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Modelling the duration of residence and plans for future residential relocation: a multilevel analysis

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Among the multitude of studies of factors that determine residential (im)mobility, relatively little attention has been paid to the length of time that people spend in a particular location and the importance of duration of stay for future relocation propensities. This study uses a large and detailed commercial survey sample of individuals in England and Wales and an appropriately tailored statistical approach to uncover new insights into the multilevel and spatially heterogeneous interactions that exist between residential duration, place attachment and plans for future residential relocation. We demonstrate how an individual's residential duration, as an essential ingredient for the accumulation of social capital and place-based attachment, is critical for informing plans for future (im)mobility. After controlling for a range of individual and contextual covariates, the predicted probability of planning a residential relocation is found to increase initially with duration of stay, to a peak after 4–5 years, and then to decline as the length of duration increases. However, there is evidence of strong geographical variation in this relationship, with some neighbourhoods being characterised by stable or even increasing propensities for movement with duration. The paper pays particular attention to the importance of wider neighbourhood dynamics (composition, selective sorting and population (in)stability), suggesting that they too play an important role in mediating duration-of-stay effects for individuals. The paper concludes by highlighting the need for researchers and policy practitioners interested in community dynamics, the development/accumulation of social capital and place attachment/rootedness, to give due consideration to multilevel durations of residence and, more broadly, the inherently spatial and temporal ties that bind individuals to place.

Key words residential duration; spatial mobility; place attachment; neighbourhood effects; multilevel modelling; England and Wales

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Introduction

The neighbourhood, that inherently subjective local domain of community, context, familiarity and everyday experience, has become a critical concept within the discourse and practice of mainstream public policy (Manley *et al*. 2013). Although slum clearance was commonplace in the post-war period, the 1998 New Deal for Communities marked the start of a new era of resource allocation to various area-based initiatives aimed at providing new means of addressing longstanding issues such as neighbourhood deprivation, sustainability, renewal and cohesion (Pill 2012). The emergence of the local neighbourhood as a suitable scale for this kind of 'modern' policy intervention can be attributed to New Labour's supposed 'third way' approach to economic and social policy, an approach that espoused what are now well-rehearsed narratives of mutuality, localism, self-help, community empowerment and civic renewal (Tiesdell and Allmendinger 2001). Indeed, many of these have remained in contemporary policy, an overt example being David Cameron's flagship 'Big Society' (Corbett and Walker 2013). However, beyond the abstractions of 'bottom-up' and 'third way' political philosophy, the reality of events such as the 2001 urban riots emphasised the centrality of localised issues, including the place-based coincidence of ethnicity and poverty, and concerns about community interaction and wider societal cohesion. Against this backdrop, it is unsurprising that many academics, from different disciplinary backgrounds, have actively sought to better understand the importance of neighbourhood composition and dynamics.

At the heart of many of the debates surrounding these concerns are the processes of residential duration and (im)mobility, 'multilevel' phenomena whose relationships with individual and neighbourhood compositional characteristics and dynamics have, to

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date, lacked sufficient conceptual and empirical attention (Hedman 2011). More specifically, residential (im)mobility can be expected to interact with the often subtle and hard to measure processes associated with the development and experience of local social capital – the very concept that underlies the social cohesion, mutuality, self-help and civic renewal that policymakers and practitioners have so ardently sought to engender (Tiesdell and Allmendinger 2001). There may also exist a tension within regeneration initiatives between encouraging individual social (and thus often spatial) mobility while simultaneously attempting to reduce the community 'churn' that is considered detrimental to the development of social capital (Coulter *et al.* 2015).

By synthesising longstanding theories of duration-of-residence effects, we seek to highlight the complex multilevel, multifaceted and spatially heterogeneous interactions that exist between residential duration, mobility and neighbourhood dynamics. Using a large and unique source of detailed geo-coded microdata and a multilevel statistical approach, we suggest that the processes of residential duration and (im)mobility, from the individual/household to the neighbourhood and district, are crucial factors in, and reflections of, the development of social capital, place attachment and community integration. More specifically, we reveal how: (a) individual duration of residence, as an essential ingredient for the development of place-based attachment and social capital accumulation, is a crucial predictor of individual mobility behaviour; (b) neighbourhood dynamics (composition, selective sorting and population (in)stability) can work to mediate individual duration-of-residence effects and mobility propensities; and (c) the size and direction of the duration-of-residence effect is characterised by considerable spatial variation, suggesting that sizable differences may exist between neighbourhoods in terms of the opportunities they provide for the accumulation of social capital and attachment to place. Thus, whether one is interested in the identification of neighbourhood effects and selection biases, or more practical policy considerations such as the implementation and sustainability of neighbourhood regeneration initiatives, the findings below are valuable in emphasising the need for a wider acknowledgement of the multilevel and spatially heterogeneous interactions of residential duration, spatial mobility and neighbourhood dynamics.

Literature review

Residential relocation

Over the past two decades the life-course approach has emerged as the primary theoretical tool for understanding what motivates individuals and households to change residence (Bailey 2009; Mulder 1993). This approach has proved a valuable theoretical tool for conceptualising the dynamism and uniqueness of individuals' lives, primarily by stressing the diversity in such factors as the timing, sequence and duration of what are crucial and mutually determined life events, transitions and states (Dykstra and van Wissen 1999). The decision to move is generally thought to be the result of ongoing individual and collective (household) evaluations of competing residential environments; that is, where the relative 'costs' of staying in the current location are balanced against those of moving to an alternative (Clark and Dieleman 1996). However, the emergence and evolution of events and transitions associated with, for example, unemployment, pregnancy, union dissolution and widowhood, can lead to serious adjustments in residential preferences, and in many cases increase the likelihood of relocation. These 'trigger' events, and their associated transitions, tend to provide the most common theme of enquiry in contemporary mobility studies. Far rarer are examples of research that consider the importance of life-course durations and, in particular, the ways in which residential duration can inform and respond to the evaluation of the residential environment and the subsequent 'costs' of relocation. The failure of previous analyses to acknowledge such factors is indicative of how extant research has struggled to recognise the importance of the ways in which lives are linked through time and space (Bailey 2009). Mainstream analyses of specific life-course events and transitions can all too often fail to acknowledge the essential relevance of the wider residential environment and the temporally and spatially defined relational ties that bind people to place (Coulter *et al.* 2015).

Residential duration

While explicit empirical analyses of duration-of-residence effects are rare, the concept of *cumulative inertia* has long been a mainstay of debate in population mobility research (Davies Withers 1997). The theory of cumulative inertia implies that as residential duration increases, stronger social and economic ties to the place of residence (household and/or area) are developed, the 'costs' associated with departure are increased and thus the likelihood of a future residential relocation is cumulatively reduced. Although rarely ever shown empirically, early conceptualisations supposed the functional form of cumulative inertia to be monotonic in nature, the passage of time bringing ever-greater reductions in the propensity to change residence (Land 1969; Morrison 1971). However, such a concept was said to avoid the reality of processes associated with *cumulative stress*, wherein it is anticipated that individuals/households become progressively dissatisfied with their housing and/or area of residence as their needs and aspirations change in relation to life-course progression (Huff and Clark 1978). If we expect individuals/households new to a residence to have selected the accommodation and area which, at least to

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some extent, fulfils their current housing, lifestyle and consumption preferences, then under conditions of cumulative stress we would expect these preferences to continue to evolve with the life course, such that the longer the duration of residence, the greater the mismatch between current and desired residential environment.

Although both theories offer valuable theoretical reflections on the disparate ways in which duration of residence can be bound to residential environment, social capital development and life-course adjustments, the appeal of Gordon and Molho's theoretical model lies in their succinct synthesis of inertia and stress, recognising that

> although longer residence in an area may generally increase the 'costs' of any subsequent move, the passage of time will always lead to a minority (at least) of the population to re-evaluate their original [residential] preferences. (Gordon and Molho 1995, 1972)

This notion of ongoing (re)evaluation of preferences ties into the various considerations that will emerge as the life-course develops, but it can also be used to acknowledge how preferences for moving are 'adaptive' so that, over time, the emergence of (sometimes unforeseen) opportunities to move might also shape durations and plans to relocate. Their theory implied an associational relationship characterised by a rise to an initial peak followed by a gradual tailing-off in movement probabilities as duration increases – a relationship they demonstrated empirically using the 1983 General Household Survey.

According to Gordon and Molho (1995), a key factor behind the empirical demonstration of a non-monotonic duration relationship is the development and incorporation of suitably rigorous controls for important additional sources of heterogeneity in the response variable, controls designed with the purpose of helping to separate out independent duration-of-residence effects. Early studies by Land (1969) and Morrison (1971), both of which included just a few covariates, found a negative monotonic duration-of-residence relationship. Yet, this relationship may be little more than a spurious effect of selection, whereby those with the lowest propensities to move, over and above the effects of the explanatory variables – perhaps due to unmeasured behavioural predispositions – will tend to have longer than expected durations, while those with a behavioural predisposition for regular mobility will tend to have shorter than expected durations-of-residence (Davies and Pickles 1985). Thus, a spurious negative relationship may emerge because those with longer durations are also those with a 'natural' (and unmeasured) predisposition to stay put. When Gordon and Molho applied a bivariate analysis, they too found a simple monotonic inertia effect, yet, once a theoretically informed selection of controls was included in a multivariate model, the relationship changed to the non-monotonic one described by their theory. While the observational nature of such studies means that all potential sources of heterogeneity cannot be covered in a final model (Feijten and van Ham 2009), it is clear that attempts to incorporate sufficient controls will be crucial for identifying real duration effects.

Residential context

One potentially critical and hitherto understudied source of heterogeneity is that of the wider residential context. Mixed empirical results have led to much debate about the relative importance of the residential context on micro-level mobility behaviours (Clark and Ledwith 2006; Rabe and Taylor 2010). However, an increasing body of work suggests that certain place-based characteristics are relevant (Crowder *et al.* 2012; Feijten and van Ham 2009; Thomas *et al.* 2015; van Ham and Clark 2009). Social norms and discourses surrounding social status and neighbourhood desirability are said to motivate individuals to leave neighbourhoods where their neighbours are assumed to be of lower socioeconomic status than themselves (Harris 1999). Moreover, where higher levels of neighbourhood deprivation have been linked to lower levels of social cohesion and higher levels of crime and disorder (Sampson *et al.* 1997), the reality of such selective neighbourhood processes has been revealed (Bailey and Livingston 2008). Those who are of higher socioeconomic status, having greater (financial) means, tend to self-select out of deprived neighbourhoods – a process that steadily reinforces place-based deprivation (i.e. leaving behind and concentrating the deprived).

Beyond neighbourhood deprivation, some analysts have suggested that greater ethnic heterogeneity is associated with greater residential dissatisfaction and resultant out-migration among the majority population – so-called 'white flight' (Crowder 2000). Conversely, the opposite relationship can exist for minority groups, with more diverse neighbourhoods and those with greater co-ethnic density being more attractive (Finney and Jivraj 2013). However, other studies suggest that once important confounding factors are controlled for, most noticeably that of the socioeconomic composition of the neighbourhood, the influence of ethnic heterogeneity on residential satisfaction and mobility intentions disappears, or is very minimal at most (Harris 1999). Finally, a third factor, population instability (the intensity of movement to, from and within an area), has also been suggested as a potentially important influence on a multitude of individual/household and neighbourhood relevant dynamics, and, given our substantive focus, is deemed deserving of particular attention here.

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Literature exploring the influence of neighbourhood population instability has suggested that it be associated with broadly negative externalities, reflected, for instance, in greater fears and occurrences of violence and crime (Sampson *et al.* 1997) and generally lower residential attractiveness (Andersson and Bråmå 2004). For duration-of-residence effects, the degree of neighbourhood instability can also be thought to influence the opportunity and potential for residents to form meaningful community and place-based social interactions and attachments. A central tenet of duration-dependence theory is that with longer residential duration stronger social ties and attachments are formed, thus increasing the costs and reducing the probability of relocation. Therefore, while stable residential populations may be conducive to the formation of stronger social ties, networks and capital, population instability can be expected to disrupt their formation and maintenance (Hedman 2011).

It is, however, important to recognise the complexity, selectivity and heterogeneity that can exist when considering place-based effects/processes. In the UK, the highest levels of population instability are found in the more dynamic urban areas of city living and/or high student populations (Dennett and Stillwell 2008). Such neighbourhoods have high proportions of privately rented dwellings and young, typically single, adults (van Ham and Clark 2009). Consequently, though areas of high population instability may be detrimental to the forging of stronger place-based social ties, given the housing stock and demographic profile of these areas, it is equally likely that those living in and moving to them are less concerned by such matters given their (assumed) desire for residential flexibility (i.e. short durations) at this life-course stage. If moves into areas of high *instability* are generally made with the pre-understanding that residency will be short term, it would be fair to expect the inhabitants of such areas, many of whom may have arrived only a short time previously, to have an increased likelihood for further mobility when compared with similar residents in areas of greater population *stability*.

Yet, while neighbourhood composition, selection and population (in)stability may be expected to play important roles in mediating durations of residence, attachments to place, development of social capital and subsequent mobility behaviours, more subtle neighbourhood influences should also be considered. As suggested by Sampson *et al.* (2002), a plethora of additional factors associated with social processes and institutional mechanisms can be expected to contribute to our evaluation of, and commitment to, places. Certainly, spatial variation in the opportunity to develop strong social ties, familiarity and interactions, mutual trust and collective efficacy, and an attachment to local institutional resources and routines (e.g. organised social and recreational activities), should be expected. Indeed, certain locations may lend themselves to the accumulation of social capital and place-based attachment through their relative abundance of local institutional resources and routines, while other places may have very little in the way of such assets.

The development of subtle links to place can take time, and the extent to which their influence will be realised may depend strongly on the resident remaining in place for at least a critical duration ('exposure') period (Fischer and Malmberg 2001; Hedman 2011; Tienda 1991). Thus, given our focus on duration-of-residence effects, we may expect individual duration-dependence to vary in strength, and possibly direction, between local neighbourhoods, and possibly between larger scale districts also, as a result of the varying opportunities for the development and maintenance of these more subtle residential influences and externalities. After all, in the presence of few positive externalities, longer durations need not necessarily be satisfactory durations bound by strong social capital investment and place attachment; rather they can be undesired consequences of disparate restrictions, financial or otherwise, on relocation (Coulter and van Ham 2013).

In an attempt to synthesise the points raised so far, we derive a series of specific, though inherently interlinked, research aims:

- to examine the functional form of the relationship between individual residential duration and future mobility propensities
- to establish the ways in which neighbourhood dynamics mediate and inform the effect of individual duration dependence and mobility propensities and
- to reveal whether the size and direction of the duration-of-residence effect is characterised by considerable spatial variation, having controlled for observed individual and neighbourhood composition.

Data and measures

The individual-level data used in the analysis are drawn from the Acxiom Ltd[1] Research Opinion Poll (ROP), a voluntary and principally paper-based cross-sectional consumer survey of individual respondents aged 18 and over in Great Britain (GB). While the exact collection and response details are not disclosed by Acxiom, various postal-address sources were used that enabled the ROP to generate a large sample with extensive geographical coverage, detailed geo-identifiers (full postcode), key demographic, socio-economic and residential characteristics, as well as more novel

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behavioural and lifestyle information (Rees *et al.* 2009). Following a comprehensive model-based benchmarking and validation process (Thomas 2014; Thomas *et al.* 2014), the ROP appears to be a useful and reliable source of data for the multilevel analysis of individual propensities to move within GB.

Beyond its size, the ROP has a number of advantages over alternative data sources for the analysis of duration dependence and residential relocation. First, for the years 2005–07, the ROP included the questions 'When did you move to this address?' and 'Are you planning to move (in the next 12 months)?' From these questions, it is possible to calculate the residential durations (by year) and the propensity to move in the 12 months following survey completion. Second, when the data are pooled across this three-year period, a large and spatially extensive (non-clustered) analytical sample of individual household respondents is yielded.[2] Third, each individual respondent has a full unit postcode address identifier, which allows great flexibility in operationalising and specifying spatial residential contexts.

A binary dependent variable indicating whether the individual (household respondent) is planning a move in the next 12 months (0 = no; 1 = yes) is used. Although the cross-sectional nature of the data prevents any examination of *actual* mobility outcomes at a subsequent wave, planning a move would suggest that serious practical considerations (including financial costs and the likelihood of success) had been made by the individual/household and can thus be expected to correlate closely with *real* movement propensities (Lu 1998). In keeping with similar studies, the independent variable of interest, duration of residence, is measured from the time of arrival at the current residence (for adult movers) or the time immediately after reaching adulthood (where movement intentions are assumed to be more independent), here defined as 18 years of age (Gordon and Molho 1995). The range of durations is limited to 20 years so as to avoid problems with sparsity in the sample and to reduce the potential for recall bias, which can be expected to be particularly severe for those with very long durations. Drawing on the literature reviewed above, a battery of micro-level (individual and household) covariates are used in an attempt to control for important sources of heterogeneity in the dependent variable. These controls include: age, gender, ethnicity, occupation, gross annual household income, educational attainment, housing tenure and marital status. An additional variable is included to account for the fact that the analytical sample is made up of three separate ROP cross-sections (January 2005, 2006 and 2007).

Moreover, given that individual evaluations of residential satisfaction are assumed to extend beyond the individual and household, a multilevel modelling (MLM) approach is deemed appropriate, with individuals being nested within residential neighbourhoods that can themselves be nested within higher-level spatial units. The subjective nature of what constitutes a neighbourhood makes its empirical definition and operationalisation a particularly difficult endeavour (Kearns and Parkinson 2001) since its meaning and relevance will change according to the people and places studied (Orford and Leigh 2014). Nevertheless, different types of administrative or statistical geography have been employed as neighbourhood proxies in empirical research, and certain boundary definitions have been explicitly designed to accommodate considerations of their conceptual definition – the UK system of census Output Areas (OAs) being a prime example (Martin 2002). Drawing on the unique spatial coverage and detail of the ROP, the residential neighbourhood is defined here using the census Middle Super Output Area (MSOA) geography for England and Wales. In addition to accommodating conceptual definitions and physical features (e.g. major roads and typological features), these geographical units are designed to be stable over time and similar in terms of their constituent population size ($n \approx 3000$ households) (Martin 2002). Smaller geographical units are available, but MSOAs are a useful compromise in being small enough to be reasonable approximations of the local neighbourhood while being large enough to enable sufficient numbers of individuals to be clustered within them, the latter being a valuable characteristic for estimating MLM parameters. An additional benefit is that MSOAs nest perfectly into Local Authority Districts (LADs), the geographical level of local government operation and allocation. LADs can themselves aggregate into functional geographical city regions, spatial units designed to provide a manageable set of regions based on metropolitan cores and their 'tributary' hinterland areas (metro rest, near, coast and country areas) (Stillwell *et al.* 2000). City regions are particularly useful for spatial mobility analyses as they provide approximations for the urban hierarchy and wider spatial economic system in England and Wales.

The nesting of MSOAs into these higher level geographies is important for a number of reasons. First, as hinted at in the choice of higher level units, we can expect there to be certain sources of variation in mobility propensities that operate at levels beyond the neighbourhood, such as district and regional variations in property markets, labour markets, wealth, urbanicity and the environment. Second, as Brunton-Smith and Sturgis (2011, 342) have pointed out, the reliance on fixed MSOA boundaries means that our definition of the neighbourhood is somewhat arbitrary – particularly for those who live near areal boundaries and whose subjective locality is likely to stretch beyond their designated operational neighbourhood. By nesting

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MSOAs into higher level units in a MLM, we acknowledge the conceptual spatial clustering and dependency of nearby areas, a trait that also holds additional technical advantages *vis-à-vis* the standard assumption of the independence of observations in regression modelling (Snijders and Bosker 2012).

Unfortunately, MSOAs are not available for Scotland and, although Intermediate Zones (equivalent to MSOAs) were designed in 2005, the lack of availability/consistency of relevant neighbourhood characteristics measured at this level means that our analysis is restricted to England and Wales only. The neighbourhood characteristics used are informed by the literature discussed above and are derived from a mixture of 2001 Census aggregate population data and ONS model-based area estimates.[3] In line with other studies of this type, the Herfindahl Concentration Index (Sturgis *et al.* 2011) was applied to calculate the degree of ethnic heterogeneity in each MSOA based on 2001 Census data. Furthermore, an ONS model-based estimate (Fry 2011) of the proportion of households in poverty (defined as below 60% of the UK median net equalised household income after housing costs) for each MSOA (2007/08) is used to assess the levels of relative deprivation and income poverty in the wider residential neighbourhood. Finally, differential levels of neighbourhood population instability are measured via a population churn statistic using data from the 2001 Special Migration Statistics. The churn statistic for area i is defined as the sum of the in-migrants to, out-migrants from and movers within area i, divided by the population of area i, and is expressed as a rate per thousand. A failure to incorporate within-area movement relative to the population size can lead to a situation where two areas of similar turnover, but with drastically different internal mobility, are treated as similar residential contexts when in reality the stability of the neighbourhood populations are very different (Dennett and Stillwell 2008). Table I presents the summary statistics of the variables used in the analysis.

Analysis and modelling strategy

Using the definitions outlined above, a substantial analytical sample of 224 164 individuals (25 978 planning to move, 11.6%) (level 1) is incorporated into a MLM with 7192 (level-2) MSOAs (containing a mean average of 31.2 respondents), 346 (level-3) LADs and 33 (level-4) city regions. MLMs allow us to simultaneously model the effects of individual and area-level characteristics, as well as any cross-level interactions of potential substantive interest, on the propensity to be planning a move (Snijders and Bosker 2012). Moreover, by nesting individuals into neighbourhoods, and the latter into higher level units, a MLM handles issues of dependency and the clustering of responses and also allows the separation and exploration of the relative contribution of each level to the total variation in the response.

A full multilevel logistic regression model with random intercepts and random coefficients is specified. Having randomly varying intercepts allows us to uncover the between-region, within-region-between-LAD and within-LAD-between-MSOA residual differentials in the propensity to be planning a move. Furthermore, randomly varying coefficients provide the opportunity to test whether certain slope terms vary across higher level units. Indeed, the coefficient for duration of residence is allowed to vary across neighbourhoods (level 2) and districts (level 3). Equation 1 shows a simplified form of the full random intercepts and slopes logit model incorporating a single individual-level variable, a single neighbourhood-level variable and a cross-level interaction between the two variables:

$$\ln\left(\frac{\pi_{ijkl}}{1-\pi_{ijkl}}\right) = \begin{array}{l}\beta_0 + \beta_{1jk}x_{1ijkl} + \beta_2 x_{2jkl} + \beta_3 x_{1ijkl}x_{2jkl} \\ + f_{0l} + v_{0kl} + v_{1kl}x_{1ijkl} + u_{0jkl} \\ + u_{1jkl}x_{1ijkl},\end{array} \quad (1)$$

where

$\ln\left(\frac{\pi_{ijkl}}{1-\pi_{ijkl}}\right)$ is the log-odds that individual i (level 1) in neighbourhood j (level 2), district k (level 3) and region l (level 4) is planning a move in the next 12 months;

x_{1ijkl} is a level-1 predictor variable (e.g. duration at residence);

x_{2jkl} is a level-2 predictor variable (e.g. neighbourhood churn);

β_0 is the overall intercept and represents the log-odds that $y = 1$ across all i, j, k and l units when all predictors are held at their reference (i.e. $x = 0$ and $f = 0, v = 0, u = 0$);

β_{1jk} is the estimated slope term associated with the level-1 predictor variable, the jk subscripts denote that this term is allowed to vary at level 2 and level 3;

β_2 is the estimated slope term associated with the level-2 predictor variable;

β_3 is the estimated slope term associated with the cross-level interaction between the level-1 and level-2 predictor variables;

f_{0l} is the conditional random differential intercepts term for city regions (level 4);

v_{0kl}, v_{1kl} are the within-region-between-district conditional random differential intercepts term and random coefficient term (level 3);

u_{0jkl}, u_{1jkl} are the within-district-between-neighbourhood conditional random differential intercepts term and random coefficient term (level 2).

Due to the binary outcome, the level-1 variance is assumed to come from the Bernoulli distribution with mean π_{ijkl} and a variance $\pi_{ijkl}(1 - \pi_{ijkl})$. The random effects in Equation 1, $f_{0l}, v_{0kl}, v_{1kl}, u_{0jkl}$ and u_{1jkl} are on the logit scale and are assumed to follow normal

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Table I Frequencies and means of variables (n = 224 164)

Frequencies	*n*	*%*	*Frequencies*	*n*	*%*
Planning to move in next 12 months					
Yes	25 978	11.6			
No	198 186	88.4			
Residential duration (years)			*Gross household income (£)*		
1	19 819	8.8	Up to 5 000	12 484	5.6
2	17 277	7.7	5 000–9 999	27 222	12.1
3	18 389	8.2	10 000–14 999	29 316	13.1
4	18 908	8.4	15 000–19 999	26 421	11.8
5	18 032	8.0	20 000–24 999	24 482	10.9
6	17 293	7.7	25 000–29 999	23 253	10.4
7	16 066	7.2	30 000–34 999	20 593	9.2
8	13 278	5.9	35 000–39 999	15 021	6.7
9	11 045	4.9	40 000–44 999	12 094	5.4
10	9420	4.2	45 000–49 999	9355	4.2
11	9379	4.2	50 000+	23 923	10.7
12	7041	3.1	*Occupation group*		
13	6811	3.0	Higher managerial administrative & professional	72 998	32.6
14	5974	2.7	Intermediate	43 866	19.6
15	6140	2.7	Routine & manual	26 887	12.0
16	5617	2.5	Student	6270	2.8
17	6084	2.7	Retired	37 373	16.7
18	5708	2.5	Homemaker	25 787	11.5
19	6049	2.7	Unemployed	10 983	4.9
20	5834	2.6	*Educational attainment*		
Gender			Degree	57 443	25.6
Female	136 159	60.7	2+ 'A' levels	35 484	15.8
Male	88 005	39.3	5+ GCSEs	79 423	35.4
Ethnic group			None	51 814	23.1
Asian	5309	2.4	*Housing tenure*		
Black	3269	1.5	Homeowner	148 059	66.0
Other	4144	1.8	Rent private	29 092	13.0
White	211 442	94.3	Rent housing association	17 677	7.9
Marital status			Rent council	29 336	13.1
Divorced/separated	33 972	15.2	*Data set*		
Living with partner	30 395	13.6	2005	75 979	33.9
Married	110 525	49.3	2006	32 240	14.4
Single	39 015	17.4	2007	115 945	51.7
Widowed	10 257	4.6			

Means	*Mean*	S.D.
Age	45.9	14.3
Neighbourhood churn	184.5	67.6
Neighbourhood income poverty	22.0	8.0
Neighbourhood ethnic heterogeneity	0.1	0.1

distributions with zero means, variances $\sigma^2_{f0}, \sigma^2_{v0}, \sigma^2_{v1}, \sigma^2_{u0}$ and σ^2_{u1} respectively, and covariances σ_{v01} and σ_{u01} reflecting the covariance between the intercepts and slopes at level 3 and level 2 respectively. All level-1 and level-2 fixed-part predictor variables have been centred at their mean (or typical) value so as to aid interpretation of the random part. Gross household income and residential duration are both measured using orthogonal polynomials, a parsimonious parameter coding system that allows for the maintenance and measurement of order within an ordinal categorical (Rasbash *et al.* 2012). The resultant set of variables have a mean of zero and are orthogonal to one another, thus protecting against issues of multicollinearity traditionally associated with the inclusion of multiple polynomial forms of the same variable. Initial tests suggested a linear polynomial was sufficient for capturing the relationship for household income, whereas a quartic polynomial was required to describe the complexity of the duration-of-residence relationship.

Given the binary nature of the response variable, Bayesian Markov chain Monte Carlo (MCMC) estimation is used, providing a more efficient and robust estimation to alternative maximum likelihood-based methods (Browne and Draper 2006). The technical and philosophical details of the Bayesian approach are

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complex and far beyond the scope of this paper – useful discussions of Bayesian methods for multilevel modelling are given in Gelman *et al.* (2004) and Congdon (2010). Broadly speaking, modelled parameters are not to be regarded as having fixed values, as in the frequentist tradition. The Bayesian approach involves the combination of prior beliefs with empirical data to form a posterior distribution for each parameter, a distribution that gives the degree of support for different values of the parameter. The mean of this distribution can be used as an approximate equivalent to a maximum likelihood point estimate, the standard deviation of the distribution can be used as a standard error while the 2.5% lowest and highest values of the distribution form the 95% credible intervals – giving the 95% probability that the parameter falls within the interval (Snijders and Bosker 2012). In practice it is often not desirable to use informative prior distributions in the calculation of the posterior; rather the aim may be to only use *evidence* from the empirical data collected (Browne 2015). Thus, in our models, the prior distribution is specified as flat/uniform and therefore minimally informative, with starting values based on initial maximum likelihood methods. All models are estimated using the MLwiN software with model convergence assessed following the good-practice recommendations of Draper (2006) and Jones and Subramanian (2012). The Deviance Information Criterion (DIC) is used to compare models and is a 'badness-of-fit' measure that penalises for model complexity; lower values of DIC suggest a better, more parsimonious, model – a reduction of just 3–7 units should be considered a potentially important difference in model fit (Spiegelhalter *et al*. 2002).

Our modelling strategy involves the specification of three models of increasing complexity. Model 1, a null model (variance components model) with random intercepts only, provides an initial indication of how the total variability in the propensity of planning a move is partitioned across individuals, neighbourhoods, districts and regions, before compositional differences between individuals and neighbourhoods are accounted for. With the aim of uncovering the conditional effect of residential duration on mobility propensities, Model 2 includes all the level-1 and level-2 variables and interactions (mentioned above). Model 3 (Equation 1) builds on Model 2 by allowing the residential-duration effect to vary across the different neighbourhoods and districts of England and Wales. By adding the random slope terms, it is possible to assess the extent to which remaining (residual) between-neighbourhood and between-district differentials depend on duration of stay.

Results

Table II presents the model results. In order to facilitate an interpretation of the magnitude of non-individual variance, the between-individual variance is assumed to follow a standard logistic distribution of 3.29 (Snijders and Bosker 2012). Through the use of this standard assumption, the null model (Model 1) estimates that 4 per cent of the variance in individuals' plans for future residential movement is attributable to contextual, non-individual, variation ([0.03 + 0.02 + 0.078]/[0.03 + 0.02 + 0.078 + 3.29]). While this value may initially appear rather small, it closely reflects the findings of similar analysis by Feijten and van Ham (2009). Given that the micro-level (individual/household) is where, ultimately, the decision to change residence is made, we should expect the differential characteristics at this level to be dominant. Building on this, the level-1 and level-2 covariates and their cross-level interactions are included (Model 2), leading to a substantially improved model (DIC is 13 561 units lower than in Model 1) before, finally (Model 3), the estimated duration-of-residence effects are allowed to vary across neighbourhoods (level 2) and districts (level 3), which again leads to a significant reduction in the DIC statistic (66 units lower than in Model 2).

Before moving to the multilevel interactions between residential duration, mobility and immobility, some additional observations of relevance for predicting the probability of planning a future residential move are considered (see additional supporting information, Figure S1, for plotted predicted probabilities and 95% credible intervals). These include: (a) marital status; (b) occupational status; (c) educational attainment; (d) the interaction between age and housing tenure; and the cross-level interactions between; (e) ethnicity and neighbourhood ethnic heterogeneity and (f) household income and neighbourhood deprivation.

Marital status is used here as a rather crude proxy for co-residency, household structure and the identification of tied decisionmaking processes. A particular limitation of relevance here is the omission of additional family-relevant covariates detailing the effects of pregnancy and childbirth (unavailable in the ROP), which are known to raise the probability for residential relocation (Clark and Huang 2003), and the presence of school-age dependent children in the household, where parental desires to avoid disrupting children's education are expected to lower mobility propensities. While the lack of such characteristics, as well as a longitudinal dimension, preclude the opportunity to explore potentially important household events and transitions, holding all other variables constant, married individuals are the least likely to be planning a change of residence, a finding that likely reflects the relative stability of this partnership formation when compared with others.

In regard to occupational status, quite small differences between the groups are observed, with the

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Table II Multilevel logit model for individual plans to move in the next 12 months[6]

	Model 1 *Null: Estimate (S.E.)*	*Model 2* *Intermediate: Estimate (S.E.)*	*Model 3* *Full: Estimate (S.E.)*
Fixed effects			
Constant	−2.115 (0.034)*	−2.660 (0.027)*	−2.682 (0.028)*
Age (centred at 46)		−0.022 (0.001)*	−0.022 (0.001)*
Age^2		0.000 (0.000)*	0.000 (0.000)*
Gender (ref = Female)		0.073 (0.015)*	0.073 (0.015)*
Ethnic group (ref = White)			
Asian		0.222 (0.063)*	0.221 (0.063)*
Black		0.342 (0.074)*	0.338 (0.075)*
Other		0.352 (0.051)*	0.352 (0.051)*
Marital status (ref = Married)			
Living with partner		0.262 (0.021)*	0.262 (0.021)*
Divorced/separated		0.272 (0.023)*	0.271 (0.023)*
Widowed		0.027 (0.051)	0.027 (0.051)
Single		0.125 (0.021)*	0.125 (0.021)*
Gross household income (linear polynomial)		0.385 (0.035)*	0.386 (0.035)*
Occupation group (ref = Intermediate)			
Higher managerial administrative & professional		0.051 (0.020)*	0.052 (0.020)*
Routine & manual		−0.075 (0.026)*	−0.075 (0.026)*
Student		−0.048 (0.039)	−0.047 (0.039)
Retired		−0.021 (0.038)	−0.020 (0.038)
Homemaker		0.025 (0.027)	0.026 (0.027)
Unemployed		0.189 (0.034)*	0.188 (0.034)*
*Educational attainment (*ref = 5+ GCSEs)			
First degree		0.100 (0.019)*	0.101 (0.020)*
2+ 'A' levels		0.046 (0.020)*	0.046 (0.020)*
No qualifications		−0.051 (0.021)*	−0.051 (0.021)*
Housing tenure (ref = Homeowner)			
Rent private		1.063 (0.027)*	1.068 (0.027)*
Rent housing association		0.227 (0.038)*	0.227 (0.038)*
Rent council		0.159 (0.032)*	0.163 (0.032)*
Housing tenure × Age			
Rent private, Age		−0.022 (0.002)*	−0.022 (0.002)*
Rent private, Age^2		−0.000 (0.000)*	−0.000 (0.000)*
Rent housing association, Age		−0.028 (0.002)*	−0.028 (0.002)*
Rent housing association, Age^2		0.000 (0.000)	0.000 (0.000)
Rent council, Age		−0.025 (0.002)*	−0.025 (0.002)*
Rent council, Age^2		0.000 (0.000)*	0.000 (0.000)*
Residential duration			
Linear polynomial		−0.356 (0.045)*	−0.455 (0.056)*
Quadratic polynomial		−0.071 (0.041)*	−0.135 (0.043)*
Cubic polynomial		0.147 (0.040)*	0.143 (0.041)*
Quartic polynomial		−0.116 (0.035)*	−0.117 (0.035)*
Data set (ref = 2007)			
2005		0.037 (0.015)*	0.036 (0.015)*
2006		−0.356 (0.024)*	−0.357 (0.024)*
Neighbourhood churn (gm-centred)		0.001 (0.000)*	0.001 (0.000)*
Duration × Neighbourhood churn		−0.003 (0.000)*	−0.003 (0.001)*
Neighbourhood income poverty (gm-centred)		0.008 (0.001)*	0.008 (0.001)*
Gross household income × Neighbourhood income poverty		0.011 (0.003)*	0.012 (0.003)*
Neighbourhood ethnic heterogeneity (gm-centred)		0.474 (0.083)*	0.462 (0.081)*
Ethnic group × Neighbourhood ethnic heterogeneity			
Asian, Ethnic heterogeneity		−0.518 (0.195)*	−0.507 (0.196)*
Black, Ethnic heterogeneity		−0.178 (0.213)	−0.160 (0.215)
Other, Ethnic heterogeneity		−0.898 (0.203)*	−0.886 (0.203)*

(Continued)

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Table II (Continued)

	Model 1 Null: Estimate (S.E.)	*Model 2 Intermediate: Estimate (S.E.)*	*Model 3 Full: Estimate (S.E.)*
Random effects			
Level-4 City Region:			
σ^2_{f0} (Intercept variance)	0.030 (0.011)	0.004 (0.002)	0.003 (0.002)
Level-3 District:			
σ^2_{v0} (Intercept variance)	0.020 (0.003)	0.003 (0.002)	0.008 (0.003)
σ^2_{v1} (Duration slope variance)			0.070 (0.029)
σ_{v01} (Intercept-duration covariance)			0.021 (0.008)
Level-2 Neighbourhood:			
σ^2_{u0} (Intercept variance)	0.078 (0.007)	0.026 (0.006)	0.043 (0.010)
σ^2_{u1} (Duration slope variance)			0.717 (0.162)
σ_{u01} (Intercept-duration covariance)			0.113 (0.035)
Level-1 Individual:			
Variance (Residual)	3.29	3.29	3.29
DIC:	159 345.474	145 784.156	145 718.504

N.B. Estimated coefficients are logits; *indicates fixed-part parameter is significant at the 95 per cent level; gm-centred denotes variable is centred on its grand mean value – ethnic heterogeneity (centred at 0.102), income poverty (centred at 21.946) and churn (centred at 184.501).

exception being the unemployed who, whether self-determined or socially/economically imposed, are seen to have particularly raised probabilities of planning a future move. In terms of educational qualifications, the common pattern emerges wherein those with higher educational attainment are generally associated with increased probabilities of planning a residential move (van Ham *et al.* 2001).

By far the largest differential effects are found when age and housing tenure are interacted. As expected, across all tenure groups the probability of planning a move decreases with age; however, the extent of each slope is quite different, particularly for private renters as compared with homeowners. It appears that across the age groups, owner occupiers generally reflect comparatively low movement propensities. As Mulder (2013) has noted, homeownership is the least flexible tenure type; the high transaction costs, transfer tax and the mortgage costs as well as the security of tenure that ownership provides, are all factors that can reduce the propensity for residential relocation. This contrasts with the private rental sector in the UK, where greater flexibility, or for some insecurity, is associated with a mix of lower relocation costs, short-term tenancies and higher propensities for residential mobility. Private renting can reflect very different social and economic circumstances for individuals depending on their life-course stage, which itself may explain the particularly sharp decrease in movement propensities with age for this group. Although private renting is a common and often desired tenure type for those in younger age groups, considering the greater space, quality and security often afforded by homeownership, as well as the strong social norms prescribing homeownership as the desirable/successful way of living (Lauster 2010), private renting can be expected to reflect a relatively disadvantaged social and economic position for those in their middle and later years.

Finally, the white ethnic majority appear to have lower propensities for movement when compared with non-white ethnic minorities; however, their propensity to move increases as neighbourhood ethnic diversity grows. This fits with expectations discussed previously. Similarly, in terms of household income and neighbourhood deprivation, the expected pattern emerges: higher levels of neighbourhood deprivation increase plans for movement. While we must be aware of potential selection effects, the negative externalities and lower levels of place-based attachment associated with greater neighbourhood deprivation may be an important explanatory factor. However, crucially, when predicted probabilities are estimated (see Figure S1), there appears to be little difference in movement propensities according to neighbourhood deprivation for low-income households; the real divergence only appears for those in the highest incomes. This points to the fact that those with greater incomes are better placed to act on preferences to relocate away from areas of deprivation, whereas those with access to the lowest incomes are unlikely to be in a position to approach a stage of serious planning, even if a move away was indeed desired.

Duration-of-residence effects

Having controlled for a wide range of individual and contextual characteristics, the estimates from Model 3 (Table II) reveal a non-monotonic duration-of-residence effect. As shown by the thick line in Figure 1, the functional form for the average residential-duration relationship is reflective of neither simple cumulative inertia nor cumulative stress; rather it closely echoes that of Gordon and Molho's (1995) analysis, wherein we observe an initial rise before a gradual tailing-off in

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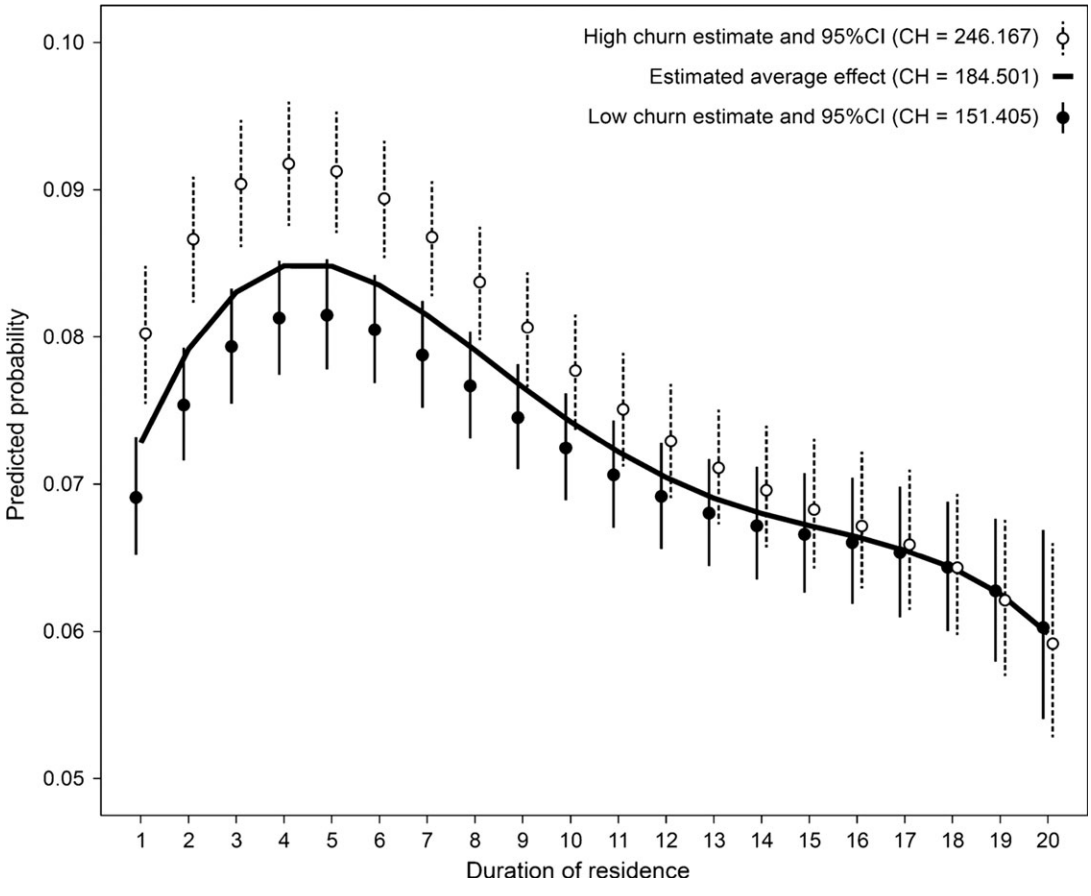

Figure 1 Probability of planning a residential relocation by residential duration and neighbourhood population churn

movement probabilities as duration increases. As Gordon and Molho argued, longer residential durations may increase the 'costs' of a residential move, but changes brought on by the passage of time will often lead to a situation where original residential preferences are re-evaluated in favour of alternatives. Thus, while the propensity to relocate is relatively low for the very shortest (1 or 2 year) durations, the non-stationarity of residential preferences can lead to residential mismatches that, in some cases, will necessitate a change of residence.

Moreover, Figure 1 appears to support the expected relevance of neighbourhood instability in terms of its ability to condition the duration-of-residence effect. As was predicted, the probability of planning a move is raised for those residing in neighbourhoods with higher population instability. However, the differential effect is found to be most pronounced when the duration-of-residence is relatively short. While it is possible that population instability creates an environment that is detrimental to the forging and maintenance of stronger place-based social ties and the associated development and accumulation of social capital, given the raised peaking for short durations and the apparent insignificance of population instability as a mediating factor for those with longer durations, an alternative explanation is more appropriate. Indeed, as discussed above, neighbourhoods with the highest population instability are generally those that contain high proportions of privately rented dwellings as well as student and young unattached populations. Thus, given the housing stock and demographic profile of these neighbourhoods, it is perhaps more probable that moves to such areas are made with the pre-understanding and preference that residency will be short term and flexible.

Previous studies revealing cumulative inertia effects have been said to more accurately portray the results of the unwanted correlation between the duration-of-residence variable and the residual – an issue that results from the failure to sufficiently account for heterogeneity in the dependent variable. While this is something that must be considered in all observational studies, our results do not reflect the relationship that would be expected if this were the case, i.e. a monotonically negative duration effect. The inclusion of a large number of individual, household and

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neighbourhood attributes appears to have been successful in capturing the sample heterogeneity which has, in previous analyses, led to spurious negative duration dependence.[4] With the consistency in the pattern observed here and by Gordon and Molho (1995), we can have a greater degree of confidence in suggesting that the shared non-monotonic relationship is a more accurate description of the genuine duration-dependence effect, as opposed to being the result of a simple selection effect.

Yet, while the average duration effect is of clear interest, given the expected importance of social and economic processes and mechanisms that operate within the wider residential locale, there is strong reason to expect the duration effect to vary geographically between neighbourhoods and even districts. Beyond the individual and compositional characteristics of the neighbourhood, the opportunity, existence and degree of local social capital can be expected to be crucial for informing context-specific residential satisfaction, place-based attachment and residential durations. Longer durations may also be crucial for enabling individuals to accumulate and maintain greater levels of local social capital, which in turn encourages greater integration/attachment and lower probabilities of movement over time. Conversely, in certain environments, greater exposure times to wider residential contexts may also be important in allowing for negative neighbourhood effects to manifest, thus encouraging higher probabilities to be planning a move away. With this in mind, the effect of residential duration was allowed to vary across neighbourhoods (level 2) and districts (level 3).

The positive covariance terms for levels 2 (σ_{u01}) and 3 (σ_{v01}) in Table II suggest that there is evidence for a quadratic growth in contextual variation as duration increases. Despite the residual *between-district* variation in the log-odds of planning a residential relocation remaining relatively low regardless of duration, the *between-neighbourhood* variation is observed to grow considerably as we move up the duration scale (see Figure S2).[5] In other words, while the existence of omitted variables operating at the individual and contextual levels makes the definitive confirmation of neighbourhood effects somewhat difficult, the large positive covariance term at the neighbourhood level appears consistent with the argument that longer durations are important for differential neighbourhood externalities (positive or negative) to emerge and thus influence individuals' attachment to place and subsequent mobility behaviours.

A more detailed exploration of the between-neighbourhood variation is provided by Figure 2, where it is clear that quite substantial differences exist between neighbourhoods in both the strength and direction of their respective slope terms. For instance, Figure 2a presents a sample of 30 neighbourhoods that are characterised by negative coefficients wherein, on average, the probability of planning a residential move is found to decrease with duration (i.e. consistent with cumulative inertia). It may well be the case that these neighbourhoods are particularly conducive to the creation of greater social and institutional capital as discussed by Sampson *et al.* (2002), with their residents enjoying greater place-based attachment as residential durations increase.

Conversely, Figure 2b presents a similar-sized sample of neighbourhoods with flat duration relationships, where the length of duration in these neighbourhoods does not appear to be important for informing individual propensities for residential mobility. Figure 2c shows neighbourhoods with patterns reflecting those expected under cumulative stress, wherein longer duration-of-residence is associated with a greater probability to be planning a move. These neighbourhoods may well engender particular unmeasured (residual) externalities that work to cumulatively encourage plans to move. In the presence of few positive influences and externalities, longer durations in place may more accurately reflect the undesired consequences of disparate social and economic constraints on relocation (Coulter and van Ham 2013). Finally, Figure 2d presents the random slopes for *all* neighbourhoods included in the analysis (n = 7192), revealing the extent of appreciable neighbourhood heterogeneity across England and Wales. For an otherwise typical person, it is suggested that those with longer durations at an address will see their probability of planning a move noticeably vary according to a constellation of factors that appear to include the unmeasured contextual differences associated with the residential environment in which they live.

Summary and conclusions

We have presented duration of residence and the multilevel and interlinked processes of residential mobility and immobility as potentially key mechanisms through which location-specific social capital and attachment is developed, disrupted and experienced. Through the employment of longstanding theories of duration dependence, detailed geo-coded microdata and an MLM approach, the paper reveals how individual duration of residence, as an essential ingredient for the accumulation of social capital and place-based attachment, is strongly associated with plans for future (im)mobility; how neighbourhood dynamics (composition, selective sorting and population instability) work to mediate the effect of individual duration-dependence and mobility propensities; and how the size and direction of the duration-of-residence effect is characterised by considerable spatial variation.

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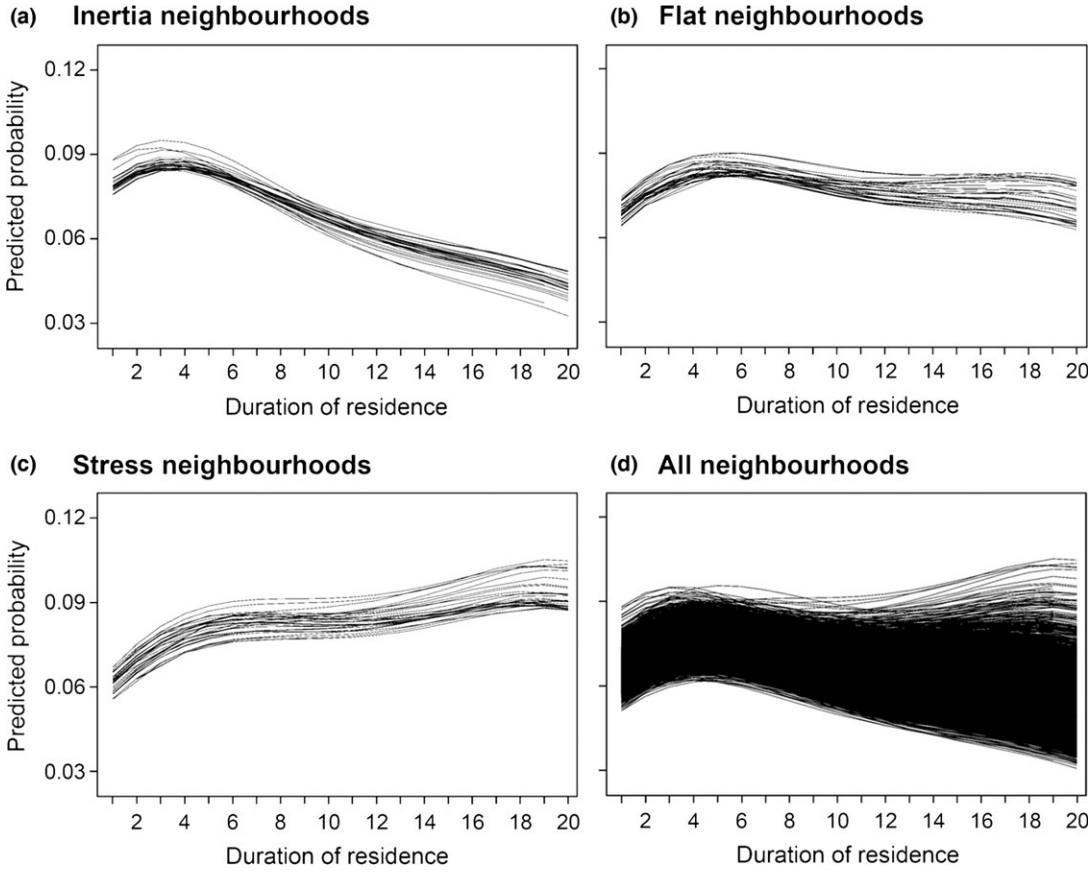

Figure 2 Predicted probability of planning a residential relocation by residential duration (years) across selected (a–c) and all (d) neighbourhoods

The importance of factors relevant to the wider residential context has been more explicitly examined than in many previous works. As expected, the degree of neighbourhood population instability is found to play an important intervening role in the duration-of-residence effects, though its influence is largely restricted to those with relatively short durations. While high neighbourhood population instability may indeed create an environment that is problematic for the creation and maintenance of strong place-based social networks and ties, given that the major differentials are found between those with relatively short durations, it is suggested that the effects are perhaps more an artefact of the differing housing and demographic profiles (composition) of the neighbourhoods than much else. With high-churn neighbourhoods generally observed to be the more dynamic urban areas of England and Wales, those with high proportions of young single adults, students and privately rented dwellings, we can perhaps expect individuals who recently moved to these areas to have made the decision with the pre-understanding and preference that residency would be highly flexible and thus short term. This finding would point to a recommendation that the pre-existing neighbourhood composition, housing stock and associated selective in- and out-flows be carefully understood and considered if policy interventions aimed at engendering greater social capital and attachments to place are to be viable and ultimately successful.

A further contribution of this work has been to focus on the potential influences of the more subtle, and harder to measure, neighbourhood dynamics and to reveal the degree of spatial heterogeneity that exists in the duration-of-residence effects. Opportunities to develop strong place-based habitual practices, social ties and interactions, mutual trust and an attachment to local institutional resources can all be expected to take time, while their influences on individual evaluations of residential satisfaction and mobility behaviour can also necessitate a critical period of cumulative exposure. Yet, acknowledging that such factors are inherently subjective, there has been very little empirical work to date that has focused on the ways in which longer residential duration may be crucial for their development and observation. Using a multilevel random

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coefficients model we reveal first, how the duration-of-residence effects vary quite substantially in both direction and strength across the different neighbourhoods of England and Wales, and second, how residual spatial heterogeneity in the propensity to be planning a move (having controlled for individual and area composition) appears to grow considerably with duration of residence.

While we should remain cautious about the potential influence of omitted variable bias in multilevel observational studies, the associations we find lend support to the notion that exposure times are important for the detection and observation of appreciable neighbourhood effects and, perhaps most significantly, the more subtle hard-to-measure externalities, on individuals' evaluations of the residential milieu and their associated movement behaviours. This is an important observation given the current debates on the relevance of neighbourhood effects above and beyond simple compositional factors.

Given the findings presented here, we call for research into important policy-relevant areas of geographical enquiry, such as spatial mobility and neighbourhood dynamics, social capital accumulation and place-based attachment, to more thoroughly engage with the concept of multilevel durations of residence and, more broadly, with the inherently spatiotemporal ties that bind individual life courses to place(s). Certainly, there would appear to be a great deal of scope in conducting qualitative/biographical studies of residential durations, moving plans and behaviours and how they are linked to wider neighbourhood and spatial dynamics. The benefits of an appropriate use of realistically complex MLM approaches should of course be embraced by geographers as they attempt to identify, test and explain these multilevel concepts and issues. However, fuller understanding of the actual processes and mechanisms will only be achieved through an effective combination of intensive quantitative and qualitative methods.

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Notes

1 Acxiom Ltd 2016 Home page (http://www.acxiom.com/) Accessed 7 March 2016.

2 The individual and pooled analytical samples were included in the validation exercises by Thomas (2014) and Thomas *et al.* (2014). Results suggest reassuringly comparable results across and between the samples, as well as against 2001 Census microdata, when analysing individual movement propensities.

3 Potentially important macro-level characteristics, including median house price and job density at the LAD and city region levels, were also collected but were found to contribute little in our empirical analyses.

4 As with Gordon and Molho, our bivariate model, before controls, did reveal the monotonic negative duration pattern.

5 Using the terms from Equation 1, the within-district-between-neighbourhood variance for Model 3 with a random slope for residential duration and a quadratic specification is: $var(u_{0jkl}x_0 + u_{1jkl}x_{1ijkl}) = \sigma^2_{u0}x_0^2 + 2\sigma_{u01}x_0x_{1ijkl} + \sigma^2_{u1}x^2_{1ijkl}$.

6 Correction added 18 May 2016, after first online publication. We regret that errors in the placement of the "*" symbols were introduced during the production process. Instances where the "*" incorrectly indicated statistical significance have now been deleted from Table II.

References

Andersson R and Bråmå A 2004 Selective migration in Swedish distressed neighbourhoods: can area-based urban policies counteract segregation processes? *Housing Studies* 19 517–39

Bailey A J 2009 Population geography: lifecourse matters *Progress in Human Geography* 33 407–18

Bailey N and Livingston M 2008 Selective migration and neighbourhood deprivation: evidence from 2001 Census migration data for England and Scotland *Urban Studies* 45 943–61

Browne W J 2015 *MCMC estimation in MLwiN, v2.33* Centre for Multilevel Modelling, University of Bristol, Bristol

Browne W J and Draper D 2006 A comparison of Bayesian and likelihood-based methods for fitting multilevel models *Bayesian Analysis* 1 473–550

Brunton-Smith I and Sturgis P 2011 Do neighbourhoods generate fear of crime? An empirical test using the British Crime Survey *Criminology* 49 311–69

Clark W A V and Dieleman F 1996 *Households and housing: choice and outcomes in the housing market* State University Center for Urban Policy Research, Rutgers NJ

Clark W A V and Huang Y 2003 The life course and residential mobility in British housing markets *Environment and Planning A* 35 323–39

Clark W A V and Ledwith V 2006 Mobility, housing stress, and neighbourhood contexts: evidence from Los Angeles *Environment and Planning A* 38 1077–93

Congdon P 2010 *Applied Bayesian hierarchical methods* Chapman & Hall/CRC, Boca Raton FL

Corbett S and Walker A 2013 The big society: rediscovery of 'the social' or rhetorical fig-leaf for neo-liberalism? *Critical Social Policy* 33 451–72

Coulter R and van Ham M 2013 Following people through time: an analysis of individual residential mobility biographies *Housing Studies* 28 1037–55

Coulter R, van Ham M and Findlay A M 2015 Re-thinking residential mobility: linking lives through time and space

ISSN 0020-2754 Citation: 2016 doi: 10.1111/tran.12123

Progress in Human Geography doi: 10.1177/03091325 15575417

Crowder K 2000 The racial context of white mobility: an individual-level assessment of the white flight hypothesis *Social Science Research* 29 223–57

Crowder K, Pais J and South S J 2012 Neighborhood diversity, metropolitan constraints, and household migration *American Sociological Review* 77 325–53

Davies Withers S 1997 Methodological considerations in the analysis of residential mobility: a test of duration, state dependence, and associated events *Geographical Analysis* 29 354–72

Davies R B and Pickles A R 1985 Longitudinal versus cross-sectional methods for behavioural research: a first-round knockout *Environment and Planning A* 17 1315–29

Dennett A and Stillwell J 2008 Population 'turnover' and 'churn': enhancing understanding of internal migration in Britain through measures of stability *Population Trends* 134 24–41

Draper D 2006 *Bayesian multilevel analysis and MCMC* Springer, New York

Dykstra P A and van Wissen L J G 1999 Introduction: The life course approach as an interdisciplinary framework for population studies in **van Wissen L J G and Dykstra P A** eds *Population studies: an interdisciplinary focus* Plenum Press, New York NY 1–22

Feijten P and van Ham M 2009 Neighbourhood change ... reason to leave? *Urban Studies* 46 2103–22

Finney N and Jivraj S 2013 Ethnic group population change and neighbourhood belonging *Urban Studies* 50 3323–41

Fischer P A and Malmberg G 2001 Settled people don't move: on life course and (im-)mobility in Sweden *International Journal of Population Geography* 7 357–71

Fry R 2011 Understanding household income poverty at small area level *Regional Trends* 43 87–102

Gelman A, Carlin J B, Stern H S and Rubin D B 2004 *Bayesian data analysis* 2nd edn Chapman & Hall/CRC, Boca Raton FL

Gordon I R and Molho I 1995 Duration dependence in migration behaviour: cumulative inertia versus stochastic change *Environment and Planning A* 27 1961–75

Harris D R 1999 Poverty values drop when blacks move in, because ...: racial and socioeconomic determinants of neighbourhood desirability *American Sociological Review* 64 461–79

Hedman L 2011 The impact of residential mobility on measurements of neighbourhood effects *Housing Studies* 26 501–19

Huff J O and Clark W A V 1978 Cumulative stress and cumulative inertia: a behavioural model of the decision to move *Environment and Planning A* 10 1101–19

Jones K and Subramanian V S 2012 Developing multilevel models for analysing contextuality, heterogeneity and change (Volume 1) Centre for Multilevel Modelling, University of Bristol (http://www.mendeley.com/profiles/kelvyn-jones/) Accessed 10 March 2016

Kearns A and Parkinson M 2001 The significance of neighbourhood *Urban Studies* 38 2103–10

Land K 1969 Duration of residence and prospective migration: further evidence *Demography* 6 133–40

Lauster N T 2010 Housing and the proper performance of American motherhood, 1940–2005 *Housing Studies* 25 543–57

Lu M 1998 Analyzing migration decision making: relationships between residential satisfaction, mobility intentions, and moving behaviour *Environment and Planning A* 30 1473–95

Manley D J, van Ham M, Bailey N, Simpson L and MacLennan D eds 2013 *Neighbourhood effects or neighbourhood based problems? A policy context* Springer, Dordrecht

Martin D 2002 Output areas for 2001 in **Rees P, Martin D and Williamson P** eds *The census data system* Wiley, Chichester 37–46

Morrison P A 1971 Chronic movers and the future redistribution of population: a longitudinal analysis *Demography* 8 171–84

Mulder C H 1993 *Migration dynamics: a life course approach* Thesis Publishers, Amsterdam

Mulder C H 2013 Family dynamics and housing: concepts issues and empirical findings *Demographic Research* 29 355–78

Orford S and Leigh C 2014 The relationship between self-reported definitions of urban neighbourhood and respondent characteristics: a study of Cardiff, UK *Urban Studies* 51 1891–908

Pill G 2012 Neighbourhood Initiatives in Wales and England: shifting purposes and changing scales *People, Place and Policy* 6 79–89

Rabe B and Taylor M 2010 Residential mobility, quality of neighbourhood and life-course events *Journal of the Royal Statistical Society: Series A* 173 531–55

Rasbash J, Charlton C, Jones K and Pillinger R 2012 *Manual supplement to MLwiN Version 2.26* Centre for Multilevel Modelling, University of Bristol

Rees P, Stillwell J, Boden P and Dennett A 2009 A review of migration statistics literature in **Rees P, Stillwell J, Boden P and Dennett A** eds *Migration statistics: the way ahead?* UKSA, London

Sampson R J, Raudenbush S and Earls F 1997 Neighbourhoods and violent crime: a multilevel study of collective efficacy *Science* 277 918–24

Sampson R J, Morenoff J D and Gannon-Rowley T 2002 Assessing 'neighbourhood effects': social processes and new directions in research *Annual Review of Sociology* 28 442–78

Snijders T A B and Bosker R J 2012 *Multilevel analysis: an introduction to basic and advanced multilevel modelling* 2nd edn Sage, London

Spiegelhalter D J, Best N G, Carlin B P and van der Linde A 2002 Bayesian measures of model complexity and fit (with discussion) *Journal of the Royal Statistical Society, Series B* 64 191–232

Stillwell J, Bell M, Blake M, Duke-Williams O and Rees P 2000 Net migration and migration effectiveness: a comparison between Australia and the United Kingdom, 1976–96 part 1: total migration patterns *Journal of Population Research* 17 17–38

Sturgis P, Brunton-Smith I, Read S and Allum N 2011 Does ethnic diversity erode trust? Putnam's 'hunkering down' thesis reconsidered *British Journal of Political Science* 41 57–82

Thomas M 2014 Modelling individual and place variations in residential moves using commercial data and official statistics Unpublished PhD thesis University of Leeds, Leeds

Thomas M, Stillwell J and Gould M 2014 Exploring and validating a commercial lifestyle survey for its use in the

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analysis of population migration *Applied Spatial Analysis and Policy* 7 71–95

Thomas M, Stillwell J and Gould M 2015 Modelling multilevel variations in distance moved between origins and destinations in England and Wales *Environment and Planning A* 47 996–1014

Tienda M 1991 Poor people and poor places: deciphering neighbourhood effects on poverty outcomes in **Huber J** ed *Macro-micro linkages in sociology* Sage, Newburgh Park CA 204–12

Tiesdell S and Allmendinger P 2001 Neighbourhood regeneration and New Labour's third way *Environment and Planning C: Government and Policy* 19 903–26

van Ham M and Clark W A V 2009 Neighbourhood mobility in context: household moves and changing neighbourhoods in the Netherlands *Environment and Planning A* 41 1442–59

van Ham M, Mulder C H and Hooimeijer P 2001 Spatial flexibility in job mobility: macro-level opportunities and micro-level restrictions *Environment and Planning A* 33 921–40

Supporting Information

Additional supporting information may be found in the online version of this article:

Figure S1. Predicted probability of planning a residential move by selected covariates, estimates and 95% credible levels.

Figure S2. Between-neighbourhood and between-district variance (as a function of duration) in the log-odds of planning a residential move.

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