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Introduction

New 2011 Travel to Work Areas (TTWA) have been defined using 2011 Census origin-destination data, covering lower layer super output areas (LSOA) in England and Wales, data zones (DZ) in Scotland and super output areas (SOA) in Northern Ireland – for brevity referred to as LSOAs in the methodology section. The 2011 TTWAs have been created without being constrained to national boundaries, and form a UK wide set of 228 TTWAs. These definitions have been produced with support from Newcastle University. This note provides a short description of the data and methodology used to create the TTWAs.

Data

The 2011 Census commuting flow data used to create the TTWAs was a matrix of origin by destination commuting flows for workers aged 16 and over - including students who were working, based on residence postcode and address of the place of work in main job.

In addition to workers with differently recorded home and work addresses, workers were also included if they stated that they mainly worked at or from home, worked at an offshore installation, or stated no fixed workplace. In each of these cases their home residence address was used as their destination workplace. Sensitivity testing was done to examine the impact of including or excluding each of these sets of workers in turn for creating the TTWA, the outcome was that it was considered that the best TTWA results were obtained by including all of these workers.

The data used differs slightly to the input data used for the 2001 TTWAs as workers at an offshore installation were excluded. As with the 2001 TTWAs, workers who stated that their workplace was outside the UK were excluded.

Data were provided at: (1) output area (OA) for England and Wales and (2) Scotland, and aggregated to LSOA level and DZ level respectively, and (3) SOAs in Northern Ireland (no aggregation required). For Scotland, the data supplied were aggregated to 2001 DZs as 2011 DZs had not been defined at the time.

The final TTWAs are based on aggregations of LSOAs (34,753), DZs (6,976) and SOAs (890). For Scotland the initial TTWAs were based on aggregations of 2001 DZs (6,505), and these TTWAs were then redefined using a best fit of 2011 DZs. Checks were also undertaken that the reworked TTWAs based on 2011 DZs still met all the criteria for a TTWA (as outlined in the methodology section).

Methodology

The algorithm to be applied to the data uses the number of work journeys between LSOAs. It groups the LSOAs into areas in such a way that most workers living in an area also work in the same area and most people who work in an area also live there. There is no single theoretically correct algorithm for grouping LSOAs to meet this objective. The algorithm was therefore developed by testing various alternatives and selecting the best that has been developed over the time of the research. The current algorithm is the one developed by Newcastle University

and with slight adaptation is as-used for previous TTWA definitions and now also used in other countries.

In assessing the relative merits of various alternatives, the factors taken into account include:

1. Maximising the number of self-contained areas resulting from a given algorithm.
2. Restraining the size of the largest TTWAs and in particular the one centred on London (to curtail its tendency to swallow up the South East, whilst ensuring that the TTWAs which surround London are each sensible labour market areas).
3. Minimising change to the 2001 definitions, to support as far as possible meaningful inferences of change over time.

In measuring the strength of the commuting link between two areas a formula is required which takes account of journeys in both directions. A decision as to whether to attach an LSOA to a particular area should depend not only on the number of people who commute from the LSOA to the area concerned but also on the number who commute in the opposite direction.

The formula needs also to take account of the size of the areas concerned; if a choice is being made to attach a LSOA to one of two areas, a simple comparison of the numbers of journeys involved would tend to favour the choice of the larger area. This consideration is particularly important in arriving at an algorithm which produces a substantial number of TTWAs without needlessly combining distinct areas. In particular, it aids the identification of separate TTWAs in the surroundings of large cities.

In calculating the formula, the flow from area A to area B is measured as a proportion of the residents in area A and also as a proportion of the jobs in area B and these two proportions are multiplied together to give a measure of the "importance" of that flow for the areas concerned. The full formula is the sum of the "importances", measured in this way, of the flows in each direction between the two areas.

Algebraically the formula is:

$$\frac{F_{a,b}}{R_a} * \frac{F_{a,b}}{W_b} + \frac{F_{b,a}}{R_b} * \frac{F_{b,a}}{W_a}$$

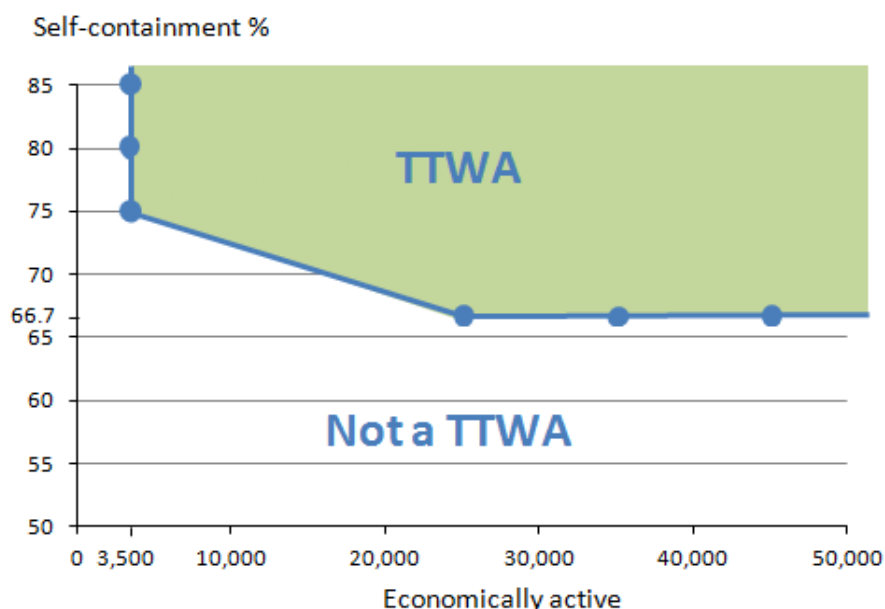
Where $F_{a,b}$ is the number of journeys to work from area A to area B; R_a is the number of workers who live in area A; and W_a is the number of people who work in area A.

An index is also needed which assesses whether a grouping of LSOAs comprises a viable TTWA. This index is a statistical function which evaluates potential TTWAs on the following principles:

- (i) An area with self-containment - on both residence based and workplace based measures - exceeding 75% and at least 3,500 workers living in the area should be accepted.
- (ii) An area with self-containment - on both measures - exceeding 66.67% and at least 25,000 workers living in the area should be accepted.
- (iii) An area in which fewer than 3,500 workers live should be rejected.
- (iv) An area with self-containment - on either measure - of less than 66.7% should be rejected.

(v) For areas where between 3,500 and 25,000 workers live, the minimum self-containment required - on both measures - for acceptance as a TTWA should progressively decrease from 75% for the smallest areas to 66.7% for the largest.

The chart below shows schematically how the viability of each TTWA is considered based on the area's economically active population and its self-containment. Self-containment here refers to the lower of the residence based or workplace based self-containment values.



The algorithm creates TTWAs through an iterative process of splitting up the area that has the lowest value on the index (note this may be a single LSOA initially, or a group of LSOAs later), reassigning the individual LSOAs to other LSOAs/groups of LSOAs using the formula above. Within this process, all possible reassignments are considered (not just those involving neighbouring areas). The process stops when all groups are viable TTWAs, and a set of draft TTWAs have been produced.

There then followed a period of stakeholder engagement to identify any peculiarities with the draft TTWAs, or to identify potential improvements in order to ensure that the final TTWAs were fit for purpose. A set of criteria were applied in accepting or rejecting changes to the draft TTWAs. Non-contiguities were also resolved whereby small areas allocated to a particular TTWA were geographically separated from the main part of a TTWA.

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