

UMBR-14: a small-area poverty proxy for Britain, 2001-2013

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1 Introduction

The accompanying package contains an updated version of the **Unadjusted Means-Tested Benefits Rate** (UMBR) data set. UMBR is a proxy measure of income poverty for small geographic areas in England, Scotland and Wales. It provides a single-number household poverty rate for somewhat over 40,000 small area units annually from 2001 to 2013.

UMBR is produced from public data sources by the Centre for Analysis of Social Exclusion at the London School of Economics, as part of the Social Policy in a Cold Climate (SPCC) research programme¹. UMBR is suitable for a variety of purposes, including analysis of the local distribution of poverty over time, and the coding of other individual or area data-sets with an income poverty indicator.

Key differences between UMBR-12 and UMBR-14

The first edition of UMBR was published in 2012². The design of UMBR-14 is substantially the same as the previous edition, except that:

- UMBR-14 extends annual coverage to 2013. The previous version, UMBR-12 covered the calendar years 2001 to 2011.
- UMBR-14 uses Census 2011 data, and associated updates to population estimates, to revise estimates from 2001 to 2011.
- UMBR-14 is measured to the latest 2011 Census geographic boundaries (LSOAs) in England and Wales

¹ The *Social Policy in a Cold Climate* programme was funded by the Joseph Rowntree Foundation, the Nuffield Foundation and the Trust for London.

² Available for download at <http://eprints.lse.ac.uk/46449/>

Getting started

The dataset is provided as a comma-separated (CSV) file, called `umbr14-esw.csv`. This can be loaded in any statistical or numerical software, including R, Stata or SPSS. Each row contains information for one area (a 2011 LSOA in England and Wales, a 2001 Datazone in Scotland) in one year. The poverty proxy rate (proportion of households that are poor) is in the field `UMBR.HH`. The rest of this document describes the design and potential use of UMBR in more detail.

2 Conceptualisation and design of UMBR

The UMBR rate for a given area in a given year is the calendar-year average **number of claimants of major means-tested benefits** in that area, **divided by the mid-year estimate of households**.

UMBR as a poverty proxy

UMBR is conceived of as a proxy for poverty according to the common European and international standard which is widely used in major social surveys, such as *Households Below Average Income*: poverty as an equivalised household income falling below a threshold set as a proportion, 60%, of the population median.

In addition, UMBR as a proxy for this rate was required to provide a single number figure, covering all of Great Britain for 2001 to 2013 and easily aggregable to higher level spatial units, which was reproducible in a timely manner from publicly available data sources.

Source data selection and design

The selection of data for the numerator was informed by analysis of the *Family Resources Survey*, looking at the validity and coverage of a variety of administrative data proxies for income poverty³. On this basis, the receipt of four major means-tested social security benefits (Job Seekers Allowance, Income Support, Employment and Support Allowance and Pension Credit-Guarantee Element) is the numerator. Households are used as a denominator to control as best as possible for inter-area variations in family size and structure, as it is very rare for households to contain more than one primary recipient of these benefits.

UMBR is not only a partial *count* of poor households, but a strong *correlate* of the spatial distribution of all poor households. The observed presence of low-income households who *do* claim benefits is a strong predictor of the presence of low-income households who *do not* claim benefits. This analysis indicates that for most areas, UMBR and measures of underlying income poverty fall in a linear relationship. Difference of scale in UMBR are thus typically equivalent to differences of the same scale in the "true" poverty rate.

Similarities and differences to other poverty and deprivation indices

In its sources and design, UMBR is similar to several official measures of local income poverty and deprivation available in the UK, such as the various country-specific *Indices of Multiple Deprivation*, the *Economic Deprivation Indices* (England) and HMRC's *Child Poverty Estimates* (Great Britain). In comparison with these sources, it:

- measures only income poverty, not other aspects of deprivation;
- gives a poverty proxy measured as a single real rate, rather than a rank;

³ The principles and empirical investigations underlying UMBR are set out in detail in Fenton (2013) *Small Area Measures of Income Poverty* CASE Paper 174 <http://eprints.lse.ac.uk/58053/>.

- offers annual coverage from 2001 to 2013;
- is measured consistently across England, Scotland and Wales;
- is reproducible only from public sources and using open-source software;

For some uses, these other sources may be more appropriate. Since they are able to draw on source data that is not publicly available, they may offer more accurate measurement than that provided by UMBR for the equivalent years. In practice, UMBR is very closely correlated with the income domains of the various IMDs.

3 Using UMBR

The UMBR dataset

The UMBR-14 dataset is presented as a CSV (comma-separated values) file. This should be suitable for use in any statistical application, including R, Stata and SPSS. The dataset contains 536,289 rows, each of which represent one of 41,253 small areas in one of 13 years. Each case contains the following fields:

Geogcode The ONS geographic code for the small area (2011 LSOA in England and Wales, 2001 Datazone in Scotland)

Year The calendar year to which the values refer

All.MTB The average number of claimants of means-tested benefits in this area in this year

Hholds The mid-year estimated count of households in this area

UMBR.HH The household UMBR rate (=All.MTB/Hholds) for this area

Geog.Indic One-letter code indicating whether and how this area is affected by changes to statistical boundaries

Geog.XRef For areas affected by major boundary changes, indicates where this area's count data are held

Every area has a value for UMBR.HH for every year. For certain areas, the All.MTB and Hholds fields are missing; these are marked with "NA". For further information on this and on the Geog.Indic and Geog.XRef fields, see the section on changes to spatial units below.

Appropriate uses

Uses to which UMBR can be put include:

- To make statements about relative poverty rates in different parts of a wider area (a city, a region). For single LSOAs and Datazones, small differences of less than $\pm 10\%$ (certainly not less than $\pm 5\%$) at a single point in time should not be considered as indicating significant differences in the underlying poverty rate;
- To assess how poverty rates have changed over time in an area or a group of areas over time, including aggregating to higher spatial units (such as MSOAs or Wards) to make comparisons at that level;
- To judge how much any such change might be attributed to falls in absolute numbers of poor households, or to increases in the household population;
- To code other datasets, such as survey, census or administrative data, with a poverty indicator for further analysis.

Limitations and cautions

It is important to note that although UMBR is an interval measure, it is not directly comparable to a poverty rate as normally conceived. Furthermore, the measurement of poverty for small areas inherently involves estimation of quantities that are not directly observed, as well as compromises between the simplicity of the method and the complexity of the underlying construct (poverty).

Some particular cautions apply to UMBR as a representation of poverty as it is conventionally measured using a threshold of population median income:

- UMBR does not fully reflect the incidence of in-work poverty, or poverty resulting from high housing costs. Thus UMBR tends to indicate lower levels of poverty in areas of high housing costs (notably London), in comparison to survey or other sources.
- It follows from this that caution should be exercised in directly comparing areas with very dissimilar housing and labour market characteristics.
- UMBR also does not fully account for changes in the welfare system which affect the material welfare of claimants or their eligibility for means-tested benefits. Thus the effects of, for example, cuts to Housing Benefit and Council Tax Benefit on poverty rates are not reflected in UMBR, nor are changes to lone-parents' claims to Income Support.
- The source data from which UMBR is derived include multiple forms of estimation, rounding, and geographic resampling, and UMBR makes some interpolation and projection of data over time. As noted, small differences (less than $\pm 5\%$) between single years or between single areas should not be interpreted as indicating a significant difference in the underlying poverty rate.
- The average size of small areas and the algorithm by which they are constructed is different in Scotland than in England and Wales. Thus measures of dispersion (for example, standard deviation) cannot be directly compared between Scotland and England and Wales.
- The limited information available on population change between the Censuses in 2001 and 2011, and changes to statistical boundaries, mean that estimates for areas where there were substantial population or housing changes are subject to substantially greater uncertainty.
- In areas with large institutional populations (people living in communal establishments such as nursing homes), and especially in areas where such establishments closed or opened between the Censuses, UMBR may produce erroneous results, such as UMBR scores substantially greater than 1.
- These cases cannot be systematically identified, so are left unaltered. Inferences should not be drawn from single outlying cases, and detailed analysis of a small number of specific areas should be supplemented with other sources.

4 Comparing UMBR-12 and UMBR-14

This edition of the dataset follows the same method as the first edition of UMBR. In comparison to the previous edition it draws on additional sources, which both extend the timeframe covered by the dataset, and improve the accuracy of the estimates that were already in the previous edition, by:

- using administrative data on social security benefits to Q4 2013;
- using the results of the 2011 Census of Population;

- using revised population estimates from ONS (England and Wales) and GROS (Scotland);
- providing results aligned to updated (in England and Wales) standard geographic units.

The effect on existing estimates for 2001 to 2011 follow from revisions to official small-area population estimates and to the UMBR household estimates as a result of these revisions and new Census data. The effects of the availability of new data on the previous UMBR estimates are described in the following sections.

Size of revisions between UMBR-12 and UMBR-14

Comparisons can be made for the years and areas which appear in both UMBR-12 and UMBR-14 to describe the scale of revisions made in the light of newly available source data. For simplicity, only areas unaffected by major boundary changes are compared ($\approx 98\%$ of areas in England and Wales, 100% in Scotland), and thus the effects of major housing developments and local population changes are not included. Table 1 shows the absolute change for these rates from the previous (UMBR-12) to current edition, by year.

	<1%	1%-5%	5%-10%	10%-25%	>25%
2001	92.7	4.6	0.0	0.0	0.0
2002	87.9	10.0	0.2	0.0	0.0
2003	84.0	14.1	0.4	0.1	0.0
2004	80.7	17.4	0.7	0.1	0.0
2005	76.1	21.7	1.2	0.2	0.0
2006	71.0	26.1	1.9	0.3	0.0
2007	67.2	29.1	2.7	0.5	0.0
2008	63.0	32.2	3.5	0.7	0.0
2009	53.4	39.6	5.3	1.2	0.1
2010	49.7	42.0	6.3	1.7	0.1
2011	48.0	42.4	7.0	2.1	0.1

Table 1: Absolute size of revisions to UMBR in UMBR-14 compared to UMBR-12, per cent of areas by year

The revisions to the previous UMBR estimates are greatest in 2011, when the population and household data was furthest projected since the last Census in 2001. In 2011, just under half of all areas had revisions of less than 1% (0.01) in their UMBR score. However, even in that year, less than 10% of all areas had revisions of greater than 5% (0.05).

Regional pattern of UMBR revisions

The chart in Figure 1 shows the pattern of revisions by region (separating Inner and Outer London) by year. It shows the size of the revision at the 5th, 25th, 50th (median), 75th and 95th percentiles.

In all regions, the median revision lies close to zero; the largest median revision is in Outer London in 2010 (+0.56%). At regional level the revisions do not point to substantial bias in the earlier estimates. The largest revisions are seen in Inner London, where several features of the population make inter-censal population estimates more difficult. The relatively large revisions in Scotland are likely to be attributable to the smaller mean population of the areal units (Datazones) there; equivalent absolute revisions in the population estimates result in larger revisions to the UMBR rate.

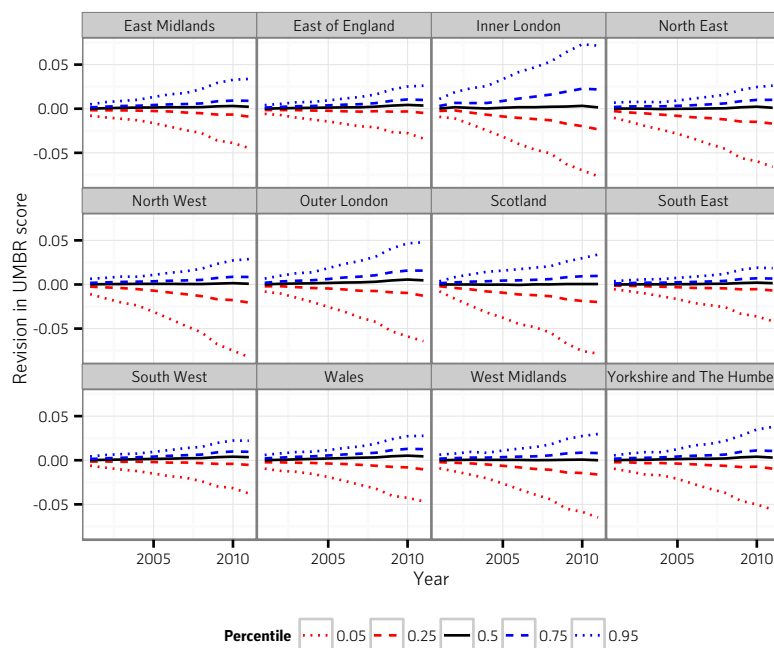


Figure 1: UMBR-14 revisions by year and region, values at selected percentiles

Typological pattern of UMBR revisions

The chart in Figure 2 uses the 2001 Census Area Classification⁴ to analyse the pattern of revisions by area type.

This again shows the greater overall scale of revisions to inner-city areas, notably the "Multicultural City Life" type. More importantly, there are significant downward revisions at the median for the "Disadvantaged Urban Communities" type. This implies that with the advantage of revised population estimates, UMBR-14 estimates for this type of area are generally somewhat lower than those in UMBR-12. The median revision in 2011 is -1.5%.

5 Changes to statistical geographies

The results of the 2011 Census are of unparalleled importance in improving the accuracy of the estimates in a dataset such as UMBR. However, the publication of Census 2011 results has entailed changes to the geographic boundaries to which small-area aggregate data are published, according to the rules and parameters for these small-areas set by ONS⁵.

In England and Wales, Output Areas as well as Super Output Areas have been redesigned, where necessary, on the basis of the 2011 Census results⁶. In Scotland new Output Areas have been created where necessary for the 2011 Census results, but changes to the standard Scottish small-area geography used in UMBR, the Datzone,

⁴ The 2011 Census Area Classification has been recently released, but is currently only available for the Output Area Geography in England and Wales.

⁵ The minimum and maximum household and population sizes for an LSOA are given at <http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/census/super-output-areas--soas-/index.html>

⁶ Office for National Statistics (2012) *Changes to Output Areas and Super Output Areas in England and Wales, 2001 to 2011* <http://www.ons.gov.uk/ons/guide-method/geography/products/census/>

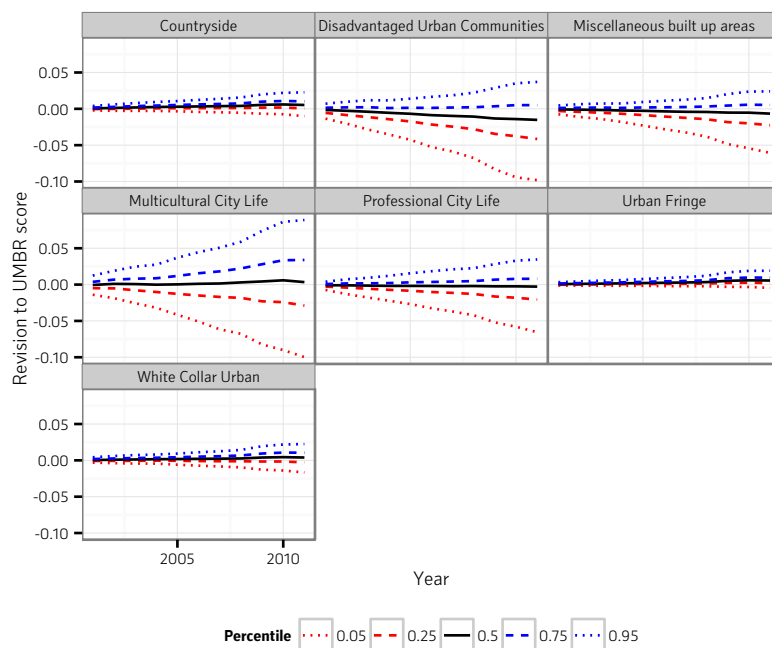


Figure 2: UMBR-14 revisions by year and neighbourhood type, values at selected percentiles

have not yet been finalised⁷.

Other government agencies, such as DWP, have not yet adopted the new Census 2011 geographies, and continue to publish administrative data to the 2001 boundaries. UMBR-14 must therefore combine data published to different sets of boundaries which are largely, but not wholly, compatible. The approach to combining statistical geographies follows these principles:

- to use standard geographies (LSOAs) in their current (2011) version for output;
- to enable typical analyses to proceed with little or no alteration;
- to provide a data set that includes all values from the source data, consistent with figures for higher-level areas;
- to give values for as many geographies as possible, where the available data directly provide figures or enable reasonable estimation;
- to mark clearly where figures are unavailable or subject to estimation.

More detailed information on how ONS boundary changes are handled in UMBR is provided in the technical information.

Effects of spatial unit boundary changes

Each case in UMBR-14 has a field `Geog.Indic`, which indicates whether and how that area has been affected by boundary changes. The codes and possible types of changes are as follows:

A areas composed only of one or more whole source data geographies, no special techniques used. Note that such areas are still affected by rounding, best-fit and disclosure-control techniques used in the source data.

⁷ Scottish Government (2011) *Datazone Consultation Response* <http://www.scotland.gov.uk/Topics/Statistics/sns/SNSRef/DZresponseintro>

B areas affected by irregular boundary changes by ONS, and/or composed of smaller geographic units where some values have been apportioned.

C and Cx areas with major population increases or decreases, and thus multiple new areas in source data. UMBR data is reported jointly for a composite of several contiguous LSOAs within one MSOA, all of which have the same rate. Count data (claimants and households) for areas marked **Cx** is missing ("NA") and held for all the areas under a corresponding **C** area, noted by the `Geog.XRef` field.

Areas marked **B**, **C** and **Cx** are likely to suffer additional estimation error and in some cases unreliable estimates. The proportion of areas affected is shown in Table 2:

	A	B	C	Cx
England	97.6	0.6	0.7	1.1
Scotland	100.0	0.0	0.0	0.0
Wales	98.1	0.7	0.5	0.8

Table 2: Geography change indicators by country, per cent of areas affected

Note that in Scotland, five Datazone codes do not appear in UMBR-14. As a result of large decreases in population between 2001 and 2011, these Datazones now have no 2011 Census data attached to them by the best-fit method used to produce the Scottish Census results.

Using the geography changes in analyses

Changes to geography are intended to be for most uses of UMBR transparent to the user, so that no special handling of cases is needed. For higher-level analysis, one can simply aggregate and sum `A11.MTB` and `Hhols` to higher geographies such as MSOAs, Wards, Local Authorities or Parliamentary Constituencies, omitting missing values. The UMBR rate for the higher geography is then simply the summed numerator (`A11.MTB`) divided by the summed denominator (`Hhols`).

Analyses of rates over time, and codings of other datasets using UMBR should be in most cases robust to the effects of the changes. Where the results of interest are at the boundaries of significance, it may be useful to repeat the analysis omitting areas affected by boundary changes.

6 Technical Information

The Numerator: Means-Tested Benefit Claimants

The numerator of UMBR is the sum of claimants of the following benefits:

Job-Seeker's Allowance (JSA) both Income-based and Contribution-based claimants are included

Income Support (IS) welfare changes mean that several groups of Income Support claimants such as older people and some lone parents were transferred to other UMBR benefits during the period

Pension Credit (PC-GC) 2003 onwards; only claimants who claim the "Guarantee Element" are included

Employment Support Allowance (ESA) 2008 onwards; both Income-based and Contribution-based claimants are included

Universal Credit (UC) 2013 onwards, pilot areas only

Quarterly data for JSA, IS, PC-GC and ESA are extracted from NOMIS⁸ and averaged over four calendar-year quarters. Data for newly introduced benefits (PC, ESA, UC) are still averaged over a full year, even where in the year of introduction data for only some quarters are available.

The heavily delayed introduction of Universal Credit means that over 2013, when the first pilots were started, there was a monthly average of only around 1,200 claimants across Great Britain, heavily concentrated in a small number of pilot authorities (Wigan, Oldham, Tameside and Warrington). Local authority and LSOA claimant data for Universal Credit has not yet been made publicly available. UMBR-14 therefore takes the four Job Centres with more than 100 UC claimants as at the end of 2013 and allocates UC claimants at these to the corresponding local authority. Since in the pilots, only single people without work were handled under UC, local authority counts of UC claimants are distributed across that local authority's LSOAs in proportion to the LSOA's 2013 share of JSA claimants.

In general, the stability of a proxy measure like UMBR and its comparability over time depend in part on the stability of the administrative system from which the data are drawn. Clearly, while there has been some continuity in the British welfare system in the 2000s, there has also been major changes in benefits for low-income people of retirement age, lone parents and those unable to work through sickness or disability. Further wide-ranging changes have been introduced since 2010, which have only been partly thus far implemented.

Estimation of OA-level benefits data

DWP's counts of benefit claimants, which provide the numerator for UMBR, are not generally available for Output Areas or 2011 LSOAs, only 2001 LSOAs. This means that for areas whose boundaries have changed, published 2001 LSOA figures must be assigned to 2011 geographies.

To do this, the means-tested benefit claimant counts in the source 2001 LSOA data is first distributed among the OAs that constitute that LSOA (see below), before being re-summed to 2011 boundaries.

Each OA's share of its LSOA parent's claimants is calculated from two indicators:

1. The 2001 Census count (from table CAS030) of all people aged 16-74 in households who are either:
 - Unemployed;
 - Permanently sick or disabled; or
 - Looking After Family/Children *AND* not living in a couple
2. The rounded count of Out-of-Work benefit claimants in that OA, in the data published by DWP at that level for 2013 only (four-quarter average).

The actual indicator for an OA in a given year is a time-weighted average of these two numbers. They are evenly weighted in 2001, and the weight of the Census 2001 data is then steadily reduced to zero in 2013. The indicators and weighting were selected by manually maximising the Pearson correlation between them and the LSOA count of all means-tested benefit claimants from 2001 to 2013. The final indicator has a correlation of ≥ 0.94 in all years.

⁸ <http://www.nomisweb.co.uk>

Household Estimates

The details of the procedure for estimating numbers of households in each LSOA and Datazone in each year is as set out previously in a SPCC Research Note⁹. In overview it entails:

1. Starting with the annual small-area adult population estimates produced by ONS (England and Wales) and GROS (Scotland), banded into twelve (ten in Scotland) groups by age band and sex.
2. From this, deriving the population living in households, by deducting the number in each age/sex group living in communal establishment in the 2001 and 2011 Censuses
3. For each age/sex group in each area, calculating the proportion of that group who are household representative persons (the "household representative rate") in the 2001 and 2011 Censuses
4. Multiplying the household population in each age/sex group by the household representative rate for that group to give a number of households, then summing across all age/sex groups in each area
5. Constraining the totals for all areas in each local authority to the published estimate or projection of households in that area.

Small-area population estimates are not yet available for 2013. The base household counts in each area are thus instead calculated by applying the four-year (2008 to 2012) annualised change rate for that area to the 2012 total before constraining to local authority projections as normal.

For all three countries, the latest national household projections based on 2011 Census results are used. In Scotland, these indicate an implausibly large shift from recent trends in some areas, and so they are averaged with the results of a straight-line projection. In England, the latest local authority household figures do not include values for 2002 to 2010. These are interpolated per local authority, with the rate of change between 2001 and 2011 proportional to the all-England change in population.

Geographic matching of main datasets

The source datasets are used with the following geographic transformations or recodings:

2001 Census data (households, residential establishments) summed from 2001 OAs to included 2011 LSOAs by one-to-one matching

2011 Census data (households, residential establishments) direct 2011 values used, summed to included LSOAs

DWP Benefits apportioned from 2001 LSOAs to 2001 OAs, then re-summed to 2011 boundaries

Inter-censal small-area population estimates Now published by ONS to 2011 boundaries in England and Wales

All Scottish data consistent 2001 Datazone estimates used, five deleted Datazones are omitted

⁹ A Fenton (2012) *Post-censal household estimates for small areas* <http://sticerd.lse.ac.uk/dps/case/spcc/rn003.pdf>

For these, the approach taken to converting data from 2001 to 2011 LSOA geographies is to work with data at the smaller 2001 OA level, and then match these more precise boundaries to the larger 2011 LSOAs. Even where boundaries have been redrawn due to housing and population change, the large majority ($\approx 90\%$) of OAs affected are unambiguously assigned to a single 2011 LSOA.¹⁰

A small number of 2001 OAs have been split into multiple 2011 LSOAs. This normally occurs where large quantities of housing have been completed and occupied on sites that had in 2001 few or no occupied dwellings. For these areas there is insufficient available to attribute data to one of the resultant LSOA.

Allocation of Output Areas to LSOAs

The 2001 Output Areas are matched to 2011 Output Areas (which may be one-to-one, one-to-many or many-to-one). These are then matched onto 2011 LSOAs (which is always one-to-one). The matching is done as follows:

- 2001 Output Areas belonging to only one 2011 LSOA are attributed to it. These correspond to those labelled **A** or **B** in the UMBR dataset
- 2001 Output Areas belonging to two or more 2011 LSOAs within the same MSOA: the LSOAs are combined and reported together. These correspond to those labelled **C** or **Cx** in the UMBR dataset
- 2001 Output Areas belonging to two or more 2011 LSOAs in two or more MSOAs: assigned to an LSOA in the MSOA where the majority of the corresponding 2011 Output Areas lie, combining 2011 LSOAs if necessary. In the case of ties (4), random assignment is used. These are labelled **B**, **C** or **Cx** in the UMBR dataset.

This produces 1) a table linking every 2001 Output Area to a 2011 LSOA and 2) a table for all 2011 LSOAs, with the LSOA code where its data is enumerated (in most cases, itself). These tables are available on request.

Deleted Scottish Datazones

The following five Scottish 2001 Datazones are omitted in the 2011 Census results, and thus do not appear in UMBR-2014.

- S01002296 (Edinburgh)
- S01003505, S01003031, S01003319, S01003548 (all in Glasgow).

The population estimate report¹¹ reports three of these as having 0 population in 2011, with the two remaining having falls of $>50\%$. These are thus areas which as a result of falling population no longer have any Census Output Postcodes assigned to them by the best-fit method used in Scotland to produce the Datazone Census figures.

¹⁰ It is likely more accurate conversions could be made by analysis of the postcode records and postcode-level household and population data from the Census. This is the technique employed by Geoconvert, where, however, no conversions to 2011 geography are yet available. The complexity of such conversion is, however, beyond the scope of UMBR, and also leaves unresolved uncertainties about the inter-Censal years.

¹¹ National Records of Scotland (2013) *2011 Census Reconciliation Report – Small Area Population Estimates (SAPE) Scotland: Explaining the difference between the 2011 SAPE rolled-forward from the 2011 Census and the 2011 SAPE rolled-forward from the 2001 Census* <http://www.gro-scotland.gov.uk/statistics/theme/population/estimates/special-area/sape/>. See esp table 3.5.

7 Licence and Reuse

The accompanying data are adapted from data from the Office for National Statistics licensed under the Open Government Licence v.3.0.

The package includes the R script files used to produce UMBR from the source datasets. These are in the folder 'R'. They may freely under a liberal licence (see below) to reproduce or adapt any part of UMBR.

The dataset was prepared using R 3.1.1, and requires the use of the `data.table`=[fn:7] package in particular to handle the relatively large datasets efficiently. The tables and figures in this *README* file can be recreated using the accompanying R or emacs-org files (=umbr-14-README.R, umbr-14-README.org).

Licence of files

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