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The evolution of Local Labour Market Areas in contrasting regions

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Abstract

In many local labour markets across Europe and elsewhere, a rapidly growing minority of workers are making long commuting trips. One consequence for research into journey-to-work flows which seeks to identify the boundaries of local labour market areas (LLMAs), is that these boundaries represent a 'snap shot' of an increasingly volatile pattern. In fact, it remains an unmet challenge for regional science to represent the way commuting patterns are evolving. Is it sufficient to simply update maps, using a consistent method which is then applied to successive 'snap-shot' datasets? This approach will be illustrated in contrasting regions. On the other hand, are there alternative forms of analysis better able to identify areas where change has been greater – or less – than elsewhere? The paper will end with some explorations in pursuit of this aim.

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1 Introduction

As the OECD (2002) showed recently to be also true of many countries now, the government in Britain has long recognised the need to have a set of accurate and consistent definitions of local labour market areas (LLMAs) for statistical and/or policy purposes. Several decades ago the response was to define Travel to Work Areas (TTWAs) based on the most up-to-date data available on commuting patterns (Smart 1974). From a more academic standpoint, the policy uses of these TTWA boundaries is very significant because they make it essential that the TTWAs are a set of 'crisp' – rather than fuzzy – LLMA boundaries. The result is that when these boundaries are updated the effect tends to be rather dramatic; these changes only occur intermittently, partly to reduce the inconvenience of this discontinuity in boundary definitions but mainly because the data necessary for their updating tends to be only available once per decade. This pattern of intermittent but disrupting change in 'crisp' boundaries is a familiar one in the British policy context, where changes to the boundaries of local government areas occur in a similar way. This pattern can be contrasted with academic, and perhaps commercial, research which is less in need of 'crisp' boundaries and so can recognise that in reality most socio-economic objects have much more indeterminate boundaries (Burrough 1996). For example, a town's hinterland, or the area where a language is spoken, is an area with a fuzzy boundary because it is essentially the clustering of spatial behaviour which has meaning but which is prone to changing in a near continuous process of evolution. The relevance here of the fuzziness and changeability of the 'real world' is that boundaries such as those of TTWAs aim to represent 'real' patterns underlying commuting flows. Patterns like these constantly change, so the boundaries can only be a crisp 'snap shot' which simplifies a fuzzy reality, whilst also ossifying patterns which continue to gradually evolve.

The paper next provides a brief review of the factors leading to changing commuting patterns. Following this there are LLMA analyses of 2001 Census data in the Valencia region and also the south and east of England so as to assess, in contrasting circumstances, the extent to which updating LLMA boundaries reveals changes in commuting patterns. In the last main section of the paper the same regions are examined in terms of the change in LLMAs' self-containment values. Finally some conclusions are drawn, and a few possible future research strategies are outlined.

2 The evolution of commuting patterns

For this paper, a central question is how best to represent the ways in which commuting patterns are changing. The starting point is the assertion that more research in this topic is well justified, because commuting is one key form of mobility and there can be little doubt that, in modern western economies in particular, there is a major tendency for personal mobility to increase. This trend has been enabled by several factors common to many advanced countries, most notably

- rising average earnings, making greater commuting costs more affordable
- increased car use, enabling more diffused and distended commuting patterns, and
- decreasing real cost of car use.

In some areas, improved transport infrastructure has facilitated longer commuting journeys; because evidence shows people's commuting choices are mainly influenced by commuting *time* rather than distance, they may well commute further when presented with the opportunity to cover greater distances within the same time. In summary, these processes have reinforced each other over recent decades to increase the proportion of people who commute longer distances and, as a result, to increase the integration of previously separate local areas. To give just one example, the main towns of the Ruhr areas were each once largely distinct labour pools, but now there are very substantial commuting flows between many of them (Pumain 2004).

The processes seen to cause the long-term increase in the proportion of workers commuting longer distances are unlikely to diminish in the future, although there are some potentially countervailing pressures. The growth of part-time employment is a particularly important factor, with part-time workers among the least likely to travel longer distances to work. There is also the potential for new work patterns such as telecommuting to allow workers to access more remote employment opportunities without a long journey to work. Other new developments include the emergence of more complex work arrangements and lifestyles, sometimes associated with people making fewer but longer distance journeys to work which are followed by a stay away from home for a few days, perhaps on an irregular basis. More complex working arrangements are often the ways people cope with the increasingly prevalent pattern of dual career households. In many countries recently this pattern has been

one aspect of a growing divergence between ‘work rich’ and ‘work poor’ households. The latter category includes people who rely on low paid, perhaps temporary and often part-time work.

Projecting these trends forward suggests increases in the segmentation of the labour market, which then ranges from an advantaged group who are ever more likely to commute longer-distances – and/or perhaps be involved in complex work patterns such as split-site and periodic telecommuting to reduce the commuting burden – whilst at the other end of the spectrum are the most marginalized group whose jobs may be intermittent and will not pay well enough to warrant commuting very far at all. In practice there is likely to be considerable diversity within this spectrum (for example, a growing number of people with more than one part-time job) but this diversity underlines the basic point here that the future is unlikely to be constrained within the ‘traditional’ pattern in which the vast majority of commuters journeyed daily from their one place of residence to a workplace rarely more than 10km away.

This discussion has so far focussed on the behaviour of individuals and the opportunities open to them in the labour market. Labour supply responds to, and in fewer cases can shape, the pattern of labour demand. Changes to the location of both job opportunities and the housing where the work-force live are part of evolving settlement patterns which were for several decades dominated by growing urbanization. The increasing diversity of commuting patterns summarised here has been linked with urban systems maturing through suburbanisation, and even counter-urbanisation in some cases. The inheritance of closely spaced urban settlements in much of Western Europe led the ESPON study (Nordregio 1999) to suggest polynuclear urban systems are now coalescing in many regions. Seminal changes such as these further emphasise the ‘fuzziness’ of LLMA boundaries when and where the zones of influence of previously distinct urban areas increasingly merge.

3 Updating 'snap shot' boundaries

As already noted, the most familiar way in which changes to commuting patterns are observed is by the updating of an established set of LLMA boundaries. The longest sequence of boundary updating in a relevant field is the repeatedly revised sets of Metropolitan Statistical Areas which have been defined the USA since the 1950s (Frey and Speare 1995). The drift towards longer commuting distances has for many decades been visible in the gradual shrinking of the areas which are not in any city's labour catchment area. This simple form of analysis is less successful in more highly urbanized regions – not only in parts of the USA but also across much of Europe – because there almost all settlements have been within one or more city's catchment area for a long time. In any case, representing modern patterns of commuting solely by flows to cities from non-city areas ignores a diversity of recent developments such as counter-urbanisation and the suburbanisation of employment, not to mention the emerging polynuclear urban systems in which city-to-city flows are especially prominent. These limitations of the simple city-and-hinterland model partly explain why the methods for defining Metropolitan Statistical Areas have had to be revised repeatedly over the decades (Fitzsimmons and Ratcliffe 2004).

Applying a consistent methodology to each new period's dataset is the basic approach which has been adopted in Britain since the 1981-based definition of TTWAs (Coombes et al 1986). This section of the paper evaluates how far the updating of TTWAs can give helpful evidence on developing local labour market patterns. This evidence will mainly emerge due to the increase in journeys to work distances which cause more commuters to cross any given boundary: since the TTWA definition criteria focus on the ***self-containment*** of commuting within the boundaries, the gradual increase in longer distance commuting can cause an existing TTWA which had previously been just above the minimum acceptable self-containment level to fall just below when the more up-to-date information is analysed. The question is whether monitoring this TTWA boundary change – and particularly the merging of previously separate TTWAs – provides useful insights to the degree and nature of change in commuting patterns. There are grounds for scepticism at the outset, because the updating process may well leave unchanged those TTWAs which had had very high self-containment

levels, even though the gradual lengthening of commuting trips is very likely to have happened there too.

3.1 TTWAs in south and east England in 1991 and 2001

To understand how to interpret the difference between 1991- and 2001-based TTWAs, it is first necessary to recognise the basis of the TTWA definitional method. The primary design objective follows from the need to maximise the detail of the unemployment statistics which are published for these areas (Dept of Employment, 1984). As a result the aim is to define as many TTWAs as possible, subject to certain statistical constraints which ensure that TTWAs are not so small as to make them statistically volatile. In particular, they must all meet a minimum level of commuting self-containment: that is, a relatively low proportion of a TTWA's resident workforce must cross its border to their workplace *and* a similarly low proportion of local jobs must be taken by those living elsewhere. There are numerous alternative methods for boundary definition using flow data (eg. Slater 1976 or Dawson *et al* 1986 or Boatti 1988), but the TTWA method has proved able to produce results which were broadly consistent with widely accepted local knowledge in very different types of area. Eurostat (1992) positively evaluated the TTWA algorithm against the definitions of LLMAs in other European Union countries, and this has been reflected in the Italian Statistical Office ISTAT basing the definition of Italian LLMAs on the TTWA method (ISTAT-IRPET 1989 ; ISTAT 1997), while more recent applications of the method extend to New Zealand (Papps and Newell 2002). Later in this paper, analyses follow Casado-Diaz (2000) in applying the TTWA method to the data for the Valencia region (nb. 1991 commuting data was only available for certain regions in Spain).

The central question for this paper is how well this form of analysis reveals the changes in the pattern of commuting when it is applied to an updated version of the dataset (in this case, 2001 rather than 1991). For practical purposes, the most influential factor in the TTWA definitions is the self-containment of commuting. Commuting distances have lengthened, causing self-containment values to fall, so retaining the same minimum self-containment level makes it entirely understandable that each updating of TTWA boundaries in the past has led to rather fewer separable TTWAs. This outcome raises specific issues, but it is in fact one version of the more general truth that an exclusive emphasis on using the most up-to-date data must involve sacrificing stability through time. A more practical question is whether

updating the boundaries is really a net benefit to users of the areas: over-emphasising recent adjustments to commuting flows tends to focus attention on large numbers of minor adjustments, whilst over-looking the deeper geographical structure which may well have changed very little.

The next step here is to illustrate this discussion with empirical evidence from an initial application of the TTWA method to British 2001 Census data on commuting (with results reported for London and the adjacent Eastern and South East regions). It is essential to first distinguish between two sets of 1991-based boundaries:

- the basic results from the analysis of 1991 data, and
- the eventual "1998 TTWAs" which followed a process of consultation on the draft boundaries from the basic results (ONS and Coombes 1998).

Whilst the existing 1998 TTWAs are the set of boundaries in the public domain, it is the basic results from he analysis of 1991 data which are the relevant comparator set for an initial 2001-based analysis.

Measures of the sensitivity – or stability – of the TTWA definitions are partly shaped by how comparable the 2001 commuting data is to the 1991 data: commuting patterns could appear very different in areas where people's behaviour has changed little if the 2001 dataset was compiled very differently to its predecessors. Three key changes must be borne in mind in the following comparisons of the results from analysing in 1991 and 2001 British data:

- **Students**

  Census day 2001 was during term-time so, unlike in the 1991 data, students are not counted at their parents' addresses: this will tend to reduce the well-established drift of the employed population away from cities (nb. many British students have part-time jobs);

- **Coverage**

  2001 commuting data should provide robust evidence because it covers all workers (nb. in every previous Census the commuting data was based on a 10% sample); and

- **SCAM**

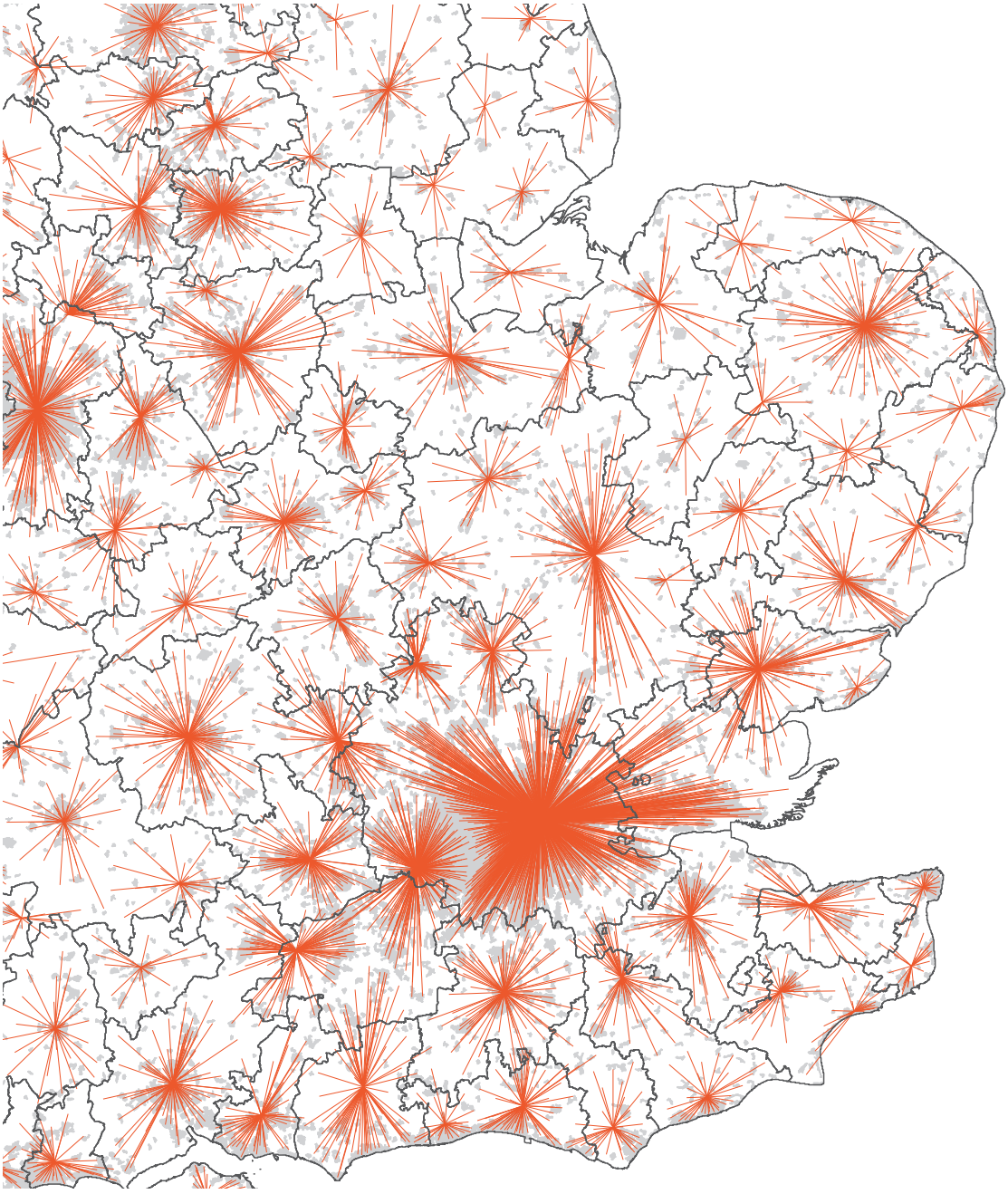
  2001 datasets are subject to a Small Cell Adjustment Method (SCAM) which recodes all values to of 1 or 2 (to either 0 or 3) which acutely affects commuting datasets because these very large matrices are sparse, with the relatively small proportion of cells which are non-zero mostly having a value of 1 (and for many of the others the value was 2**).**

Map 1 provides the first evidence of the difference between the 1991- and 2001-based results. The map covers the Eastern and South East regions of England which are adjacent to London (a region in its own right), with urban areas shaded grey. The unadjusted 1991-based TTWAs are shown as red 'stars' (with a line connecting each of the TTWA's member wards to the centroid for that TTWA). The boundaries shown are from a preliminary TTWA analysis of the 2001 data. These boundaries reveal that the new analysis has produced numerous cases of the initial 2001-based areas grouping together several 1991-based TTWAs (as represented by the stars). This confirms the expected reduction in number of separable areas which follows from the very long-term trend towards more people commuting longer distances.

The map suggests that the London area has shifted in orientation as well as growing in size. The separate 1991-based Slough & Heathrow area to the west has been absorbed back into London while a substantial zone to the north has also become part of the capital's primary labour market area on this initial analysis. An equal surprise is that the area to the east – which had been split from London by the consultation process rather than the basic analysis of 1991 data – emerges here as a separable area (nb. there has been increasing policy concern about a growing east-west divide within the broader London region). Further to the north the Eastern region is dominated by a sprawling 2001-based area centred on Cambridge but, rather less obviously, Norwich too has absorbed some previously separable smaller areas. There are several other more rural areas where small country towns are no longer centres of separable TTWAs in this initial 2001-based analysis. Table 1 summarises the comparison between the 1991- and 2001-based results shown in the map. To conclude, there seems to be a high level of change here in TTWA boundaries; given that long-distance commuting has taken place in the London region for many decades, the question is whether the evidence in south and east England is of TTWA boundaries 'over-reacting' to changes which, in fact, are not anything remarkably new in this region.

Table 1 TTWAs based on 1991 or 2001 data in South/East England

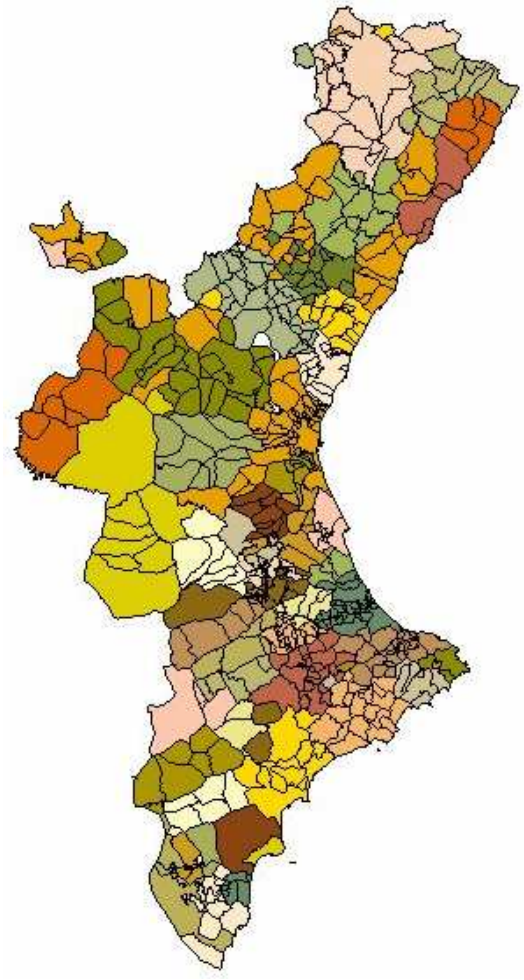
	1998 TTWAs (1991-based)	basic results from 1991 data	initial results from 2001 data
London	1	1	1
South East	28	25	19
Eastern	25	22	12



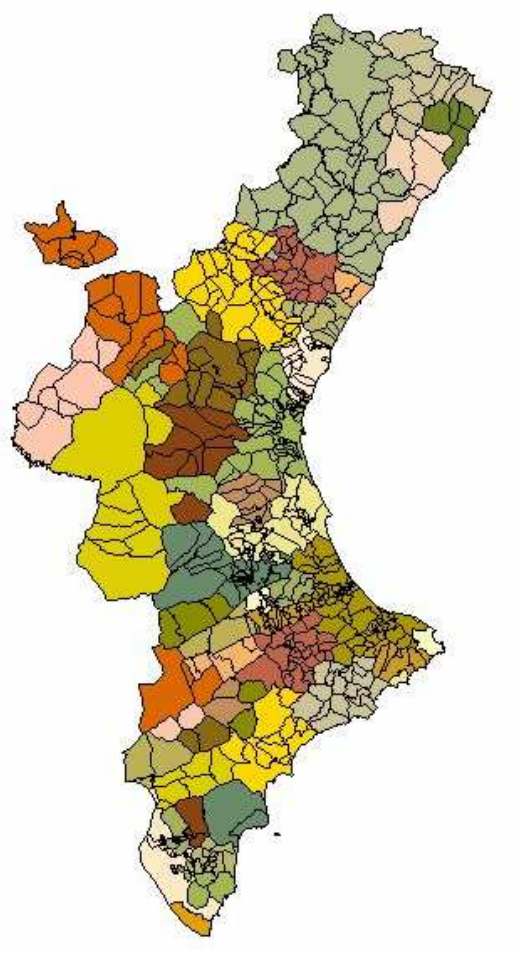
Map 1 TTWAs in South/East England in 1991 and 2001

3.2 TTWAs in Valencia Region in 1991 and 2001

Casado-Diaz (2000) applied the TTWA-based method to 1991 data on the Valencia region (of course, there are several minor differences due to slight differences in available data; for example, the size measure does not include the unemployed in Valencia). Maps 2a and 2b show LLMA boundaries within the region of Valencia derived from the 1991 and 2001 data respectively. There are similar numbers of LLMAs in the two maps, but there is still a form of instability here because many boundaries have altered. This level of 'turbulence' could be summarised as 10 of the 1991-based LLMAs being absorbed into larger groupings, whilst 8 of the 2001-based LLMAs are newly emerged from larger 1991-based LLMAs.



Map 2a Valencia region in 1991: 48 LLMAs



Map 2b Valencia region in 2001: 46 LLMAs

Table 2 shows that the pattern of change in LLMAs was unevenly distributed across the region's three provinces. The pattern of change is largely related to the region's urban structure, with more metropolitan features common to the coastal municipalities in Castellón and Valencia provinces but there is a more sparse pattern of urban settlement in the south of Valencia province and also in Alicante province (where several medium size cities specialise in traditional manufacturing sectors, like textiles, or in the tourism industry, as in the case of Benidorm).

Table 2 LLMAs based on 1991 and 2001 data in the Valencia region

Province	1991-based LLMAs	2001-based LLMAs
Alicante	19	22
Castellón	9	8
Valencia	20	16

Three of the four LLMAs centred on the region's largest cities expanded during the period analysed, whilst the other (Alicante) remained unchanged. The regional capital of Valencia absorbed one adjacent LLMA (whose self-containment level was only marginally acceptable in 1991). Castellón de la Plana absorbed two previously independent LLMAs, one of which (Alcora) had experienced the largest fall in self-containment (22.3%) among the set of 1991-based LLMAs, largely due to the growth of employment locally. By contrast, Elche (the fourth largest city in the region) absorbed the adjacent coastal 1991-based LLMA of Santa Pola because the latter experienced population growth linked to out-commuting to the nearby city. Thus in the Valencia region there have been cases of both rapid suburbanisation and the emergence of new centres of employment on the edge of larger cities. The changes in LLMA boundaries do follow from these transformations, but rather different analyses – perhaps including the breakdown of commuting flows by occupation or industry – would be needed to clarify the mix of processes involved in each area.

Minimum size requirements seem also to be responsible for some of the changes, notably the fragmentation of LLMAs. One such 1991-based LLMAs to break up was Elda (in the province of Alicante), which embraced several highly self-contained small labour markets that were forced to form a single LLMA to meet the minimum size requirements. Since 1991 these areas have seen localised growth and so the 2001 data shows the 1991 Elda LLMA split into three LLMAs whose self-containment values are all well above the minimum threshold. In fact this is an example of a more general point because the LLMA definitions are

dependent on *both* size and self-containment criteria: thus in a region with rapidly growing settlements there is likely to be change in the pattern of LLMAs without this being particularly indicative of any changes in the commuting patterns which are of principal interest here.

In practice, the TTWA method maximises the number of separate areas defined – all of which meet the self-containment and size criteria – by partitioning much of the country into TTWAs of which many only marginally surpass the statistical criteria. As a result, even a slight trend towards declining levels of self-containment can cause a surprisingly high proportion of all the existing TTWAs to fall below the critical threshold. Many of these then become merged with a larger neighbouring area, and this can causing the instability of boundaries to also affect these areas, even though their self-containment had *not* been marginal. To summarise, the optimality of a set of boundary definitions such as the TTWAs is inevitably rather short-lived and this in turn emphasises their essential instability, deriving from the fact that they at best represent a 'snap shot' (which in fact can already be out-of-date as soon as they are published because of the delays in release of Census commuting data).

4 Monitoring self-containment levels

The previous section of this paper has shown that the updating of LLMA boundaries – in the case of two regions and one particular LLMA definition method (albeit a method widely seen as 'best practice') is not ideal as a method for examining the change in commuting patterns. One simple and related alternative is to compare the change in level of self-containment over time for the *same* set of LLMA boundaries. This more limited form of analysis, in which the changing self-containment values will be partly shaped by the pre-defined LLMA boundaries, may still provide a more direct view of change in commuting patterns than monitoring how LLMA boundaries change.

The criteria for defining TTWAs require that all the final boundaries include a minimum population but, away from more remote areas, this is not often a very influential constraint. Far and away the most important statistical requirement is that every TTWA should meet the set minimum level of the ***self-containment*** of commuting flows (ONS and Coombes 1998). There are two elements to this criterion:

Supply–side = % of all an area's working residents who work in the area, and

Demand–side = % of all workers at an area's *workplaces* who live in the area.

TTWAs meet the required level of self-containment on *both* the supply- and demand-side measures which means the critical level of self-containment for any area is the lower of its supply- and demand-side values. For most larger cities, the demand-side value is the critical one: the reason is that there tends to be a net inflow of commuters to these cities, which in turn means that they have a larger denominator for the demand-side measure and hence this form of self-containment has a lower value (since both measures use as their numerator the number of people who both live and work within the area). Smaller areas surrounding the large cities tend to have net outflows of commuters, mainly to those larger cities, and so the supply-side measure is the form of self-containment which tends to be the critical one for them. In these analyses, for a few areas the lower of the two values is the supply-side one at one time point and the demand-side one at the other, but this is unusual and does not affect the general interpretation of the results.

4.1 Trends in south and east England

Having set the context for this analysis, the next step is to look at the findings. All the results in this section of the report rely upon a prior 'best fit' of 2001 Census wards to the current TTWA boundaries. The error which this introduces will affect TTWAs in areas where ward boundaries changed between 1991 and 2002: more specifically, it will tend to reduce somewhat the observed 2001 self-containment value of the smaller TTWAs in these areas. Table 3 provides the regional averages of 2001 self-containment values in south and east England (with each TTWA represented by the lower of its demand- and supply-side values). Setting aside the high value for the single TTWA centred in the London region, the averages for TTWAs in the other two regions (and indeed other English regions) are very similar.

Table 3 2001 self-containment of 1991-based TTWAs

	Number of 1998 TTWAs	TTWAs' average 2001 self-containment
London	1	81.8
South East	28	72.6
Eastern	25	70.1

Table 4 then goes beyond the average values to reveal the distribution of TTWAs across different 2001 self-containment levels. The two low categories embrace over half of the TTWAs in the Eastern region, and not many fewer for the South East TTWAs. The key significance of these two categories is that they are both less than the 69.5% minimum 1991 self-containment level which was required of current TTWAs.

Table 4 Number of 1991-based TTWAs by level of 2001 self-containment

	under 65	65 to 69.5	69.5 to 75	75 to 82.5	over 82.5
London	0	0	0	1	0
South East	1	9	13	1	4
Eastern	5	10	3	5	2

Map 3 shows that within these regions the TTWAs in fact present a very fragmented pattern of higher and lower self-containment values. The distribution is not readily summarised

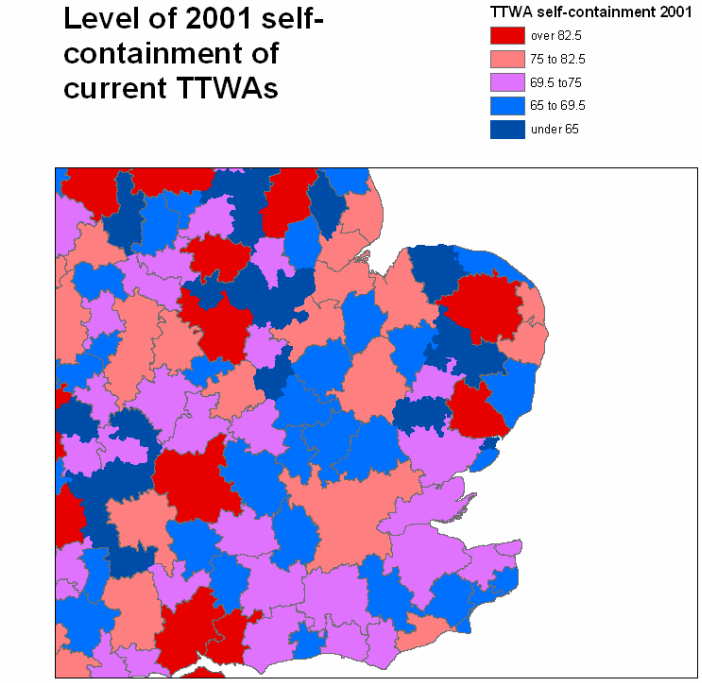
within a generalised contrast between more urban or rural areas, for example. The reason for this is a complex one, with the particular thresholds for TTWA status interacting with the nature of the region itself. The best example of this is provided by London having a rather high self-containment value, despite being the centre for more long-distance commuting than anywhere else in the country: in order for any TTWA boundary here to reach the required level of self-containment it must be a large aggregate of areas which have not been remotely self-contained for many decades, and so the outcome is a set of TTWAs which are so large that few commuters cross their boundaries.

This analysis of current TTWAs' levels of 2001 self-containment has been undertaken to gain insight into the stability of these 1991-based boundaries. Put another way, a TTWA's change in self-containment from 1991 to 2001 is partly determined by the nature of its boundary, which was drawn on the basis of 1991 data. The average for TTWAs in the south and east of England were similar to those across the country more generally: Table 5 shows there was an average reduction from 1991 to 2001 of around 5% in TTWA self-containment values.

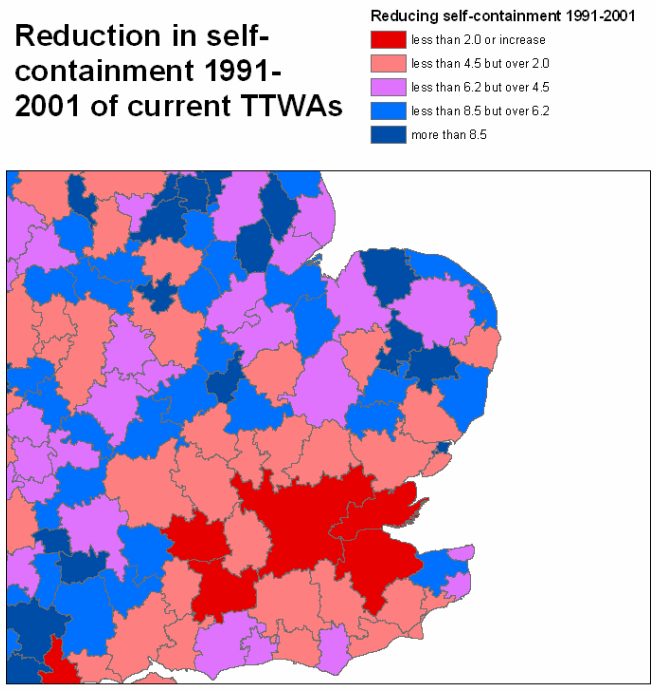
Table 5 Reduction 1991 to 2001 in 1991-based TTWAs' self-containment values

	Number of TTWAs	TTWAs' average (% point) self-containment reduction
London	1	0.0
South East	28	4.5
Eastern	25	6.0

Map 4 confirms that London and its neighbouring TTWAs have had relatively low levels of self-containment reduction, a pattern which is not repeated very consistently anywhere in this broad region. Areas with the highest reduction rates are often in more remote rural locations: it is impossible to know from this map alone how far this is due to these areas' attractiveness to people who then commute longer distances, rather than to some technical aspect of this analysis for example.



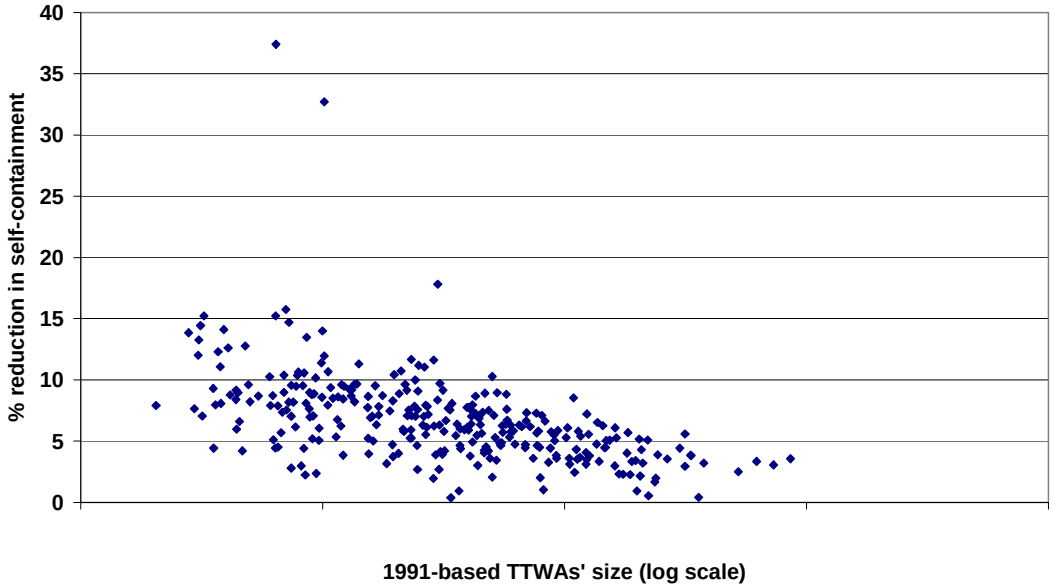
Map 3 1991-based TTWAs' 2001 self-containment values



Map 4 1991-based TTWAs' reduction in self-containment values

Figure 1 confirms that current TTWAs with the more extreme reductions of self-containment values tend to be among the smaller ones. Of course, part of the explanation could be that smaller areas are always more vulnerable to greater levels of change, but there is much evidence across developed countries that smaller towns and rural areas are attracting many well-paid in-migrants who can afford to commute quite long distances to jobs in larger cities (eg. Bourne and Simmons 2004). Once again, analyses of the kind shown here are only able to indicate whether the patterns they find are – or are not – consistent with such hypothesised changes in commuting patterns; other forms of analysis are needed to move closer to formal hypothesis testing.

Figure 1 TTWA size and reduction in self-containment 1991 to 2001



4.2 Trends in Valencia Region

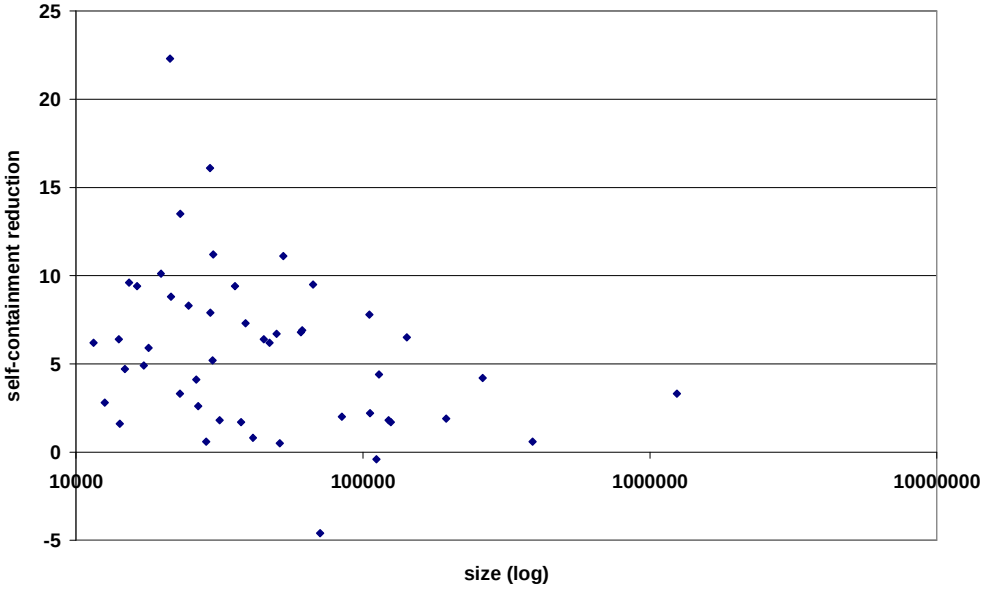
Before reaching a final view on the utility of analysing change in self-containment values, there are good reasons for checking whether the results in a different region provide a more positive example. Table 6 summarises the results for 1991-based LLMAs in Valencia region from an analysis of 2001 self-containment levels. The influence of differing degrees of urbanisation is quite clear here, with the greater rate of reduction in self-containment in the LLMAs in the more urbanised provinces of the north, whereas the average fell by only 3.1%

in the less urbanised Alicante province in the south. Yet this is not simply to say that these results are starkly different from those in the English case, where more rapid self-containment reduction was found in less urbanised areas. Figure 2 shows that when individual LLMAs are analysed, the more extreme reductions were – as might be expected – to be found among smaller areas. The explanation which fits both these apparently contradictory observations is that the most extreme reduction has occurred in the smaller LLMAs nearer to the region's larger urban centres. This pattern is consistent with the probability that the process of change in the Valencia region is still at a fairly early stage of suburbanisation, especially when compared to the region around London where 'over-spill' growth was taking place in earlier decades but more recent trends are towards a much more diffused pattern.

Table 6 Changing self-containment of 1991-based LLMAs in Valencia

Province	No. of 1991-based LLMAs	Average 1991 self-containment	Average 2001 self-containment
Alicante	19	88.6	85.4
Castellón	9	88.2	80.7
Valencia	20	84.1	76.9

Figure 2 LLMA size and reduction in self-containment 1991 to 2001 in Valencia



One other way of exploring the change in self-containment values is to shift the analysis scale down to the level of the municipalities which are the constituent units of LLMAs. Table 7 shows a strong decline in self-containment from 1991 (when 46.2% of municipalities were over 70% self-contained) to the 2001 situation (when only 21.3% reach that level). The fact that this degree of reduction was not reflected in more dramatic change in LLMA boundaries (Maps 2a and 2b) is again due to a large proportion of the change taking place near to large cities which resulted in increasing integration *between* LLMAs' component municipalities – and most especially around the city of Valencia itself – but there is little impact on most LLMA boundaries as a result.

Table 7 Changing patterns of self-containment among municipalities in Valencia

% of municipalities by self-containment	<50	50-<60	60-<70	70-<75	75-<80	80-<85	85-<90	90-<95
1991	22.6	13.9	17.3	11.5	12.4	11.9	6.5	3.9
2001	42.5	18.5	17.9	8.3	5.7	4.4	2.0	0.7

The analyses presented here can support interpretations of LLMA level change, but it is often necessary to examine the *context* in which an area is located in order to better understand changes in the patterns of commuting. Processes such as suburbanisation can be obscured where the analyses are at too broad a scale (as with the rapid change occurring within the Valencia LLMA). To compile evidence about changing commuting patterns, so as to assess factors such as the residential preferences of long-distance commuters for example, calls for analyses at a more detailed level. LLMA boundaries can then help this research by providing the relevant spatial frame for the analysis taking place at a finer scale within them.

5 Review and future prospects

This paper has been concerned with the need to better understand the ways in which patterns of commuting are changing. The paper began by examining some factors driving what are now increasingly dramatic changes in levels of personal mobility in many areas of the developed world. It was noted that there is little past research to draw on as a template for studying changing patterns of commuting (or indeed other more localised forms of mobility).

One of the ways in which commuting change is brought to the attention of researchers and – most especially – policymakers is by the periodic updating of LLMA boundaries. The paper examined examples of the evidence that this form of analysis provides on commuting change, these examples taken from the contrasting regions centred on Valencia and London so that the conclusions are not simply reflecting the peculiarities of one region. Although in both regions there have been notable increases in commuting distances on average, monitoring the change in LLMA boundaries did not really reflect this widespread and steady trend. The nature of the boundaries makes them prone to either remain unchanged (if they are in a region where there is quite wide spacing between urban settlements) or to change to a degree which is more extreme than the gradual underlying change in commuting (eg. two or three previously separate LLMAs merge to become a single one, usually because the smaller areas' self-containment levels have slipped below the minimum level which is required by the definitional criteria. Taking a rather more reflective view, it can be said that LLMA definitions appear to be the 'victims of their own success' because they define as many separable LLMAs as possible on any year's data, with the inevitable result that they include a high proportion whose self-containment level was only just above the critical threshold; in consequence, declines in self-containment levels in the following years tip many existing LLMAs below the critical threshold when the next available commuting dataset is analysed.

Analyses of changing self-containment values, across fixed LLMA boundaries, were also carried out in the two contrasting case study regions. These measures provided a different but equally partial view of local trends in commuting flows. The conclusion drawn was that a further possible role for the LLMA boundaries was as context for analyses at a finer spatial scale. Coombes and Raybould (2004) offer one example of such analyses, with an exploratory study of micro and meso scale factors associated with the environmentally-desirable

behaviour of short-distance commuting. Yet that analysis can be said to be only examining one dimension of the issue which is this paper's central concern, changes in the *patterns* of commuting flows. The question remains how to capture key features of the change in this essentially two dimensional phenomenon. More sophisticated analysis options include the modelling of underlying factors of commuting behaviour – such as the strong growth in longer-distance commuting — then projecting this trend onto the earlier spatial flow patterns: comparing this 'expected' pattern with the actual pattern of current flows might identify where and how change had been unusual. Such analyses might provide a more detailed picture of local trends, which could then be set alongside the more familiar, but very indirect, evidence provided by comparing the two 'snapshot' sets of LLMA definitions based on the earlier and later datasets.

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