The process of socio-economic constraint on geographical mobility: England 1991 to 2008.

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Abstract:

This paper suggests that the process of socio-economic constraint should be of central concern in studies of geographical mobility. A theoretical framework is advanced which situates this process within a life course perspective, recognising both the fluid, dynamic nature of local place and the role that social structures play in the creation of individual and spatial inequalities. Within this framework socio-economic constraint can be considered as the process that links these individual and spatial inequalities together. This paper aims to examine the process of spatial socio-economic constraint and to test the hypotheses that individuals with low income are more likely to be geographically constrained and are more likely to be constrained to areas of higher material deprivation. The analysis employs multilevel models and uses longitudinal data from the British Household Panel Survey, combined with aggregate ward level Census data. The findings provide evidence in support of the hypotheses and for the existence of a process of socio-economic constraint. The main conclusion is that an understanding of the process of constraint should be central to theoretical and empirical studies of geographic mobility.

Keywords: Geographical mobility, socio-economic constraint, income inequality, spatial inequality, neighbourhood deprivation

Introduction:

Mobility and modernity, a cause for concern?

Concerns in relation to geographical mobility have a long history in sociology, Durkheim's notion of anomie and solidarity and Tonnies' concept of Gemeinsschaft and Gesellschaft were concerned with changes to communities resulting from the onset of modernity. In these early perspectives geographical mobility is generally seen as problematic, see Delanty (2007). More recent commentary on the effects of modernity and globalisation share some of these early concerns. Entriken (1991), drawing on the work of Nagel (1986), proposes that there has been a shift in human consciousness from being centred, part of place and period, to being decentred, transcending the here and now. Coleman (1993) uses the term the 'transcendence of place' to describe the same process and, similarly, Szerszynski and Urry (2006) believe individuals are increasingly 'inhabiting the world from afar'. Harvey (1990) presents a theory of time-space compression to describe the increased ability for movement and communications and the stretching out of personal relationships over larger geographies. Some have argued that these processes lead to weaker attachments between individuals and places, see Relph (1976), Wellman (1988), and to weaker attachments amongst people within places. Putnam (2000), for example, suggests that geographic mobility weakens the bonds between individuals at the local level and so reduces social capital, see also Quentin et al (2010) and David et al (2010). The connections between such views and the early sociological concerns regarding the loss of community are clear and the concept of social capital has been influential with government policy makers, for example in UK government policies that view high geographical mobility as leading to reduced local social cohesion, see Lawrence and Heath (2008), Beatty et al (2009).

Alternative views of mobility

The view that geographical mobility creates problems for communities and weakens bonds between individuals may be overly simplistic for a couple of reasons. First, the notion of community may be of little use in describing modern place based social relations, see Vaisey (2007) who argues this point and Agnew (1989) who believes that the concept of community is unhelpful as single or homogonous communities are unlikely to exist in any given place. The notion of community can appear static and exclusive in contrast to more fluid and open theories about the relationship between people and place. Massey (1991) develops the idea of place as an 'articulated moment', the 'constellation of social relations, meetings and weaving together at a particular locus', see also Massey (1999) (2005). Lippard (1997) holds similar views about the openness and fluidity of place, seeing place as a hybrid consisting of those living there at any given point in time. Secondly, there is reason to doubt that the act of mobility invariably reduces connections between individuals or has negative outcomes for individuals. Recent longitudinal research using the British Household Panel Survey has suggested that individual life satisfaction increases after mobility, see Findlay and Nowok (2012) and Nowok et al (2013). Also Oishi et al (2013) find that mobility leads to individuals seeking to make new social connections in the places they move into. Indeed lack of mobility may have negative implications for individuals. Urry (2012) argues that in contemporary society network connections are central to power relations, that mobility leads to increased connections between individuals and that a lack of connections acts to reinforce individual level inequalities.

Mobility and socio-economic constraint

The previous section introduced the notion that a lack of geographical mobility may act to reinforce social inequality. This is a central aspect of the argument that this paper is seeking to develop, that inequality and geographical mobility are linked. To further develop this argument it is recognised that not all individuals have transcended the local place and that the relationship between individuals and local place may be conditional, based on individual level inequality. Massey (1991) argues that everyone does not experience time-space compression in the same way, rather the experience is dictated by an individual's position in the global social hierarchy. Massey develops the concept of 'the power geometry of time-space compression', that some people are in charge of the phenomena and some at the receiving end, 'effectively imprisoned' by it. Similarly Bauman (1998) uses the term 'glocalisation' to describe the situation whereby the affluent take advantage of increased mobility while impoverished, marginalized social groups become localised due to lack of resources and growing powerlessness. Castells (1996) (2004) also believes that in contemporary societies it is the elite that are cosmopolitan and the majority of the population remains localised, see also Bolt and van Kempen (2003) and Boltanski and Chiapello (2007).

Studies of geographical mobility

An understanding of the processes of socio-economic constraint is largely missing from early theories of geographical mobility, such as Lee's push-pull model (Lee 1966). Early approaches stressed notions of individual choice based on compared utility, see Wolpert (1966), Quigley and Weinberg (1977) and Hanushek and Quigley (1978). In economic theory Bartel (1979) suggested that a decision to move results from an individual making an analysis of the costs and benefits of alternative options

and the influential work of Brown and Moore (1970) proposed that the act of mobility arises simply from a choice to move and a choice of destination. Similarly Speare et al (1975) developed a theory of mobility that consists of three stages, (a) the development of a desire to consider moving, (b) the selection of an alternative location, and (c) the decision to move or stay. The desire to consider moving was held to largely be driven by individual satisfaction with their current situation and the notion of stress factors has been developed in later works by Clark and Huff (1978) and Brummell (1979). As stated these early approaches largely emphasise rational choice based on individual evaluation of expected utility. However, it is now recognised that mobility does not necessarily occur as a result of desire to move and that there is a discrepancy between the desire to move and actual moving behaviour, see for example Lu (1998), Coulter et al (2011). These studies seek to challenge the notion that dissatisfaction invariably leads to mobility. However they do not go as far as to acknowledge that socio-economic constraint may be the reason for the observed disparity between the desire to move and actual mobility.

Rossi (1955) proposed a 'life cycle' approach which argues that geographic mobility results from life cycle changes linked to the unsuitability of an individual's current situation. While this approach challenges the view that mobility is inherently problematic it too fails to adequately account for the process of socio-economic constraint and essentially assumes all individuals respond to life cycle changes in the same way. More useful, it is argued, is the life course perspective which differs from the life cycle approach in that it allows for differences in the life paths for individuals, with these different paths shaped by structural, social and cultural processes. Elder, one of the first writers from a life course perspective, see Elder (1975), believes that

what makes the life course approach distinctive is the emphasis on time, process and context, see (Elder 1992). Clausen (1986) describes a life course as a sequence of states and events embedding individual lives into social structures. Similarly for Riley (1998) the distinctive aspect of the life course perspective is that it is a 'combined social-systems approach' concerned with both individual and system dynamics. Social structures and material factors lead to different experiences for individuals through their life course, see Elder (1994), Giele and Elder (1998) and Mortimer and Shanahan (2003). Along with differential experiences arising from social context the notions of process and time are, as noted, central to the life course perspective. This makes the approach well suited to the study of geographical mobility. Pred (1977) conceives of the life course as 'a weaving dance through time space'. Pred builds on the theory of time-geography proposed by Hägerstrand (1957) (1967), which makes the distinction between mobility, seen as an 'all the time' event, and migration, which is seen as a shift in the centre of gravity of an individual's mobility patterns. Hägerstrand (1975) recognised that individual spatial activity is often subject to constraint and argued that individuals do not posses complete spatial autonomy.

So while human agency is a central theme in the life course approach, as individuals can alter their life course through individual actions, see Elder (1994), the key point is that social structures interact with individuals to produce different life course trajectories for different groups. However it is worth noting that Mayer (2009) contends that the life course approach is not yet a fully formed field of study and that it lacks a coherent body of theory. Dannefer (2003) and Geist and McManus (2008) make a similar point and highlight that there has been very little research from a life course perspective into the experience of groups based on levels of affluence. King

(2012) believes that there is a need to reaffirm the importance of issues of poverty and exclusion in understanding motility and lack of mobility. Some recent research has begun to address this, Bailey and Livingston,(2007) (2008), Foulkes and Schafft (2010) report findings to suggest that internal migration acts to reinforce the concentration of poor people to deprived areas in the UK and US. However there does appear someway to go in the development of theory, supported by empirical evidence, that seeks to understand geographical mobility from a life course perspective.

More recently geographical mobility has been discussed within the neighbourhood effects literature. Interest in neighbourhood effects began with Wilson (1987) who argued that neighbourhood characteristics can have a separate independent effect on individual outcomes over and above individual characteristics, see van Ham et al (2012) for a review. Examples of studies of mobility from a neighbourhood effects perspective include Feitjten and van Ham (2009) who propose that a high level of population turnover increases the probability that residents want to leave their neighbourhood and van Ham and Feitjten (2008) who suggest that an increased proportion of low income households in an area makes people more likely to move. However there may be certain weaknesses in the inference made in these studies. One weakness being the very notion of independent neighbourhood effects. Cheshire (2012) argues that differences and inequalities between neighbourhoods are the spatial manifestation of wider economic and social processes that create income inequalities and constrain individuals to places on the basis of income inequality. Another related weakness is the difficulty in disentangling the notion of neighbourhood effects from the processes that lead to individuals living in different areas. This point is addressed by Hedman (2011) and Hedman and van Ham (2012) who argue that selection bias is

the biggest problem in the study of neighbourhood effects, as observed associations between neighbourhood type and individual outcomes may be the result of selection mechanisms leading to certain groups living in certain types of areas. They argue that this is more than a statistical problem and stress the need for a critical understanding of notions of choice in residential mobility, that choice is restricted for people on low income and that low income groups can become trapped in more deprived neighbourhoods. These are important insights but they are largely absent from empirical studies in the field of neighbourhood effects. For example Rabe and Taylor (2010) seek to bring together the literature of residential mobility and neighbourhood effects to develop the notion of neighbourhood adjustment as an extension to the life stage understanding of mobility but they do not account for socio-economic status of individuals and do not tackle the issue of constraint directly.

Research question and hypothesis.

The aim of the discussion above is to argue that an understanding of the process of socio-economic constraint should be of prime concern for theories of geographical mobility. There are a number of aspects to this argument. It is suggested that the focus on mobility as a threat to social capital or social cohesion is misplaced and that local place is best conceived of as a dynamic system rather than a bounded static entity. Furthermore, mobility should not be simply seen as problematic for neighbourhoods or individuals as mobility can lead to new place based connections between individuals and, in the modern network society, these connections can lead to individual level benefits. The crucial point in the argument presented here is that alongside the open dynamic conceptualisation of local place and mobility there is a

concurrent process of spatial socio-economic constraint in operation. An understanding of the process of socio-economic constraint is largely missing from studies of geographical mobility, however the life course perspective does offer potential to develop such an understanding. What this perspective offers is the conceptualisation of the individual life course as a process that is shaped by relationships between the individual and wider social structures. The life course approach incorporates mobility into individual life course trajectories rather than conceiving mobility as a problematic activity. However, as recognised by some authors from this perspective, there is a need to be more focussed on the effects that social inequality has on individual life course outcomes. As noted, recently some authors from the neighbourhood effects literature have developed a more critical notion of choice in neighbourhood selection processes. While this is an important development in the understanding of the relationship between individuals and local place the weakness of the neighbourhood effects approach may be it's central premise that there is a separate independent effect of neighbourhood on individuals. Perhaps the neighbourhood effects approach is inherently too static and fails to account for wider socio-economic processes. A better conceptual framework may be that both spatial inequality between neighbourhoods and inequalities between individuals are manifestations of wider socio-economic processes. Spatial socio-economic constraint can then be understood as another manifestation of these wider processes and as the social structural phenomena interacting with individual characteristics to influence individual mobility trajectories through a life course.

In order to advance this theoretical framework this paper aims to examine empirical evidence of patterns of geographical mobility based on levels of income. Specifically this paper seeks to test the hypothesis that individuals with low income are more likely to be geographically constrained, and the hypothesis that individuals with low income are more likely to be constrained to areas of higher material deprivation.

Data and methods

This analysis uses data from the British Household Panel Survey (BHPS), carried out by the ESRC UK Longitudinal Studies Centre. This is a longitudinal survey which began in 1991 with an initial sample of 5,050 households, and around 10,000 individuals, constructed using a two stage stratified cluster design, with postcode sectors as the first stage units and individual addresses as the second. All eligible adult household members were interviewed in wave 1 and annually thereafter. This analysis uses respondents in England who were interviewed in all 18 waves (3,140 individuals) or who were interviewed in 1991 and 2008 (3,750 individuals). For further details of the survey see Taylor et al (2001).

The survey collects details of geographical mobility including the distance of any move. The data contains location details and these were used to identify the ward of residence. The outcome variables modelled are the total distance moved for individuals over the period 1991 to 2008 and the change in ward level deprivation for those that move ward during the period. Explanatory variables are age, household income and ward level material deprivation. Household income is measured in the survey and has been equalised by dividing by the total number of people in the household and, to aid comparison between time points, the equalised income was

standardised, converted to *z* scores. Measures of economic deprivation were calculated for standard ward geographies using Census data. Standard ward geographies were chosen to overcome the problem of changes to administrative boundaries that have occurred over time. Data for the 1991 and 2001 Census was obtained using CASEWEB (Census Dissemination Unit), 2011 Census data was obtained from ONS and the data was converted from different geographies to standard wards using the GEOCONVERT tool on the Census Dissemination Unit website. Census data was used to calculate the ward level Townsend index, Townsend et al (1988), as a direct measure of material deprivation. The index, a sum of four equally weighted standardised measures of deprivation, has been used extensively in social research and is generally considered an adequate measure of relative material deprivation, see Senior (2002). Data from the 1991 Census was used to create the 1991 Townsend index score and 2008 ward measures were estimated from 2001 and 2011 Census measures treating any change in the period as linear.

The analysis uses longitudinal data and multilevel regression models to test the hypotheses. Multilevel models take account of the nested nature of individuals in households and households within neighbourhoods. This is important as individuals within the same area tend to be more alike than individuals in different areas, see Holt et al (1996) and taking no account of the nested nature of the data would treat household and ward values as independent which they are not and this would lead to incorrect, overly small, standard errors, see Hox (2010). Multilevel models allow for the appropriate modelling of outcomes that have dependence due to clustering, see Browne and Goldstein (2010) and also multilevel models allow for the decomposition of variance at the different levels, this is useful for evaluating whether there are

neighbourhood effects in operation. For detailed discussions of multilevel models see Goldstein (2003), Hox (2010) and Snijders and Bosker (2012). The analysis was carried out using MLwiN software, see Rasbash et al (2009), employing MCMC methods, Browne (2009). For more detail on MCMC methods for multilevel models see Browne (2012).

Results

Geographical mobility observed in the sample.

As the original sample design was geographically clustered, by postcode sector, the sample was confined to certain geographical areas in 1991. However the mobility of sample members has led to a geographic dispersal over the period, as demonstrated in figure 1.

Figure 1: The geographical dispersion of the BHPS sample 1991 to 2008.

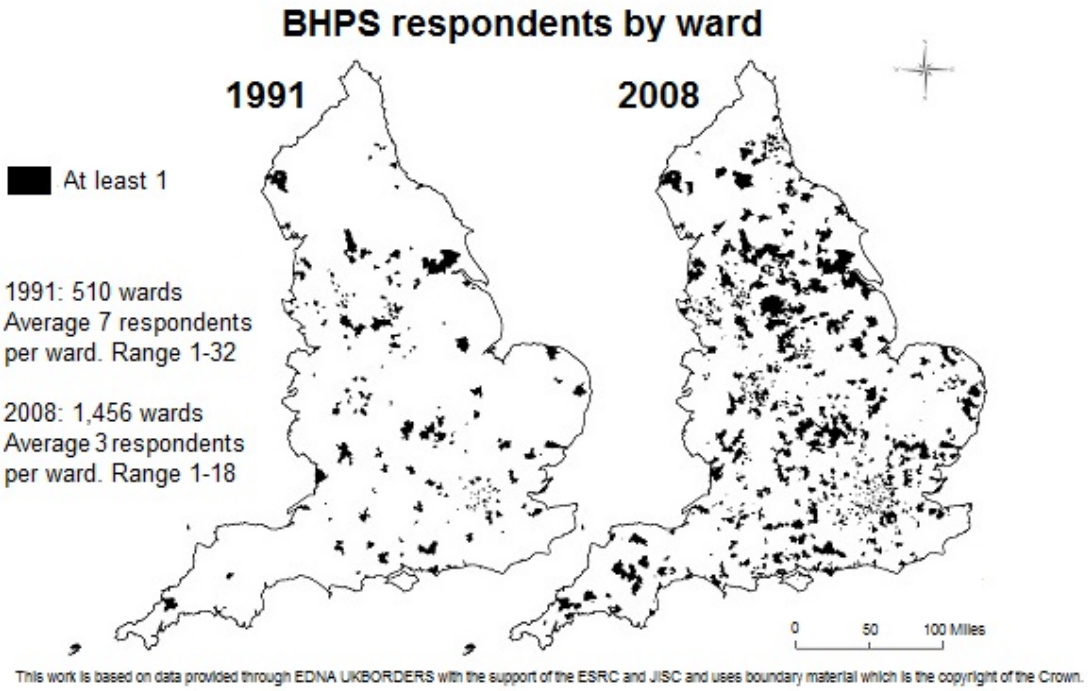


Table 1 shows the variation in mobility by age group, at 1991. As expected younger individuals are more likely to move, eighty percent of those aged sixteen to twenty four years at 1991 moved ward compared with twenty nine percent of those aged sixty five plus. However it is worth noting that there is still a substantial proportion of older age groups moving in the period.

Table 1: Geographical mobility by birth cohort

Age		Percentage who moved:		
at 1991	n	Ward	District	Region
16-24	597	79.7%	43.7%	19.1%
25-34	883	57.9%	31.0%	12.8%
35-44	836	36.2%	16.7%	7.7%
45-54	730	31.9%	17.0%	7.4%
55-64	457	27.8%	14.2%	7.4%
65 plus	247	28.7%	13.0%	4.9%
Total	3,750	45.9%	23.9%	10.4%

Table 2 shows the variation in mobility by household income at 1991, here it is clear that those with higher household incomes are more likely to move, particularly the highest income groups. Indeed twenty three percent of those in the highest income decile moved region during the period compared to eight percent of those in the lowest income decile.

Table 2: Geographical mobility by 1991 household income

Household Income		Percentage who moved:		
at 1991	n	Ward	District	Region
1: Highest income decile	374	60.4%	43.6%	23.0%
2	377	53.3%	28.4%	11.1%
3	374	47.3%	28.3%	13.4%
4	374	39.3%	18.7%	8.6%
5	375	41.9%	22.1%	9.3%
6	376	45.5%	23.1%	8.0%
7	375	41.1%	18.1%	9.1%
8	375	42.7%	15.7%	4.8%
9	377	43.8%	21.5%	9.3%
10: Lowest income decile	373	43.7%	19.3%	7.8%
Total	3,750	45.9%	23.9%	10.4%

Table 3 shows the variation in mobility by the level of ward deprivation at 1991. As expected, mobility is higher from wards that are more deprived, but it should be noted that this relationship is not as strong as it is for age and household income. This disparity between lower mobility for lower income groups but higher mobility from materially deprived wards will be addressed in the course of the analysis.

Table 3: Geographical mobility by 1991 ward material deprivation

Ward Townsend Index		Percentage who moved:		
1991	n	Ward	District	Region
1: Least deprived decile	373	38.6%	22.0%	8.8%
2	376	41.5%	21.8%	9.3%
3	378	46.0%	24.9%	10.3%
4	372	43.5%	26.3%	11.3%
5	380	43.7%	21.8%	9.2%
6	365	44.9%	22.5%	9.6%
7	385	47.8%	22.6%	11.9%
8	370	43.8%	18.6%	9.2%
9	378	54.0%	27.8%	13.0%
10: Most deprived decile	373	55.0%	30.6%	11.5%
Total	3,750	45.9%	23.9%	10.4%

Model 1: total distance moved by individuals in the period

These models were constructed in order to test the hypothesis that individuals with low incomes were more likely to be geographically constrained over time, the outcome being the total distance moved in the period 1991 to 2008. These models were applied to all those with eighteen completed interviews over the period and the outcome includes those that moved no distance. The explanatory variables are age at 1991, household income at 1991, change in household income 1991 to 2008 and ward Townsend score 1991. As outlined in the data section above the household income variables have been equalised, dividing the income by the total number of individuals in the household, and standardised. The properties of the outcome and explanatory

variables are shown in table 4. It is worth noting that the outcome and the household income at 1991 variables are positively skewed with a small number of extreme high values.

Table 4: Outcome and explanatory variables used in model 1.

	Min.	Max.	Mean	Std. Deviation	Range	Skewness
Outcome: Total distance moved 1991 to 2008 (km)	0.00	1325.22	31.75	98.89	1325.22	5.229
Age at 1991	16	80	41.1	14.50	64	.298
Household income at 1991	-1.37	21.28	0.00	0.99	22.65	4.680
Change in household income 1991 to 2008	-16.355	8.765	-0.02	1.09	25.120	-.808
Ward Townsend score 1991	-5.41	11.36	0.51	3.57	16.76	.759

The multilevel structure is specified as in equation 1. Here the variance at individual, household and ward level is allowed to be random and residuals are assumed to be normally distributed with a mean of zero.

$$y_{ijk} = \beta_0 cons + v_k + u_{jk} + e_{ijk}$$

$$[v_k] \sim N(0,\Omega_v) \quad : \Omega_v = [\sigma^2_v]$$
$$[u_{jk}] \sim N(0,\Omega_u) \quad : \Omega_u = [\sigma^2_u]$$
$$[e_{ijk}] \sim N(0,\Omega_e) \quad : \Omega_e = [\sigma^2_e] \qquad (1)$$

Equation 1 relates to model 1a, the empty model. Models 1b and 1c were constructed by including the household level income variables and the ward level Townsend score at 1991. The models were estimated using MCMC methods and all explanatory variables have been mean centred. The DIC statistic is a measure of model fit, Spiegelhalter et al (2002) suggest that a decrease of between 3 and 7 in the DIC score of nested models signifies a better fit. The final model, model 1d, has the best model fit and includes a cross-level interaction between age and household income at 1991. Model 1d is specified as in equation 2 and results are shown in table 5.

$$y_{ijk} = \beta_0 cons + \beta_1 Age1991_{ijk} + \beta_2 Household\ Income1991_{jk} + \beta_3 \Delta Household\ Income_{ijk} + \beta_4 Age1991*Household\ Income1991_{ijk} + v_k + u_{jk} + e_{ijk}$$

$$[v_k] \sim N(0,\Omega_v) \quad : \Omega_v = [\sigma^2_v]$$
$$[u_{jk}] \sim N(0,\Omega_u) \quad : \Omega_u = [\sigma^2_u]$$
$$[e_{ijk}] \sim N(0,\Omega_e) \quad : \Omega_e = [\sigma^2_e] \qquad (2)$$

The empty model, model 1a, shows the average distance moved of 31.4km and the variance at ward, household and individual level. These estimates of variance should be understood as the variance between wards, between households within wards and between individuals within households. It can be seen that most of the variance is at the individual and household levels. The variance at the ward level, that is between wards, is small, accounting for just under two percent of the total variance for the model, but it is significant.

Table 5: Model 1, total distance moved 1991 to 2008

Distance moved (km) 1991 to 2008	**Model 1a**		**Model 1b**		**Model 1c**		**Model 1d**	
	Est.	**S.E.**	**Est.**	**S.E.**	**Est.**	**S.E.**	**Est.**	**S.E.**
Fixed Part								
Constant	31.392		32.028		31.937		32.029	
$Age1991_{ijk}$			-1.258	0.120	-1.251	0.121	-1.309	0.122
$Household\ Income1991_{jk}$			9.018	2.408	9.327	2.439	8.286	2.338
$\Delta Household\ Income_{ijk}$			5.447	2.177	5.663	2.164	4.890	2.167
$Ward\ deprivation1991_k$					0.397	0.549		
$Age1991*Household\ Income1991_{ijk}$							-0.292	0.147
Random Part								
Variance ward $\sigma^2 v$	188.24	92.33	0.125	0.277	8.504	22.572	64.862	62.263
Variance household $\sigma^2 u$	3684.07	278.85	3854.75	276.26	3827.50	277.15	3817.95	277.56
Variance individual $\sigma^2 e$	5942.96	238.31	5570.61	223.90	5580.67	225.31	5538.48	220.54
DIC:	37156.62		36991.23		36993.36		36978.94	

In model 1b, once age, household income at 1991 and change in household income are introduced into the model, the variation between wards is greatly reduced and is no longer significant. In other words, the variation between wards in the total distance

moved by individuals in the period is explained by compositional effects. The coefficient for age represents the change in the number of kilometres moved in the period with a change of one year in age. Age is mean centred at 41.1 years so, holding income at 1991 and change in income constant, those aged 41.1 at 1991 are predicted to move 30.3 km in the period. For every increase in one year of age the predicted distance moved decreases by 1.3km and for every decrease in age of one year the predicted distance moved increases by 1.3km. So, on average, those aged 16 at the start of the period are predicted to have moved 63.5km in the period and those aged 66 to have moved only 0.6km. However after controlling for age the effects of household income at 1991 and change in household income over the period are also significant. The coefficients represent the change in the number of kilometres moved in the period resulting from a change of one standard deviation in the explanatory variables. If we hold age constant at the mean age of 41.1 and with no change to income over the period, the total distance moved for those who are 2 standard deviations below the mean income at 1991 is 14.0km compared to 50.1km for those who are 2 standard deviations above the mean household income. Those aged 41.1 on average household income at 1991 and who experience a decrease in household income of 2 standard deviations below the mean change of zero are predicted to move 21.1km, while those that experience an increase in household income of 2 standard deviations above the mean change are predicted to move 42.9km.

Adding ward deprivation at 1991, as in model 1c, leads to a worse model fit and the coefficient for ward deprivation at 1991 is not significantly different from zero. This, together with the non significant variation between wards, suggests that for this

outcome there are no ward level effects, or variation between wards, once the contextual variables of age and income are accounted for.

In model 1d ward deprivation at 1991 has been removed and an interaction between age and household income at 1991 has been added. The effects of age at 1991 remain similar as do the effects of household income at 1991. However these main effects now need to be interpreted alongside the interaction. The effect size for household income at 1991 on the total distance moved is smaller for those who are older at 1991 and larger for those who are younger. For example the effect of being one standard deviation above mean income at 1991 for those at average age 41.1, holding change in income constant, is to increase the distance moved by 8.3km, but for those aged 16 at 1991 the increase in distance moved is 15.6 km while those aged 66 at 1991 the increase in distance moved is only 1.0km. In this final model change in household income remains as a separate independent effect on the outcome. In the final model the variation between wards is less than one percent of the total variation in the outcome and is not significant. Most of the variation in the outcome is between individuals within households, this accounts for almost sixty percent of the total variance, with around forty percent of the total variance being between households within wards. This reflects the fact that geographical mobility as measured here can be individuals leaving households or whole household mobility. The key substantive interpretation of the decomposed variance is that, after controlling for age and household income, there is no significant variation in the outcome between wards.

Model 2: change in level of ward deprivation for those that move ward

This part of the analysis is concerned with testing the hypothesis that individuals with low income are more likely to be constrained to areas of higher material deprivation. It should be noted that, as levels of ward deprivation remain fairly constant over time, it is those individuals who move ward that are more likely to experience a change in the level of ward deprivation, this can be seen in figure 2.

Figure 2: The relationship between ward deprivation scores for those that do not move ward between 1991 and 2008 and those that do.

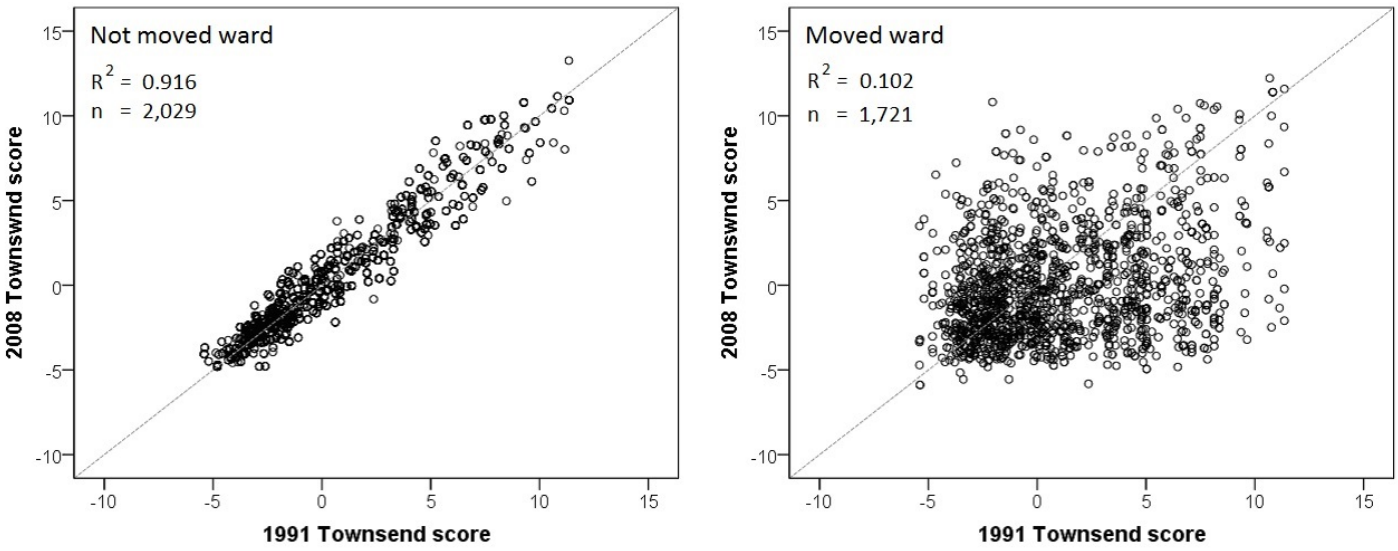
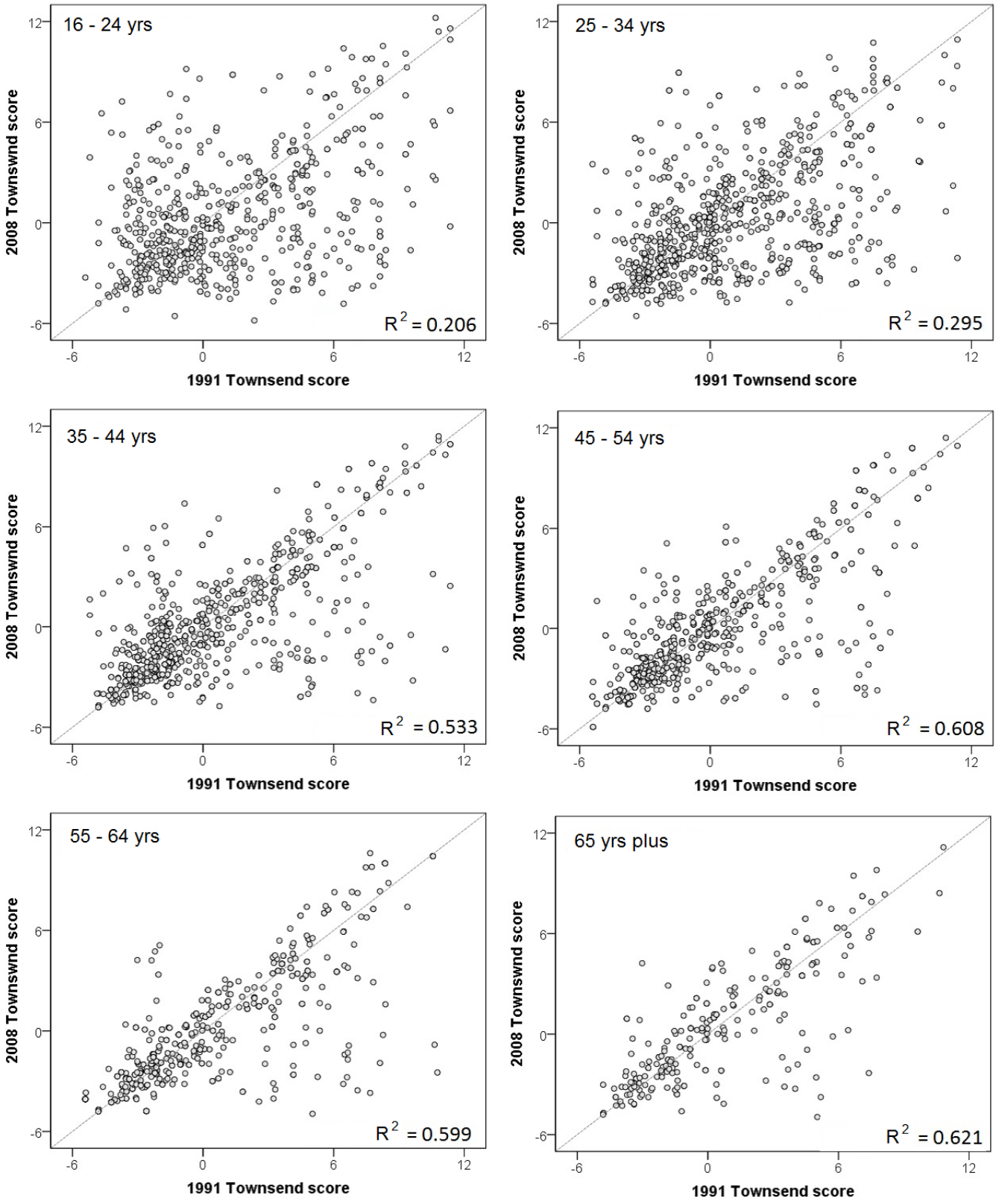


Figure 3 shows the relationship between the level of ward deprivation in 1991 and 2008 for all sample members, whether moved ward or not, by age group. This illustrates that while younger individuals are more likely to move ward it is noticeable that they are appear as likely to move into more deprived wards as into less deprived wards. As individuals get older there is less movement but any movement that does occur is predominately from more deprived to less deprived wards.

Figure 3: relationship between ward deprivation score in 1991 and 2008 for all sample members by age group at 1991, whether moved or not.



The outcome for model 2 is the change in ward deprivation for those that moved ward. As noted above, it is those that change ward that are likely to experience a change in ward deprivation and this outcome can only be considered as an individual level outcome for those that do move ward. The change in ward Townsend scores between 1991 and 2008 range from -13.34 to 12.86 for those that move ward and from -3.52 to 3.30 for those that do not move ward. The mean change for those that move ward is -1.02 compared to 0.04 for those that do not move ward. In total forty six percent of the sample (1,721) moved ward between 1991 and 2008. The outcome and explanatory variables for this model are shown in table 6, it is also worth noting that the mean age is lower when those not moving ward are excluded.

Table 6: Outcome and explanatory variables used in model 2.

	Min.	Max.	Mean	Std. Deviation	Range	Skewness
Outcome: Change in Townsend score 1991 to 2008	-13.45	12.86	-1.01	4.06	26.31	-0.181
Age at 1991	16	78	35.2	14.20	62	0.763
Household income at 1991	-1.32	21.28	0.20	1.15	22.60	5.089
Change in household income 1991 to 2008	-16.35	24.14	0.00	1.37	40.50	2.428
Ward Townsend score 1991	-5.41	11.36	0.94	3.72	16.76	0.640

The multilevel models were constructed as before, starting with an empty model, model 2a, as equation 1. Equation 3 represents the final model for this outcome, model 2c and results from these models are shown in table 7. The outcome represents the change in ward Townsend score for those that move ward. The ward Townsend score at 1991, the ward that individuals moved from, is included as an explanatory variable to test whether those moving out of deprived wards were, on average, more or less likely to move to less deprived wards.

$$y_{ijk} = \beta_0 cons + \beta_1 Ward\ deprivation1991_k + \beta_2 Household\ Income1991_{jk} + \beta_3 \Delta Household\ Income_{ijk} + \beta_4 Age1991_{ijk} + \beta_5 Age1991^{*} \Delta Household\ Income_{ijk} + v_k + u_{jk} + e_{ijk}$$

$$[v_k] \sim N(0,\Omega_v) \quad : \Omega_v = [\sigma^2_v]$$
$$[u_{jk}] \sim N(0,\Omega_u) \quad : \Omega_u = [\sigma^2_u]$$
$$[e_{ijk}] \sim N(0,\Omega_e) \quad : \Omega_e = [\sigma^2_e] \qquad (3)$$

The empty model, model 2a, estimates the average change in ward deprivation for those that moved ward, indicating that those moving ward experience a reduction of around 0.85 in the ward Townsend score. In other words individuals who move ward are, on average, moving to slightly less deprived wards. It is noticeable that in model 2a forty six percent of the total variance in the outcome is as a result of variation between wards.

Table 7: Model 2, change in ward deprivation 1991 to 2008 for those that moved ward.

Change in ward deprivation 1991 to 2008	**Model 2a**		**Model 2b**		**Model 2c**	
	Est.	**S.E.**	**Est.**	**S.E.**	**Est.**	**S.E.**
Fixed Part						
Constant	-0.852		-0.957		-0.978	
Ward deprivation1991$_k$			-0.708	0.024	-0.711	0.024
Household Income1991$_{jk}$					-0.309	0.084
ΔHousehold Income$_{ijk}$					-0.089	0.064
Age1991$_{ijk}$					-0.014	0.005
Age1991*ΔHousehold income $_{ijk}$					-0.012	0.005
Random Part						
Variance ward σ^2v	7.667	0.825	0.281	0.251	0.314	0.243
Variance household σ^2u	6.011	0.454	6.170	0.443	6.062	0.433
Variance individual σ^2e	2.862	0.178	2.873	0.176	2.836	0.175
DIC:	7629.232		7573.790		7553.703	

When ward Townsend score at 1991 is added, as in model 2b, it can be seen that, without controlling for age or income, individuals who move from more deprived wards experience a greater reduction in the Townsend score compared to those that move from less deprived wards. For example, individuals who move from wards with

an average Townsend score at 1991 experience a reduction in the ward Townsend score by of 0.96 points, while individuals who move from wards that are two standard deviations above the mean Townsend score at 1991, that is more deprived than average, reduce the ward Townsend score by 2.37 points. In model 2b the variation between wards is greatly reduced to around three percent of the total variance and is no longer significant. This suggests that the observed difference in the outcome between wards is explained by the level of ward deprivation at 1991.

In model 2c age and household income at 1991 have been added along with change in household income and an interaction between age at 1991 and change in household income. This represents the best model fit, adding an interaction between age and household income at 1991 did not improve the fit of this model. Note that, like model 2b, there is no significant variation between wards and the effect of ward deprivation at 1991 is similar to model 2b. The effect of household income at 1991 shows that, holding everything else constant, those with mean income in 1991 will experience a reduction in ward Townsend score of 0.98 compared to an individual two standard deviations above the mean income in 1991 who will experience a larger reduction in Townsend score of 1.60. While an individual two standard deviations below the mean income in 1991 will experience a reduction in Townsend score of 0.36. The effect of age is again significant and older individuals who move ward are likely to experience, on average, a larger decrease in ward deprivation. Holding everything else constant those aged 66 at 1991 who move ward experience an average reduction in Townsend score of 1.39 compared to an average reduction of 0.72 for those aged 16 at 1991. The main effects of change in income are not significant but the effect of change in income needs to be interpreted along with the interaction with age. Change in income

has a greater effect on the outcome for older individuals. For those aged 66 at 1991 who move ward an increase in income of two standard deviations above the mean change, holding everything else constant, leads to a 2.62 reduction in Townsend score, while for those aged 66 at 1991 a reduction in income of two standard deviations below the mean change leads to a reduction in the Townsend score of only 0.16.

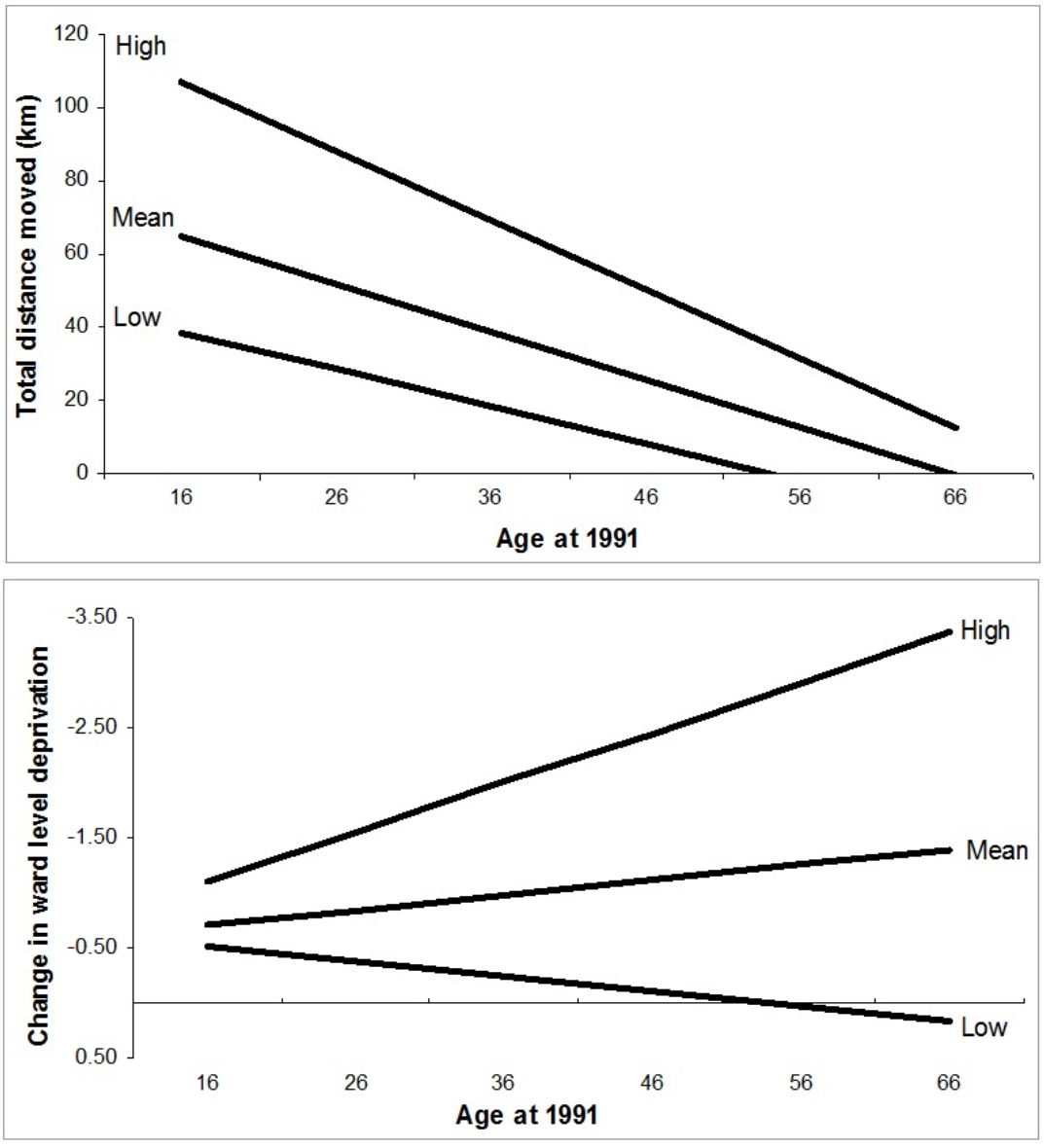
Summary

In order to aid the substantive interpretation of the multilevel regression models figure 4 graphs predicted outcomes for different values of the explanatory variables for both outcomes. 'Low' refers to individuals who are one standard deviation below the mean income at 1991 and who experience a change in income over the period that is two standard deviations below the mean change. 'Mean' refers to mean income at 1991 and mean change in income. 'High' refers to individuals who are two standard deviations above the mean income at 1991 and who experience a change in income over the period that is two standard deviations above the mean change. Where ward Townsend is in the model the predictions are based on those in average ward deprivation at 1991. These values were chosen to give an indication of outcomes for individuals at different ends of the range of income variables. The values reflect the distribution of the explanatory variables and the skewed distribution of income at 1991, as shown in tables 4 and 6. Although it should be noted that the values chosen for illustrative purposes in figure 4 are not the most extreme values observed in the data.

The illustrative predicted outcomes in figure 4 suggest that there is a substantively larger effect of income on the change in ward deprivation for those that move ward

than there is for the outcome of total distance moved between 1991 and 2008. Also it should be noted that the model for total distance moved predicts negative values for the oldest individuals in the low income group. What figure 4 does help to illustrate is the combined effects of both outcomes and how these effects are part of a process playing out over the individual life course.

FIGURE 4: predicted values by age for different income groups .
(See text for an explanation of high, mean and low income groups)



Younger people are generally more likely to move greater geographical distances but after controlling for age poorer individuals of all age groups are more likely to move shorter distances, and income at 1991 has more of an effect on the distance moved by younger individuals, the group that actually move most. For those that move ward the effect of income on the change in ward deprivation is pronounced, but again it varies with age. For younger individuals who move income variables lead to a small difference in the change in ward deprivation but income differences make a large difference to the predicted change in ward deprivation for older individuals who move ward. So, considering both outcomes together, younger individuals are more likely to move but income restricts the distance moved by younger individuals more than it does for older individuals. Older individuals are much less likely to move long distances but when older individuals move ward then the income variables have a large effect on the change in ward deprivation, while for younger people income differences have a smaller effect on the change in ward deprivation.

Conclusions

The models presented here are intended to be parsimonious, the simplest adequate models without unnecessary parameters, see Spanos (2007). One rationale for including further explanatory variables would be to control for confounding variables. However the theoretical perspective presented in this paper argues that income inequality is the variable that determines constraint. Therefore it is suggested that studies of geographical mobility which fail to account for income will suffer from omitted variable bias as income is likely to be a confounding variable for other observed relationships. In other words the theory advanced here argues that the relationship between income and geographical constraint holds for all individuals.

But, that said, there is undoubtedly further work that could be carried out looking at the subtle interplay between constraint and life events.

There is of course the problem of sample attrition. Goldstein (2009) reviews the main problems of attrition in longitudinal studies, which are lack of efficiency and the introduction of bias. Bias will arise if the attrition is not random. In my case it is not safe to assume that attrition is random as lower income groups and those that move will be over represented amongst those dropping out of the study, see Uhrig (2008) for a detailed discussion on BHPS attrition and Plewis et al (2008) for further evidence from the Millennium Cohort Study of higher attrition rates amongst those that move. The attrition results in data that can no longer be considered as a simple random sample. However this paper adopts a model based approach to statistical inference where inference about the process of socio-economic constraint is drawn from the relationship between the outcomes under study and the explanatory variables in the models. If the models are correctly specified then they should be able to identify relationships between variables that show whether the process of socio-economic constraint exists. See Särndal (1978), Brewer (2002) and Lohr (2010) for a discussion on model based inference and Goodman and Blum (1996) who found attrition in longitudinal studies led to bias in estimated means but not in the relationship between variables.

The first part of this paper presented the argument that geographical mobility should be understood as a life course process and that the local place, or neighbourhood, is itself an ongoing dynamic process. While there is no doubt individual agency exists within these open processes the central argument that this paper seeks to advance is

that individual agency operates within constraints and that understanding these constraints is essential to understanding differences in geographical mobility for individual life course trajectories. The theoretical model advanced essentially consists of a number of interlocking concurrent processes. Dynamic processes creating local place, the process of geographical mobility through a life course and the process of socio-economic constraint on individual mobility. With this perspective income inequality and spatial inequality can be understood as mirror expressions of a single unequal social system impacting on individual life course trajectories through the process of spatial socio-economic constraint.

The empirical analysis presented seeks to contribute to this theoretical framework by testing for the existence of socio-economic constraint on geographical mobility using longitudinal data and multilevel models. Two specific hypotheses were tested, that individuals with low income are more likely to be geographically constrained and individuals with low income are more likely to be constrained to areas of higher material deprivation. The analysis presented here provides evidence in support of both hypotheses and for the existence of socio-economic constraint on geographical mobility after controlling for the effects of age. The effects of income variables were found to interact with age in such a way as to help illuminate how the process of constraint operates across the life course. Individuals with low incomes are less likely to move greater distances when they are young and, as they age not only are they less likely to move compared to those with higher incomes, but if they do move ward then they are much less likely than more affluent individuals to move to less deprived wards as they get older. Individuals with higher incomes are more likely to move greater distances when young and if they move ward they are much more likely to

move to less deprived wards, particularly as they get older. The variation between wards initially observed in the empty models for both outcomes was explained away by subsequent models once explanatory variables were added. In the final models presented there is little evidence to support the existence of independent separate neighbourhood effects. To conclude, this paper presents empirical evidence to support the existence of a process of geographical socio-economic constraint based on income and adds validity to the argument that an understanding of this process should be central to the study of geographical mobility and to theories examining the relationship between individuals and local place.

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