A Framework for Housing Market Area Delineation: Principles and Application

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Abstract

A review is presented of the requirements of a framework for the delineation of housing market areas (HMAs) in the context of undertaking a housing market assessment. This prompts adoption of a methodology that features an iterative application of information obtained from estate agents, to identify HMA cores, and a functional regionalisation of 2001 Census interward migration flows. The approach is demonstrated using data for North West England. The concluding section explores some implications of the HMA framework for policy and future research.

1. Introduction

The economic component of housing market research in the UK has tended to focus on the role of housing in the national economy and on the regional structure of the national housing market (Ermisch, 1990; Clapham, 1996; Ermisch *et al.*, 1996). In recent years, national housing market research and policy have come to acknowledge that housing markets are heterogeneous and characterised by local issues with which it is difficult to engage by means of a narrow research and policy agenda that focuses predominantly on the national housing market (Robinson, 2003; Wallace, 2004). However, precisely how local housing markets should be defined has been subject to increasing debate (Maclennan *et al.*, 1990; Forster *et al.*, 1995).

Traditionally, in the UK, local authorities co-ordinate local housing provision and, in particular, establish the amount of land required to accommodate new housing. This has had a considerable impact on housing market analysis and policy development arising from the consequent acceptance of local authority administrative boundaries as approximations to local housing markets. However, more recent UK literature records efforts to address the identification and analysis of housing market operation that build on work undertaken since the 1970s relating to

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housing sub-markets (for example, Watkins, 2001; Jones *et al.*, 2003, 2004, 2005). Important advances in sub-regional housing market research have been made in Scotland due to the requirement that structure plans identify housing market areas (HMAs) (see, for example, Jones, 2002). In contrast, in England, with some exceptions (such as Greater Manchester Council, 1985), only limited attention has been given to sub-regional HMAs until relatively recently (DTZ Pieda, 2004a, 2005; Bibby, 2005; Coombes and Champion, 2006; Coombes *et al.*, 2006).

The policy context and administrative landscape within which the study of HMAs is undertaken was transformed in 2003 with the establishment of Regional Housing Boards (RHBs) charged with the delivery of policies set out in the Sustainable Communities Agenda (ODPM, 2003) and responsibility for preparing Regional Housing Strategies as a basis for strategic housing investment in England. In addition, the Barker (2004) review recognised that current methods of housing need assessment were inadequate and called for the integration of RHBs with the Regional Planning Boards to improve the basis of housing policy development in England.

The case for identifying HMAs has been reinforced with the adoption of the new Regional Spatial Strategies (RSS). *Planning policy statement 11: regional spatial strategies* (PPS11) indicates that the RSS for each of the English regions

> will need to provide housing figures for individual districts or appropriate *sub-regional housing market areas* (ODPM, 2005a, p. 2; emphasis added).

And this has been reinforced in the *Planning for housing provision: consultation paper* (ODPM, 2005b).

The task of understanding the functioning of local housing markets has been aided by the *Housing market assessment manual* (DTZ Pieda, 2004b) which offers guidance to local authorities and their partners with respect to

> developing a more strategic, long-term view of housing demand and need (ODPM, 2005c, p. 1).

This describes how a housing market assessment may be undertaken in a 10-step process of which one stage is to determine the spatial extent of the area to be assessed. The manual suggests that

> partners need to try to determine which grouping of local authority boundaries operate as a housing market area and thus the boundary of the housing market assessment (DTZ Pieda, 2004b, p. 16).

And later that

> In establishing the housing market area, the team may make a pragmatic decision to align identified functional boundaries with administrative areas to simplify information collection (DTZ Pieda, 2004b, p. 27).

In practice, local authority administrative boundaries have little meaning with respect to housing market operation and economics and, in the past, their use as approximations to HMAs has restricted the scope for housing market analysis and policy development (Cullingworth, 1997).

Further, in defining the extent of HMAs, the manual advises that consideration should be given to a number of issues, including: patterns of relocation within a local area by homeowners and tenants; travel-to-work patterns—which analyse the relationship between the place of work and the home; and the identification of core and periphery areas for the HMA (DTZ Pieda, 2004b, p. 27).

In addressing the first of these criteria, the manual notes that

> Information of movements between homes will *in due course* be available from 2001 Census data (DTZ Pieda, 2004b, p. 29; emphasis added).

In response to these criticisms, a robust approach is required to both the conceptualisation and delineation of sub-regional HMAs that is not reliant on an administrative geography and has a stronger functional basis. This paper draws on a number of contributions to the recent debate on HMA definition in the development of a new framework for HMA delineation. What emerges is both consistent with the requirements of the government-recommended housing market assessment procedure and takes advantage of the availability of 2001 migration statistics in supplementing the range of HMA delineation methods available at the time of its publication (DTZ Pieda, 2004b). The methodology gives particular emphasis to the iterative use of the functional regionalisation of interward migration flows, to identify groupings that constitute HMAs, in a process that is informed by estate agent knowledge of local housing market and sub-market geography. This is applied to data for North West England. The paper concludes with discussion of analytical and policy implications of the availability of a robustly defined set of sub-regional HMAs and the identification of directions for further research.

2. Defining Housing Market Areas

The HMA approach represents a break from the more traditional economic analysis of UK housing markets, that generally focused on individual urban housing markets, housing markets at the regional scale or even broader brush macroeconomic consideration of national housing market trends (see Maclennan, 1982; Ermisch, 1990; Clapham, 1996; Ermisch *et al.*, 1996). Recent research has stressed that certain tasks and policies can be more appropriately managed and implemented at a sub-regional level than at either regional or local levels (Roberts and Baker, 2004) and that housing is judged to be a critical issue to which a sub-regional approach is required. There has been only a limited amount of research into the nature, functioning and form of housing markets at sub-regional level—research to which more explicit reference is made later. However, at the outset, a number of principles can be identified that should ideally be accommodated in the specification of a practical method for local or sub-regional HMA delineation.

Government guidance documents provide a good starting-point. The *Housing market assessment manual* identifies two important definitional criteria that HMAs should satisfy. It suggests that HMAs are, first,

> areas within which people are willing to search for housing (DTZ Pieda, 2004b, p. 26).

and, secondly,

> geographical areas which contain both the *origin* and *destination* of the great majority of households who move home (DTZ Pieda, 2004b, p. 26).

A still more recent HMA definition is expressed as

> geographical areas within which there are clear links between where people live and work (ODPM, 2005c, p. 1).

These definitions share an implicit concern with commuting and migration patterns. To these can be added a further variant, defining a HMA as

> the geographical area within which most people both live and work and where most people moving home (without changing job) will have sought a house (O'Sullivan *et al.*, 2004, p. 42).

It is concluded that a method for HMA delineation should reflect the strong relationship between the geographies of commuting and migration, while taking into account the notion of a 'search area' within which prospective migrants seek accommodation.

Although local labour market area (LMA) geography has been operationalised through the identification of travel-to-work areas (TTWAs) (Coombes *et al.*, 1979; Coombes and ONS, 1998; Coombes, 2002), the extent to which patterns of migration are susceptible to similar forms of analysis has received less attention (but see Slater, 1976, 1993, for examples of the application of functional regionalisation methods to migration matrices). The case for applying similar principles in the analysis of migration flows is strong, as prompted by Maclennan and Bannister (1995).

Before these principles are drawn upon in the proposed new HMA delineation methodology, it is appropriate to look more closely at the concepts and practical considerations to be taken into account in its specification. This will include a review of some of the alternative ways of handling aspects of HMA delineation that are identified in the literature.

3. Conceptual Issues in Housing Market Area Definition

3.1 Migration and HMA Delineation

Migration is the defining feature of HMA delineation. Jones (2002) highlights two concepts that may be adopted in the delineation of HMAs. The first of these is market search. A 'housing market' is created whenever an individual or household wishes to purchase a residential property, generally accompanied by a move from a currently occupied property to take up residence, thus contributing to a migration flow. Market search represents the first stage in the household migration process and contributes to the demand for housing.

An obvious problem in replicating the market search process is that a large qualitative data collection strategy would be needed to understand *how* and *where* households have searched. In practice, it would be almost impossible to collect such data for all households moving across a large geographical area. However, although no widely available source exists to enable the routine examination of people's search behaviour, it is proposed that, consistent with advice offered by DTZ Pieda (2004b), this aspect of market search should be accommodated within the HMA delineation process through consultation with local estate agents.

The second migration-related concept considered by Jones (2002) is spatial arbitrage and it is this principle that underpins Jones' approach to HMA delineation

> Spatial arbitrage relates to the process of buying and selling a good at a uniform price. For this to occur, in a housing market, buyers consider transactions at any point in a geographical area to be an appropriate substitute (Jones, 2002, p. 552).

Thus, Jones' HMA delineation method draws on migration patterns and the measurement of market size, represented by transaction counts (arbitrage), over a given period, to identify market areas within which house prices are determined.

The spatial arbitrage principle thus provides a basis for conceptualising and delineating HMAs. However, a significant obstacle limits the scope for its application in England. Spatial arbitrage is a measure of transactions through space and Jones (2002) delineates HMAs based on migration flows, using data obtained from the Scottish Sasines database in which approximately 95 per cent of housing transactions are recorded. Details include sale price, origin of mover and property characteristics over a 10-year period. However, in England, there is no Sasines-style database. The nearest equivalent is the Land Registry record of housing transactions which lacks the detail of the Sasines database. Once markets are delineated, the

Land Registry sales data can be used to illustrate market size from transaction counts, but it cannot be used to illustrate spatial arbitrage explicitly because the origins and destinations of individual moves are unknown. That said, we note that Bibby (2005) has devised a novel alternative basis for HMA identification whereby the Land Registry records enable the estimation of a 'neighbourhood price' and areas of price uniformity for different categories of property that are treated as HMAs.

The practical problems associated with the use of methods based on market search and spatial arbitrage prompt consideration of alternative guiding principles for HMA delineation in England. These draw on the use of migration flow data obtained from the Census of Population (as exemplified by Coombes *et al.*, 2006). This alternative approach is subtly different from the spatial arbitrage principle in reflecting the relationship between *supply* and *demand* rather than an active transaction. It is based on the notion that flows of migrants are the outcome of the interaction between the supply of, and demand for, housing within a broadly defined market area. This stems from the observation that it is consumer behaviour, and not administrative boundaries, that defines housing markets (Meen and Meen, 2003; DTZ Pieda, 2004b).

Consumers *demand* housing within a market area, whilst producers (building companies and sellers) *supply* housing in the form of new stock, conversions or existing stock. In theory, movers will substitute their dwellings with other dwellings, having engaged in market search (Evans, 2004). The resulting migration patterns reflect the outcome of the operation of supply and demand regimes, albeit operating in different ways for different tenures and socioeconomic groups (Forster *et al.*, 1995). Interestingly, more recently, this relationship has been represented more explicitly in the work of Leishman and Bramley (2005) who used Scottish data to estimate a simple dynamic supply–demand model of a housing market system, with separate equations for inward and outward household migration.

However, it must be acknowledged that migration patterns are not a pure measure of demand and are unable to reveal the scale of excess demand as unsuccessful movers are not included in migration statistics (see Coombes *et al.*, 2006). Equally, migration flows relate to individuals rather than to households and the demand for housing is more a function of household numbers and formation rates than the number of individual migrants (Jones, 2002). Furthermore, such flows fail to take into account unrecorded demands represented by the homeless and inadequately housed (Coombes and Champion, 2006).

3.2 HMA Size and Form

HMAs are by purpose, scale and definition, sub-regional housing markets in the same way that TTWAs represent sub-regional constituents of a labour market area (Coombes, 2002). It is generally acknowledged that most people will move within a reasonable distance of their workplace in order to minimise commuting costs (Kain, 1962), a pattern verified more recently by Rouwendal (1999) in finding that households adjust their residential location, and sometimes job location, in order to shorten commuting distance. In addition, most people will seek to buy or rent a house within a geographically limited area, reflecting personal, social and economic networks, such as access to family, friends and education facilities (DTZ Pieda, 2004b). Clark and Huang (2004), drawing on the British Household Panel Survey, highlight that, of the 10 per cent of total migrating households each year, only 3.4 per cent make a long-distance move. Green (2004) also shows that, according to the 2001 Census

of Population, 3 in 5 moves are less than 10 km in length and only 1 in 8 is more than 200 km. This supports the contention that, for the majority of households, migration is geographically constrained.

As both HMAs and TTWAs represent sub-regional market areas, in principle, they might be expected to share a number of common features (Coombes and Champion, 2006; Coombes *et al.*, 2006). These are likely to include a degree of similarity in their extent and boundaries, consistent with the expectations that people will move home within their existing TTWA, with longer moves prompted by employment changes (Scottish Homes, 1993; DTZ Pieda, 2004a). It follows that, within a given region, a broadly similar number of sub-regional HMAs and TTWAs will be found that share a similar geographical coverage (Jones, 2002).

Finally, Jones (2002) suggests that distinguishing between HMAs and sub-markets is a problem in HMA identification (see also, Goodman, 1982). Sub-markets are considered to exist because of market imperfections (Whitehead and Odling-Smee, 1975) which are thought to interfere with the process of arbitrage (migration). In contrast, HMAs may be characterised by a high degree of internal migration, reflected in high levels of self-containment. However, recent research has demonstrated that sub-markets can also have relatively high levels of self-containment (Jones *et al.*, 2003, 2004, 2005). In seeking to distinguish between HMAs and sub-markets, the benefits have been recognised of drawing upon the knowledge of estate agents as part of the HMA identification process (DTZ Pieda, 2004b).

3.3 HMA Self-containment

The definition put forward by DTZ Pieda (2004b) indicates that HMAs have relatively closed migration patterns and a degree of internal coherence and, more generally, can be identifiable as a

> contiguous geographical area, more or less bounded, within which it is possible for a household to trade or substitute one dwelling unit for another without also altering its place of work or its pattern of social contacts (Bourne, 1981, p. 73).

However, an 'appropriate' level of HMA self-containment needs to be established, within the HMA framework, that is sufficiently low not unrealistically to constrain the delineation of HMAs but which is high enough to enable the identification of HMAs with relatively closed patterns of migration. Jones (2002) adopts an initial 50 per cent self-containment threshold (which is then systematically varied) for a dataset relating to transactions over a 10-year period. However, when basing HMA delimitation on 12-month migration flow data, DTZ Pieda (2004b) suggest that a HMA with below 70 per cent self-containment should not be regarded as a single market but as part of a wider HMA. The 70 per cent self-containment threshold has the attraction that it is consistent with the threshold adopted in TTWA definition (see Coombes and ONS, 1998).

Another choice is between the forms of self-containment adopted (see, for example, O'Sullivan *et al.*, 2004). A supply-side measure is expressed in terms of moves to a dwelling in an area as a percentage of those moving out of an area—i.e. with respect to migration flow origin. In contrast, a supply- and demand-side measure takes account of those migrants who have their origins within the HMA (supply side) and those who have their destinations inside (demand side). The adoption of a supply- and demand-side measure would seem to increase the robustness of the HMA framework when compared with adopting a simpler supply-side measure.

The nature of the issues to be considered in HMA delineation has now been outlined. The next section considers how these can be incorporated into a methodology for HMA delineation.

4. A Housing Market Area Delineation Methodology

There is no consensus on how these issues should be reflected in a methodological framework for HMA delineation. The guidance offered in the *Housing market assessment manual* (DTZ Pieda, 2004b) is valuable as it highlights sources of data and practical steps that can be taken to address many issues in HMA identification. However, its publication pre-dated the release of 2001 Census special migration statistics (SMS) and could offer only general advice on how anticipated tables might be used (p. 29).

The opportunity now exists to take advantage of SMS availability in HMA delineation by drawing directly on the functional regionalisation approach that forms part of the established method for delineating travel-to-work areas (Coombes *et al.*, 1979; Coombes and ONS, 1998; Coombes, 2002). Indeed, more recently, Coombes *et al.* (2006) have applied an adapted TTWA algorithm in the definition of HMAs in North East England.

The iterative algorithm for HMA identification put forward by Jones (2002, pp. 563–564) features the analysis of migration flows between neighbouring settlements and the progressive fusion of pairs that satisfy flow scale criteria. In practice, there is a wider choice of methods for use in the functional regionalisation of areas based on criteria derived from flow matrix properties.

As noted by MVA and David Simmonds Consultancy (2005) and Feldman *et al.* (2005), a review of three of the principal approaches by Masser and Scheurwater (1980) highlights the merits of intramax over the alternatives in the form of the computationally far more complex functional distance and iterative proportional fitting procedures.

4.1 The Intramax Procedure

The intramax procedure was developed by Masser and Brown (1975) to analyse flow structures in interaction matrices. The procedure strives

> to maximise the proportion of the total interaction which takes place within the aggregations of basic data units that form the diagonal elements of the matrix, and thereby to minimise the proportion of cross-boundary movements in the system as a whole (Masser and Brown, 1975, p. 510).

Intramax is a modified version of Ward's (1963) hierarchical aggregation procedure and focuses on the relative strength of interactions, once the effects of size variation in row and column totals are removed. These are taken into account, in the specification of the objective function to be maximised, as the difference between an observed flow and the expected value that is derived from the multiplication of the corresponding row and column totals, when the matrix is standardised to sum to unity. An observed value that exceeds an expected value represents a 'higher than expected' level of interaction. The pair of areas for which this difference is greatest is combined at each stage of the grouping process. After the fusion, row and column totals are re-estimated before the search begins for the next pair of areas for which the objective function is maximised.

The objective function to be optimised at each stage is expressed as (Brown and Pitfield, 1990, p. 62)

$$\text{Max } Z = \frac{a(i,j)}{a(i,j)^{\star}} + \frac{a(j,i)}{a(j,i)^{\star}}, i \neq j \qquad (1)$$

where, $a(i, j)$ is the observed value of the cell entry in the ith row and the jth column of the interaction matrix after it has been standardised, so that

$$\sum_i \sum_j a(i,j) = 1 \qquad (2)$$

and the expected values $(\ )^{\star}$ are estimated as follows

$$a(i,j)^* = \sum_p a(p,j) \sum_q a(i,q) \qquad (3)$$

$$a(j,i)^* = \sum_p a(p,i) \sum_q a(j,q) \qquad (4)$$

subject to the contiguity constraint

$$\begin{aligned} &c(i,j) = 1 \text{ (when basic data units } i \\ &\qquad \text{and } j \text{ are contiguous);} \\ &c(i,j) = 0 \text{ otherwise} \end{aligned} \qquad (5)$$

Aggregation thus proceeds in a stepwise manner, with the interaction between the two joining areas becoming the intrazonal interaction of the new area (Feldman *et al.*, 2005). The fusion of non-adjacent areas is avoided by applying a contiguity constraint to identify areas that share a common boundary (Masser and Brown, 1975). Step-by-step grouping may be illustrated with the aid of a tree-diagram or dendrogram (see, for example, Brown and Pitfield, 1990) and intramax can be readily implemented using the accessible Flowmap package (van der Zwan *et al.*, 2005).

4.2 Estate Agent Knowledge: A Basis for Guiding HMA Delineation

The intramax procedure does not include an objective basis for determining the number of market areas. The choice of an appropriate number of markets is at the discretion of the user. Brown and Pitfield (1990) suggest that the optimum number will be a compromise between the retention of essential detail and the achievement of appropriate representation. This otherwise welcome flexibility introduces a degree of choice or arbitrary specification of the outcome. However, in an application concerned with HMA delineation, it is argued earlier that there should be a degree of similarity with TTWA geography in terms of size, and thus number, of resulting market areas. In addition, benchmarks, or other criteria, may be incorporated into the intramax area-pair fusion decision-making process to increase the utility of the final groups for particular purposes (Coombes *et al.*, 1979). This feature is exploited here in the specification of 'core areas' to define the 'seed points' around which HMA groupings can be formed.

At the outset, it was difficult to know which settlements should constitute HMA cores and which to treat as extensions of larger HMAs. In practice, this was resolved by drawing upon estate agent knowledge of local housing markets, following Palm (1978) and reflecting advice given by DTZ Pieda (2004b). However, it is recognised that estate agents are active 'players' in the functioning of housing markets and that their influence may be both positive and negative. Indeed, McDowell suggests that estate agent operations can be viewed as a

> continuum ranging from passive co-ordination to active manipulation of market processes (McDowell, 1982, p. 86).

Further, DTZ Pieda comment that

> The analysis of a housing market area is not a precise science. Hence an approach is recommended which seeks to refine the HMA boundary based on a variety of measures. It is also important to stress the need to incorporate *local knowledge and expertise* in the process. Purely statistical approaches may fail to reflect particular issues, which are 'front of mind' either for the HMA team or partners, or indeed *housing and planning practitioners whose day-to-day activities provide insight into the operation of the housing market* (DTZ Pieda, 2004b, p. 28; emphasis added).

This is supported in the work of Smith *et al.* (2006) who examine market operation from a conceptual standpoint more closely aligned to cultural economy and economic sociology than pure economics. In exploring Edinburgh housing market performance, the authors suggest that, while economic pressures are central to the functioning of the housing market,

other non-economic factors have an important role in a complex interplay of cultural, legal, political and institutional arrangements, processes and actors.

Thus, initially, a number of settlements were identified that were broadly consistent with those covered by the TTWAs, reflecting the assumption that the HMAs and TTWAs should be geographically comparable. In these settlements, the branches of national estate agents were contacted to enable the compilation of a list of settlements, judged to constitute local markets, that could be drawn upon in guiding the delineation of HMAs. This was based on the assumption that, in their catchment area, estate agents have specialist knowledge of housing market operation and are aware of the typical patterns of prospective-mover search behaviour (Palm, 1978). In areas where national estate agent coverage was low, local estate agents were used and this proved necessary in parts of Cheshire and Cumbria. The consultation was then extended, beyond the initial core settlements, to identify further settlements that might constitute the cores of additional HMAs.

In total, 43 potential core HMA settlements were identified through estate agent consultation. Within these settlements, the most densely populated ward was identified as constituting the core of the HMA and seeded or 'flagged' in the intramax algorithm (1= core, 0 otherwise). The intramax procedure was then applied in such a way that each of the resulting groups could contain only a single seed ward around which non-seed wards were grouped to form the HMAs (see Figure 1).

4.3 Data and Unit Scale

A further practical consideration is the choice of migration flow data on which to focus, both with respect to the geographical units and level of disaggregation of migration streams. The 2001 Census of Population Special Migration Statistics (SMS) (Table MG201) record the origin and destination of migrants within a one-year period of the census date. Privacy and anonymity protection is achieved through application of Small Cell Adjustment Methodology (SCAM). There is scope for the analysis of both aggregate flows and those recorded with respect to population sub-groups (for example, by age, gender, ethnic group). This opens up the possibility of delineating sub-group HMAs based on SMS data disaggregated by specific characteristics, such as moving group (i.e. owner-occupiers, social renters and private renters), to which discussion returns later. Indeed, Coombes *et al.* (2006) explore the development of sub-group HMAs using moving-group SMS data relating to North East England. However, here, aggregate flow data have been used, in the first instance, for the purposes of demonstrating how the proposed delineation methodology may be applied in practice.

The disaggregation capability is particularly useful for the development and monitoring of policy measures directed at achieving housing market objectives, such as tackling low demand in the social rented housing sector or affordability issues in the owner-occupied sector. Even so, it is recognised that such flows provide only a snapshot view of migration patterns and that even the aggregate flow matrices recording movements are relatively sparse. This sparseness can affect the robustness of a regionalisation process, as acknowledged by others at the outset of similar analytical procedures (see Green *et al.*, 1986; Coombes *et al.*, 1988; Coombes and ONS, 1998; Coombes, 2002; Casado-Diaz, 2000).

The scale of the units used to 'build' the HMAs is another important consideration. In principle, the output areas (OAs) defined as the geographical building blocks of the 2001 Census (Martin, 2002) could be used to delineate both TTWAs and HMAs. However, significant problems would be faced in handling both the potential scale of the interOA flow matrices and the small cell adjustment issue that is likely to be most acute at finer

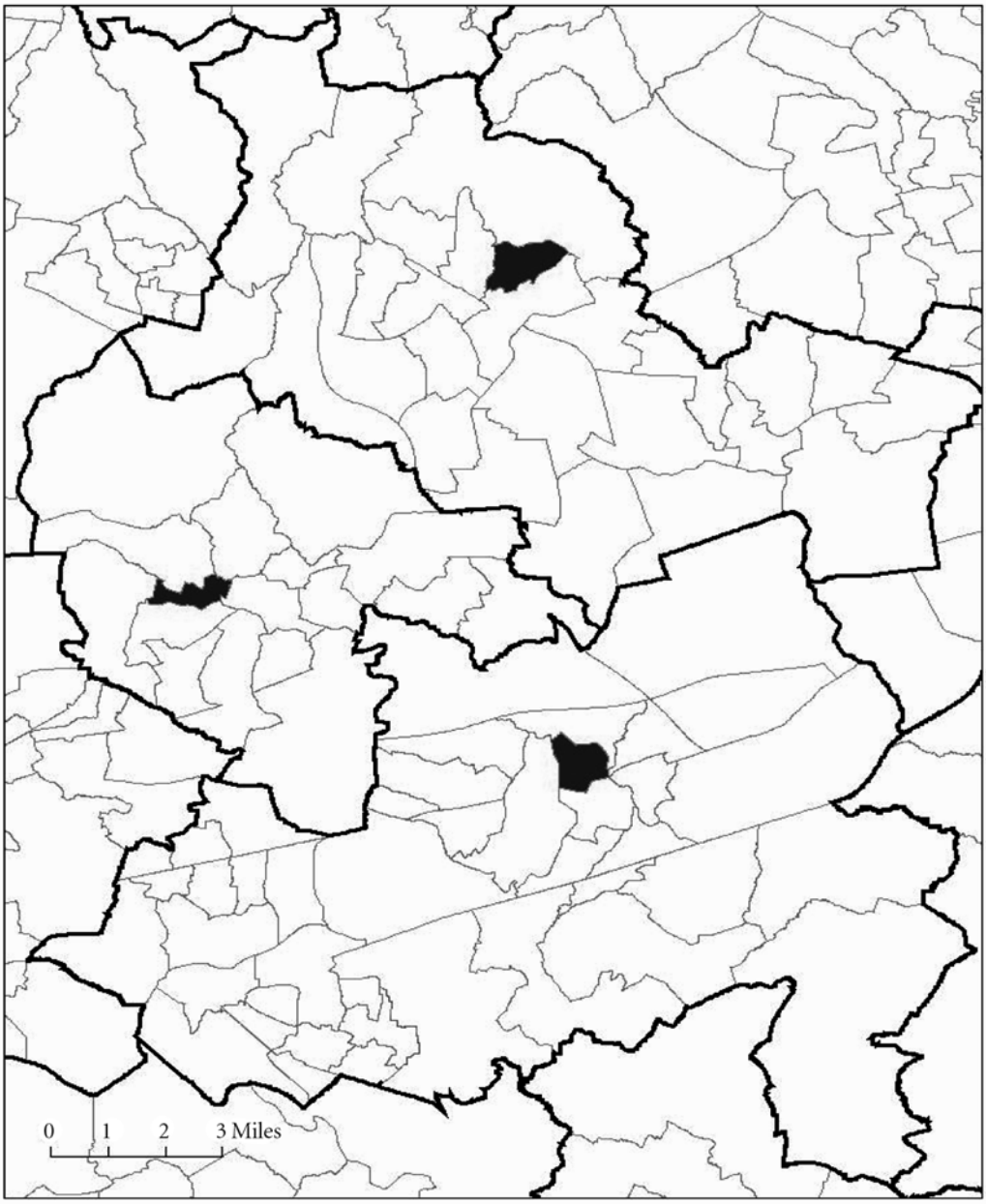

Figure 1. Illustration of seed or 'core' wards in hypothetical HMAs

spatial scales (Coombes, 2002). In the past, the geography of TTWAs has been based on wards. This prompted use of the ward as the base unit for HMA delineation, providing a further degree of consistency between the TTWA and HMA frameworks.

4.4 The Iterative Process

The review of theoretical and practical issues to be taken into account in HMA delineation led to the identification of the following sets of principles

(1) The HMAs should be derived using data recording the flows of migrants between wards—flows reflecting the relationship between the patterns of supply of and demand for housing.
(2) Systematic consultation with local estate agents will inform understanding of the process of market search.
(3) Resulting HMAs should satisfy both supply-side and demand-side self-containment criteria, with a minimum threshold of 70 per cent.
(4) The HMAs will be similar in size to TTWAs.

These principles are reflected in the iterative procedure that is summarised in Figure 2. This indicates that the HMA cores, first defined using information supplied by estate agents, act as constraints on the process of aggregating interarea migration flows using the intramax procedure. The self-containment of the resulting HMAs is examined to identify potential candidate HMAs for which core respecification may be appropriate in the light of a further round of estate agent consultation. The iterative process continues until the HMA self-containment criterion and estate agent criteria are satisfied. In the empirical application introduced in the next section, this was achieved after four cycles.

5. Delineating Housing Market Areas: The Case of North West England

The principles and issues explored thus far are here applied to data relating to the North West of England, the most densely populated region in England, after London, with a population in 2001 of 6.9 million people and a density of 4.77 people per hectare. The region includes two large and dominant conurbations, Greater Manchester and Merseyside, as well as a number of freestanding cities and towns. Over half the region is rural and a number of smaller settlements are located in the large rural expanses of Cheshire, Lancashire and Cumbria, that need to be given careful consideration in the HMA delineation process.

The initial outcome of the application of the procedure outlined earlier was the identification of 43 groupings of North West wards. The 43-group solution (illustrated in Figure 3, left-hand map) contained 14 prospective HMAs that failed to exceed the 70 per cent self-containment threshold on either the supply side, the demand side or both sides of the measure (see Table 1).

The second (and subsequent) stages of the process sought to improve the efficiency of the grouping by taking steps to increase HMA self-containment levels. Areas failing to exceed the self-containment threshold were scrutinised and some were found to be satellite settlements of larger and more dominant urban areas, or other smaller-sized communities in rural parts of the region, notably in Cumbria. The intramax procedure was reapplied following the removal of 'core flags' of wards in groupings in peripheral settlements falling below the self-containment threshold.

In later stages of aggregation, self-containment issues were further examined in detail. To illustrate the process, in the case of Keswick [26], Kendal [33] and Windermere [34] HMAs (see Figure 3), it was found that Kendal had consistently high supply- and demand-side self-containment levels, throughout all stages of grouping, while Keswick and Windermere had lower levels on both measures. Thus, Kendal was retained as the more dominant settlement. However, the decision on removal of the Keswick or Windermere cores was less obvious. Removal of only one had little effect on the self-containment of the retained HMA. Indeed, when Keswick was retained, the measure for Windermere was 66 per cent on the supply side and 68 per cent on the demand

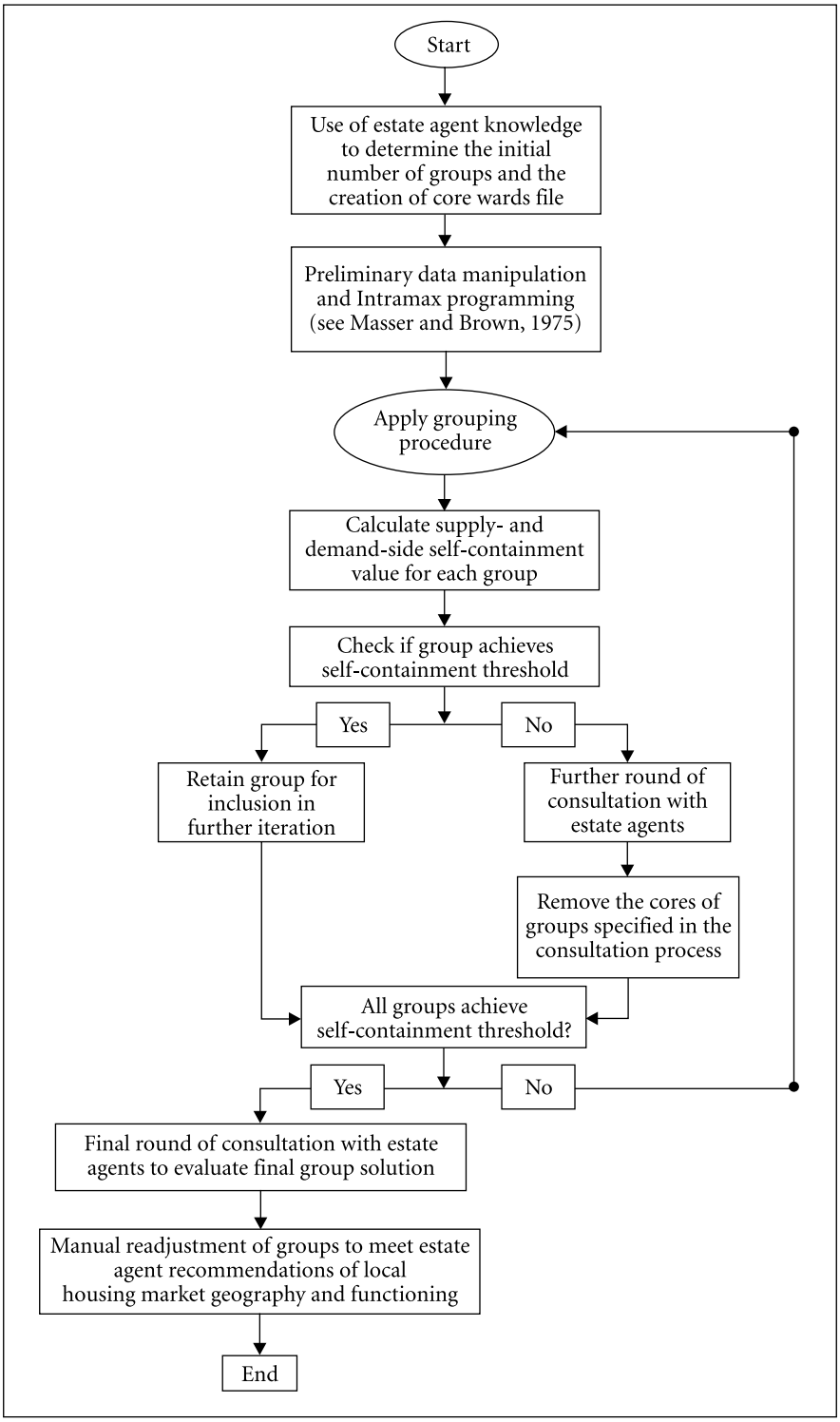

Figure 2. Outline of the HMA delineation methodology

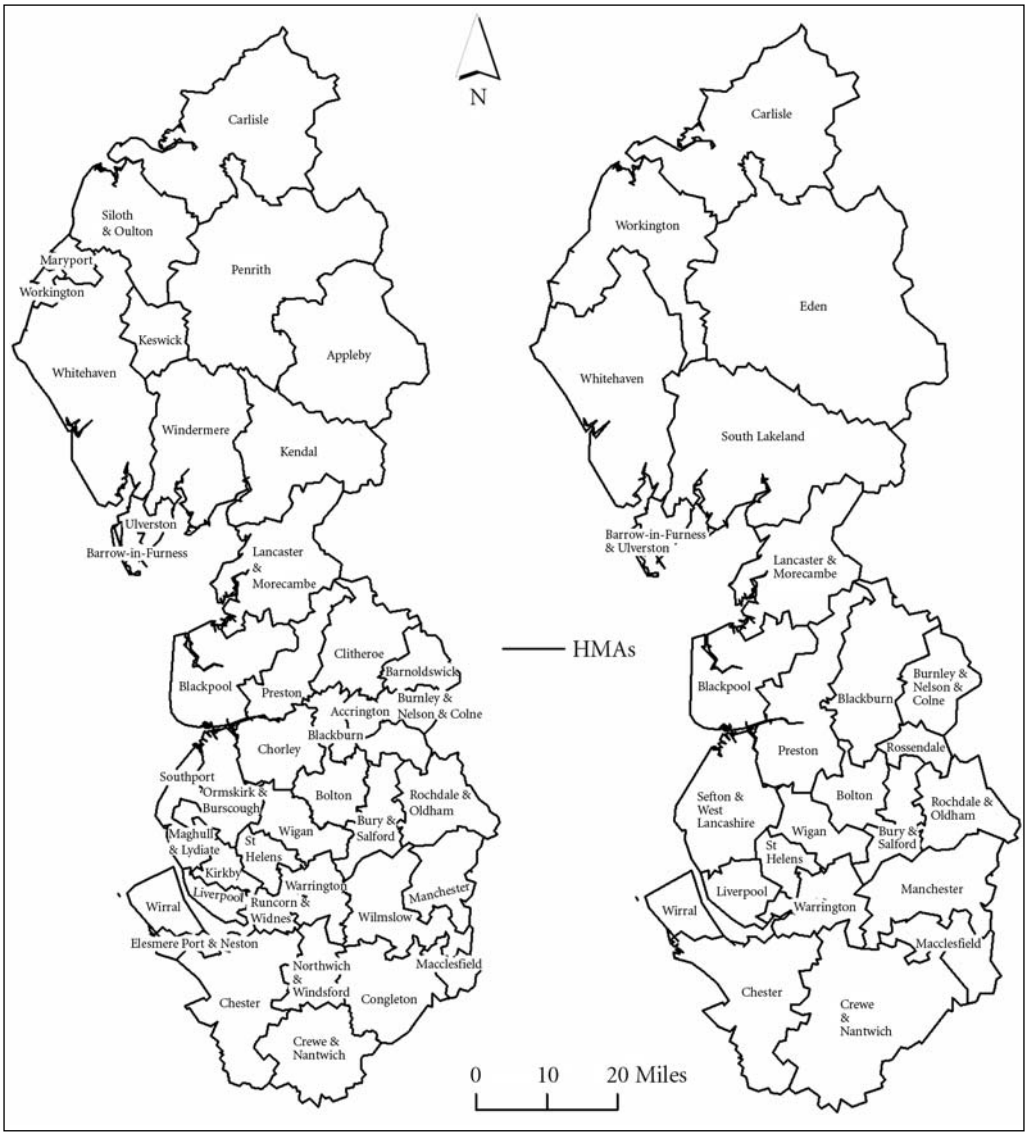

Figure 3. HMAs in North West England. left: the 43-group solution; right: the 25-group solution

side. Those for Keswick with Windermere core retention were 61 per cent and 65 per cent respectively. As a consequence, both the Keswick and Windermere cores were dropped. Difficulties in satisfactorily defining HMAs around the Lake District National Park reflect the fact that the South Lakeland area is a popular location for higher-income retirees who often explore larger search areas than those of lower-income groups (Forster *et al.*, 1995).

A further stage involved assessment of whether smaller ward groupings constituted HMAs in their own right or were likely to be extensions/sub-markets of more dominant settlements, despite exceeding the self-containment threshold. This was discussed in a final cycle of consultation with estate agents,

Table 1. The 43-group solution and corresponding self-containment measures

Group number and name	*Supply-side self-containment (percentage)*	*Demand-side self-containment (percentage)*
1 Bolton	80	79
2 Bury and Salford	75	76
3 Wilmslow	74	75
4 Manchester	80	79
5 Rochdale and Oldham	84	86
6 Wigan	82	80
7 Kirkby	66*	69*
8 Liverpool	75	76
9 Maghull and Lydiate	68*	70
10 St Helens	78	79
11 Southport	74	73
12 Wirral	87	88
13 Runcorn and Widnes	76	81
14 Warrington	76	75
15 Blackburn	81	84
16 Blackpool	88	86
17 Chester	73	73
18 Congleton	71	67*
19 Crewe and Nantwich	84	78
20 Ellesmere Port and Neston	72	70
21 Macclesfield	73	73
22 Northwich and Winsford	76	69*
23 Maryport	67*	69*
24 Siloth and Oulton	65*	65*
25 Whitehaven	79	80
26 Keswick	57*	64*
27 Workington	72	77
28 Carlisle	86	85
29 Barrow-in-Furness	83	83
30 Ulverston	61*	61*
31 Penrith	72	68*
32 Appleby	59*	62*
33 Kendal	73	69*
34 Windermere	61*	65*
35 Lancaster and Morecambe	85	81
36 Burnley and Nelson and Colne	77	81
37 Chorley	76	71
38 Accrington	76	77
39 Barnoldswick	81	81
40 Preston	72	73
41 Clitheroe	67*	62*
42 Rossendale	72	72
43 Ormskirk and Burscough	69*	69*

*HMAs that failed to exceed the 70 per cent threshold.

Table 2. Features of the 25-group solution including self-containment measures

Group number and name	*2001 population [1]*	*Percentage of total population (%TotPop) [2]*	*2001 migration from group [3]*	*2001 out-migration rate (percentage) [4]*	*Index out-migration rate wrt %TotPop [5]*	*Index in-migration rate wrt %TotPop [6]*	*Supply-side self-containment (percentage) [7]*	*Demand-side self-containment (percentage) [8]*
1 Bolton	259 903	3.9	22 470	8.6	99	99	80	79
2 Bury and Salford	403 456	6.1	37 233	9.2	102	103	75	76
3 Manchester	997 333	15.1	98 543	9.9	111	111	86	86
4 Rochdale and Oldham	505 874	7.6	45 274	9.0	98	101	84	86
5 Wigan	309 007	4.7	24 561	7.9	92	90	82	80
6 Liverpool	490 608	7.4	47 521	9.7	107	108	82	84
7 Sefton and West Lancashire	473 465	7.2	37 243	7.9	87	89	80	81
8 St Helens	163 701	2.5	12 416	7.6	85	85	78	79
9 Wirral	308 452	4.7	24 078	7.8	88	88	87	88
10 Warrington	305 747	4.6	23 861	7.8	87	89	79	80
11 Blackburn	255 840	3.9	24 868	9.7	106	111	86	88
12 Blackpool	312 262	4.7	30 884	9.9	114	112	88	86
13 Chester	218 678	3.3	15 538	7.1	82	82	79	78
14 Crewe and Nantwich	305 094	4.6	23 318	7.6	93	85	87	81
15 Macclesfield	134 341	2.8	10 689	8.0	89	94	70	71
16 Workington	84 200	1.3	7 126	8.5	94	94	79	83
17 Whitehaven	75 001	1.1	6 178	8.2	88	97	79	80
18 Carlisle	98 693	1.5	9 681	8.8	101	101	86	86
19 Barrow and Ulverston	86 585	1.3	7 699	8.9	99	107	87	87
20 Eden	52 974	0.8	4 378	8.3	100	87	77	74
21 South Lakeland	81 173	1.2	7 150	8.8	98	90	77	77
22 Lancaster and Morecambe	127 088	1.9	16 683	13.1	156	141	85	81
23 Burnley and Nelson and Colne	176 938	2.7	17 401	9.8	108	108	87	90
24 Preston	328 872	5.0	29 074	8.8	103	99	83	80
25 Rossendale	61 387	0.9	5 928	9.7	108	97	72	72
Total or mean	6 615 672	100	588 795	8.9	100	100	81	81

a process that highlighted the case for linking the contiguous Chorley [37], Accrington [38] and Barnoldswick [30] HMAs with the other more dominant local HMAs. In addition, the estate agents recommended removal of the Ellesmere Port and Neston [20], Wilmslow [3] and Runcorn and Widnes [13] cores. Further adjustments[1] proved necessary to the extent that, in the final stage, the number of groups was reduced to 25 (Figure 3, right-hand map). The resulting HMAs were examined to provide confirmation (see Table 2, cols 7 and 8) that all now satisfied both the supply- and demand-side self-containment criteria as well as the estate agent recommendations.

6. Features of the North West England HMA System

Earlier sections have outlined the HMA delineation methodology and how it has been put into practice to identify 25 HMAs in North West England. Features of the resulting HMA system are now examined.

6.1 The Configuration of HMA Boundaries

Comparison of the two parts of Figure 3 reveals the extent to which the earlier 43-group boundaries have been dissolved to create the final 25-group solution. The latter also shows how larger groupings of local authority districts have been created as a consequence of the fusion of the earlier ward groupings. This is most evident, for example, in Sefton and West Lancashire [7], Crewe and Nantwich [14], and Workington [16]. This illustrates the degree to which, in many areas, the HMA geography differs quite markedly from that of the underlying local authority administrative boundary geography. Interestingly, Jones (2002) also found a lack of correspondence between HMA and administrative boundaries in west central Scotland and that the administrative areas tended to be larger than the identified HMAs. This differs from the outcome here, where administrative boundaries tend to be smaller than the HMAs, reflecting the fact that administrative areas in west central Scotland tend to be larger than those in the North West.

It is also instructive to observe how the geography of the 25 HMAs compares with that of the corresponding 23 TTWAs defined for North West England (Coombes and ONS, 1998), as illustrated in Figure 4 where the HMA boundaries are superimposed on the latter. This reveals striking similarities in some areas, such as Manchester [3], Sefton and West Lancashire [7] and Preston [2], but marked differences in most parts of Cumbria, with the exception of Carlisle [18], perhaps raising a question about the effect of consistent use of the same self-containment threshold throughout the region, an issue to which the discussion returns later.

To aid clarity, the relationship between HMA and local authority boundary configuration is illustrated in Figure 5 for the area known as the Mersey Belt, between Liverpool and Manchester. This highlights the marked differences, for example, in the case of the Liverpool and Sefton and West Lancashire HMAs to the west, covering the districts of Liverpool, Knowsley, Sefton and West Lancashire, while the St Helens HMA coincides very closely with the local authority district boundary. To the east, the Manchester HMA accounts for four districts and parts of a fifth.

As well as the supply- and demand-side self-containment measures noted earlier (cols 7 and 8), Table 2 contains a summary of features of the aggregated interHMA migration flow matrix. This includes the resident population and number of migrants originating from each HMA and the share this represents of the North West total. For simplicity, this share is then compared (col. 5) in index form with the corresponding share of the total population (col. 2) to highlight

Figure 4. The 25-group HMA solution for North West England, superimposed on TTWA boundaries

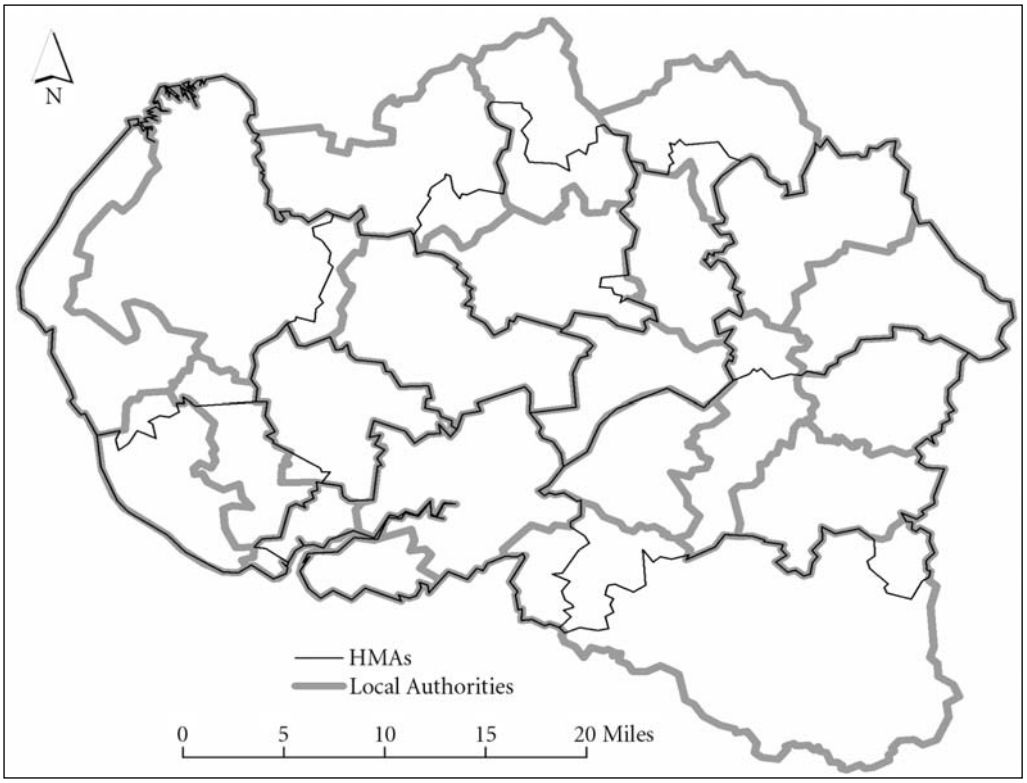

Figure 5. The 25-group HMA solution in the 'Mersey Belt', superimposed on local authority district boundaries

greater or lesser levels of out-migration than suggested by HMA population size. The corresponding in-migration index values are also supplied (col. 6).

There is a fair degree of consistency in the rates of out-migration (col. 4) around the mean rate of 8.9 per cent, with the obvious exceptions of Lancaster and Morecambe HMA [22] with the highest rate of 13.1 per cent and Chester [13] the lowest at only 7.1 per cent. Most HMAs display similar rates of out- and in-migration (cols 4 and 5), with Lancaster and Morecambe again proving to be an exception with out-migration more than 50 per cent above the mean rate and in-migration just 40 per cent above that based on its share of population size. The Manchester HMA [3] accounts for the largest share of migrants with an index of 111 on both measures, representing rates of over 16 per cent. Also consistently high on both measures are Liverpool [6], Blackpool [12], Burnley and Nelson and Colne [23], with Blackburn [11] close.

Columns 7 and 8 reveal that Manchester HMA [3] also has a relatively high degree of self-containment at 86 per cent, but is exceeded by Blackpool [12] (88 per cent), Wirral [9] (87 per cent), Burnley and Nelson and Colne [23] (87 per cent), Barrow-in-Furness and Ulverston [19] (87 per cent), Crewe and Nantwich [14] (87 per cent), and Blackburn [11] (86 per cent), with Liverpool [6] at 82 per cent falling closer to the overall average rate of 83 per cent.

There appears to be a degree of fuzziness at the boundaries of the metropolitan HMAs that display the high internal migration rates,

Manchester having strong links with the Bury and Salford, Rochdale and Oldham, and Macclesfield HMAs, and Liverpool closely associated with neighbouring Sefton and West Lancashire. In addition, there are relatively high self-containment levels for HMAs with a coastal boundary and next to the regional border, reflecting the effects of physical geography (the coastline, especially of Wirral, and the Pennines) as well as the artificial cut-off imposed on HMA delineation at the regional boundary.

The HMAs containing the Housing Market Renewal (HMR) Pathfinder areas also have relatively high migration rates (for example, Manchester, Rochdale and Oldham, Liverpool, Sefton and West Lancashire, and Bury and Salford). In addition, Blackburn, Wirral, Burnley and Nelson and Colne, and Bolton display moderate turnover and have been identified as areas at risk from housing market failure (Leather *et al.*, 2003). This suggests that areas of low housing demand and abandonment have witnessed an increase in the migration flows within the affected HMAs. Indeed, in an analysis of housing market trends in the North West, Leather and Roberts (2004) highlight the M62 corridor as a low-value housing zone in which private-sector vacancy rates and housing association void rates increased significantly between 1996 and 2001. These factors, combined with relatively high migration rates, provide clear evidence of weaknesses in the housing market (Nevin *et al.*, 2001; Leather *et al.*, 2003).

The smaller HMAs, lower down the table, are mainly located in Cumbria, to the north, remote from the southern metropolitan belt, and record among the lowest levels of self-containment, including Rossendale [25] and Macclesfield [15] which are only just above the 70 per cent threshold. The lower migration rates in the Cumbrian HMAs partly reflect local factors, including low levels of housing supply (Gallent *et al.*, 2003), coupled with high house prices, creating problems of affordability, exacerbated by rates of second-homeownership of between 5 and 10 per cent that reduce the ability of households to enter the local housing market (Leather and Roberts, 2004). This again raises a question about the use of a consistent self-containment criterion throughout the region, prompting the use of different thresholds in urban and rural areas.

7. Concluding Comments

This paper has set out the circumstances in which it is timely to establish a systematic basis for sub-regional HMA delineation that takes advantage of the migration data now available from the 2001 Census. A review of relevant concepts and principles led to the adoption of a functional regionalisation methodology that is informed by local estate agent information and is free of the constraints of local authority geography. While established TTWA geography provides a satisfactory basis for examining labour market operation, it is acknowledged that HMAs are likely to have a similar, but separate, functional geography. The principal contribution of this paper is in describing a systematic approach to the delineation of HMA boundaries that is both consistent with the requirements set out in the *Housing market assessment manual* (DTZ Pieda, 2004b) and readily transferable to regions beyond the North West to which the demonstration example relates.

If applied more widely, perhaps initially on a regional basis, it is suggested that the adoption of the resulting national system of HMAs would enable the assembly of housing market statistics on a more meaningful basis. This could include the production of population projections (mid-year estimates) at three scales: the regional, sub-regional (in the form of HMAs) and local authority levels, rather than current regional and local authority figures. This could facilitate the assessment of local housing demand at the sub-regional level.

Housing provision estimates could also be allocated to sub-regional HMAs and, in turn, disaggregated to the local sub-market level, as suggested by Jones (2002). Such an approach would improve the economic basis of housing provision and the assessment of housing market operation, and could be supplemented with an examination of structural features of HMAs and sub-markets, notably using demographic and housing stock profiles (DTZ Pieda, 2004b).

The delineation of HMA boundaries nationally would almost certainly draw on census migration data, as does the approach specified here. This would mean that the updating of the HMA boundaries would be undertaken every 10 years, as is currently the case with UK TTWAs. This obviously creates problems because of the time-lag between the initial delineation of the HMAs and the updating of the boundaries following the release of new census data. However, this trade-off has to be weighted against the fact that the census provides the most comprehensive and robust migration dataset available.

A number of issues need to be examined in future research. HMA delineation has been based on the aggregation of interward migration data in a manner similar to that used in defining TTWAs. However, availability of disaggregated 2001 Census migration datasets, opens up the possibility of delineating HMAs relevant to sub-groups and of analysing the functional relationships within and between HMAs for those groups at local authority, ward and OA levels. Confidentiality considerations dictate that disaggregation level declines as the fineness of the spatial scale increases (from local authority to OA). For disaggregated HMA development, the ward-level datasets (including moving groups by tenure, by age and sex and family status by sex) have attractions over the more disaggregated datasets at local authority level, especially in being unconstrained by administrative boundaries. Pursuit of these possibilities would enable the analysis of housing market features and processes to inform policies targeting specific population sub-groups. This reflects similar arguments raised in relation to TTWA delineation for different population sub-groups based on a socioeconomic classification (Green *et al.*, 1986; Coombes *et al.*, 1988; Casado-Diaz, 2000).

In addition, the contrast between urban and rural areas has been highlighted and a better basis is required for the identification of HMA cores in these contrasting circumstances. There is potential to incorporate a self-containment trade-off into the HMA procedure, similar to that used in the TTWA framework, to reflect urban and rural area contrasts.

Finally, the relevance of adoption of the proposed framework for HMA delineation for policy analysis purposes is underlined in the requirements of the new Regional Spatial Strategies in seeking to address regional issues through a sub-regional approach, in order to tailor 'provision' to the requirements of specific areas. Indeed, *PPS 11* argues for

> splitting the region into a series of sub-regions for the purposes of developing distinct sets of policies for each sub-region and sub-regional divisions in the RSS for the purposes of distributing provision for housing or employment (ODPM, 2005a, p. 5).

Thus, from a spatial planning perspective, a combination of HMA and TTWA geographies would help to provide policy-makers with a more effective framework within which to assess housing and labour market performance. This would assist in the identification of relationships between the different *functional* markets associated with individual settlements, a capability that is not afforded by current reliance on the TTWA framework alone. This and related issues are more fully explored by Hincks and Brown (2006) and Hincks (2007).

Note

1. Wilmslow [3] with Macclesfield [21]; Runcorn and Widnes [13] with Warrington [14]; Blackburn [15] and Burnley and Nelson and Colne [36] with Accrington [38]; Chester [17] with Ellesmere Port and Neston [20]; Keswick [26] with Workington [27]; Kendal [33] with Windermere [34]; Chorley [37] with Preston [40].

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