-stage regression models of GHG emissions (kgCO2e) from air travel, including selection equation (Logit – participation in air travel) and outcome equation (OLS – emissions of air travellers, log-transformed).

|  |  |
| --- | --- |
|  | **Model 5** |
|  | **Logit** | **OLS**  |
|  | Coef. (b) | Coef. (b) [in log(kg)] |
| **Rural - urban classification (ref.cat.: C – Urban: City and town)** |  |  |
| A1 - Urban: Major Conurbation / London | 0.25\*\* | 0.03 |
| A1 - Urban: Major Conurbation / Other | 0.07 | 0.01 |
| B1 - Minor Conurbation | -0.03 | -0.03 |
| D - Rural: Town and Fringe | -0.02 | -0.03 |
| E - Rural: Village | -0.09 | 0.13\* |
| F - Rural: Hamlets and Isolated Dwellings | -0.17 | -0.02 |
| **Travel time to nearest town centre by public transport or walking (minutes)** | 0.001 | -0.004\* |
| **Income quintile (ref. cat.: 1st)** |  |  |
| 2nd  | -0.04 | 0.09 |
| 3rd  | 0.67\*\*\* | 0.20 |
| 4th  | 0.73\*\*\* | 0.34\* |
| 5th  | 1.70\*\*\* | 0.45\*\* |
| **Tertiary education qualification (dummy)** | 0.32\*\*\* | 0.04 |
| **Employment status (ref. cat.: In employment)** |  |  |
| Retired | -0.30\*\*\* | -0.04 |
| Other (non-employed, non-retired) | -0.30\*\*\* | 0.07\* |
| **Age (ref.cat. 16-29 years old)** |  |  |
| 30-59 years old | -0.26\*\*\* | 0.11\*\* |
| 60-74 years old | -0.04 | 0.19\*\*\* |
| 75+ years old | -0.61\*\*\* | 0.13 |
| **Cohabiting couple (dummy)** | 0.19\*\*\* | 0.00 |
| **Female (dummy)** | 0.21\*\*\* | 0.00 |
| **Responsible for children <16 years old (dummy)** | -0.38\*\*\* | -0.20\*\*\* |
| **Long-standing illness or disability (dummy)** | -0.31\*\*\* | -0.08\*\* |
| **Migration generation (ref. cat.: 4th+)** |  |  |
| 3rd | 0.03 | 0.05 |
| 2nd | 0.12 | 0.02 |
| 1st (5+ years) | 0.30\*\* | 0.02 |
| 1st (less than 5 years) | 0.12 | 0.50\*\*\* |
| **Ethnic group (ref. cat.: White British)** |  |  |
| Other white | 0.34\* | -0.05 |
| Asian or Asian British | -0.20 | 0.51\*\*\* |
| Black or Black British | -0.42\*\* | 0.26\*\* |
| Other + Mixed | -0.06 | 0.16 |
| **Friends outside of local area (ref.cat.: none)** |  |  |
| half or less | 0.19\*\* | 0.02 |
| more than half | 0.05 | 0.08 |
| **Best friends abroad (dummy)** | 0.33\*\*\* | 0.14\*\* |
| **Close family abroad (dummy)** | 0.56\*\*\* | 0.28\*\*\* |
| **Travel time to nearest large airport (hours)** | -0.11\* | 0.00 |
| **No. of airports within 60 minutes travel time**  | 0.06 | 0.04 |
| **Annual passengers at nearest large airport (millions)** | 0.000 | 0.002\*\* |
| **Cars in household (dummy)** | 0.58\*\*\* | 0.12 |
| **Distance driven by car in last 12 months (household total) (thousand miles)** | 0.004 | 0.002 |
| **Interaction terms between income and cars in household(ref. cat.: 1st quintile)** |  |  |
| 2nd quintile  | 0.13 | -0.20 |
| 3rd quintile | -0.13 | -0.21 |
| 4th quintile | 0.04 | -0.27 |
| 5th quintile  | -0.35 | -0.07 |
| **Interaction terms between income and car distance driven(ref. cat.: 1st quintile)** |  |  |
| 2nd quintile  | 0.002 | 0.002 |
| 3rd quintile | -0.008 | 0.002 |
| 4th quintile | 0.005 | 0.003 |
| 5th quintile  | 0.008 | 0.000 |
| Constant | -1.5\*\*\* | 7.0\*\*\* |
| N | 16696 | 7518 |
| Pseudo-R2 / R2 | 0.13 | 0.10 |
| AIC | 21795 | 20327 |

Notes: \* p<0.05 \*\* p<0.01 \*\*\* p<0.001