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Geodemographic travel to work flows into London, UK.

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Abstract

We present a method for using geodemographic classifications to profile travel-to-work flows into and within London, UK. Geodemographics have been used in the past to profile these flows, but have focused on the residential locations of flow origins due to limitations in data availability and appropriate spatial units. The 2011 census in England and Wales introduced new spatial units designed specifically for workplace data, leading to creation of a classification of workplaces and workers. Combining this workplace classification with a residential based equivalent means the flows between each can be calculated. This innovative approach results in a two-way classification which can be interrogated to better understand and simplify the complexities of commuting into and within London, thus exploring travel to work within a global city at fine spatial resolution.

1. Introduction

Travel to work flows enhance our understanding of local labour markets, economic delivery, transport planning, daytime service delivery and general mobility within a population. Traditional sources of these data, such as national censuses, provide detailed outputs (Stillwell et al., 2010), however the level of complexity that accompanies such rich and large datasets makes any attempt to summarise, visualise or interpret the flows challenging. For example, 4.5 million travel to work flows were recorded into and within London in the 2011 census in England and Wales.

A solution to this problem is to reduce the level of complexity by using geodemographic classifications – summary indicators of the social, economic, demographic and built characteristics of small areas. However, conventional geodemographic classifications focus on residential populations, rather than those of the workplace, with the 2011 Area Classification for Output Areas (2011 OAC) (Gale et al., 2016), being one such example. Without an accompanying workplace classification, the scope for geodemographic analysis of travel to work flow data are limited. The creation of the Classification of Workplace Zones for England and Wales, or COWZ-EW (Cockings et al., 2015), using a new workplace geography of England and Wales (Martin et al., 2013) is therefore an important development. Combining the 2011 OAC and COWZ-EW to profile places of work and residence allows for a unique insight into the population flows into London.

2. Data and methods

The 2011 OAC (Gale et al., 2016) is a geodemographic classification of the UK created using 2011 census data for output areas (OAs). OAs are the smallest geographical units for which census residential statistics are available in the UK. The 2011 OAC is the most recent example of a residential based classification based on census data, with previous classifications created based on 2001 (Vickers and Rees, 2007), 1991 (Blake and Openshaw, 1994, 1995) and 1981 (Charlton et al., 1985) UK census outputs. Conversely, COWZ-EW takes advantage of a new type of small geographical units for workplace statistics from the latest census of England and Wales in 2011. These units, known as workplace zones (WZs) (Martin et al., 2013), allowed for a classification based on the characteristics of the workplace population at places of work

to be constructed for the first time in England and Wales (Cockings et al., 2015). The 2011 OAC and COWZ-EW share some input variables, such as employment types. However, these primarily relate to individuals and are required to characterise both residential and workplace locations and hence use different geographical referencing frames. Variables primarily focused on residential characteristics, for example, are absent from the workplace classification.

The 2011 OAC and COWZ-EW are both hierarchical classifications, with the 2011 OAC consisting of 8 Supergroups, 26 Groups and 76 Subgroups; while COWZ-EW consists of 7 Supergroups and 29 Groups. For consistency we use the designated nomenclature of each cluster in our analysis to provide descriptive shorthand labels for the different area types, although the analysis presented here is restricted to using only the Supergroup level of each classification. However, the methods used could also be applied to other tiers in each classification.

The aim of our analysis is not to provide a comprehensive analysis of travel to work patterns into and within London, but rather to demonstrate an alternative approach to established techniques like the use of Travel to Work Areas (TTWAs), often known internationally as Labour Market Areas, (Coombes and Bond, 2008; Coombes and ONS, 2015) to understand the complexities of population flows. To that end, we examine travel to work flows in terms of travel from the 2011 OAC (residential) to COWZ-EW (workplace). This is facilitated by the availability of 2011 census data for England and Wales detailing counts of persons travelling from their OA of residence to their WZ of primary employment. In total there are 26.6 million flows in England and Wales and 4.5 million flows into and within London. It would be interesting to extend this analysis by considering travel to work in terms of time rather than distance, but this is not asked in the census, nor is there information on the composition of multimodal journeys. Estimation of these extra flow dynamics using external data is however a potential extension to the research presented here.

Characterisation of journeys to work can be undertaken in terms of both where a journey originates (the 2011 OAC) and by its destination (the COWZ-EW). A 56-way classification of journeys to work can therefore be created based on the 8 2011 OAC and 7 COWZ-EW Supergroups. To demonstrate the potential of this new data combination we use the example of flows into and within London, UK. London's status as a special settlement within the UK (Petersen et al., 2011) and the net increase of 500,000 people aged between 16 and 74 in employment during the day make it a challenging study of real substantive interest.

3. Results

Figure 1 maps the 2011 OAC (left) and COWZ-EW (right) at the Supergroup level in south east England, with the boundary of the Greater London administrative area shown. While the detailed pattern of individual OAs and WZs is not visible at this level some general observations can be made. Firstly, the Supergroups labelled as rural in both classifications cover the majority of non-urban areas. Secondly, the other clusters in both classifications are essentially urban or suburban in nature, thereby highlighting the towns and cities of south east England. A comparison of the two classifications in London shows differences in the internal subdivision, with the 2011 OAC displaying a broadly concentric pattern of urban and suburban clusters. Conversely, COWZ-EW displays the 'Top Jobs' Supergroup is predominately found in central areas with outer areas being primarily classified as 'Metro Suburbs'.

Table 1 provides a summary of the commuting flows from 2011 OAC Supergroups to COWZ-EW Supergroups located in London. Each cell contains the number of people in employment travelling from all OAs in one 2011 OAC Supergroup located anywhere in England or Wales to all WZs in one COWZ-EW Supergroup found in London, a measure of how this differs from expected and the median distance travelled. Our table effectively provides a new geodemographic classification of journeys to work. Values in the cells show the total flow

between each pair of groups (mean value 80,799), divergence from uniformity (in brackets) and the median distance travelled for each pairing. Divergence from uniformity is calculated using the observed minus the expected flow, divided by the expected flow, which is the flow that would be expected if residence and work locations were uniformly mixed. Values greater than 1.0 or lower than -0.5 have been highlighted in the table.

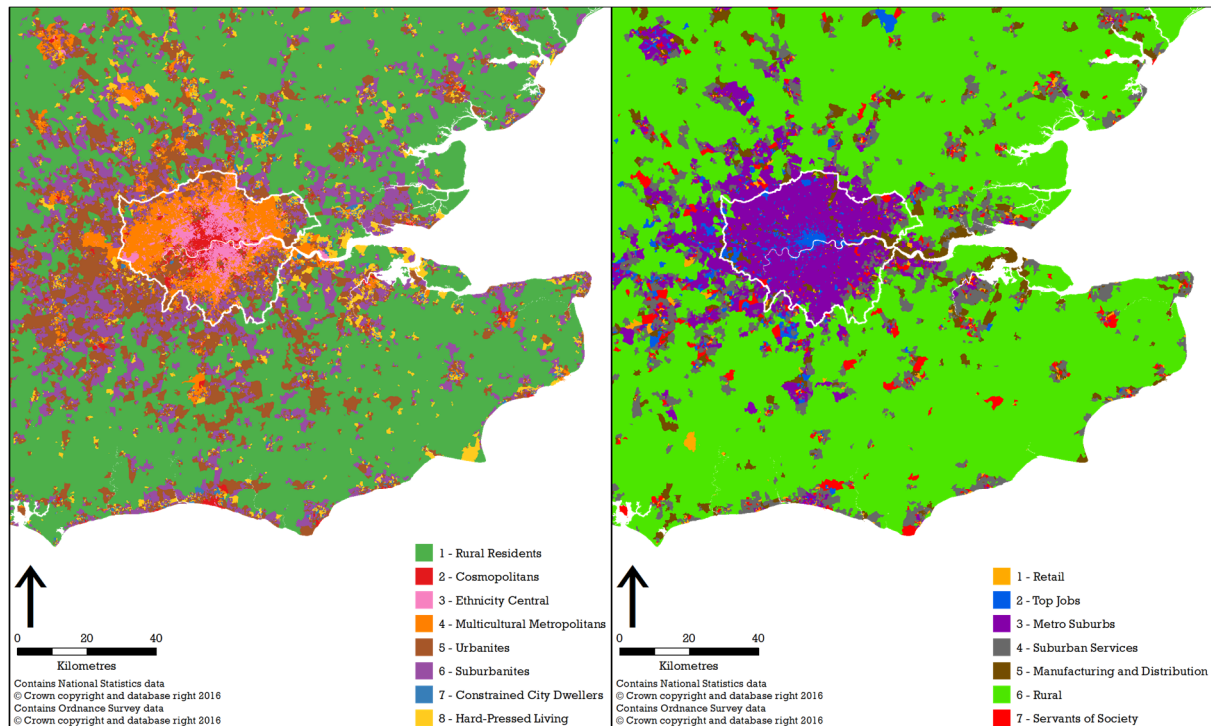


Figure 1. 2011 OAC Supergroups in south east England (left), COWZ-EW Supergroups in south east England (right).

Flows to ‘Top Jobs’ and ‘Metro Suburbs’ dominate journeys into and within London, accounting for 90% of all commutes; with the majority of these being close to the expected flow levels. There are notable exceptions to this, such as a larger than expected number of flows occurring from ‘Rural Residents’ to ‘Top Jobs’ (0.5), with a median distance travelled of 75.2km; an indication of the willingness and financial resources of some to commute large distances in order to live in rural areas outside of London. In general people appear to be willing further to travel to ‘Top Jobs’ than ‘Metro Suburbs’, as evidenced by the lower than expected flow from ‘Rural Residents’ to ‘Metro Suburbs’ (-0.61) coupled with a median distance to travel of 62.3km. The larger distances travelled to reach ‘Top Jobs’ are likely to a combination of the attractiveness of the jobs in these areas and because the areas where ‘Top Jobs’ intersect for the most part only with the 2011 OAC Supergroups ‘Cosmopolitans’ and ‘Ethnicity Central’.

An alternative method of analysing the flows between places of home and work is to map residential areas according to the destinations of their primary flows. Figure 2 maps OAs in southern England in terms of the COWZ-EW Supergroup destinations in London of their first, second and third largest commuting flows. The geographic extent in which people commute to London is shown in the first order map. A notable feature is that the majority of OAs across southern England contain individuals who commute into London, with the most likely destination being the ‘Top Jobs’ Supergroup. The second order map shows the reduced geographic area of flows into London with most travelling to ‘Metro Suburbs’, although a greater mix of COWZ-EW Supergroups is apparent. The third order map reveals a greater

complexity of more localised flows into and within London, with ‘Retail’ and ‘Manufacturing and Distribution’ being the most visible within London.

Table 1. Observed flows of 2011 OAC to COWZ-EW Supergroups in London: count of flows, (divergence from expected), median distance (km)

2011 OAC (rows) and COWZ-EW (columns)	1: Retail	2: Top Jobs	3: Metro Suburbs	4: Suburban Services	5: Manufacturing and Distribution	6: Rural	7: Servants of Society	Total
1: Rural Residents	732 (-0.59) 32.8	50,273 (0.5) 75.2	10,228 (-0.61) 62.3	332 (-0.41) 17.5	2,638 (0.05) 49.5	994 (6.32) 0	1,004 (-0.13) 42.1	66,201 (0.73)
2: Cosmopolitans	6,508 (-0.62) 3.0	434,008 (0.37) 6.0	174,394 (-0.3) 0.1	551 (-0.90) 6.1	5,909 (-0.75) 8.1	131 (-0.9) 13.6	4,396 (-0.6) 4.6	625,897 (-0.53)
3: Ethnicity Central	24,816 (-0.31) 4.2	675,442 (0.01) 6.3	578,072 (0.09) 0.9	1,155 (-0.90) 8.8	30,058 (-0.4) 5.3	434 (-0.84) 13.0	12,624 (-0.45) 4.7	1,322,601 (-0.4)
4: Multicultural Metropolitans	48,712 (0.31) 3.8	530,693 (-0.24) 11.8	689,129 (0.26) 1.3	4,554 (-0.61) 3.6	74,164 (0.42) 4.8	1,216 (-0.57) 8.2	25,542 (0.07) 3.8	1,374,010 (-0.05)
5: Urbanites	20,341 (0.24) 3.7	329,112 (0.07) 23.0	194,417 (-0.19) 3.5	13,682 (1.66) 0.0	26,321 (0.15) 11.1	2,732 (1.2) 1.9	17,551 (0.67) 4.9	604,156 (0.54)
6: Suburbanites	13,227 (0.31) 4.2	203,980 (0.08) 32.6	109,598 (-0.26) 5.5	13,290 (3.2) 0.0	17,855 (0.26) 17.1	2,667 (2.49) 1.5	11,592 (0.79) 5.7	372,209 (0.98)
7: Constrained City Dwellers	3,272 (1.18) 4.3	24,192 (-0.14) 29.4	18,897 (-0.15) 7.7	1,632 (2.45) 0.7	5,075 (1.4) 11.2	357 (2.13) 4.9	2,194 (1.27) 5.7	55,619 (1.16)
8: Hard- Pressed Living	4,759 (0.69) 5.6	49,832 (-0.06) 38.0	31,523 (-0.24) 14.4	3,299 (2.73) 0.3	10,103 (1.55) 17.5	753 (2.53) 5.3	3,755 (1.08) 9.0	104,024 (1.18)
Total	122,367	2,297,532	1,806,258	38,495	172,123	9,284	78,658	4,524,717

4. Conclusion

We have combined residential and workplace geodemographic classifications to provide a unique method of exploring the structure of travel-to-work flows. The example of flows into and within London provides an illustration of the different methods of investigation possible, such as exploring the characteristics of flows from home to work, identifying the level of connectivity between different clusters and the distances people are prepared to travel. This has been made possible by the release of origin and destination data from the 2011 census in England and Wales at a granular level as an open dataset. These data are however limited to only providing counts of OAs to WZs due to disclosure control. A potential future avenue of research on this topic would be through the use of microdata to explore the demographic and socio-economic characteristics of individuals. Linking flow data and individual characteristics of commuters with geodemographic classifications would provide a rich dataset that could further enhance our understanding of the complexities of travel-to-work flows.

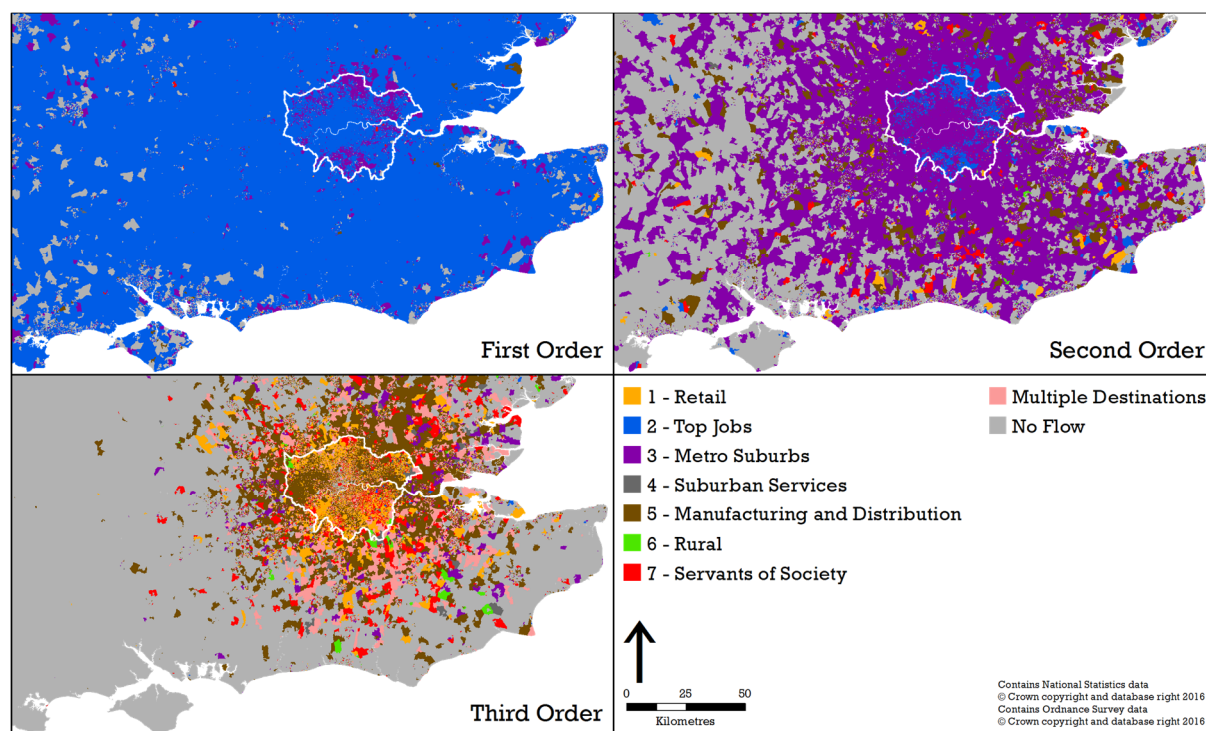


Figure 2. First, Second and Third order dominant COWZ-EW Supergroup destinations in London by output areas

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