**Supplementary information:**

The unequal distribution of household carbon footprints in Europe and its link to sustainability

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Contents

[1. Data 2](#_Toc41401167)

[Household budget surveys 2](#_Toc41401168)

[Harmonisation of HBSs and EXIOBASE 2](#_Toc41401169)

[2. Expenditure distribution 4](#_Toc41401170)

[Air travel spending 6](#_Toc41401171)

[3. Expenditure elasticities 6](#_Toc41401172)

[Expenditure elasticities by country and consumption category 6](#_Toc41401173)

[Expenditure elasticities by country, expenditure quintile and detailed consumption category 7](#_Toc41401174)

[4. Carbon footprint distribution 12](#_Toc41401175)

[Histograms – log of total carbon footprints 12](#_Toc41401176)

[Carbon and expenditure concentration indices 13](#_Toc41401177)

[Carbon intensities 13](#_Toc41401178)

[Carbon footprint ranges by regions 16](#_Toc41401179)

[5. Verification 17](#_Toc41401180)

# Data

## Household budget surveys

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country code** | **Country name** | **Achieved sample size** | **Effective sample size** | **Response rate (%)** | **Recording period** | **Expenditure detail** |
| BE | Belgium | 7177 | 3459 | 5.6\* | One month | 63 products |
| BG | Bulgaria | 2982 | 1343 | 52.6 | 15 days | 63 products |
| CY | Cyprus | 2707 | 1910 | 76.4 | Two weeks | 63 products |
| CZ | Czech Republic | 2932 | 3182 | \*\* | One month | 63 products |
| DE | Germany | 53996 | 37606 | \*\* | Three months | 51 products |
| DK | Denmark | 2484 | 1697 | 42.3 | Two weeks | 63 products |
| EE | Estonia | 3632 | 1619 | 49.0 | Two weeks | 63 products |
| ES | Spain | 22203 | 8743 | 71.0 | Two weeks | 63 products |
| FI | Finland | 3551 | 2532 | 43.1 | Two weeks | 63 products |
| FR | France | 15797 | 5114 | 68.7 | One week | 63 products |
| GB | Great Britain | 5263 | 3856 | 51.0 | Two weeks | 63 products |
| GR | Greece | 3512 | 1512 | 68.6 | Two weeks | 63 products |
| HR | Croatia | 3461 | 2464 | 62.7 | Two weeks | 63 products |
| HU | Hungary | 9937 | 4175 | 45.5 | One month | 63 products |
| IE | Ireland | 5891 | 2562 | 39.7 | Two weeks | 63 products |
| IT | Italy | 22246 | 8884 | 80.9 | One week | 63 products |
| LT | Lithuania | 6103 | 1242 | 56.0 | 15 days | 63 products |
| LU | Luxembourg | 3492 | 3068 | 57.9 | Two weeks | 63 products |
| LV | Latvia | 3798 | 1653 | 40.4 | Two weeks | 63 products |
| MT | Malta | 1250 | 851 | 57.1 | Two weeks | 63 products |
| PL | Poland | 37412 | 30228 | 29.2 | One month | 63 products |
| PT | Portugal | 9489 | 4022 | 66.8 | Two weeks | 63 products |
| RO | Romania | 31336 | 6328 | 87.6 | One month | 63 products |
| SE | Sweden | 2047 | 2157 | 51.0 | Two weeks | 59 products |
| SI | Slovenia | 3924 | 2658 | 64.7 | Two weeks | 63 products |
| SK | Slovakia | 6143 | 2076 | 49.8 | One month | 63 products |

SI table 1: Summary of HBS information for the 2010 wave. (\*) The low figure for Belgium is calculated taking into account the total population of households initially contacted to participate in the HBS. (\*\*) in cases of quota sampling, the non-response rate is generally unknown. Source: Eurostat (2015)

Many of the samples were stratified by geographical region and weighted to correct for differences that may lead to bias, thus, improving the representability of the samples1. The mean response rate at EU level was around 60%, with the percentage varying significantly across countries1. Czech Republic and Germany adopted quota sampling. All other HBS samples were selected according to a probability sampling schemes, which usually over- and under-covers different various units1. Some households may experience recall problems when asked for regular expenditure and bills (e.g. rent and energy payments, air travel) over a longer period of time1. A detailed overview of the HBS relevance, accuracy (sampling and non-sampling errors), timeliness, comparability and representativeness is provided elsewhere1.

## Harmonisation of HBSs and EXIOBASE

We compared and bridged expenditure from HBSs and EXIOBASE on a country level. The original HBS (*v × 1)* vector represents household annual expenditure for an average survey respondent from a country *r* in EUR purchaser prices *pp*, where *v* represents the number of surveyed products (a total of 63 for most countries)*.* We derived this based on household expenditure by survey product *v*, and a household size vector.

represents a set of concordance *v × n* matrices, which is needed for the bridging to EXIOBASE product classification across *r* countries (26 countries), where *n* represents the number of product sectors in EXIOBASE (a total of 200 products). This step was needed as carbon intensities by products were only available in the EXIOBASE product classification (by 200 products). represents the set of transpose *n × v* matrices of the matrices. Each concordance matrix is subject to the following:

(1)

(2)

, with

where (*n × 1*) represent the average per capita expenditure reported in EXIOBASE in purchaser prices (see also2). The sum of each row vector in is one, with indicating a vector of ones of the specified dimensions. The spending from each COICOP product is fully allocated to one or more of the EXIOBASE sectors. Thus, the optimal bridge is selected minimizing the difference between the estimated (*n × 1*) vector of HBS expenditure in EXIOBASE product classification () and the EXIOBASE’s actual final demand vector ().

Each bridge is set up to conform the definition of sectors, e.g. allocating spending on vegetables to the EXIOBASE sector defined in the closest way – “Vegetables, fruit, nuts”. We consulted official correspondences for statistics reporting 3 in the conversion of household expenditure to EXIOBASE classification. The original country bridge constrained by product definitions was optimized through the procedure outlined in equation (2) using root-mean-square optimization where we shifted expenditure from products with surplus to deficit. We adopted separate product classification for Germany and Sweden, as their surveys provided less detail in the categories of food, housing and transport.

We then apply the optimised bridges with the household-level data, where the original HBS vector is a *v × i* matrix representing consumption expenditure of a household *i* belonging to a country (region) *r* in a number of consumption sectors *v* (see Equation 1).

Despite the large sample sizes, it is common to find significant differences between total expenditure as reported in HBSs and as estimated in National Accounts. At the product level, this can be even higher, e.g. with hospitality and “discretionary” expenditure often underestimated in surveys. A number of methods have been proposed to re-estimate expenditure to account for this under (or over)-reporting. Here we proportionally re-allocate under or over-reporting directly to households*.*

Through a comparison of and country averages, a (200 products x 49 countries) matrix of difference ratios **G** was constructed where ratios between 0 and 1 signalled for survey over-reporting and ratios above 1 – for survey under-reporting. Thus, we preserved the comparability of country averages with EXIOBASE accounts (and hence the National Accounts) structure.

We then multiplied with the household spending in that product. Total expenditure by product in EXIOBASE classification for each respondent is then included in:

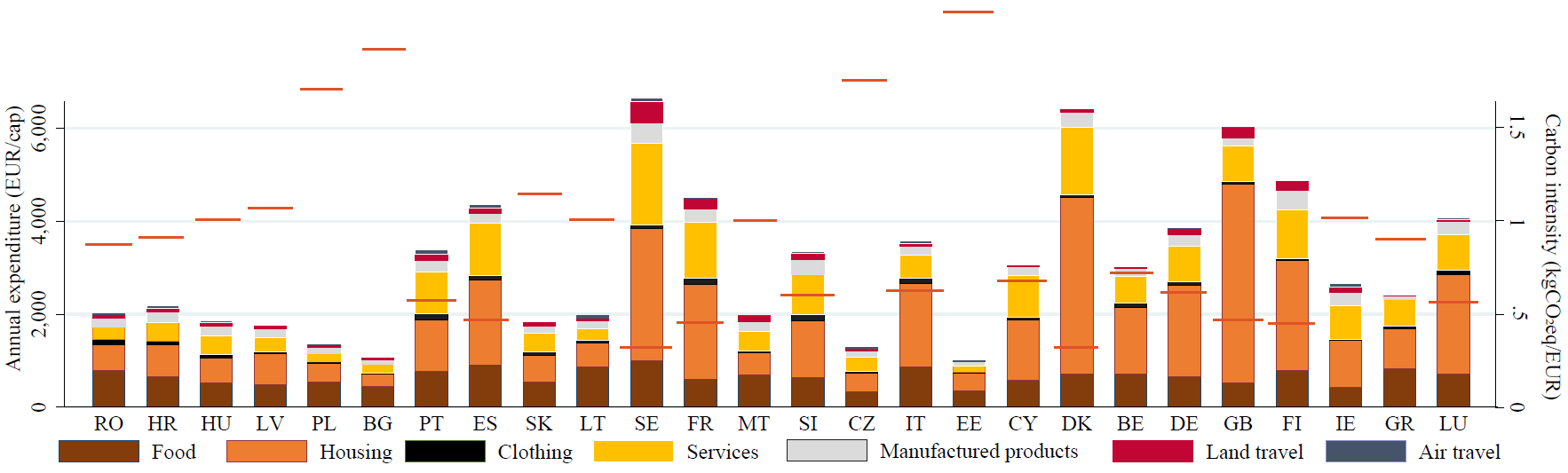
We noted that for several sectors, the survey spending was not representative of the household consumption noted in EXIOBASE, where this resulted in overly inflated carbon footprints for a part of the sample. In sectors such as 'Sea and coastal water transportation services' and 'Inland water transportation services' (especially for Cyprus, Greece and the United Kingdom), the under-reporting ratio was quite high reflecting the low spending in the survey driven by only 5-10% of respondents (who were not the highest spenders in the country and had rather low footprints in other consumption categories). In these cases, was set to 1 for all countries with under-reporting.

Carbon footprints (excluding direct emissions from households) are then calculated as follows:

Where is the vector of carbon intensities (multipliers) specific to the mix of goods consumed in each country (considering domestically produced and imported goods). For a detailed discussion about average multipliers weighted between domestic and imported goods, see 4.

# Expenditure distribution

We provide an overview of carbon and expenditure distribution by consumption category for each expenditure quintile in the SI2 and SI4 to show the most relevant products with rising spending (and income) and inform about where price difference information across expenditure groups is most needed.



SI Figure 1: Annual household expenditure by consumption category (left axis, bar chart) and carbon intensity of consumption (right axis, red lines) for the sub-sample with a carbon footprint below 2.5 tCO2eq/cap. Countries are ordered by average carbon footprint per capita. See SI table 2 for price level indices.

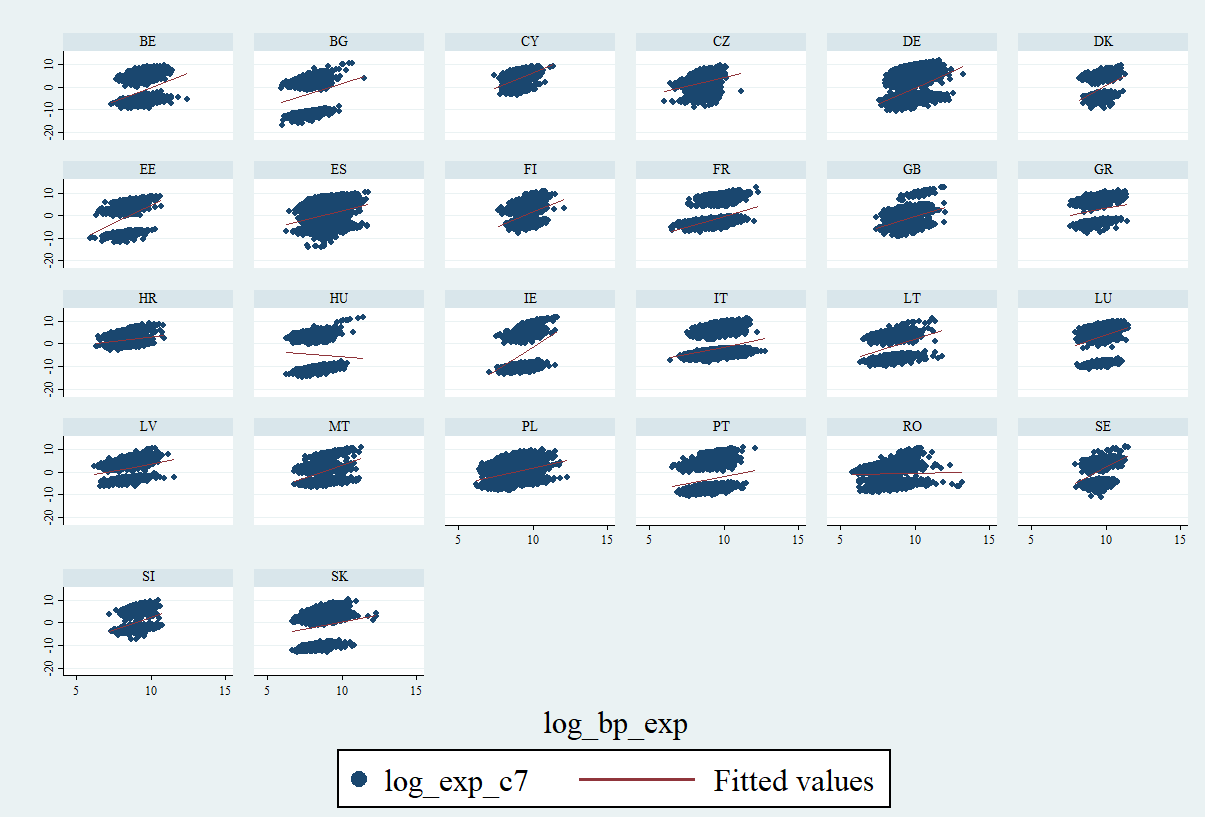
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| GEO/PPP\_CAT | Actual individual consumption | Food and non-alcoholic beverages | Alcoholic beverages, tobacco and narcotics | Clothing and footwear | Housing, water, electricity, gas and other fuels | Household furnishings, equipment and maintenance | Health | Transport | Communication | Recreation and culture | Education | Restaurants and hotels | Miscellaneous goods and services |
| EU28 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Belgium | 111.9 | 116.1 | 100.5 | 115.5 | 109.4 | 104.4 | 122.5 | 102.7 | 122.2 | 99.3 | 136.6 | 112.7 | 110.3 |
| Bulgaria | 45.7 | 66.6 | 63.5 | 74.3 | 37.0 | 64.4 | 26.2 | 71.2 | 79.5 | 58.0 | 20.1 | 46.3 | 47.7 |
| Czechia | 66.6 | 77.2 | 82.9 | 97.8 | 64.4 | 83.3 | 51.5 | 78.2 | 112.2 | 70.8 | 49.6 | 58.5 | 64.6 |
| Denmark | 140.0 | 138.3 | 126.2 | 127.7 | 144.3 | 122.3 | 142.1 | 138.1 | 81.1 | 139.2 | 166.6 | 151.3 | 140.8 |
| Germany | 103.1 | 110.9 | 99.6 | 104.3 | 110.0 | 97.8 | 100.5 | 107.9 | 83.7 | 106.1 | 101.2 | 97.6 | 100.3 |
| Estonia | 66.0 | 81.5 | 78.7 | 103.0 | 57.3 | 84.3 | 52.1 | 81.2 | 74.4 | 77.0 | 43.1 | 69.5 | 66.0 |
| Ireland | 122.7 | 121.9 | 163.6 | 93.9 | 110.4 | 109.2 | 154.9 | 109.0 | 110.4 | 116.8 | 133.7 | 128.4 | 125.3 |
| Greece | 95.4 | 102.0 | 89.6 | 106.5 | 86.5 | 97.9 | 99.8 | 94.3 | 126.3 | 92.1 | 98.3 | 97.2 | 95.3 |
| Spain | 98.7 | 92.3 | 82.5 | 95.4 | 100.7 | 98.4 | 110.6 | 92.2 | 155.9 | 99.6 | 97.1 | 97.7 | 97.7 |
| France | 109.9 | 108.9 | 108.7 | 105.5 | 113.6 | 111.1 | 114.4 | 104.9 | 137.0 | 105.8 | 108.8 | 103.9 | 109.7 |
| Croatia | 70.1 | 91.6 | 80.2 | 102.4 | 48.2 | 83.1 | 63.0 | 85.3 | 76.0 | 81.9 | 52.6 | 90.8 | 69.3 |
| Italy | 100.4 | 107.5 | 103.9 | 105.1 | 93.6 | 106.3 | 110.9 | 94.4 | 99.0 | 103.5 | 102.2 | 106.8 | 96.1 |
| Cyprus | 94.6 | 107.6 | 94.0 | 93.9 | 87.2 | 94.8 | 99.2 | 88.2 | 55.0 | 100.3 | 120.8 | 105.7 | 92.7 |
| Latvia | 62.3 | 84.4 | 84.4 | 100.4 | 49.9 | 79.7 | 41.2 | 79.2 | 73.2 | 68.8 | 37.2 | 80.8 | 61.5 |
| Lithuania | 57.8 | 72.8 | 75.8 | 100.2 | 42.8 | 76.5 | 46.2 | 79.3 | 50.7 | 66.4 | 33.5 | 65.8 | 58.7 |
| Luxembourg | 136.5 | 117.9 | 89.2 | 107.0 | 146.4 | 110.1 | 174.2 | 92.0 | 89.2 | 111.5 | 307.2 | 107.5 | 136.3 |
| Hungary | 57.4 | 81.5 | 66.0 | 86.8 | 49.9 | 70.9 | 38.7 | 84.7 | 102.7 | 62.0 | 39.4 | 51.2 | 54.0 |
| Malta | 76.6 | 91.5 | 90.8 | 89.4 | 56.9 | 96.3 | 83.8 | 80.3 | 99.4 | 79.0 | 64.3 | 80.4 | 77.8 |
| Poland | 55.2 | 69.4 | 72.7 | 93.7 | 41.4 | 63.2 | 42.1 | 72.8 | 63.5 | 61.5 | 37.1 | 74.6 | 55.4 |
| Portugal | 85.0 | 89.7 | 83.4 | 95.8 | 73.2 | 91.8 | 95.9 | 92.2 | 114.0 | 93.9 | 72.6 | 80.0 | 86.3 |
| Romania | 46.9 | 67.2 | 65.2 | 94.0 | 40.7 | 67.7 | 28.6 | 69.7 | 61.5 | 51.5 | 20.0 | 49.6 | 44.3 |
| Slovenia | 84.3 | 96.1 | 79.4 | 97.0 | 74.7 | 91.4 | 80.3 | 87.6 | 83.7 | 96.1 | 86.8 | 86.2 | 83.9 |
| Slovakia | 62.5 | 81.1 | 83.6 | 98.0 | 53.0 | 84.3 | 41.5 | 76.0 | 117.6 | 71.9 | 34.2 | 69.9 | 57.0 |
| Finland | 120.3 | 112.8 | 134.9 | 124.1 | 124.1 | 111.8 | 121.9 | 118.4 | 71.9 | 130.8 | 123.6 | 125.9 | 123.8 |
| Sweden | 124.6 | 115.4 | 139.1 | 125.8 | 109.1 | 116.8 | 147.7 | 118.4 | 65.9 | 117.0 | 180.4 | 135.0 | 129.6 |
| UK | 111.4 | 101.2 | 139.9 | 84.5 | 138.6 | 101.1 | 102.6 | 100.7 | 97.0 | 99.9 | 147.3 | 106.3 | 104.2 |

SI table 2: Price level indices (EU28=100) by EU countries and COICOP categories in 2010. Source: Eurostat, Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates [prc\_ppp\_ind]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Food** | | | | | **Housing** | | | | | **Clothing** | | | | | **Services** | | | | | **Manufactured products** | | | | | **Land travel** | | | | | **Air travel** | | | | |
|  | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** |
| BE | 23% | 22% | 20% | 18% | 13% | 34% | 30% | 29% | 27% | 22% | 4% | 4% | 4% | 4% | 4% | 24% | 28% | 29% | 30% | 31% | 8% | 10% | 10% | 11% | 12% | 5% | 6% | 7% | 8% | 14% | 1% | 2% | 2% | 2% | 4% |
| BG | 45% | 38% | 31% | 26% | 17% | 24% | 23% | 23% | 24% | 21% | 3% | 4% | 4% | 4% | 5% | 16% | 18% | 21% | 22% | 24% | 9% | 10% | 11% | 12% | 15% | 4% | 6% | 9% | 11% | 15% | 0% | 1% | 1% | 1% | 3% |
| CY | 25% | 20% | 17% | 14% | 9% | 33% | 31% | 30% | 28% | 26% | 2% | 2% | 2% | 2% | 2% | 27% | 32% | 34% | 40% | 43% | 7% | 7% | 7% | 6% | 6% | 5% | 6% | 7% | 7% | 9% | 1% | 2% | 3% | 3% | 4% |
| CZ | 26% | 24% | 22% | 19% | 14% | 28% | 30% | 31% | 32% | 35% | 3% | 3% | 3% | 3% | 3% | 23% | 23% | 23% | 23% | 23% | 11% | 12% | 12% | 12% | 11% | 7% | 7% | 7% | 7% | 10% | 1% | 2% | 2% | 3% | 3% |
| DE | 21% | 18% | 16% | 13% | 9% | 37% | 34% | 31% | 29% | 25% | 3% | 4% | 4% | 4% | 3% | 20% | 23% | 26% | 28% | 29% | 10% | 11% | 12% | 13% | 14% | 8% | 9% | 10% | 11% | 16% | 0% | 1% | 1% | 2% | 4% |
| DK | 18% | 16% | 16% | 15% | 12% | 37% | 36% | 36% | 35% | 32% | 3% | 3% | 3% | 3% | 3% | 28% | 28% | 26% | 27% | 27% | 8% | 10% | 11% | 11% | 13% | 6% | 7% | 7% | 8% | 9% | 0% | 1% | 1% | 2% | 3% |
| EE | 35% | 32% | 29% | 25% | 18% | 38% | 36% | 32% | 27% | 21% | 2% | 3% | 4% | 5% | 7% | 12% | 14% | 15% | 18% | 25% | 9% | 10% | 11% | 12% | 12% | 3% | 5% | 7% | 11% | 14% | 0% | 1% | 1% | 2% | 3% |
| ES | 25% | 21% | 18% | 15% | 11% | 34% | 31% | 28% | 25% | 22% | 3% | 3% | 3% | 3% | 3% | 24% | 29% | 33% | 36% | 41% | 7% | 7% | 7% | 8% | 7% | 5% | 6% | 8% | 10% | 12% | 2% | 2% | 3% | 3% | 3% |
| FI | 22% | 19% | 17% | 15% | 12% | 35% | 36% | 35% | 34% | 29% | 2% | 3% | 3% | 3% | 3% | 22% | 22% | 23% | 24% | 28% | 14% | 13% | 14% | 13% | 13% | 6% | 8% | 8% | 10% | 11% | 0% | 1% | 1% | 1% | 5% |
| FR | 20% | 18% | 18% | 16% | 13% | 35% | 35% | 34% | 31% | 27% | 5% | 3% | 3% | 3% | 3% | 24% | 25% | 25% | 26% | 27% | 8% | 10% | 10% | 11% | 11% | 8% | 8% | 10% | 12% | 17% | 0% | 1% | 1% | 1% | 3% |
| GB | 22% | 17% | 14% | 10% | 7% | 22% | 24% | 26% | 33% | 34% | 4% | 4% | 4% | 3% | 3% | 32% | 33% | 33% | 31% | 31% | 11% | 11% | 11% | 10% | 10% | 9% | 11% | 12% | 12% | 13% | 1% | 1% | 1% | 1% | 3% |
| GR | 26% | 22% | 19% | 15% | 11% | 35% | 32% | 31% | 27% | 25% | 2% | 3% | 3% | 4% | 4% | 22% | 26% | 29% | 33% | 35% | 8% | 8% | 8% | 8% | 8% | 6% | 8% | 9% | 12% | 14% | 1% | 1% | 1% | 2% | 3% |
| HR | 33% | 29% | 27% | 23% | 16% | 28% | 26% | 25% | 23% | 17% | 4% | 5% | 5% | 5% | 6% | 16% | 19% | 21% | 26% | 39% | 12% | 13% | 13% | 13% | 11% | 5% | 6% | 7% | 8% | 9% | 1% | 2% | 2% | 2% | 3% |
| HU | 34% | 27% | 25% | 21% | 15% | 28% | 28% | 27% | 26% | 21% | 4% | 3% | 3% | 3% | 3% | 17% | 20% | 22% | 26% | 33% | 11% | 12% | 12% | 12% | 11% | 5% | 8% | 10% | 11% | 14% | 2% | 2% | 1% | 1% | 2% |
| IE | 23% | 18% | 15% | 12% | 9% | 28% | 24% | 22% | 22% | 19% | 3% | 3% | 3% | 3% | 3% | 27% | 32% | 36% | 38% | 41% | 9% | 10% | 10% | 11% | 10% | 7% | 9% | 10% | 10% | 11% | 3% | 4% | 4% | 4% | 7% |
| IT | 28% | 23% | 20% | 18% | 12% | 38% | 35% | 33% | 29% | 21% | 6% | 7% | 8% | 8% | 8% | 15% | 17% | 20% | 24% | 30% | 8% | 10% | 11% | 11% | 13% | 5% | 6% | 6% | 8% | 12% | 1% | 2% | 2% | 2% | 3% |
| LT | 48% | 40% | 35% | 30% | 20% | 24% | 24% | 23% | 22% | 18% | 3% | 4% | 5% | 5% | 5% | 10% | 11% | 13% | 16% | 21% | 9% | 12% | 12% | 13% | 17% | 5% | 7% | 9% | 11% | 16% | 1% | 2% | 3% | 3% | 4% |
| LU | 19% | 16% | 14% | 12% | 11% | 36% | 33% | 31% | 31% | 29% | 3% | 3% | 3% | 3% | 3% | 19% | 22% | 24% | 25% | 24% | 10% | 11% | 10% | 11% | 13% | 10% | 11% | 13% | 13% | 15% | 3% | 4% | 4% | 5% | 5% |
| LV | 31% | 26% | 24% | 21% | 14% | 37% | 34% | 32% | 28% | 21% | 2% | 3% | 3% | 3% | 4% | 14% | 16% | 17% | 19% | 23% | 10% | 13% | 16% | 18% | 20% | 5% | 7% | 8% | 10% | 14% | 1% | 1% | 1% | 1% | 4% |
| MT | 33% | 26% | 23% | 19% | 12% | 19% | 16% | 15% | 15% | 18% | 4% | 5% | 6% | 6% | 5% | 21% | 23% | 24% | 24% | 22% | 12% | 15% | 15% | 16% | 16% | 12% | 14% | 15% | 15% | 15% | 0% | 1% | 2% | 6% | 12% |
| PL | 40% | 35% | 30% | 26% | 17% | 29% | 30% | 30% | 30% | 26% | 3% | 4% | 4% | 5% | 5% | 12% | 13% | 14% | 16% | 23% | 10% | 12% | 14% | 15% | 15% | 5% | 6% | 6% | 7% | 11% | 1% | 1% | 1% | 1% | 4% |
| PT | 28% | 25% | 22% | 19% | 13% | 33% | 27% | 23% | 19% | 15% | 4% | 5% | 6% | 7% | 7% | 19% | 24% | 28% | 33% | 37% | 9% | 10% | 10% | 10% | 10% | 5% | 7% | 8% | 9% | 14% | 2% | 2% | 2% | 2% | 3% |
| RO | 53% | 42% | 36% | 30% | 20% | 22% | 26% | 29% | 31% | 31% | 4% | 5% | 5% | 6% | 5% | 10% | 12% | 13% | 15% | 20% | 7% | 9% | 10% | 11% | 13% | 3% | 5% | 6% | 7% | 11% | 0% | 0% | 0% | 1% | 1% |
| SE | 17% | 15% | 14% | 13% | 10% | 38% | 37% | 34% | 32% | 28% | 2% | 2% | 2% | 2% | 2% | 27% | 28% | 29% | 29% | 32% | 8% | 9% | 10% | 11% | 13% | 6% | 7% | 8% | 10% | 11% | 2% | 2% | 2% | 3% | 4% |
| SI | 22% | 20% | 19% | 17% | 13% | 32% | 28% | 27% | 24% | 20% | 4% | 4% | 4% | 4% | 4% | 24% | 25% | 25% | 26% | 28% | 10% | 11% | 12% | 13% | 14% | 7% | 9% | 9% | 12% | 16% | 1% | 2% | 3% | 4% | 5% |
| SK | 29% | 25% | 23% | 20% | 14% | 31% | 30% | 30% | 28% | 24% | 4% | 5% | 6% | 6% | 6% | 19% | 21% | 21% | 22% | 24% | 9% | 12% | 13% | 14% | 19% | 6% | 7% | 7% | 8% | 10% | 1% | 1% | 1% | 1% | 4% |

SI table 3: Household expenditure shares across expenditure quintiles – from the lowest spenders (Q1) to the highest spenders (Q5)

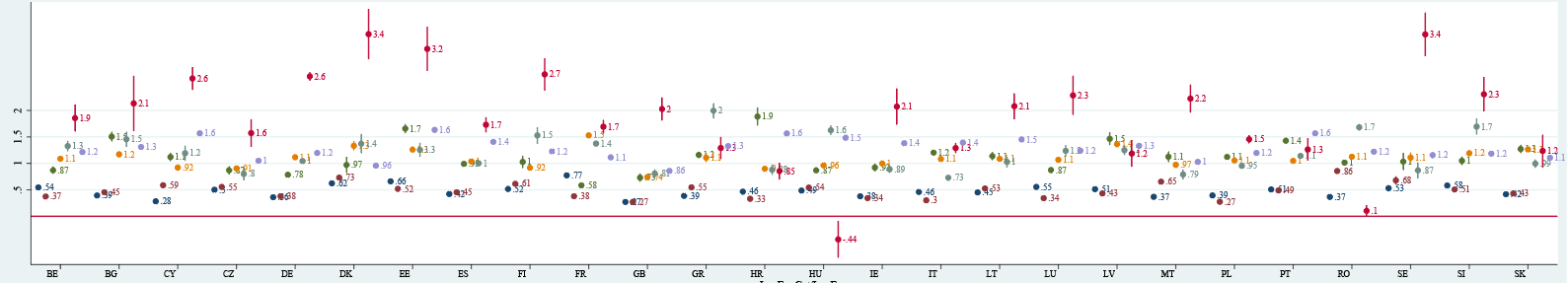
## Air travel spending



SI Figure 2: Scatter plots on the flying sub-sample depicting the log of air travel expenditure (y-axis) and the log of total expenditure (x-axis) across EU countries.

# Expenditure elasticities

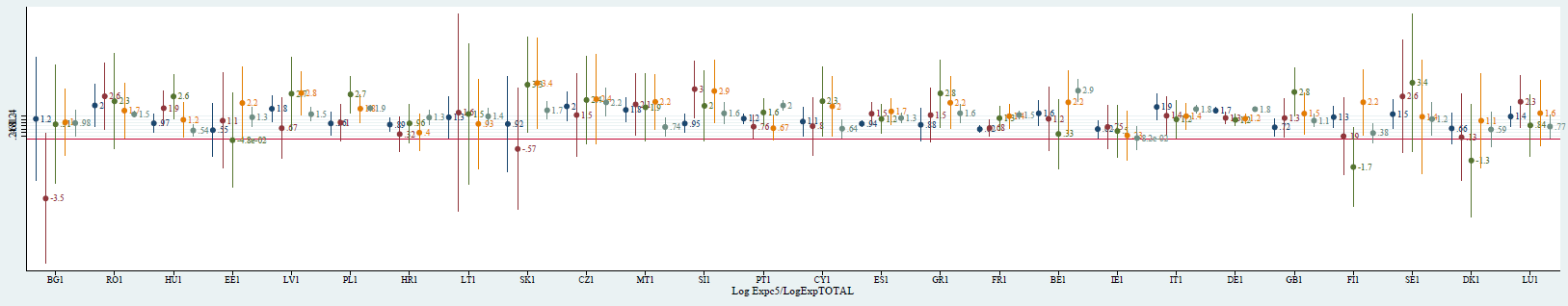
## Expenditure elasticities by country and consumption category



SI Figure 4: Expenditure elasticity by consumption category and country. The following colour legend applies: food (blue), housing (red), clothing (green), manufactured products (yellow), land-based travel (grey), air travel (pink) and services (purple).

## Expenditure elasticities by country, expenditure quintile and detailed consumption category

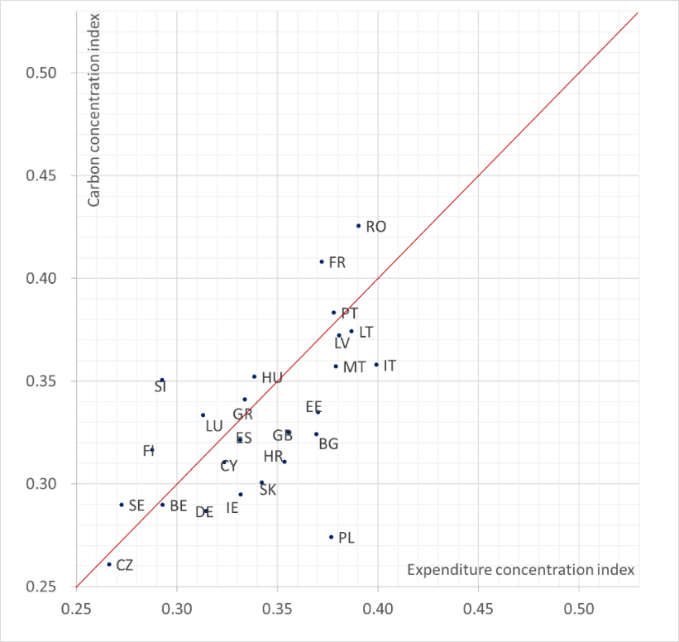
SI Figure 4: Expenditure elasticity by expenditure quintile. Consumption categories: (1) plant-based food, (2) animal-based food, (3) Processed food, (4) Clothing, (5)Vehicles and other private transport equipment, (6) Transport fuels, (7) Air travel, (8) Other transport services, (9) Services, (10) Appliances, machinery and electronics, (11) Furniture, household commodities manufactured products nec, (12) Imputed and actual rent, (13) Electricity and housing fuels, (14) Construction materials, (15) Waste management, water distribution and miscellaneous services.

# Carbon footprint distribution

## Histograms – log of total carbon footprints

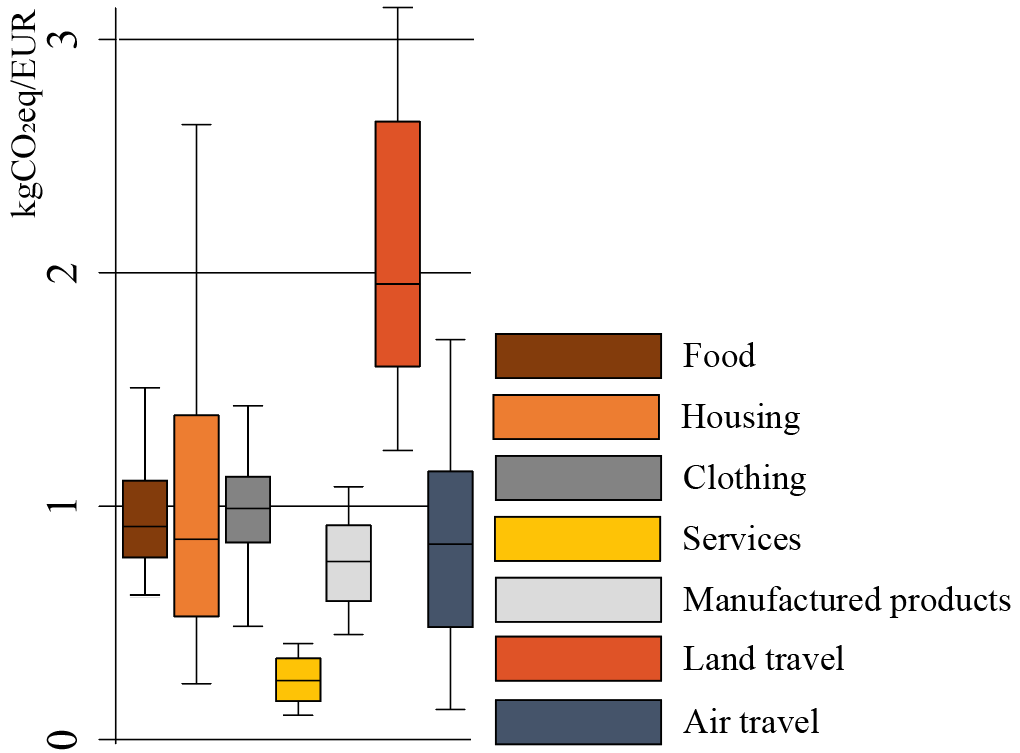
SI Figure 5: Log of total carbon footprint per capita.

## Carbon and expenditure concentration indices

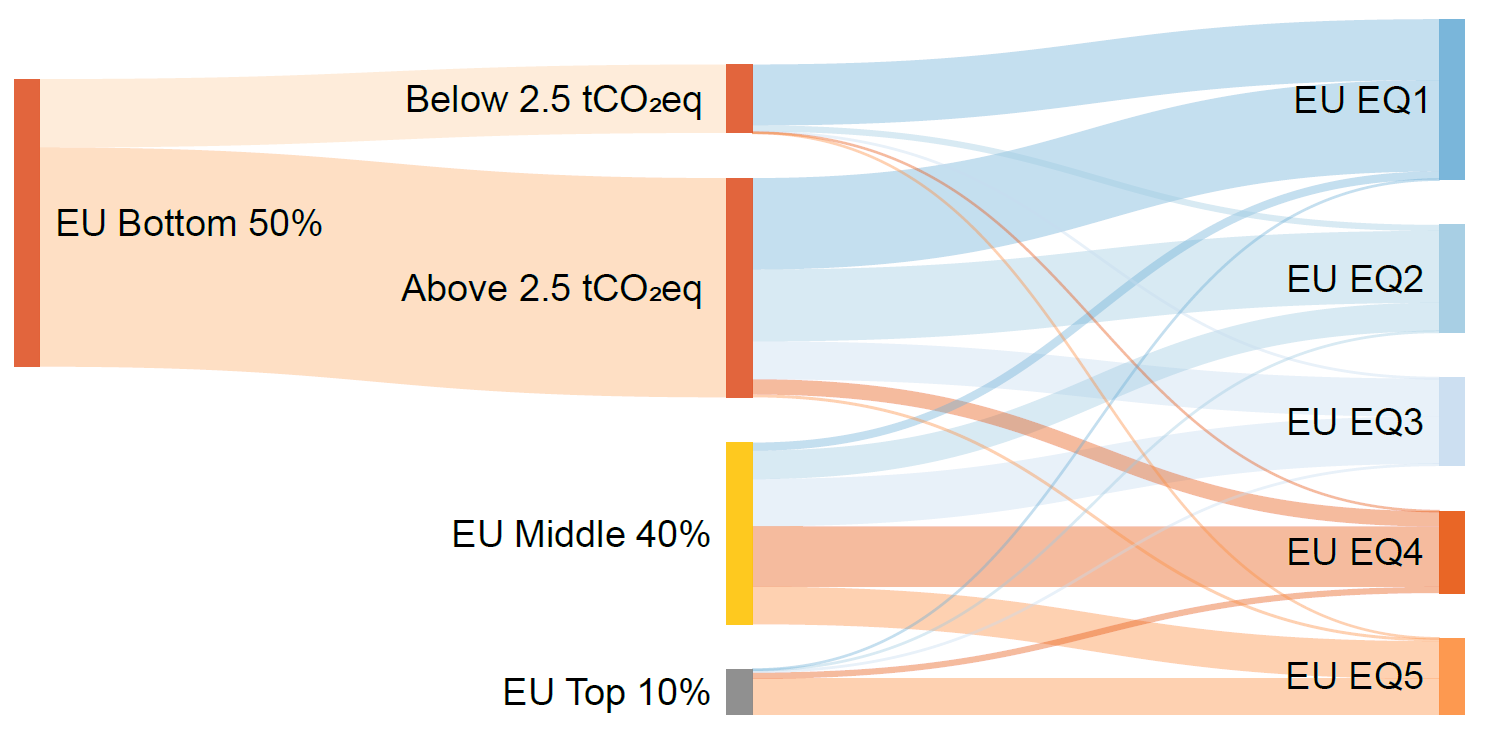
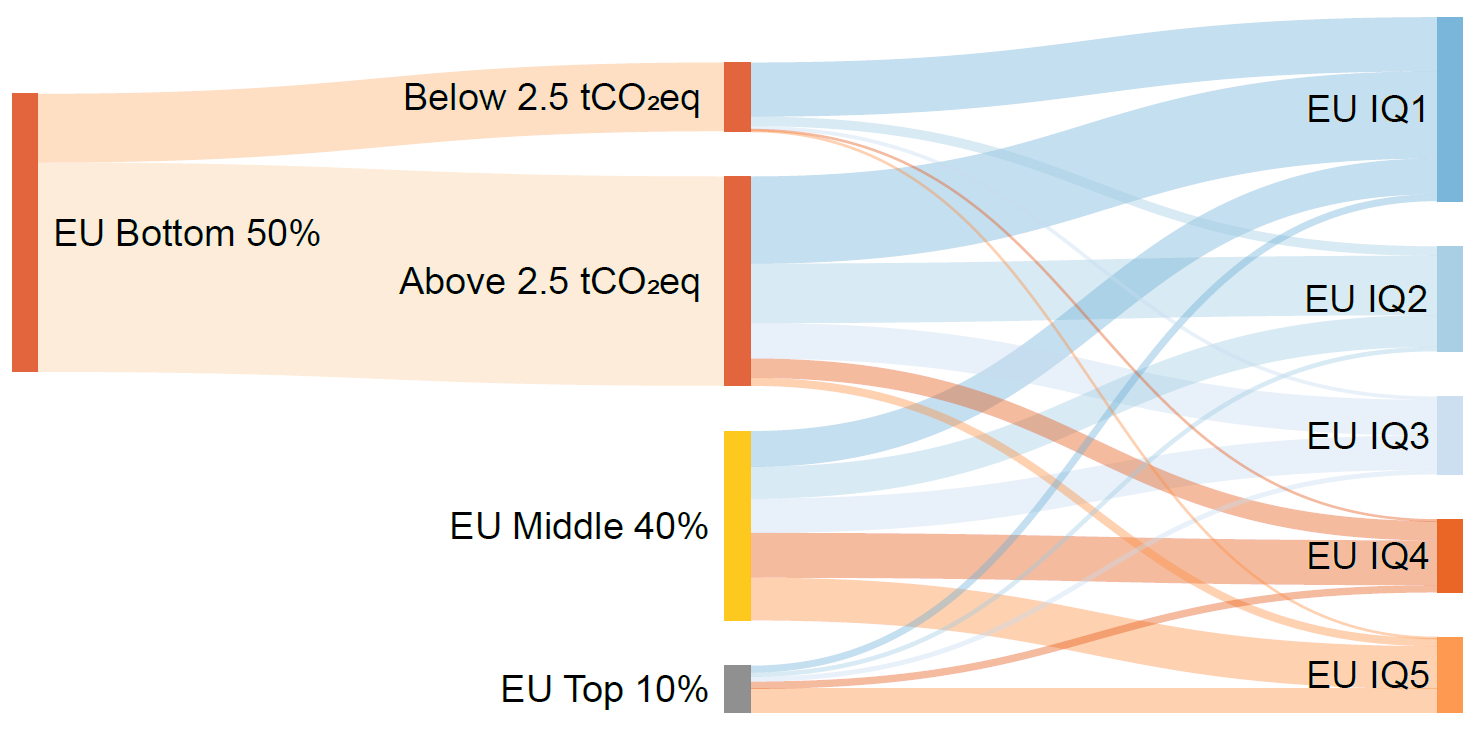


SI Figure 6: Carbon concentration indices across countries (y axis), and total expenditure in basic prices (x axis, left). Each concentration index can be interpreted as a Gini coefficient depicting, for example, the distribution of carbon footprints per capita. That is, a zero represents zero-concentration in a country’s carbon footprint (everyone has the same carbon footprint per capita) or total equality.

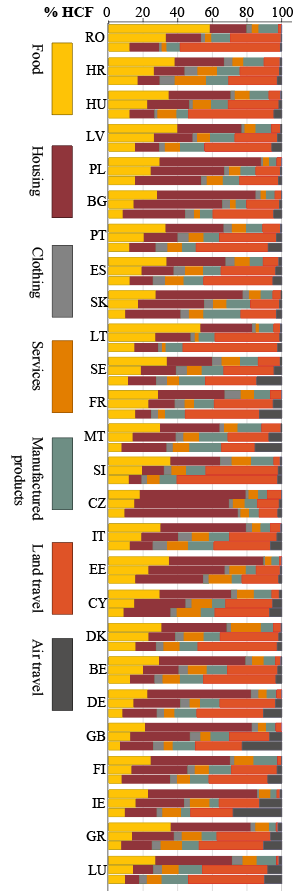
## Carbon intensities



SI Figure 7: Carbon intensities by consumption category The box plots exclude outside values and are based on EXIOBASE 3.6. Monetary carbon intensities should be interpreted with caution as they are may conceal substantial price differences. For example, air travel has been noted to be more carbon intensive per passenger km when compared to car travel5,6.

SI Figure 8: Sankey diagrams on the crossover between left/middle axis- EU emitting groups, and right axis - EU expenditure quintiles (left figure), and EU income quintiles (right figure). EU EQ1 and EU IQ1 correspond to the lowest EU expenditure and income quintiles, while EU EQ5 and EU IQ5 – to the highest quintiles. Italy has been excluded from the income graph, as there is no available income data.



SI Figure 9: Carbon footprint distribution by consumption category. The distribution of those below 2.5 tCO2eq/cap (top), average respondent (middle) and top 10% emitters (bottom) are communicated.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Food** | | | | | **Housing** | | | | | **Clothing** | | | | | **Services** | | | | | **Manufactured products** | | | | | **Land travel** | | | | | **Air travel** | | | | |
|  | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** | **Q1** | **Q2** | **Q3** | **Q4** | **Q5** |
| BE | 26.0 % | 25.0% | 23.4% | 21.4% | 17.0% | 31.8% | 25.1% | 23.0% | 21.3% | 17.5% | 4.8% | 5.3% | 5.7% | 5.5% | 5.9% | 8.1% | 10.0% | 11.0% | 11.9% | 13.9% | 8.8% | 10.3% | 11.2% | 12.3% | 13.1% | 19.7% | 22.9% | 24.1% | 25.3% | 28.9% | 0.8% | 1.4% | 1.7% | 2.2% | 3.6% |
| BG | 23.0 % | 20.6% | 18.2% | 16.4% | 12.7% | 64.3% | 61.1% | 56.0% | 51.9% | 42.9% | 2.4% | 3.4% | 4.4% | 4.7% | 6.3% | 1.9% | 2.4% | 3.1% | 3.7% | 4.8% | 3.7% | 4.5% | 5.1% | 6.1% | 9.1% | 4.6% | 7.8% | 13.0% | 16.6% | 22.7% | 0.1% | 0.2% | 0.2% | 0.5% | 1.5% |
| CY | 25.2% | 21.1% | 18.4% | 15.4% | 10.8% | 36.7% | 31.6% | 31.2% | 29.2% | 26.5% | 3.0% | 3.4% | 3.5% | 4.0% | 3.9% | 6.4% | 8.4% | 10.2% | 12.9% | 16.6% | 8.0% | 7.7% | 8.3% | 7.6% | 8.2% | 19.5% | 25.3% | 24.4% | 25.5% | 25.9% | 1.2% | 2.5% | 4.0% | 5.5% | 8.1% |
| CZ | 17.5% | 17.7% | 17.1% | 16.6% | 13.8% | 55.9% | 53.5% | 52.1% | 51.8% | 49.0% | 2.2% | 2.5% | 2.5% | 2.6% | 2.7% | 5.7% | 6.5% | 7.2% | 7.5% | 9.0% | 6.0% | 6.9% | 7.3% | 7.8% | 8.3% | 12.0% | 12.0% | 12.6% | 12.1% | 14.6% | 0.5% | 0.8% | 1.2% | 1.6% | 2.5% |
| DE | 20.7% | 18.9% | 17.4% | 15.6% | 11.9% | 38.3% | 32.8% | 29.9% | 27.5% | 23.6% | 5.0% | 5.6% | 6.0% | 6.2% | 5.7% | 3.8% | 5.1% | 6.0% | 6.9% | 8.7% | 7.2% | 9.1% | 10.3% | 11.9% | 13.8% | 24.6% | 27.7% | 29.1% | 29.6% | 30.7% | 0.3% | 0.8% | 1.3% | 2.2% | 5.5% |
| DK | 30.4% | 27.8% | 26.7% | 25.3% | 21.0% | 19.4% | 17.1% | 16.9% | 17.7% | 15.8% | 4.3% | 4.5% | 5.1% | 5.2% | 5.2% | 12.8% | 12.5% | 12.1% | 12.7% | 13.1% | 7.1% | 8.1% | 9.3% | 9.6% | 11.8% | 25.1% | 29.0% | 28.8% | 27.6% | 30.1% | 0.7% | 0.8% | 1.0% | 1.7% | 3.0% |
| EE | 28.9% | 29.8% | 27.6% | 25.0% | 19.9% | 59.0% | 53.1% | 47.5% | 42.3% | 34.9% | 0.9% | 1.5% | 2.0% | 3.1% | 4.3% | 3.1% | 4.8% | 6.5% | 8.7% | 15.4% | 4.0% | 4.7% | 5.8% | 6.4% | 7.0% | 3.8% | 5.7% | 10.1% | 13.7% | 16.7% | 0.1% | 0.3% | 0.4% | 0.8% | 1.8% |
| ES | 29.5% | 26.0% | 22.9% | 20.3% | 15.8% | 27.8% | 23.9% | 21.4% | 19.0% | 17.1% | 5.3% | 6.0% | 6.6% | 7.1% | 7.4% | 6.0% | 8.1% | 9.7% | 11.7% | 15.3% | 7.7% | 9.2% | 9.7% | 10.4% | 10.9% | 21.8% | 24.6% | 26.8% | 28.2% | 28.9% | 1.9% | 2.3% | 2.9% | 3.3% | 4.6% |
| FI | 19.7% | 17.6% | 16.0% | 14.6% | 11.8% | 40.9% | 36.4% | 34.6% | 32.5% | 28.8% | 3.2% | 3.8% | 4.4% | 4.9% | 5.0% | 7.0% | 7.5% | 7.8% | 8.8% | 11.2% | 13.2% | 12.9% | 13.8% | 13.8% | 13.4% | 15.8% | 21.4% | 22.5% | 24.4% | 25.4% | 0.2% | 0.3% | 0.9% | 0.9% | 4.3% |
| FR | 27.1% | 28.5% | 28.1% | 26.5% | 21.2% | 35.4% | 23.7% | 20.0% | 17.2% | 14.2% | 9.1% | 7.0% | 6.1% | 6.5% | 5.8% | 5.2% | 6.2% | 6.4% | 6.5% | 7.5% | 8.1% | 10.4% | 11.4% | 12.0% | 12.9% | 14.2% | 22.9% | 26.6% | 29.5% | 33.3% | 0.6% | 1.2% | 1.3% | 1.7% | 5.2% |
| GB | 17.5% | 16.2% | 15.6% | 14.4% | 11.3% | 49.7% | 43.3% | 38.9% | 39.7% | 34.7% | 4.5% | 5.7% | 6.5% | 6.2% | 6.5% | 3.9% | 5.1% | 5.9% | 6.5% | 8.3% | 7.0% | 8.7% | 10.3% | 10.1% | 12.2% | 16.3% | 19.5% | 21.3% | 21.6% | 22.4% | 1.1% | 1.5% | 1.5% | 1.6% | 4.6% |
| GR | 23.6% | 20.4% | 17.7% | 14.0% | 10.6% | 36.6% | 31.6% | 28.6% | 24.4% | 21.1% | 3.1% | 3.6% | 4.1% | 4.9% | 5.4% | 7.6% | 9.6% | 10.5% | 12.3% | 14.2% | 8.3% | 8.5% | 8.5% | 8.6% | 9.3% | 17.3% | 22.1% | 26.1% | 30.1% | 32.3% | 3.6% | 4.2% | 4.5% | 5.7% | 7.1% |
| HR | 35.9% | 33.7% | 30.9% | 28.3% | 21.8% | 27.8% | 22.7% | 20.4% | 18.6% | 14.4% | 4.7% | 5.7% | 6.7% | 7.3% | 9.3% | 4.6% | 6.2% | 7.2% | 9.4% | 18.1% | 11.4% | 12.4% | 13.4% | 14.0% | 13.4% | 14.7% | 18.2% | 20.3% | 20.9% | 20.8% | 0.6% | 0.9% | 1.0% | 1.3% | 2.1% |
| HU | 35.3% | 29.8% | 27.4% | 24.8% | 19.4% | 35.8% | 31.0% | 28.6% | 26.8% | 22.5% | 2.3% | 2.1% | 2.1% | 2.2% | 2.4% | 5.9% | 7.4% | 8.8% | 11.1% | 16.5% | 9.2% | 10.5% | 11.0% | 11.1% | 11.1% | 10.4% | 18.3% | 21.3% | 23.4% | 27.0% | 0.6% | 0.6% | 0.6% | 0.5% | 1.0% |
| IE | 22.3% | 20.7% | 18.2% | 16.5% | 12.9% | 42.8% | 34.1% | 30.7% | 28.6% | 24.6% | 2.8% | 3.1% | 3.3% | 3.7% | 4.2% | 5.6% | 8.4% | 10.8% | 13.0% | 16.8% | 3.9% | 4.9% | 5.2% | 6.1% | 6.6% | 15.9% | 20.9% | 23.6% | 23.5% | 23.1% | 6.8% | 7.9% | 8.1% | 8.6% | 11.9% |
| IT | 26.2% | 25.1% | 23.6% | 21.5% | 15.4% | 37.0% | 29.6% | 26.6% | 22.7% | 17.3% | 4.7% | 6.4% | 7.4% | 8.5% | 9.1% | 4.0% | 5.8% | 7.5% | 10.0% | 15.2% | 6.8% | 9.0% | 10.4% | 11.0% | 13.3% | 20.5% | 23.1% | 23.0% | 24.4% | 26.4% | 0.6% | 0.9% | 1.2% | 1.8% | 3.3% |
| LT | 46.3% | 39.1% | 34.5% | 30.8% | 23.8% | 27.2% | 25.3% | 24.6% | 23.3% | 20.6% | 1.6% | 2.1% | 2.6% | 2.8% | 3.2% | 1.1% | 1.4% | 1.7% | 2.4% | 4.4% | 6.8% | 8.8% | 9.0% | 9.1% | 12.2% | 16.4% | 22.8% | 26.8% | 30.5% | 34.1% | 0.4% | 0.5% | 0.8% | 1.0% | 1.7% |
| LU | 21.3% | 19.0% | 17.4% | 14.7% | 13.0% | 20.8% | 15.7% | 13.6% | 12.0% | 10.6% | 5.4% | 5.5% | 5.8% | 5.4% | 5.6% | 6.8% | 8.8% | 10.7% | 11.2% | 11.8% | 11.4% | 12.2% | 12.2% | 12.9% | 15.9% | 29.2% | 32.6% | 33.4% | 35.2% | 33.5% | 5.0% | 6.3% | 7.0% | 8.5% | 9.6% |
| LV | 40.3% | 35.5% | 33.4% | 28.8% | 21.3% | 36.3% | 30.6% | 28.2% | 24.0% | 19.0% | 1.5% | 1.9% | 2.3% | 2.8% | 3.8% | 4.9% | 5.6% | 6.1% | 7.4% | 9.8% | 7.5% | 11.2% | 14.1% | 15.5% | 17.2% | 9.0% | 14.3% | 15.0% | 20.2% | 25.4% | 0.5% | 0.7% | 0.9% | 1.3% | 3.5% |
| MT | 24.9% | 20.5% | 17.7% | 15.2% | 10.6% | 31.0% | 26.1% | 24.1% | 22.7% | 23.8% | 3.1% | 4.2% | 5.2% | 5.3% | 4.4% | 6.9% | 8.3% | 9.1% | 9.7% | 10.6% | 13.1% | 15.6% | 15.6% | 16.2% | 17.1% | 20.7% | 24.3% | 26.3% | 25.0% | 21.9% | 0.3% | 1.0% | 1.9% | 5.8% | 11.6% |
| PL | 29.3% | 29.2% | 28.4% | 26.7% | 20.7% | 53.5% | 47.3% | 44.8% | 42.0% | 35.7% | 1.4% | 2.1% | 2.5% | 3.1% | 3.8% | 3.2% | 4.1% | 4.8% | 6.1% | 10.4% | 4.9% | 6.9% | 8.2% | 9.6% | 10.9% | 7.4% | 10.1% | 10.9% | 11.9% | 16.4% | 0.1% | 0.2% | 0.3% | 0.5% | 2.0% |
| PT | 31.9% | 28.6% | 25.9% | 22.9% | 16.1% | 33.0% | 26.0% | 22.5% | 19.8% | 16.6% | 4.1% | 5.1% | 5.9% | 6.8% | 8.0% | 4.3% | 6.0% | 8.1% | 10.7% | 13.7% | 8.7% | 9.8% | 9.5% | 9.5% | 9.6% | 17.5% | 23.6% | 26.9% | 28.6% | 32.0% | 0.5% | 0.9% | 1.1% | 1.7% | 4.0% |
| RO | 65.7% | 54.4% | 47.4% | 40.7% | 29.2% | 17.2% | 20.1% | 21.7% | 22.2% | 23.5% | 2.3% | 2.7% | 2.9% | 3.1% | 3.1% | 2.6% | 3.1% | 3.4% | 3.9% | 6.1% | 8.2% | 10.7% | 11.7% | 12.5% | 14.1% | 3.6% | 8.7% | 12.7% | 17.4% | 23.3% | 0.1% | 0.1% | 0.1% | 0.2% | 0.6% |
| SE | 25.1% | 22.8% | 22.0% | 21.0% | 16.6% | 23.6% | 23.5% | 22.2% | 20.8% | 18.7% | 5.5% | 6.6% | 5.7% | 6.6% | 7.2% | 7.6% | 8.6% | 8.9% | 9.2% | 11.3% | 9.6% | 10.1% | 11.7% | 12.8% | 15.4% | 27.6% | 27.2% | 28.0% | 27.9% | 26.6% | 0.9% | 1.2% | 1.5% | 1.7% | 4.2% |
| SI | 31.0% | 26.4% | 24.6% | 21.7% | 17.5% | 22.0% | 17.4% | 16.3% | 14.1% | 11.8% | 5.2% | 4.8% | 4.9% | 5.1% | 4.9% | 8.1% | 8.2% | 8.7% | 9.3% | 11.6% | 10.7% | 10.6% | 11.9% | 12.4% | 14.1% | 21.4% | 30.8% | 31.3% | 34.7% | 35.9% | 0.7% | 1.3% | 1.8% | 2.4% | 3.9% |
| SK | 24.3% | 21.7% | 20.7% | 18.6% | 14.0% | 47.8% | 43.0% | 41.3% | 39.2% | 32.7% | 3.7% | 4.3% | 5.1% | 5.7% | 6.0% | 5.7% | 6.8% | 7.0% | 8.1% | 10.5% | 7.1% | 9.3% | 10.4% | 12.3% | 17.4% | 11.0% | 14.5% | 15.0% | 15.4% | 16.2% | 0.3% | 0.4% | 0.4% | 0.7% | 3.1% |

SI table 4: Carbon footprint shares across expenditure quintiles – from the lowest spenders (Q1) to the highest spenders (Q5)

## Carbon footprint ranges by regions

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | NUTS1 region | Region name | e(p1) | e(p10) | e(p25) | e(p50) | e(p75) | e(p90) | e(p99) | e(mean) | Carbon Gini | Expenditure Gini |
| 1 | BE1 | Brussels | 1963 | 3420 | 5159 | 7684 | 11518 | 16196 | 33835 | 9149 | 0.33 | 0.33 |
| 2 | BE2 | Flanders | 2842 | 4661 | 6139 | 8379 | 11692 | 15909 | 28790 | 9633 | 0.28 | 0.27 |
| 3 | BE3 | Wallonia | 2324 | 4236 | 5879 | 8309 | 11825 | 15990 | 28012 | 9544 | 0.29 | 0.30 |
| 4 | BG3 | Northern and Eastern Bulgaria | 792 | 1937 | 2909 | 4299 | 6364 | 9058 | 19276 | 5166 | 0.34 | 0.39 |
| 5 | BG4 | South-Western and South-Central Bulgaria | 1356 | 2540 | 3367 | 4619 | 6645 | 9206 | 17164 | 5499 | 0.30 | 0.34 |
| 6 | CY0 | Cyprus | 1782 | 3485 | 4870 | 6919 | 10095 | 14239 | 27823 | 8207 | 0.31 | 0.32 |
| 7 | CZ12 | Prague | 2396 | 4280 | 5627 | 7494 | 9996 | 13485 | 23733 | 8460 | 0.26 | 0.28 |
| 8 | CZ22 | Central Bohemia | 2156 | 4367 | 5496 | 7208 | 9793 | 13357 | 22300 | 8199 | 0.25 | 0.26 |
| 9 | CZ32 | Southwest Czech Republic | 2336 | 3830 | 4926 | 6282 | 9054 | 12356 | 20169 | 7384 | 0.26 | 0.26 |
| 10 | CZ42 | Northwest Czech Republic | 2329 | 3924 | 5030 | 6842 | 9132 | 12165 | 20309 | 7668 | 0.26 | 0.26 |
| 11 | CZ52 | Northeast Czech Republic | 2021 | 4086 | 5176 | 6678 | 9731 | 12927 | 20643 | 7745 | 0.26 | 0.25 |
| 12 | CZ62 | Southeast Czech Republic | 2610 | 4278 | 5334 | 7035 | 9696 | 12631 | 21292 | 8021 | 0.25 | 0.24 |
| 13 | CZ72 | Central Moravia | 3010 | 3973 | 5027 | 6573 | 9811 | 13809 | 21186 | 7858 | 0.27 | 0.23 |
| 14 | CZ82 | Moravian-Silesian | 1945 | 3868 | 4959 | 6519 | 8822 | 12423 | 20979 | 7523 | 0.27 | 0.26 |
| 15 | DE00 | Germany | 3028 | 4734 | 6188 | 8556 | 11953 | 16489 | 34429 | 10029 | 0.29 | 0.32 |
| 16 | DE3 | Berlin | 3053 | 4867 | 6474 | 8816 | 12285 | 16740 | 35238 | 10297 | 0.29 | 0.32 |
| 17 | DE4 | Brandenburg | 2932 | 4494 | 5945 | 8246 | 11521 | 15745 | 32052 | 9614 | 0.29 | 0.31 |
| 18 | DE5 | Bremen | 2791 | 4214 | 5556 | 7485 | 10264 | 13945 | 27092 | 8616 | 0.27 | 0.29 |
| 19 | DK0 | Denmark | 2372 | 4077 | 5774 | 8140 | 11598 | 15601 | 27099 | 9345 | 0.29 | 0.25 |
| 20 | EE0 | Estonia | 1513 | 3123 | 4489 | 6761 | 10159 | 14635 | 28317 | 8195 | 0.34 | 0.37 |
| 21 | EL00 | Greece | 2920 | 4736 | 6909 | 10202 | 15667 | 22757 | 48640 | 12616 | 0.34 | 0.33 |
| 22 | ES1 | Northwest Spain | 1101 | 2165 | 3276 | 4967 | 7390 | 10215 | 18396 | 5825 | 0.33 | 0.32 |
| 23 | ES2 | Northeast Spain | 1312 | 2636 | 3673 | 5298 | 7697 | 10680 | 19895 | 6169 | 0.31 | 0.31 |
| 24 | ES3 | Community of Madrid | 1504 | 2859 | 4035 | 5885 | 8453 | 11573 | 21349 | 6832 | 0.31 | 0.32 |
| 25 | ES4 | Central Spain | 1052 | 1993 | 2917 | 4483 | 6630 | 9224 | 16838 | 5217 | 0.32 | 0.33 |
| 26 | ES5 | Eastern Spain | 1157 | 2281 | 3272 | 4990 | 7383 | 10430 | 19619 | 5838 | 0.32 | 0.32 |
| 27 | ES6 | Southern Spain | 937 | 2085 | 2972 | 4492 | 6621 | 9568 | 17606 | 5310 | 0.33 | 0.35 |
| 28 | ES7 | Canary Islands | 871 | 1852 | 2802 | 4195 | 6405 | 9212 | 17089 | 5071 | 0.34 | 0.36 |
| 29 | FI1 | Mainland Finland | 2327 | 4146 | 5896 | 8794 | 12557 | 17796 | 33617 | 10276 | 0.32 | 0.29 |
| 30 | FI2 | Åland | 2644 | 4687 | 6909 | 8747 | 12481 | 16074 | 30471 | 10375 | 0.29 | 0.29 |
| 31 | FR1 | Paris Region | 1241 | 2582 | 3930 | 6051 | 9743 | 15067 | 31730 | 7883 | 0.38 | 0.35 |
| 32 | FR2 | Paris Basin | 1140 | 2309 | 3643 | 6082 | 9024 | 13148 | 26166 | 7132 | 0.36 | 0.32 |
| 33 | FR3 | North France | 1117 | 2262 | 3406 | 5442 | 8285 | 11902 | 26819 | 6586 | 0.36 | 0.32 |
| 34 | FR4 | East France | 1310 | 2662 | 3828 | 6224 | 9527 | 13686 | 28807 | 7558 | 0.36 | 0.31 |
| 35 | FR5 | West France | 1038 | 2452 | 3601 | 5768 | 9175 | 13447 | 24691 | 7094 | 0.36 | 0.30 |
| 36 | FR6 | Southwest France | 1306 | 2644 | 4004 | 6457 | 10025 | 14703 | 28888 | 7840 | 0.35 | 0.30 |
| 37 | FR7 | East-Central France | 1189 | 2547 | 3987 | 6214 | 9441 | 13366 | 26284 | 7386 | 0.34 | 0.30 |
| 38 | FR8 | Mediterranean | 1055 | 2483 | 3667 | 5991 | 8943 | 13384 | 25199 | 7136 | 0.35 | 0.31 |
| 39 | FR9 | Overseas department and region | 588 | 1285 | 2291 | 4336 | 7527 | 12386 | 28079 | 6049 | 0.46 | 0.40 |
| 40 | FRZ | Extra-regio France | 378 | 594 | 904 | 1651 | 3256 | 6502 | 21334 | 3041 | 0.55 | 0.52 |
| 41 | HR0 | Croatia | 1041 | 1795 | 2469 | 3546 | 5065 | 7143 | 14623 | 4189 | 0.31 | 0.35 |
| 42 | HU1 | Central Hungary | 986 | 1867 | 2681 | 4044 | 6087 | 9094 | 19877 | 5096 | 0.36 | 0.33 |
| 43 | HU2 | Transdanubia | 900 | 1585 | 2270 | 3340 | 4825 | 7182 | 13512 | 4026 | 0.33 | 0.32 |
| 44 | HU3 | Great Plain and North Hungary | 836 | 1471 | 2125 | 3190 | 4706 | 6979 | 15328 | 3934 | 0.35 | 0.33 |
| 45 | IE1 | Border, Midland and Western Ireland | 3177 | 5030 | 6720 | 9623 | 13226 | 18007 | 33328 | 11028 | 0.29 | 0.32 |
| 46 | IE2 | Southern and Eastern Ireland | 3028 | 5264 | 7039 | 9779 | 13497 | 18312 | 41980 | 11434 | 0.30 | 0.33 |
| 47 | ITC | Northwest Italy | 1945 | 3371 | 4808 | 7150 | 10951 | 16967 | 36588 | 9140 | 0.36 | 0.40 |
| 48 | ITF | South Italy | 1560 | 2576 | 3536 | 5139 | 7603 | 11443 | 25313 | 6423 | 0.34 | 0.38 |
| 49 | ITG | Insular Italy | 1535 | 2529 | 3478 | 5105 | 7662 | 11208 | 21693 | 6210 | 0.33 | 0.34 |
| 50 | ITH | Northeast Italy | 1794 | 3357 | 4789 | 7089 | 10816 | 16080 | 39965 | 9068 | 0.36 | 0.39 |
| 51 | ITI | Central Italy | 1757 | 3206 | 4555 | 6591 | 9707 | 14299 | 30891 | 8068 | 0.33 | 0.37 |
| 52 | LT0 | Lithuania | 1110 | 2023 | 3014 | 4800 | 7535 | 11289 | 24483 | 6075 | 0.37 | 0.39 |
| 53 | LU0 | Luxembourg | 2677 | 5167 | 7590 | 11793 | 17825 | 25767 | 45771 | 14004 | 0.33 | 0.31 |
| 54 | LV0 | Latvia | 905 | 1653 | 2424 | 3662 | 5623 | 8591 | 21441 | 4712 | 0.37 | 0.38 |
| 55 | MT0 | Malta | 1279 | 2660 | 3743 | 5469 | 8181 | 12412 | 32836 | 6974 | 0.36 | 0.38 |
| 56 | PL1 | Central Poland | 1997 | 2875 | 3649 | 4850 | 6727 | 9724 | 20540 | 5895 | 0.30 | 0.41 |
| 57 | PL2 | Southern Poland | 1964 | 2692 | 3373 | 4407 | 5987 | 8300 | 16358 | 5135 | 0.26 | 0.36 |
| 58 | PL3 | Eastern Poland | 1862 | 2506 | 3059 | 3944 | 5300 | 7114 | 14399 | 4575 | 0.25 | 0.35 |
| 59 | PL4 | Northwest Poland | 1952 | 2632 | 3313 | 4312 | 5804 | 7924 | 15193 | 4996 | 0.26 | 0.36 |
| 60 | PL5 | Southwest Poland | 1988 | 2744 | 3502 | 4646 | 6206 | 8713 | 16287 | 5362 | 0.27 | 0.35 |
| 61 | PL6 | Northern Poland | 1793 | 2564 | 3274 | 4325 | 5883 | 8343 | 16900 | 5123 | 0.28 | 0.37 |
| 62 | PT1 | Continental Portugal | 915 | 1891 | 2855 | 4535 | 7263 | 11140 | 23360 | 5807 | 0.38 | 0.37 |
| 63 | PT2 | The Azores | 626 | 1366 | 2061 | 3243 | 5238 | 7928 | 18413 | 4138 | 0.37 | 0.38 |
| 64 | PT3 | Madeira | 758 | 1481 | 2205 | 3602 | 5976 | 9332 | 22025 | 4838 | 0.41 | 0.37 |
| 65 | RO1 | Northwest and Central Romania | 638 | 1236 | 1714 | 2539 | 4138 | 6961 | 16963 | 3605 | 0.41 | 0.38 |
| 66 | RO2 | Northest and Southeast Romania | 549 | 1018 | 1454 | 2156 | 3403 | 6123 | 17239 | 3166 | 0.43 | 0.40 |
| 67 | RO3 | South – Muntenia and București - Ilfov development region | 643 | 1172 | 1678 | 2553 | 4396 | 7883 | 21180 | 3886 | 0.44 | 0.40 |
| 68 | RO4 | South-West Oltenia and Western Romania | 599 | 1156 | 1680 | 2526 | 3919 | 6873 | 16482 | 3550 | 0.42 | 0.38 |
| 69 | SE1 | East Sweden | 1499 | 3035 | 4103 | 5704 | 8130.45 | 11425 | 27033 | 6977 | 0.32 | 0.29 |
| 70 | SE2 | South Sweden | 1691 | 3049 | 4201 | 5754 | 7780.55 | 10409 | 18223 | 6417 | 0.27 | 0.26 |
| 71 | SE3 | North Sweden | 1568 | 3229 | 4340 | 5764 | 7826.1 | 10765 | 18316 | 6526 | 0.27 | 0.26 |
| 72 | SI0 | Slovenia | 1397 | 2585 | 3812 | 6054 | 9139 | 13324 | 26798 | 7317 | 0.35 | 0.29 |
| 73 | SK0 | Slovakia | 1574 | 2711 | 3655 | 5067 | 7042 | 9659 | 20153 | 5970 | 0.30 | 0.34 |
| 74 | UKC | North East England | 2412 | 3888 | 5227 | 7538 | 10728 | 15087 | 27150 | 8871 | 0.30 | 0.31 |
| 75 | UKD | North West England | 2042 | 3985 | 5529 | 7644 | 10690 | 13939 | 28491 | 9071 | 0.32 | 0.35 |
| 76 | UKE | Yorkshire and the Humber, England | 1967 | 3729 | 5270 | 7498 | 10553 | 15006 | 24154 | 8610 | 0.29 | 0.34 |
| 77 | UKF | East Midlands, England | 2644 | 4445 | 5767 | 7752 | 11263 | 15115 | 34944 | 9508 | 0.30 | 0.35 |
| 78 | UKG | West Midlands, England | 1877 | 3795 | 5416 | 7397 | 10063 | 14209 | 29802 | 8489 | 0.29 | 0.35 |
| 79 | UKH | East of England | 2384 | 4357 | 6097 | 9058 | 12429 | 16474 | 33376 | 10032 | 0.29 | 0.32 |
| 80 | UKI | London, England | 2071 | 3942 | 5628 | 8342 | 12490 | 18367 | 54395 | 10977 | 0.38 | 0.39 |
| 81 | UKJ | South East England | 2265 | 4448 | 6118 | 8622 | 12165 | 17622 | 35506 | 10550 | 0.34 | 0.36 |
| 82 | UKK | South West England | 2881 | 4377 | 5995 | 8884 | 12259 | 17834 | 57334 | 10836 | 0.34 | 0.36 |
| 83 | UKL | Wales | 1640 | 3905 | 5431 | 7578 | 10978 | 14689 | 23955 | 8748 | 0.29 | 0.33 |
| 84 | UKM | Scotland | 2482 | 4191 | 5813 | 8177 | 11436 | 16186 | 37266 | 10259 | 0.29 | 0.33 |
| 85 | UKN | Northern Ireland | 2612 | 4700 | 5797 | 9117 | 12821 | 17202 | 59464 | 10975 | 0.34 | 0.36 |

SI table 5: Total carbon footprint, and carbon and expenditure Ginis across NUTS1 regions. Superscripts in the region code denote where NUTS0 and NUTS2 detail is communicated instead.

# Verification

We estimated that the top carbon quintile (top 20% of the EU population with the highest carbon footprint levels) contribute to 43% of EU’s total emissions, within a reasonable range to a prior estimate of 37% for the carbon contributions of the highest income quintile7. Through the micro-level assessment, we find that the top 10% of EU emitters contribute to as much as 27% of EU emissions, much higher estimate than prior calculations based on regional averages8. A recent study on the GHG emissions embodied in the consumption of the super-rich suggests that a typical super-rich household of two people produces a carbon footprint of 129.3 tCO2eq annually9. In our sample, there are 182 households with a carbon contribution of that magnitude, equivalent to 0.07% of the total sample.

Differences in results may remain due to differences in the calculation procedure, under-reporting treatment, survey and MRIO data, year of analysis and outlier treatment. Table 3 provides an overview of prior country-level studies and enables a comparison with our carbon footprint analysis including confidence intervals.

|  |  |  |
| --- | --- | --- |
| **Context** | **Carbon footprint in this study** | **Carbon footprint in other studies** |
| United Kingdom | an average household carbon footprint of 20.8 (95% CI: 20.2-21.3) tCO2eq/cap and a median of 17.1 tCO2eq/household | median of 17.3 tCO2eq/household and a mean of 20.2 tCO2eq/household |
| Finland | 10.3 (95% CI: 10.0-10.5) tCO2eq/cap | Finnish carbon footprint assessments between 10.9 tCO2eq/cap and 8.9 tCO2eq/cap; prior sub-population estimates of 11.5-12.5 tCO2eq/cap10. |
| Germany | 9.6 (95% CI: 9.6-9.8) tCO2eq/cap | 10.2 tCO2eq/consumption unit11 and 11.4 and 14.3 tCO2eq/cap (including governemental consumption)12 |
| Denmark | an average of 9.3 (95% CI: 9.1-9.6) tCO2eq/cap | 11.4 tCO2eq/cap, including governmental spending13. |

SI table 6: Verification of carbon footprint estimates with prior country-level studies.

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