The effect of internal migration on the socioeconomic composition of neighbourhoods in England

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Abstract

This thesis determines the extent to which internal migration affects the socioeconomic composition of neighbourhoods in England and how its impact compares with that of other components of area change. It is hypothesised that the selective character of internal migration contributes to increased concentration of poverty in the most deprived neighbourhoods. The focus of the analysis at this small spatial scale will interest policy makers who have sought to reverse the spiral of socioeconomic decline in selected neighbourhoods through area-based regeneration initiatives. It will also add to neighbourhood change theory that assumes internal migration is widening spatial inequalities, which has rarely been empirically tested.

The analysis is conducted using an administrative dataset called the School Census. The School Census enables detailed geographical analysis that is not possible with existing datasets used to measure internal migration in the UK. The thesis demonstrates the potential of the School Census for migration research and its usefulness in shaping policy. Change in the socioeconomic composition of a neighbourhood can be measured using the proportion of pupils claiming Free School Meals (FSM), which is widely used as a measure of poverty in educational research. The change in the concentration of FSM pupils is uniquely analysed at varying spatial scales to determine an appropriate neighbourhood level at which to conduct further analysis.

The effect of internal migration on neighbourhood socioeconomic change is analysed using a growth model for Lower Super Output Areas. It shows that internal migration contributes to increased concentration of FSM pupils in the most deprived neighbourhoods. However, the effect is small. The effect of pupils changing their FSM status but not moving (in-situ change) is more dominant and reduced the concentration of FSM pupils in the most deprived neighbourhoods during the period 2002-2007. These findings contribute to a small but growing literature that suggests the effect of internal migration is minor when compared with in-situ change.

Factors related to internal migration at the neighbourhood level are modelled using linear and spatial regression. A number of characteristics are found to be similarly associated with net migration of FSM and non-FSM pupils. This suggests there is an element of choice exercised by all families with school children when they move. However, there are discriminating effects, including school quality, that are related to higher net migration of non-FSM pupils but not FSM pupils. Moreover, the effects of some neighbourhood characteristics on migration including worklessness are shown to vary across different parts of the country. These findings suggest policy makers should be sensitive to local contexts when planning public service provision.
Declaration

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Abbreviations

ABI  Area-Based Initiative
AIC  Akaike Information Criterion
BHPS  British Household Panel Survey
CLG  Communities and Local Government
DfE  Department for Education
DfES  Department for Education and Skills
DCSF  Department for Children, Schools and Families
DoH  Department of Health
DWP  Department for Work and Pensions
FSM  Free School Meals
GCSE  General Certificate of Secondary Education
GOR  Government Office Region
GP  General Practitioner
GWR  Geographically Weighted Regression
IMD  Indices of Multiple Deprivation
LAD  Local Authority District
LEP  Local Enterprise Partnership
LS  England and Wales Longitudinal Study
LSOA  Lower Super Output Area
MYE  Mid-Year Estimate
NDC  New Deal for Communities
NHSCR  National Health Service Central Register
NPIA  National Police Improvement Agency
NSNR  National Strategy for Neighbourhood Renewal
OA  Output Area
ODPM  Office of the Deputy Prime Minister
OLS  Ordinary Least Squares
ONS  Office for National Statistics
PLASC  Pupil Level Annual School Census
PRDS  Patient Register Data System
SEU  Social Exclusion Unit
VIF  Variation Inflation Factor
Chapter 1 - Introduction

1. Outline of thesis

Over time, the socioeconomic composition of sub-national areas is likely to change as a result of internal migration. This is because migration flows between places are not always symmetric, with higher and lower socioeconomic groups clustering in different types of areas. Champion and Fisher (2003) suggest that within the UK, places which are large net losers or gainers by migration are likely to see their population profiles change significantly. They state that:

“The net exodus from larger cities is the most important single element in migration between places in Britain, and there is concern that this process may be removing disproportionate numbers of their wealthy and enterprising residents. This process is seen – by policy-makers and academics alike – as reinforcing trends towards the spatial concentration of less well-off social groups in these large cities and as reducing their attractiveness as living places for those in more prestigious and better-paid jobs.” (Champion and Fisher, 2003, p.230).

This thesis aims to determine to what extent selective internal migration affects the socioeconomic composition of neighbourhoods in England and how its impact compares with that of other components of area change, namely; natural change, international migration and in-situ socioeconomic status change. Preliminary sensitivity analysis is conducted at different spatial scales, ranging from Local Authority Districts to Census Output Areas, using a relatively new dataset called the School Census to determine the most appropriate neighbourhood scale at which to focus the rest of the analysis. The School Census has been collected annually since 2002 and includes information about all pupils attending a state school in England.

The School Census is an administrative dataset including information about each pupil’s age, sex, ethnicity, home postcode and Free School Meal (FSM) status. Through the inclusion of a unique pupil reference, pupil records can be matched across years with a change of postcode indicating a migrant pupil. Migrants can be disaggregated by their binary FSM status, which is a widely used measure of poverty in educational research (Hobbs and Vignoles, 2007; Styles, 2008), to investigate whether net migration flows are increasing the concentration of deprivation.
It is widely noted that data required to measure migration are inherently difficult to collect (Boden and Rees, 2010a; ONS, 2006). In the UK, internal migration data for the whole population is derived from two main datasets: the decennial Census of Population and the National Health Service Central Register (NHSCR) of all patients registered with a general practitioner (GP). However, these datasets are limited. This was recognised by a recent inquiry into the adequacy of population estimates by the House of Commons Treasury Committee (2008) which found that the estimates are not fit for purpose as they fail to properly account for internal migration. The School Census can provide more up to date information than the Census and more detailed socioeconomic and geographical information than the NHSCR. However, it is limited to state school-age pupils and their families.

2. Aims and objectives

This thesis has four broad objectives. Firstly, to evaluate the School Census as a source of internal migration data compared with other existing datasets. Secondly, to analyse the effect of internal migration at different spatial scales using the School Census to investigate whether net flows are increasing the concentration of FSM pupils. Thirdly, to ascertain the extent of change in concentration of FSM pupils due to internal migration compared with other components of change. Fourthly, to identify the characteristics of areas that increase or decrease their concentration of FSM pupils as a result of internal migration and whether these vary in different parts of England. These objectives are discussed below with reference to specific research questions.

Given the School Census is a relatively new dataset, which has not been used extensively to measure internal migration, it is essential to explore its limitations and compare it with existing data sources. This thesis therefore asks the question: how does internal migration data derived from the School Census compare with existing sources? Similar work by Boden et al. (1992) was carried out to compare the decennial Census and NHSCR when the latter was being considered for inclusion in the Office for National Statistics (ONS) population projections and estimates. In the School Census, a change of a postcode for a pupil in data matched between years can be used to measure internal migration. This type of measurement of migration is referred to as a transition because not all movements made will be identified.
Taking into account the limitations of the School Census as a measure of migration and how it compares with existing data sources, subsequent objectives of the thesis can be tackled. The effect of internal migration on the change in the concentration of FSM pupils in an area will be important to policy makers who may be required to alter their service provision, particularly if it involves sections of the population who are heavy users of public services, for example, families with children. Moreover, if an area is becoming poorer in terms of the concentration of FSM pupils, policies directed at the area will need to be revised and evaluated once taking into account the effect of migration. This is particularly important for area-based regeneration interventions that aim to improve the economic position of individuals living in targeted deprived areas as a response to the belief that living in a poor area has damaging contextual effects on individuals’ socioeconomic outcomes (Atkinson and Kintrea, 2001). The thesis therefore asks the question: do internal migration flows increase the concentration of FSM pupils in the most deprived areas?

Evaluations of the New Deal for Communities programme directed at 39 deprived neighbourhood areas in England have suggested selective migration removes the more economically advantaged individuals to be replaced by relatively more disadvantaged individuals (Cole et al., 2007). Thus, internal migration undermines the efforts of the regeneration programme to improve the socioeconomic status of the areas targeted. However, this effect varies by the type of targeted neighbourhood, with those with a more transient population, for example, with a large proportion of private rented housing, seeing the greatest increase in concentration of disadvantaged individuals (Beatty and Cole, 2009). This thesis therefore asks the question: what area characteristics are associated with population change due to internal migration in the most deprived areas? It also asks: do these correlates of migration vary between different parts of England?

It is important to consider the effect of internal migration at different spatial scales in order to determine whether the direction and extent is the same at each scale. Brimblecombe et al. (1999) have shown that very different conclusions can be drawn from conducting analysis at different spatial scales. They investigated the extent to which geographical variations in mortality are influenced by patterns of internal migration since birth. Analysis of standardised-mortality ratios with and without migration showed that selective migration had no impact on the regional geography of mortality. However, all of the variation in mortality between local authority districts could be accounted for by selective migration. This thesis is broadly concerned with the effect of
internal migration at the neighbourhood level. However, neighbourhoods are often inconsistently defined using both administrative and data boundaries (Galster, 2001). This thesis therefore asks the question: does the effect of internal migration vary by spatial scale of analysis?

The effect of internal migration on the change in the concentration of FSM pupils cannot be studied in isolation when considering implications for policy and migration theory. An area might become poorer as a result of internal migration. However, the impact of international migration, natural change and in-situ socioeconomic status change may ameliorate or exacerbate this effect. In-situ change in this thesis refers to a pupil changing their FSM status but not moving. A limited number of studies have tried to disentangle these competing mechanisms of poverty concentration (see chapter 2, section 5). This thesis asks the question: how does the effect of internal migration on socioeconomic area change compare with other components of change?

3. Methodological approach

This thesis is firmly based on a quantitative research methodology. The empirical chapters are intended to be largely self-contained with the methodological approach taken detailed within each chapter. The data used in each chapter is derived mainly from the School Census which enables analysis of migration with a longitudinal perspective at detailed spatial scales. The methods used reflect this and are bespoke to the research questions addressed in each chapter. The analysis conducted in the early parts of the thesis (chapters 3-4) follows a statistically descriptive approach that is common in migration research. Summary measures (in, out and net flows) are used to describe internal migration during the period 2002-2007. These measures are used to determine the net impact of internal migration on socioeconomic area change as well as comparative measures of other components of area change.

The descriptive approach is built upon in the subsequent parts of the thesis using statistical models. Some of these models follow conventional approaches used in migration studies whereas others are relatively new to the research area. The impact of migration on socioeconomic neighbourhood change is analysed over time using a multilevel growth curve model (chapter 5). This method takes account of the longitudinal nature of the School Census and is fitted using a multilevel model repeated measures framework. The model enables a calculation of the change year on year in the percentage of FSM pupils which makes more efficient use of the data available than an average change calculated by a difference score (Goldstein, 1986). A difference score
(sometimes referred to as a change score or gain score) indicates the amount of change between two time points. In the multilevel growth curve model, year (2002-2007) is used as the level 1 unit clustered within neighbourhoods at level 2. This enables estimation of the variance in the percentage of FSM pupils within neighbourhoods over time and between neighbourhoods as well as how this variation is moderated by other factors. Multilevel modelling is becoming increasingly common as a method used to analyse individual and area determinants of migration (Boyle and Shen, 1997; Feijten and van Ham, 2009; van Ham and Feijten, 2008). However, the application of this advanced quantitative method to socioeconomic area change as a result of internal migration is rare in migration research. The application of the multilevel growth curve model is based on an approach developed by Goldstein and Noden (2003) for analysing social segregation in schools.

Net migration rates for the most deprived neighbourhoods are modelled using linear regression (chapter 6). This approach is common in migration studies to determine the factors associated with migration (Poston et al., 2009; Rayer and Brown, 2001). A limitation of this approach is that it is unable to capture the spatial connection between areas unlike spatial interaction modelling which has been used in migration research for this purpose (Champion et al., 1998; Congdon, 2010; Fotheringham et al., 2000). Spatial interaction models assume flows (e.g. migration flows) are a function of characteristics of origins and destinations and the friction or gravity, which is often represented by distance, between them (Fotheringham and O'Kelly, 1989). Nonetheless, the complexity of a spatial interaction model for a neighbourhood level analysis in England would be computationally unfeasible due to the size of the migration matrix that it would create. Therefore, this approach was not considered appropriate in this thesis.

The spatial element of internal migration is explored in this thesis using Geographically Weighted Regression (GWR) (chapter 7). This technique was designed specifically to take account of spatial relationships between dependent and independent variables that are not accounted for when estimating linear regression models (Fotheringham et al., 2002). GWR produces local parameter estimates for each observation, in this case neighbourhoods, which are weighted by distance from estimates for other neighbourhoods within a defined area referred to as the bandwidth. The method therefore allows the relationship between a dependent variable and independent variables to vary over space. The application of this method provides a contribution to a small but growing literature of testing spatially varying relationships between migration and its determinants (Jensen and Deller, 2007; Nakaya, 2001; Nelson, 2008).
The quantitative approach in this thesis draws on and adds innovation to methods in internal migration research by exploiting the longitudinal and geographical characteristics of the School Census. The structure of the thesis is described in the next section.

4. Structure of thesis

The thesis is structured as follows. Chapter 2 provides the background to the thesis through a review of relevant literature. The literature review starts by discussing the definition of migration and theories of internal migration related to socioeconomic area change. The empirical evidence for the effect of internal migration on socioeconomic area change is then explored with a focus on different spatial scales of study. Existing research which compares the effect of internal migration with other components of socioeconomic area change is also reviewed. The chapter ends with a discussion of policy responses to the effect of internal migration on socioeconomic area change.

Chapter 3 compares internal migration data from the School Census with the NHSCR and 2001 Census. The characteristics of each dataset are compared in terms of how migration is measured, population coverage, temporal coverage and attributes recorded. The empirical results from each dataset are also compared to provide external validity for the internal migration data derived from the School Census. The School Census is compared with the NHSCR for each calendar year during 2002-2006 for moves between districts. Comparison with the 2001 Census is limited to the period 2002-2003 as it is the earliest period for which the School Census is available. However, unlike the NHSCR, comparison of migration data is possible for flows within districts as well as between districts.

Chapter 4 introduces the Free School Meal indicator as a measure of socioeconomic status of a pupil. The change in the percentage of FSM pupils due to different components of change are analysed at varying spatial scales, from district to output area, that comprise administrative and data boundaries. The components analysed are internal migration, a proxy for international migration, school turnover and in-situ socioeconomic status change. The effect of each component is analysed for an average one-year period during 2002-2007 by deprivation deciles. The aim of this chapter is two-fold. First, to set in context the impact of internal migration on socioeconomic area change. Second, to determine whether the components have different effects at varying spatial scales for areas defined by administrative and data boundaries.
Chapter 5 examines the effect of internal migration on change in the concentration of FSM pupils at the neighbourhood scale by modelling this change for each one-year period during 2002-2007 using a repeated measures design. The aim of this approach is to create trajectories for neighbourhoods to determine whether the rate of increase or decrease in the concentration of FSM pupils becomes greater or smaller over time conditional on a number of covariates. These include the regional area and district type a neighbourhood is located in as well as whether the neighbourhood is ranked within the 20% most deprived in England. The chapter begins with a discussion of the appropriateness of the method, and possible alternatives, followed by statistical analysis.

Chapter 6 explores the migration dynamics in the most deprived neighbourhoods. Net migration rates are modelled for FSM and non-FSM pupils using linear regression. The aim of chapter 6 is to determine the area characteristics that are associated with net migration by socioeconomic status of pupils and their families. These findings will interest policy makers trying to address increases in poverty concentration due to internal migration. Factors associated with net migration are considered by drawing on existing literature and discussed in relation to availability of neighbourhood level data. The net migration rate is calculated by taking an average for a one-year period during 2002-2007.

Chapter 7 builds on the analysis from previous chapters by analysing out-migration rates for all neighbourhoods in England. The aim of this chapter is to determine whether associations between key neighbourhood level explanatory variables and migration varies across space. For example, is the relationship between worklessness and migration different in the neighbourhoods in the South of England compared with neighbourhoods in the North? The analysis is undertaken using Geographically Weighted Regression (GWR). Models are fitted which predict out-migration rates using a limited number of explanatory variables selected from factors, shown to be related to migration, described in chapter 6.

Chapter 8 presents conclusions. It focuses on key findings from the substantive results, contributions to migration methods and theory, and implications for public policy. The limitations of the research are highlighted and this feeds into potential questions for further research in the field of migration studies. While the analytical chapters are to some extent self-contained, each adopting distinct methodological approaches to address a specific research objective, the thesis is
structured and written to provide a strong and coherent central narrative. As such there is considerable cross-referencing between the analytic chapters and to chapter 2 that presents and discusses the relevant literature on the substantive themes addressed.
Chapter 2 - Background

1. Introduction

Migration is a selective process which is more likely to occur for people with certain characteristics (Kanbur and Rapoport, 2005). Studies have shown, for example, that people are more likely to migrate within the UK if they are single, white, younger, well educated, unemployed, working in a managerial or professional occupation, renting their home, and have no dependent children (Boheim and Taylor, 2002; Finney and Simpson, 2008). These characteristics tend to become even more selective the larger the distance moved (Lee, 1966). This is because the costs of moving, both economic and emotional, tend to increase with distance and only those with the resources to overcome these costs are able to migrate between locations that are far apart. Whether a person migrates is also dependent on area characteristics of their origin and destination. For example, people tend to move towards areas with higher average age, green space and private rented housing, lower population density, and lower levels of unemployment and manufacturing employment (Boyle and Shen, 1997; Congdon, 2010).

The literature relating to these individual and area level determinants of migration is well developed and spans across a number of academic fields including economics, geography, sociology and demography. However, there is much less attention focused on the effects of migration within each of these disciplines (Greenwood, 1975, 1997; Greenwood et al., 1991). For example, there are few studies on how internal migration changes the socioeconomic composition of subnational areas. Socioeconomic area change resulting from migration is of great importance to policy makers as they will be required to alter their service provision if the effect of internal migration is significant (Dennett and Stillwell, 2010). For example, if there is an increased concentration of poorer residents, welfare and health services might require greater investment (Greenwood, 1975). Moreover, as an area’s population becomes poorer and perhaps smaller it will be less able to pay local forms of taxation which may result in local authorities being less able to pay for services if they rely on self-financing. At present, this is unlikely to be an issue in the UK. However, there are elements of the current Government’s Localism Bill which suggest local authorities financial autonomy may increase. There are proposals, for example, to enable them to
keep their business rates\(^1\) rather than returning them to central government to ensure a more equal distribution across the country (CLG, 2011c).

This chapter will explore the evidence of the effect of selective internal migration on the socioeconomic composition of sub-national areas in the UK as well as other early industrialising countries. There is a bias towards the UK and neighbourhood level studies because this will set the context for the empirical chapters in this thesis. This chapter is structured as follows. The next section discusses the concept of migration. Section three explores theories of internal migration in terms of how they relate to socioeconomic area change. Section four explores the contemporary impact of internal migration on socioeconomic area change. This section is split by geographic scale of internal migration flows: inter-regional, counterurbanising and inter-neighbourhood. Section five explores studies which have contextualised the effect of internal migration compared with other components of socioeconomic area change. Section six explores the policy response to the effect of internal migration on socioeconomic area change. Section seven provides a summary.

2. Conceptualising migration

Migration can be broadly defined as a change of residence by a person, family or household (Lee, 1966; Stillwell and Congdon, 1991) which is distinguishable from commuting or tourism (Clark, 1986). The concept is often refined when measured by excluding people who move from one location to another temporarily. For example, a student who lives away from their parental home during term-time but considers their parental home as their permanent residence might be considered a temporary migrant. It is often difficult to determine whether a move is temporary or permanent. A student might decide to continue living in the temporary location after his or her studies have finished. In this case, the timing of a switch between temporary and permanent migration is likely to be ambiguous. It could be argued that they were never a temporary migrant at all or that they remain a temporary migrant until they make another more permanent move. It is often the case that migrants who think they are moving temporarily subsequently stay in a location for much longer than expected (Khoo et al., 2008).

A person can be equally considered a migrant if they move into the house next door or they move from one side of the world to the other. However, distance is a key component of migration

\(^1\) Business rates is a tax that is paid by the occupiers of non-domestic property such as shops, offices, pubs, warehouses and factories to local authorities in England and Wales.
which separates sections of the literature. Migration theorists often assume that fewer migrants will migrate over greater distances because the costs of moving are expected to be greater the longer the distance moved (Lee, 1966). This is not always the case because distance is not always an accurate indicator of the cost of migration (Cadwallader, 1992). Moreover, migration is rarely measured continuously over space as it is often defined by the crossing of a spatial boundary. The broadest distinction of boundary crossing in the field of migration studies is between international and internal flows (King and Skeldon, 2010; Rowland, 2003). International migration involves movement across national boundaries whereas internal migration involves movement within the same country. This thesis will almost exclusively consider the effect of internal migration.

King and Skeldon (2010) have questioned the value of a distinction between international and internal migration because “to consider one form of migration without the other, as has so often happened in the past, is to look at only one part of the story, and results in a partial and unbalanced interpretation” (King and Skeldon, 2010, p.1640). They recognise that there is often a political dimension to crossing national borders which makes it distinct from internal migration. For example, visas and permits are often required when moving from one country to another to permanently settle. However, it would be wrong to separate the two forms of migration entirely when considering some migrants will not have to move as far to cross a national boundary as other migrants will move to stay within a country. Moreover, national boundaries do not always act as a migration barrier as such, for example, European Union citizens are entitled to move freely and settle in any other member state (Bailey and Boyle, 2004).

Internal migration is often separated by inter-regional flows and more localised flows which are sometimes referred to as residential mobility (Andrew and Meen, 2006; Rowland, 2003). The distinction between internal migration (inter-regional mobility) and residential mobility is not consistent in the literature and can lead to confusion particularly in the development of theory. The terms are sometimes used synonymously and on other occasions refer to longer and shorter distance moves. Clark (1986) suggests that internal migration can be defined as movement that is too far to continue commuting whereas residential mobility is a movement that allows commuting to the same job. This division of different levels of internal migration is related to motivations that are attached to longer and shorter distance moves. Long-distance or inter-regional moves are generally considered to be motivated by employment reasons whereas short distance moves tend to be related to housing preferences (Clark, 1982; Meen et al., 2005).
A number of authors have questioned the dominance of the labour market determinants that are used to explain long distance internal migration (Kofman, 2004; Smith, 2004). They have emphasised the importance of family dynamics, for example, marriage, divorce and other migration motivated by a desire to be closer to family members. Clark has begun to question his own distinction of internal migration and residential mobility in light of these studies. He suggests that:

“for long-distance moves it is much more complex than the previous notions of solely employment driven moves [and] it is true that housing related moves are more important in local moves but they only account in the aggregate for half of the reasons for these relocations” (Clark and Withers, 2007, p.614).

Nonetheless, Clark and others would agree that the single most important driver of long distance flows are employment related (Andrew and Meen, 2006; Clark and Withers, 2007; Niedomysl and Hansen, 2010).

Quantitative migration studies are often driven by restrictions in data rather than an interest in different types of migration. Smith (2004) argues for an integration of quantitative studies with qualitative research methods which can tease out the factors which motivate people to move rather than the associates that quantitative studies rely upon. In the UK, there is no annual quantitative dataset that measures localised moves and therefore researchers often rely on migration data that measure flows between regions and districts. These moves are often characterised as long distance. However, it is not accurate to state that inter-regional moves are long distance per se because most inter-regional migrants move to a neighbouring region (Molho, 1986; Ravenstein, 1885). This thesis is able to explore very localised internal migration in England. The term internal migration is used to describe all forms of subnational migration. The issue of the measurement of migration will be returned to in chapter 3 when the operationalised term used in this thesis is defined and compared with other alternatives. The issue of scale in internal migration studies will be revisited throughout this chapter and will be addressed empirically in chapter 4.
3. Theories of internal migration

This section explores the development of internal migration theory across interdisciplinary divides. It starts by discussing the migration ‘laws’ described by Ravenstein in the late 19th Century. This is followed by a discussion of economic theories of internal migration including the neoclassical perspective and human capital theory. They are discussed in terms of their anticipated effect on socioeconomic area change. These economic theories are contrasted with the cumulative causation perspective of internal migration. The penultimate subsection explores the family migration literature which assumes people often move together rather than as individuals and that migration is often tied to events during the life-course. This has been neglected by a large proportion of the theoretical and empirical internal migration literature. The final subsection provides a short review of child migration which is seldom considered within the family migration literature or in its own right. There are very few studies within the family migration and child migration literature that provide an insight into the effect of this type of internal migration on socioeconomic area change. Nonetheless, this literature is reviewed to provide context for the school pupil population analysed in the empirical chapters of this thesis.

3.1 Ravenstein’s laws of migration

Theories of internal migration can be traced back to Ravenstein’s laws of migration which were mainly developed using results from the 1881 UK Census (Ravenstein, 1885, 1889). Ravenstein compared the county of residence for individuals with the county of their birth to calculate migration flows and then generated statements that characterised these flows. His laws have been summarised as follows:

1. The majority of migrants move short distances
2. Migration proceeds step by step
3. Migrants moving long distances generally go by preference to one of the great centres of commerce or industry
4. Migrants from the country surrounding a town flock to that town
5. The major direction of migration is from the agricultural areas to the centres of industry and commerce
6. Each current of migration produces a compensating counter current

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2 In Ravenstein’s second historic paper (1889) he compares internal migration in the UK with continental Europe and North America.
7. The natives of towns are less migratory than those of rural areas
8. Females are more migratory than males, but males more frequently venture further
9. Migration increases in volume as industries and commerce develop and transport improves
10. The major causes of migration are economic in search of higher wage remuneration (Boyle et al., 1998b, p.60; Lee, 1966, p.48)

It is striking how many of these ‘laws’ can be used to describe the contemporary patterns of internal migration in the UK and other developed countries. The major exception is that internal migration in developed countries does not tend to flow from rural to urban areas anymore. Also, the major cause of internal migration today is not in search of work of greater remuneration because a high proportion of contemporary moves are related to housing choices (Andrew and Meen, 2006). However, contemporary moves related to housing choices tend to be made over short distances (Niedomysl and Hansen, 2010). Ravenstein’s analysis was limited to regional internal migration which contemporary studies show is likely to be dominated by employment related moves (Ibid). Interestingly, some of the problems that Ravenstein faced in terms of measuring migration and the incompleteness of his data are observed in contemporary migration studies. He talks about the misconception of comparing migration levels between unequal size counties, for example, Rutland and Yorkshire. A person could move within Yorkshire and move a much greater distance than a migrant moving between Rutland and a neighbouring county. However, due to limitations of the 1881 Census, the former would not be considered a migrant whereas the latter would.

It is interesting to note that following Ravenstein’s seminal work there has not been a similar attempt to theorise internal migration so comprehensively. This reflects the separation of internal migration literature across academic disciplines during the 20th Century which have focused on different aspects of migration. The task of bringing theoretical and empirical studies across disciplines together is perhaps an almost impossible task, although authors have tried to provide some reconciliation (Cooke, 2008; Greenwood, 1975, 1997; King and Skeldon, 2010; Molho, 1986). On the whole, these reviews of internal migration are openly biased in favour of one particular discipline.
3.2 Neoclassical economic migration perspective

Neoclassical economic theory was first applied to the study of migration by Hicks (1932) in his book *The Theory of Wages*. He argued that differences in wages are the main cause of migration and that high unemployment and low wages would have a push effect on migration whilst low unemployment and high wages would have a pull effect. This push-pull notion theory of migration can be conceptualised as an equilibrating process regulated by supply and demand for labour and therefore wage differentials (Greenwood *et al.*., 1991). The theory suggests that in the long-term there will be no difference in wage levels between regions as migration will create a socioeconomic equilibrium. Surprisingly, this model of migration has continued to be the benchmark referred to in the economics literature despite continued evidence of growing regional wage differentials in the face of increased migration (Groenewold, 1997; Kanbur and Rapoport, 2005).

The problem with neoclassical economic theory is that it assumes homogenous labour, complete information and perfect mobility of everyone within a society but the reality is more like heterogeneous labour, partial information and large differentials in mobility potential. This was partially addressed by economists with the development of human capital theory and its application to migration studies. Sjaastad (1962) integrated ideas of uncertainty and other factors related to the migration process which might slow or even halt the process towards equilibrium. This relaxes the idea that all internal migration will be from low to high wage regions because for some people the costs of moving will be higher than the return and this will vary from person to person. However, human capital theory assumes that migrants are income-maximising agents who can act on rational expectations. More recent applications of human capital theory to internal migration processes have emphasised utility-maximisation rather than income-maximisation as well as issues of uncertainty and lack of perfect information (Walker, 2008).

3.3 Cumulative causation theory

The human capital theory of internal migration has been developed and tested since the emergence of individual and household-level datasets. This type of data has enabled economists, geographers and sociologists to test factors associated with internal migration and ascertain why certain people and families move. These enquiries have led to findings that suggest internal migration is selective as described in the introduction to this chapter. The selective character of internal migration has led some authors to rethink its effect on the long-run equilibrium of
socioeconomic area change which is not explained by human capital theory (Peeters, 2008; Roberts, 2004). Greenwood (1975) proposes the idea of cumulative causation as a process explaining continued population and economic growth in regions with net in-migration and decline in regions of net out-migration. In-migration can induce greater growth in receiving regions and out-migration may induce lesser growth in sending regions which will result in a process of cumulative causation (Greenwood, 1975). This occurs as a result of migrants not being homogenous but a selective section of the population which disproportionately includes highly productive workers. These workers will be attracted away from areas where demand for employment is growing least and towards areas where labour is growing rapidly. This will result in greater income disparities between regions which will encourage yet more migration.

Meen et al. (2005) have applied this theory explicitly to short distance moves. They state that low demand neighbourhoods experience a circle of decline where lower house prices do not generate inflows, rather the expectation of further capital losses leading to further outflows, particularly from higher income households, who are more able to leave. This idea is reiterated by North and Syrett (2006) who suggest there is evidence of a ‘get on and get out’ culture in the most deprived neighbourhoods whereby those who enter employment have a greater probability of moving out of the area. This leads to a greater level of disconnection from the labour market which becomes ever more self-perpetuating as the neighbourhood spirals into further decline. These ideas are similar to those of Schelling’s (1971) segregation hypothesis which indicates that racial segregation is a stable equilibrium outcome because of individual preferences and ability to meet these preferences. Cumulative causation theory calls into question the viability of attempts to create more socially mixed communities. This will be discussed further in section five of this chapter in relation to policy responses to poverty concentration.

Nonetheless, internal migration may not change the socioeconomic composition even when it is highly selective. This is because there always tends to be a counter stream to every migration flow between areas which might be similarly selective (Gleave and Cordery-Hayes, 1977; Ravenstein, 1885). For example, the population of a student area close to a university is likely to have high population turnover which is selective but leads to very little change in its demographic composition if those that graduate and move away each year are replaced by a similar profile of school leavers each year. This was recognised by Ravenstein and more recently by Gleave and Cordery-Hayes (1977) who find that most flows between regions are fairly balanced and that there is a positive relationship between in and out-migration in the UK, North America and
continental Europe. They indicate that most migrants move from a location of economic strength rather than weakness. This suggests the effect of inter-regional internal migration on socioeconomic area change will be minimal if the selectivity of migration is balanced in terms of outflows and inflows.

### 3.4 Family migration

The theoretical economics literature on migration is largely framed at the level of the individual and rarely takes account of the fact that migration for many people will involve a household or family. There have been attempts to introduce a multi-person element to human capital theory by assuming people move when there is an aggregate family net gain from moving (Blackburn, 2010; Mincer, 1978). This means that some families will move even though one partner’s income will fall or they will have to give up employment, at least temporarily. This has led to the notion of women as ‘tied migrants’ and ‘trailing wives’ (Boyle et al., 2003). However, Blackburn (2010) suggests this is becoming less important and that internal migration is becoming more associated with location specific amenities as couples sacrifice combined earnings in order to benefit from a more pleasant living environment.

Behavioural migration theorists consider the migration process as more holistic than economists by taking account of the lack of perfect knowledge people have when they move and that some people will move as part of the family for reason beyond economic gain. Rossi (1955) was an early author who recognised this in his monograph titled ‘Why families move’. He argued the majority of moves are motivated by a desire for more space following an increase in family size. Therefore, at the centre of Rossi’s findings was the impact of the life-cycle on migration propensity. Clark (1986) summarises internal migration over the life-cycle as follows; for the first 15-18 years individuals will be tied migrants moving with their parents. On entry into adulthood an individual might move a number of times after leaving home to further education and to find their first job. This period is where people are most mobile. It is followed by marriage or some other form of living arrangement that requires a move. The arrival of children may also prompt a move between the ages of 25 and 45. The period after this point is much less migratory unless there is a divorce, for example. In the period leading up to and at the start of retirement people may move as they downsize as children leave home. Finally, towards the end of life people might move closer to relatives or into a communal home as their health becomes poorer. Figure 2.1 shows the propensity of internal migration across the life-cycle in a number of developed countries in 1981.
In the UK, this profile of internal migration by age has remained stable in the two censuses since 1981 (Champion et al., 1998; Dennett and Stillwell, 2008; Finney and Simpson, 2008).

Figure 2.1 - Percentage of the population that changed usual residence in one year for six countries, by age 1981

Source: Long (1992, p.862)

Clark’s summary represents a very simplified view of migration during the life-cycle as some people will experience each stage at very different ages and perhaps not at all. Contemporary authors prefer to use the term life-course rather than life-cycle because the former implies an age-differentiated perspective (A J Bailey, 2009; Clark and Withers, 2007; Geist and McManus, 2008; Nelson, 2008; Rabe and Taylor, 2010). In the last 30 years, the increased complexity of events during the life-course, for example, increased family dissolution and delayed first birth has created much more diverse migration processes (Clark and Withers, 2007). This is what has led Clark to challenge his classic dichotomisation of internal migration by longer-distance employment induced and shorter-distance housing induced moves discussed above. However, the complexity of family structures on migration has not been fully explored. There has been little focus on less traditional family arrangements, particularly in relation to same-sex couples which are often hard to identify (Smith, 2004).
3.5 Child migration

A large proportion of the family migration literature is limited to the economic impact of moving on married and cohabiting partners’ income. The impact of children on the internal migration of families has been underexplored as children are often equated with the position of belonging to their parents and without their own agency (Bushin, 2009; Dobson and Stillwell, 2000; Dobson, 2009). Nonetheless, the existence of children has been shown to reduce family migration propensity and limit movement to shorter distance moves compared with families of similar age without children (Long, 1992). This implies that migration is less appealing or at least restricted when there are children in the family. It is also interesting to note that the propensity of child migration declines with age which suggests parents are even less able or perhaps willing to move when their children are older (Dennett and Stillwell, 2008; Dobson and Stillwell, 2000; Long, 1992). This might be related to the higher likelihood of older children having siblings which makes it even harder for their family to decide upon a move which will not adversely affect all of their children. It could also be the case that moving at late stages in a child’s school career could be considered disruptive and potentially damaging to their studies.

Perhaps because it is less appealing to move when there are children in the family the main drivers of child migration are related to forced migration, for example, as a result of changing family structures. Children whose parents divorce or marry are much more likely to move than other children (South et al., 1998). This hypothesis is used by Long (1992) to explain the higher internal migration of children in the US compared with other developed countries (see figure 2.1). He argues that internal migration of children is higher because family dissolution and single-parenthood is more prevalent in the US. He also finds that children living in lower income families are more likely to move independent of whether they live with both of their biological parents.

Other authors suggest that the movement of families with children which is not forced by changes in family structure is becoming increasingly associated with perceived quality of schools (Dobson and Stillwell, 2000). However, these options are often restricted to families with sufficient resources to make such choices (Ibid).

This implies that children are relevant to the migration decision process and therefore should be considered in greater depth in migration studies. Bushin (2009) suggests children are sometimes directly involved in the migration decision process by helping to determine whether a family moves and where to. She finds that this varies with age which is related to competency to participate in decision making. However, age is not always a determinant of involvement as some
families with only teenage children do not involve their offspring in the decision to move (Bushin, 2009). This thesis will not explore such detailed determinants of internal migration as its primary focus is the effect on socioeconomic area change. The consequences of child migration for distribution and composition of children will have implications for public services that are provided for this age group, most notably, schools (Dobson and Stillwell, 2000). However, very few studies provide any indication of this effect. The next section will explore the empirical literature relating to the effect of migration on area change for the general population with a focus on the different measures used to assess socioeconomic change as well as the scale at which internal migration is measured.

4. Empirical evidence of the effect of internal migration on socioeconomic area change

In the UK, North America and continental Europe, internal migration has been shown to be a major contributor to population change at the subnational level (Dennett and Stillwell, 2010; Johnson et al., 2005; Stillwell and Coll, 2000). In many developed countries internal migration has been associated with effects such as counterurbanisation and economic restructuring (Rowland, 2003). Migration is considered a symptom of economic and social processes, such as the decline of employment and changes in preferences in favour of less urban living. In the UK, economically depressed regions in the North have tended to lose population through migration over the last 30 years as people have drifted towards the South East (Dennett and Stillwell, 2010). During the same period US regional migration has followed a pattern of movement from Frostbelt to Sunbelt States3 (Partridge et al., 2010). These migration flows have become less evident over time in the UK and the US. In the UK, US and to a lesser extent continental Europe, within regions people have tended to move away from large urban areas in favour of suburban and rural neighbourhoods. This process of population decentralisation is generally referred to as counterurbanisation (Champion, 1989). The changing distribution of population not only alters the number of people in certain locations but it can also change the composition of the local population. This occurs when internal migration is selective of the population and the selectivity is imbalanced in terms of outflows and inflows.

3 The Frost Belt includes states in the North-eastern, Great Lakes and Upper Midwest regions of the US where winters are cold and produce heavy snowfall. The Sun Belt includes states across the South of the US from South Carolina in the East to California in the West where winters are relatively mild.
The following subsections will explore empirical studies which have focused on these processes starting with those that have examined the effect of inter-regional migration on socioeconomic area change. The term region is often loosely defined referring to varied sized spatial scales between and within countries. In general, a region refers to the largest spatial scale at the subnational level as it is defined within a country. In the US, some states, which are referred to as regions here, are larger in area and have a larger population than many countries. Moreover, within countries regional scales will vary considerably in geographical and population size. A region is often meant to encompass a labour market and therefore a movement between regions will require a change of job as well as a change of residence (Bailey and Livingston, 2007; Clark, 1986).

The following subsection will review studies that have tested the effect of counterurbanisation on socioeconomic area outcomes. The scale of analysis in these studies generally reflects district areas within a city-region. Districts are administrative boundaries within a region that people will recognise to some extent. They will tend not to comprise self-contained labour or housing markets yet people will be aware when they move between them because there will be changes in the local authority to whom they pay local forms of taxation to.

A small number of recent studies have examined the effect of migration between neighbourhoods by deprivation status. These studies are closest to the analysis reported in this thesis and therefore will be reviewed in a separate subsection. As with the term region, there is no universally agreed definition of what constitutes a neighbourhood (Galster, 2001; Stafford et al., 2008). Therefore, some of the collections of studies reviewed in each of the following subsections are not exclusively concerned with one particular spatial scale. Nonetheless, it is convenient to separate a review of inter-regional mobility and counterurbanisation studies because the former are found mainly within the economics literature whereas the latter are found mainly within the population geography literature. Studies of the effect of migration on socioeconomic neighbourhood composition are scarce and can be described as interdisciplinary.

4.1 Regional migration

The effect of inter-regional migration is largely framed around the idea of the neoclassical economics perspective that migration will act to reduce economic disparities between regions (Kanbur and Rapoport, 2005). A number of socioeconomic outcomes have been considered by empirical studies including income and wage levels, unemployment and poverty rates, and
occupational status. Some studies, notably pre 1970s, have shown support for the idea that migration leads to convergence in socioeconomic outcomes across regions whereas more recent data tends to suggest opposition to this theory. A study of inter-regional migration flows across ten Canadian provinces using data for the 1960s and 1970s found that there was evidence for higher unemployment in origin regions to be associated with increased out-migration and decreased in-migration (Foot and Milne, 1984). There was an opposite effect for wages. This suggests that migration operates to reduce disparities in terms of unemployment and wages. A more recent study by Groenewold (1997) shows that inter-regional equilibrating forces in Australia between 1978 and 1991 were slow and did not equalise regional unemployment rates or wages. This finding is consistent with contemporary studies in the US and the UK (see below). Ostbye and Westerlund (2007) tested for regional convergence in income per capita using migration data between Swedish and Norwegian regions. They show that migration adds to convergence in Sweden but not in Norway where in-migration has a positive impact on output per capita.

Gordon and Molho (1998) have analysed patterns of inter-regional migration between standard regions in the UK for working age males from 1960 to 1991. They suggest that migration became a much less effective equilibrating mechanism in labour markets from the mid-1970s because of a sharply reduced responsiveness of migration to unemployment differentials. This is attributed to the lack of employment-induced migration by manual workers which itself is constrained by public sector housing allocation systems and a widening house price barrier around the South East. When a large proportion of public housing stock was in the control of local authorities it was very difficult for tenants to move between regions because there was limited interaction between public housing providers (Boheim and Taylor, 2002; Hughes and McCormick, 1985). This may have improved to some extent with housing stock transfer to providers that are more willing to transfer tenants between regions and the introduction of choice-based letting within the social housing sector (Manley and van Ham, forthcoming). For manual workers in the owner occupied sector it would be also difficult to move to the parts of the country with the greatest increases in employment i.e. the South East because by the late 1970s house price differentials meant it would be difficult for a low-income household to be able to afford a mortgage in the South East (Boheim and Taylor, 2002; Boyle, 1994).

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4 There are nine standard regions in the UK which vary in population size.
However, the movement of young upwardly mobile adults appears to be drawn toward the South East. Fielding (1992) has described the South East as a regional escalator which promotes the social mobility of in-migrants along with its own young people at a rate which is greater than other parts of the country. He uses data from the England and Wales Longitudinal Study (LS) between 1971 and 1981 which includes a 1% sample of individual records from UK Censuses to show that those entering the South East region\(^5\) tend to be in their early 20s and graduates from provincial universities. In a later study using LS data from 1971 to 1991 Fielding (1997) shows that inter-regional migration adds to the social polarisation of the capital city-region’s social structure. He splits the working age population by social class (service class, petty bourgeoisie, white collar, blue collar, and unemployed) and finds that there is net inflow of service class and net outflow of all other groups except unemployed in the South East Standard Region. Fielding (1992, 1997) and Gordon and Molho (1998) appear to suggest that inter-regional mobility in the UK is largely confined to entry-level graduate employment which is unlikely to eliminate regional disparities in unemployment and income (Maier and Weiss, 1991). Fielding’s theory will be revisited in the next subsection exploring the effect of counterurbanisation on socioeconomic area outcomes in relation to older people ‘stepping off’ the South East regional escalator.

In the UK, analysis of migration flows at what is defined as the regional level might hide a considerable variation of within area socioeconomic change. Roberts (2004) has addressed this by comparing the effect of migration on the growth performance of counties in Great Britain between 1977 and 1993. He finds that a 1% increase in net in-migration increases per capita income in counties by 0.93%. This suggests that migration is leading to income divergence between counties rather than convergence. This is consistent with the cumulative causation perspective described by Greenwood (1975). Roberts indicates the cause might be the inelastic nature of the housing stock in Britain whereby an increase in the price of housing does not necessarily change the level of demand. He goes on to argue that in low growth areas the housing prices will remain stable or decrease whereas in expanding areas the prices will increase rapidly which will discourage migration from declining to expanding areas. This might explain the selectivity of migration into expanding areas, as low-waged and unemployed individuals do not have the liquidity to move. This is consistent with the findings of Gordon and Molho (1998).

There are a number of limitations of Roberts’ study. He uses workplace income figures and resident-based population figures to calculate income per capita which disguises counties that

\(^5\) Includes Greater London.
have a large proportion of their workforce who commute to another county. This is partially resolved by conducting analysis excluding outliers, for example, East Sussex. This has no impact on the substantive findings. A less resolved issue is that net migration is indirectly measured using population growth. He concedes that this will include natural change as well as migration but counters this by arguing that migration is generally the largest component of population change. While this is true, there is large variation in the degree of population change due to natural change across Britain which is not perfectly correlated with net migration (Finney and Simpson, 2009). This indicates the effect of migration could be different if it was measured directly.

A number of other studies have positioned themselves within the cumulative causation perspective. Peters (2008) analyses the income growth rates in 44 municipalities in Limburg, Belgium during the 1990s. He also finds evidence of income divergence with migration nurturing this effect. A rise of a quarter of a percentage point in the net migration rate gave rise to a 6.5% increase in the income level. Another interesting finding from this study was that not only do high income areas experience greatest income growth through migration, but that, neighbouring areas do so as well. This suggests that some high-income migrants maximise their utility by balancing demand for the amenities found in the high-income areas for cheaper housing in neighbouring areas. Lundberg (2006) also finds this to be the case for income growth rates in selected Swedish municipalities between 1980 and 1999. This is an important finding for policy makers as it shows that net migration is not at the expense of an area’s immediate neighbours. Tests of spatial dependency and varying spatial relationships will be explored empirically in chapter 7 of this thesis.

The studies cited thus far in this subsection have used income, wages or unemployment levels to measure convergence or divergence across regions. The major concern in this thesis will be the effect of internal migration on poverty concentration. This has been examined using county to county migration flows in the US by Nord (1998) and more recently by Foulkes and Schafft (2010). Both of these studies are firmly based within the cumulative causation perspective and question whether human capital theory can explain the geographic concentration of poverty. Human capital theory assumes that migration may deepen poverty concentration because poor people are more likely to be immobile in poor places whilst the non-poor are likely to move away. Moreover, if the poor move they are only likely to be able to move short distances because they cannot overcome the costs of moving.
Nord uses US Census migration data for 1985-90. He separates analysis by poverty status of migration flows (poor and non-poor) using thresholds set by the US Census Bureau. He differentiates these flows for counties by their poverty rate including those that have a poverty rate of 20% or higher in the last four censuses. Nord finds that the poor move as much as the non-poor regardless of distance and that migration maintains and sometimes exacerbates poverty concentration in the poorest areas. This is because the poor move to other poor places rather than economic growth centres that the non-poor favour, a result he puts down to differential housing and labour opportunities. The poor tend to move to areas with affordable housing and low-skilled labour demand. He fits regression models which perform much better for non-poor net migration than poor net migration which indicates the poor respond somewhat differently to migration push and pull factors compared with the non-poor.

Foulkes and Schafft (2010) have updated Nord’s results using US Census migration data for 1995-2000. They also find a deepening of existing poverty concentrations with the poor migrating at higher rates and over greater distances than the non-poor. A weakness in the analysis of both studies is that poverty status is measured at the time of the census and this may not reflect poverty status before moving. Foulkes and Schafft indicate this could be addressed more fully by using longitudinal data with sufficient geographical detail. The data used in this thesis meets this requirement and will be introduced in chapter 3.

4.2 Counterurbanisation

Population redistribution between metropolitan and non-metropolitan areas has been observed in the UK and US since the 1970s (Champion, 1994; Kalogirou, 2005; Plane et al., 2005). This process is generally referred to as counterurbanisation and is often distinguished from suburbanisation which began in the late 19th Century (Champion et al., 2007). Counterurbanisation is described as migration of people out of larger cities to physically discrete settlements and rural areas whereas suburbanisation is movement within the city toward the urban periphery. Nonetheless, counterurbanising moves are not independent of distance. In the UK, Boyle (1994, 1995) has found that most out-migration from urban districts and in-migration to rural districts during 1980-1981 was short distance. He also finds that the largest urban areas were not supplying an unusually large number of migrants to rural areas because most migrants to rural areas came from small to medium sized urban areas. This suggests there is a counterurbanisation cascade where migrants take multiple steps to move down the urban hierarchy (Champion and Atkins, 1996).
The movement away from urban areas reflects an ability and willingness to commute from longer distances to workplaces located in the city. This has resulted in certain households choosing to take advantage of rural residential surroundings (Boyle et al., 1998b). Improvements in telecommunications have also weakened the geographical tie between home and workplace (Boyle, 1995) enabling people to live in less urban areas. A number of authors argue that movement away from urban areas tends not to be a result of people following jobs out of central urban areas to be closer to their workplace (Champion, 2000; Hjort and Malmberg, 2006). However, job decentralisation appears to be occurring faster than population decentralisation (Bramley, 2000).

There is a strong age selectivity associated with counterurbanisation (Bate et al., 2000; Rogerson, 1984). In the UK and the US, counterurbanising moves are most common during the child bearing ages 30-44 (Dennett and Stillwell, 2010; Plane et al., 2005). People in these age groups are more likely to recognise the benefits of a non-urban residential environment for childrearing, school quality, housing costs, and less road congestion. Moreover, the only age group that is not moving out of urban areas in net terms are people aged 16-29. These differences by age suggest that the nature and direction of movement up and down the urban hierarchy may be dependent on the stage in the life-course. Young adults tend to move up the urban hierarchy whereas all other age groups are moving down (Champion and Coombes, 2007; Niedomysl and Hansen, 2010).

Counterurbanising migrants are not only selective by age. They also tend to be more affluent and employed in managerial and professional occupations (Cox, 2000). Fielding (1992) notes this in his regional escalator hypothesis as described above. He finds that a significant proportion of those that achieve higher levels of job status and pay step off the regional escalator by moving away from the South East at the later stage of their working lives or at or near to retirement. These tend to be much shorter distance moves towards suburban and rural areas compared with the moves that brought some of these migrants to the South East. South and Crowder (1997) argue that the socioeconomic selectivity of movement away from urban areas toward more rural areas occurs because more resources are required to facilitate a move toward the suburbs. Recipients of state benefits will be less able to move from the inner city because they will be less able to afford to commute back to the city for work where most entry level jobs are located. Moreover, public housing and affordable housing, which they are more likely to rely upon, is not as widespread in less urban areas.
Hamnett (1990) finds this to be the case for the balance of migration in London using the LS between 1971 and 1981. He suggests that counterurbanisation is limited to the higher skilled and higher paid because the less skilled and lower paid have less power in the labour and housing market and are therefore less able to move away. The LS data does not enable an overall effect of migration on the socioeconomic position of London to be measured. Nonetheless, Hamnett does find that the net outward movement was greater from Inner London with most people moving to districts within Outer London. Out-migrants from Outer London were most likely to move to other parts of the South East region. Champion (2000) indicates that places which supply most of the people moving into the home counties of England from London are the wealthier suburbs, for example, Kingston upon Thames. This, he argues, means that most people counterurbanising have real choice as to whether to stay or go because they are moving from the most attractive parts of London.

Champion has tested the effect of counterurbanising moves on the socioeconomic composition of Britain’s largest conurbations directly using results from the 1991 and 2001 Censuses (Champion and Coombes, 2007; Champion et al., 2007; Champion and Fisher, 2003). Champion and Fisher (2003) have explored the extent to which migration is removing the most highly skilled from the eight largest conurbations using regional migration data from the 1991 UK Census. They find there is net out-migration by all socioeconomic groups. However, there is a clear picture of migration with the rest of the country depleting the higher paid and better qualified residents of these cities at a faster rate than their lower income counterparts. They point out that there are problems using the 1991 Census data to measure this change, including the fact that it is only available at the regional level with a socioeconomic breakdown and includes just a 10% sample.

The 2001 Census provides a much more complete dataset to measure the effect of counterurbanisation moves on the socioeconomic composition of urban areas. Champion and Coombes (2007) use 2001 Census migration data for 27 of Britain’s largest cities to study the impact of migration on socioeconomic area change. They use inter district moves between city-regions and the rest of the country and find that urban Britain experienced a renaissance with a slight positive ratio between in and out-migration of higher professional people during 2000-2001 and a negative ratio for all other socioeconomic groups. However, this was skewed by London. For all other cities combined there was a net loss of higher professional people due to migration.

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6 The home counties are the shire counties that surround Greater London.
with the effect greatest for larger city-regions. This suggests that, outside the capital, all of the very largest conurbations in Britain are becoming decreasingly concentrated with the high skilled as a result of migration as well as losing population generally. The effect, on average, for the five largest cities outside London was equivalent to a loss of ten higher managerial professionals for every six moving into the conurbations. For smaller cities the effect was much less dramatic with a ratio of higher managerial and professional out-migrants to in-migrants of 0.9. Some smaller cities were increasing their concentration of higher professionals and their population as a whole. These include Plymouth, Northampton, Derby and Brighton. Dennett and Stillwell (2010) identify these cities, amongst others, as redeveloping urban centres that are gaining population through migration.

In the US, counterurbanisation also appears to be greatest in the largest urban areas. Ambinakudigde and Parisi (2010) use Internal Revenue Service data to monitor migration between US counties for the year 2006-2007. They find that the largest metropolitan counties lost population through migration whereas small metropolitan counties and counties adjacent to metropolitan counties gained population. They also measure the impact of migration on aggregate income levels using tax return data and find that the largest urban areas have lower aggregate income as a result of migration whereas all other areas gain income. The overall effect of migration on income levels for each county type was not very large. It is measured using income migration effectiveness ratios. These are calculated by dividing net migration flows of personal income by gross migration flows of personal income and provide an indication of how well income migration is redistributing itself. A value of 100 would indicate the greatest efficiency, i.e. all moves are in the same direction, whereas a value of 0 would indicate complete inefficiency, i.e. the balance of net migration is zero. For the largest metropolitan counties the value was -2.06 suggesting a small loss of income. However, there was a large variation in the measure for individual cities. Detroit had the greatest negative effect of -25 and San Antonio had the greatest positive effect of +10.

Counterurbanisation has been somewhat less of a concern in continental Europe compared with the UK and US. Champion (2000) comments on the ‘love’ for their cities by Europeans which is not shared in the UK or US. There are a number of studies which document the counterurbanisation process in Europe (Kahsai and Schaeffer, 2010; Kanaroglou and Braun, 1992) but few of them measure the effect of such moves on the socioeconomic composition of cities. Hjort and Malmberg (2006) have analysed moves between cities, peri-urban areas, small towns
and remote countryside in Sweden and found that movement to peri-urban areas was dominated by higher educated younger migrants. However, movement towards the countryside rather than urban areas was greater for people with lower education and income.

The regional and sub-regional context (urban, town or rural) for the effect of change in the socioeconomic neighbourhood composition will be explored in chapter 5 of this thesis. This will determine how important the region and type of sub-region is in terms of explaining the effect of internal migration on socioeconomic neighbourhood change.

### 4.3 Neighbourhood migration

Champion (2000) suggests that it is usually individual neighbourhoods or estates that are losing population in net terms rather than entire cities. Nonetheless, there have been relatively few studies that have looked at the impact of internal migration on socioeconomic area change at the neighbourhood level. This is because migration data is rarely available at this scale. In the UK, the only source that can provide migration data at the neighbourhood level for the entire population is the decennial census. The census migration data at neighbourhood level has been questioned by a number of authors who are concerned about the impact of techniques used by the Office for National Statistics (ONS) to anonymise very small flows between places (Dennett and Stillwell, 2010; Stillwell and Duke-Williams, 2007). As mentioned above, census data also records most individual and household characteristics at time of enumeration rather than migration. Therefore, it is difficult to determine whether people have moved into higher or lower social groups before or after migrating.

O’Reilly and Stevenson (2003) have used 1991 census data for Northern Ireland to show migration between postcode sector areas across deprivation quintiles in the year leading up to the census. Postcode sectors are equivalent in population size to electoral wards with an average population of 7,232 in Northern Ireland in 1991. The results show that deprived areas tend to become depopulated and that those who leave these areas are the more affluent residents. They show that the poorest areas lost almost 1% of their population whereas the most affluent areas gained a similar amount. They also show that more economically active persons move out of the poorest areas than moved in. The effect of unemployed persons was the reverse. There is a similar pattern for households by car ownership, multiple income status and tenure. The overall effect of migration is therefore to widen inequalities between areas. They concede that the net migration changes they uncover are quite modest and may only represent one potential atypical
year (1990-1991). However, if these trends continue O’Reilly and Stevenson (2003) suggest they would build up to a sizeable change over time.

Bailey and Livingston (2007, 2008) have analysed migration flows using the results of the 2001 Census for England and Scotland at an even smaller spatial scale. They have used Lower Super Output Areas (LSOA) in England to measure the effect of migration in the year leading up to the census on change in concentration of people aged 25-74 with low level educational qualifications. LSOAs are about a quarter of the population size of an average electoral ward. They argue that educational qualifications are the most appropriate measure of socioeconomic status they were able to use from census data which is unlikely to change over time. This limits the effect of people changing their socioeconomic status, near to or at the same time as they move, which might distort the effects measured in the previously cited studies which have used census data. They calculate flows by educational attainment between deciles of neighbourhoods using the 2004 Index of Multiple Deprivation (ODPM, 2004). They find that in both England and Scotland migration serves to reinforce spatial segregation with flows increasing the concentration of low skilled people in the most deprived neighbourhoods whilst reducing their concentration in the least deprived neighbourhoods. However, Bailey and Livingston (2007, 2008) also indicate that the effect over one year is small. In England, migration flows raised the proportion of low skilled people by 0.06 percentage points in the most deprived decile of neighbourhoods.

Allen et al. (2010) have analysed the movement of pupils using the School Census in England to determine whether migration increases residential socioeconomic segregation. They hypothesise that socioeconomic segregation will increase as wealthier parents cluster ever closer to popular schools. However, using data for one cohort for six years they find that there is only a modest change in the segregation index of dissimilarity from 0.322 in 2002 to 0.340 in 2007. A value of one would indicate complete separation whereas a value of zero indicates no unevenness in the distribution of one particular group compared to another. They find the effect of internal migration increases segregation most in London. They also find that households with low-income families are more likely to move overall, but they are less likely to respond to low quality schools in the same way that higher income families do. These findings are consistent with the results from Nord (1998) and Foulkes and Schafft (2010) which suggest that low-income households are not less mobile, but are more restricted in terms of where they can move compared with less poor households. The greater mobility of poor people might reflect the more chaotic lifestyles they experience which lead to unintended moves following more regular family dissolution
compared with more affluent households (Astone and McLanahan, 1994; Long, 1992; South et al., 1998).

5. Contextualising the effect of internal migration

Internal migration is only one component of area socioeconomic change. The population of an area could change as it remains in-situ. For example, as the general economic conditions improve more people might move from unemployment to employment without moving home. Demographic changes are also important although they tend to take much longer to have an effect. For example, if lower income households are disproportionately having more children the individual poverty rate for all people will rise. Moreover, if disproportionate numbers of poor people die within an area the overall poverty rate will fall. There are very few studies which attempt to quantify these components of socioeconomic area change at any spatial scale (Lupton and Power, 2006). This is because it requires longitudinal data, preferably at the individual level so the different forces of change can be isolated and measured directly. This section will explore studies which discuss entire neighbourhood socioeconomic change and segregation before examining a small number of studies which have decomposed the factors that account for neighbourhood change and therefore contextualise the effect of internal migration.

In the UK, studies that have tracked neighbourhood change over time have largely used cross sectional census data (Dorling et al, 2007; Meen 2009; Norman, 2010). Norman (2010) has shown that deprivation eased between 1991 and 2001 when measured using consistent indicators that form the Townsend deprivation index. These comprise access to a car, non-home ownership, household overcrowding and unemployment. However, Dorling and Rees (2003) suggest that although the overall level of deprivation fell during the 1990s, as measured by these indicators, there was increased polarisation between areas during this time. They use an index of segregation to show that Britain became more geographically divided by area characteristics including housing tenure and access to a car.

Studies which compare the level of deprivation at one point in time with another using cross-sectional data find it difficult to unpack the component mechanisms that drive neighbourhood change because this requires individual level longitudinal data. The increased concentration of poverty for black residents in the US during the 1980s led some authors to theorise that this was driven by selective migration into and out of the most deprived areas (Wilson, 1987). Massey et al
(1994) tested this hypothesis against net downward social mobility without internal migration (in-situ change). They used data from the Panel Study of Income Dynamics (PSID) during two periods (1970-73 and 1979-84) to show transition probabilities among neighbourhood types by poverty status. The results do not support Wilson’s (1987) view that non-poor Black out-migration is the driving force of poverty concentration. Massey et al (1994) provide slightly stronger support for the in-situ change hypothesis. However, they indicate that racial segregation is the driving force behind increased poverty concentration of Black residents.

Quillian (1999) argues that Massey et al’s (1994) analysis does not provide an indication of population change because it is based on transition probabilities and therefore does not give an indication about change in the population over time. Quillian uses the PSID to show support for the Wilson’s hypothesis because migration of the non-poor Black residents away from moderately poor neighbourhoods was a key process forming new high-poverty neighbourhoods during the period 1970-90. Nonetheless, more recent analysis in the US which is concerned poverty of population as a whole, rather than by racial group, appears to show support for the in-situ change hypothesis.

Strait (2006) uses 1990 and 2000 US Census data for census tracts in Los Angeles County to compare the effect on poverty concentration of migration and in-situ status change. He finds that the overall poverty rate increased in Los Angeles County from 14% to 17% during the decade and that the poor were more spatially concentrated in poor neighbourhoods. In general, there was a greater effect of compositional change (in-situ change) than redistributive forces (migration). However, both increased the exposure of poor people to poor neighbourhoods. Strait (2006) concedes that he may underestimate the effect of migration because some people will have moved from other counties within the US as well as from abroad. He also relies on calculating the effect of migration indirectly. A direct approach to measuring the effect of migration on the concentration of poverty has been conducted by Rosenbaum (1995). She has analysed a survey dataset of households in New York City sub-boroughs which was conducted at three year intervals (1978-81, 1981-84 and 1984-87) to disentangle the competing mechanisms of poverty concentration. The results indicate that poverty-shifts (in-situ change) account for 90% of the total increase in poverty in the New York City sub-boroughs. However, selective migration also reinforces the continued decline in high-poverty areas, while sustaining the economic vitality of low-poverty areas.
Cooke (2010) takes a similar approach using the US Panel Study of Income Dynamics. The sample of this longitudinal survey is too small to analyse the movement of individuals within particular neighbourhoods but it is possible to aggregate the data into neighbourhood typologies. He uses data from 1989 to 2005 to monitor changes in poverty concentration in urban core, inner-ring and outer-ring neighbourhoods. The results show that poverty rose steadily between 1989 and 1997 in the urban core and inner-ring neighbourhoods. There was a sharp drop during 1997-2001 and a steady rise again up to 2006. The poverty rate remained fairly constant in outer-ring neighbourhoods throughout the whole period. The changes in poverty concentration in the urban core and inner-ring neighbourhoods were largely driven by in-situ change. During the 1990s more people were falling into poverty than were climbing out which led to a higher poverty rate. Migration had the same effect because there was greater out-migration of non-poor relative to poor persons. However, between 1997 and 2001 the effect of migration continued to increase the concentration of poverty but a greater effect of more people climbing out of poverty than falling into poverty reduced the overall poverty concentration. It is interesting to note that more non-poor people moved out of the urban core and inner-ring neighbourhoods during this period than any other. This indicates migration always acts to increase poverty concentration but that its effect is greater when economic opportunity improves in poor neighbourhoods.

Bailey, N (2009) finds a comparable result in a more complete analysis of the components of socioeconomic area change in Scotland. He uses the Scottish Longitudinal Study to compare four processes which impact on the concentration of the people aged 25-65 with a degree level qualification between 1991 and 2001. The processes are internal migration, natural change (deaths only), in-situ change and ageing (exit by 55-64 and entry by 15-24). Unsurprisingly, the percentage of persons with a degree increased during the period. The increases were greatest in the least deprived areas. However, the variation between deprivation deciles was not large. Bailey finds that each of the components was narrowing the gap between the most and least deprived areas in terms of the percentage of people with a degree level qualification with the exception of internal migration. Internal migration acted to reduce the concentration in the most deprived areas. However, the effect was small and almost insubstantial when compared with the largest effect which was in-situ change. Chapter 4 provides an analysis of the components of area socioeconomic change including comparable processes to those measured by Bailey.

6. Policy response to the effect of internal migration
Studies in the UK and US from the regional to neighbourhood scale appear to suggest that internal migration acts to increase polarisation of socioeconomic groups. The effect tends to be small in the short-term, particularly at the neighbourhood level. However, this does not mean the change should not be monitored or that policies should not be reconfigured to correct for this effect. In the long-run the increased concentration of poor people as a result of internal migration could have a considerable effect on poverty concentration, or temper improvements in area socioeconomic status made by in-situ change, if attempts are not made to attenuate its effect.

The concentrations of the lower socioeconomic groups in the poorest areas have been addressed by policy interventions in the UK, US and continental Europe using different methods. In the US, there has been an effort to encourage people to move away from the poorest areas toward less concentrated areas (Galster, forthcoming). These initiatives include the Gautreaux programme and Moving to Opportunity (Varady and Walker, 2003). In the UK and continental Europe policies have been characterised by area-based initiatives (ABIs) which involve regenerating particular deprived areas through placed and people-based interventions. The first major ABI that tackled small area-based poverty concentration in the UK was the Urban Programme which began in the late 1960s (McKay and Cox, 1978). It aimed to revitalise the poorest urban areas in England facing acute social problems in education, housing, health and welfare. There was a shift in regeneration policy during the 1980s away from tackling social deprivation directly through programmes, including Enterprise Zones and Urban Development Corporations, which aimed to improve built environments. The failure of these interventions to have intended spill-over and ‘trickling down’ effects to local communities was recognised by policies introduced by successive Conservative governments in the 1990s, for example, City Challenge and Single Regeneration Budget (Gripaios, 2002).

An emphasis on community led regeneration with a strong partnership working element was taken even further by the last Labour government’s National Strategy for Neighbourhood Renewal (NSNR) in England (CLG, 2010). The flagship programme of the NSNR was New Deal for Communities (NDC) which involved 39 neighbourhood partnerships across England each with £10 million to spend over ten years with two-long term goals:

“to have lower worklessness; less crime; better health; better skills; and better housing and physical environment in all the poorest neighbourhoods; and to narrow the gap on these
measures between the most deprived neighbourhoods and the rest of the country.” (SEU, 2001, p.25).

The current UK coalition government appears to be less committed to large public sector funded ABIs as a reaction to poverty concentration at the neighbourhood level. Regeneration policy appears to have moved to a sub-region and regional level with the introduction of Local Enterprise Partnerships (LEPs) and the Regional Growth Fund (Business Innovation and Skills Committee, 2011) as well as a reintroduction of Enterprise Zones akin to those implemented during the 1980s (CLG, 2011b). The implications for the current policy framework from this thesis are discussed in more detail in chapter 8, section 4.

The rationale for policies which address poverty concentration in Western Europe and the US are drawn from a belief that it is worse for poor people to live in poor areas in terms of their socioeconomic outcomes (Atkinson and Kintrea, 2001). This is evident from the aim of the NSNR in England which stated that within 10 to 20 years no-one should be disadvantaged by where they live (SEU, 2001). Studies which have tested for the existence of area effects and the impact which interventions have had on attenuating their effect are inconclusive. Galster (forthcoming, 2011) provides a thorough review of the potential causal mechanisms and evidence for area effects in the US and Europe. He suggests that individuals are affected by their area of residence through social, environmental, geographic and institutional factors. There is little in the way of consensus as to which factors are most important and most of the evidence for each factor is frustratingly conflicting. Galster (forthcoming) also reviews US efforts to reduce poverty concentration. He suggests that programmes have not been very successful in removing the poorest residents from the poorest areas. This is perhaps a result of the lack of affordable housing outside the poorest areas. The evidence from studies in the previous section shows that movement to a less deprived area is much more constrained for poorer households. The NSNR clearly states that the main priority of many households living in poor areas is to move out (SEU, 2001). This means that ABIs will face difficulties in trying to arrest the impact of selective migration on socioeconomic area change.

A conflict that ABI programmes face is the balance between place and people-based interventions. Previous research suggests that a focus on people-based interventions will lead to benefits of ABIs leaking out of the targeted areas as people ‘get on and get out’ (Cheshire et al., 2003; Lawless, 2006). Therefore, these interventions will accentuate the effect of internal
migration on socioeconomic area change. However, Bailey and Livingston (2008) found that the effect of selective migration was less adverse for NDC areas in their formative years than similarly deprived neighbourhoods. Robson et al. (2008) have suggested that this effect depends on the context a particular neighbourhood is located within and the composition of the neighbourhood. For example, a deprived neighbourhood which is isolated within a wider affluent area might lose its higher socioeconomic residents to other neighbourhoods whereas a deprived neighbourhood within a wider depressed area is less likely to see such an adverse effect because most migration is made over short distances. This has been clear in the evaluation of the NDC programme which suggests there is wide variation across partnerships in relation to the impact of internal migration (Beatty and Cole, 2009). NDCs with a student population or concentration of private rented housing have the greatest migration. Most of these are located within London. Moreover, those neighbourhoods with the highest internal migration rates have made the least gain towards meeting the objectives of the programme (Beatty et al., 2009). The analysis in this thesis will not directly test the impact of NDC or any other policy on the effect of internal migration. However, the factors that are associated with net population change due to migration by socioeconomic status in the most deprived areas will be explored in chapter 6. This will provide evidence to inform the policy debate surrounding the effect of internal migration on socioeconomic area change.

7. Summary

Most people will change their place of residence at some point during their life. In developed nations, it is more likely that this migration will occur within the country because such movement is generally unrestricted by political barriers. There will be an element of selectivity of internal migration because economic and family circumstances will shape the nature of mobility. The elements of internal migration selectivity were recognised by the pioneering migration analysis conducted by Ravenstein over 100 years ago. This is not the case for neoclassical economic theory applied to migration research, which assumes people will move free of restriction from areas of low economic opportunity to areas of higher economic opportunity. Economists have reconciled their theoretical migration perspective by assuming that not all people will have the means to move between depressed and prospering regions which explains why economic growth is not more evenly distributed in the face of internal migration. Human capital theory assumes poor people are less likely to move because poorer people cannot afford to move the distance required to escape a depressed region. However, in the US, Nord (1998) and Foulkes and Schafft
(2010) show that poor people are not less likely to move and move over longer distances than non-poor people, but they tend to move to other poor areas. They emphasise the cumulative causation perspective which suggests that prosperous areas become increasingly the reserve of the affluent as they drive up the cost of living in such areas whereas depressed regions stagnate and become the only viable residential option for the most deprived individuals.

The migration of people has largely been framed at the individual level despite many people moving as part of families. Family migration literature has begun to explore the increasingly complex nature of household structures which have led to people moving in much more diverse patterns than were evident previously. Behavioural migration theories have questioned the economic rationality idea that people have perfect information and move in order to increase their utility. The behavioural perspectives view migrants as satisficing agents who often react in the same way as others in their social position. They might move when they think their residential situation would be improved by living somewhere else. However, the lack of perfect information and the inability to process the advantages and disadvantages of moving will mean they will be unlikely to always make rational decisions. Migrants might even move against economic rationality for reasons related to family formation or dissolution, and local amenities.

The interest in whether someone moves as part of the family or whether they move as an individual, as well as the reasons tied to moving, has not been matched with an interest in the consequence of internal migration on socioeconomic area change. However, there have been attempts to measure the effect of internal migration at the regional level in relation to economic growth as well as at the sub-regional level in respect to the counterurbanisation debate. At both scales, the evidence appears to suggest that internal migration exacerbates the polarisation between areas. The policy response to increased poverty concentration has tended to be focused within cities and districts. It is recognised that neighbourhoods of differing socioeconomic compositions exist contiguously and therefore it is often particular neighbourhoods and clusters of neighbourhoods that people are keen to avoid when they move.

The evidence at the neighbourhood level appears to suggest that the impact of internal migration on the socioeconomic compositional change creates more polarised communities but the effect tends to be small. However, this evidence is largely confined to the US and there are no studies, to the author’s knowledge, that measure the impact of internal migration at the neighbourhood level and compare the effect against other components of area change in England. This thesis will
aim to fill this research gap by using a unique administrative dataset that can provide an answer to whether internal migration is increasing the concentration of poverty in the poorest areas. Moreover, the School Census also enables this effect to be tested at various spatial scales and contextualised against other components of neighbourhood change. Existing research suggests that the effects of other components, notably, in-situ socioeconomic status change tend to be more powerful. Cooke (2010) indicates that in the US in-situ change is also more responsive to changes in the wider sub-regional, regional and national economy. This does not mean that internal migration can be ignored and its consequences left to market forces. Its effect appears to be fairly unidirectional and therefore could probably be countered at a time of economic boom and bust using similar interventions. However, interventions must be careful not to exacerbate the process by enabling people to move away from a targeted area. Attempts to improve the socioeconomic conditions in the most deprived areas in the UK appear to have met little success. Residents most able appear to be moving away from targeted areas as well as deprived areas generally. Alternative strategies in the US have also faced challenges. The displacement of poor families from the poorest areas has been hindered by the fact that they find it difficult economically and socially to remain in less poor areas. What drives migration at very small spatial scales is also an under researched area. This is because data available to measure migration at small spatial scales is rarely available in the UK. This issue will be discussed in the next chapter which introduces the School Census by comparing migration data derived from the administrative source against existing migration data. Using the measure of migration at the neighbourhood level, this thesis is able to ask what factors are related to migration by socioeconomic status at a fine spatial scale and whether these predictors tend to vary in different parts of the country.
Chapter 3 – Evaluating internal migration data derived from the School Census

1. Introduction

Once defined, migration remains an inherently difficult phenomenon to measure as people who move residence are difficult to track. Datasets which track people longitudinally can provide a useful source but such data often find it difficult to retain respondents over time if they move house. Migration can also be measured by asking people retrospectively in a cross-sectional survey whether they have moved within a given time frame. This type of measurement is not without its own limitations, including the fact that survey respondents to retrospective questions will often find it difficult to remember whether they moved within the time frame specified (Bell et al., 2002).

In the UK, the two main datasets that have been used to measure internal migration are the decennial Census of population and the National Health Service Central Register (NHSCR) of all patients registered with a general practitioner (GP). This chapter introduces and examines the potential of the English School Census, a relatively new source of internal migration data that can provide more up to date information than the Census and more detailed socioeconomic and geographical information than the NHSCR. Up to date information about internal migration patterns would enable policy makers to react to short-term changes and provide prompt evidence to evaluate their interventions. Detailed socioeconomic and geographical detail can provide information to address challenging policy questions including whether internal migration is increasing the concentration of deprivation in neighbourhoods targeted by area-based regeneration.

The chapter is structured as follows. Section two provides an introduction to the School Census. Section three compares characteristics of migration data which can be derived from the School Census, NHSCR and decennial Census. Section four compares migration data from the School Census with the NHSCR. Section five compares migration data from the School Census with the 2001 Census. Section six compares migration data for the total population and the school-age population using the NHSCR and 2001 Census. Section seven compares migration patterns for compulsory school-age pupils and primary school-age pupils using the School Census. All
comparison is based on people of compulsory school-age (aged 6 to 15\(^7\)) in each dataset unless stated otherwise. Section eight provides conclusions.

2. School Census

The School Census, which is also known as the Pupil Level Annual School Census (PLASC), records details of all state-school pupils in England, and is updated annually. The School Census is derived from an electronic administrative form completed by each school to cover all enrolled pupils in January of each year (Machin et al., 2006). It is collated nationally by the Department for Education (DfE) through Local Education Authorities. Completion of the School Census has been a statutory requirement for all state maintained primary, secondary and special schools since 2002 under section 537A of the Education Act 1996 (Harland and Stillwell, 2007b).

The data forms part of the National Pupil Database, which is a warehouse of education data for Key Stage performance and information relating to schools and their staff. The School Census, which provides a link to other data sources, consists of entries for every pupil on roll including information about home postcode, ethnicity, free school meal status, age, sex and first language. Through the inclusion of a unique pupil reference the data can be matched between academic years to form a longitudinal record for each pupil that remains in the state school system.

Marquis and Jivraj (2009) have assessed the quality of data as supplied by the DfE. They find that less than 5% of pupil records are affected by errors and omissions for the variables used in this thesis (age, sex, postcode and free school meal status). Using interpolation techniques developed by Harland and Stillwell (2007b) almost all records with missing, invalid or inconsistent values were cleaned for variables that were expected to remain constant (e.g. sex) or change in a consistent pattern over time (e.g. age). However, records with errors for variables that are expected to change over time (e.g. free school meal status) were excluded. There were less than 1% of records with missing or invalid values for free school meal status.

It was also not possible to clean missing or invalid postcode values in the data. The validity of the postcodes is checked using the National Statistics Postcode Directory. There are fewer than 3.1% of records with a missing or invalid postcode in any given year the School Census was collected between 2002 and 2007. The percentage of missing and invalid postcodes recorded in the School

\(^7\) This is the age at destination in each dataset for a one-year migration period. Pupils aged five at destination would not have been included in the School Census and therefore are excluded from this analysis.
Census became less over time. The general conclusion from the assessment of the data is that it is found to be of high quality but the main conclusion regarding the use of School Census data for any research purpose is that cleaning is considered essential before analysis (Ewens, 2005; Harland and Stillwell, 2007b; Marquis and Jivraj, 2009).

Access to confidential data from the School Census was granted by the then Department for Children, Schools and Families (DCSF) (now Department for Education) in February 2009 for use in this thesis via request number DR090209.02. The conditions of use for the data are set out in the DCSF Analytical Services Division’s Confidentiality of Personal and Commercial Data document (see Appendix A). Unfortunately, research use of the School Census is now governed by secondary legislation which was enforced after the author of this thesis obtained the data. The legislation has restricted research access to the School Census to objectives concerning pupil educational achievement, and to ONS for the purposes of improving population estimates. The Education (Individual Pupil Information) (Prescribed Persons) (England) Regulations 2009 prescribes the categories of person and organisations to which individual pupil data may be provided, which mainly concern those who are involved in educational administration or services (The National Archives, 2009). Its one mention of research allows release of data to “persons conducting research into the educational achievements of pupils and who require individual pupil information for that purpose” (Ibid, p.1). It is hoped that through publication of the analysis in this thesis a case for overcoming this restriction can be made which shows how the School Census provides a unique measure of internal migration.

3. Comparison of internal migration datasets’ characteristics

Table 3.1 provides a comparison of the measure, coverage (population, spatial and temporal) and attributes recorded for the migration data which can be derived from the School Census, NHSCR and decennial Census.
Table 3.1 - Characteristics of migration data from School Census, Decennial Census, and National Health Service Central Register

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<thead>
<tr>
<th>Feature</th>
<th>School Census</th>
<th>Decennial Census</th>
<th>NHSCR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Migration measure</strong></td>
<td>Transitions</td>
<td>Transitions</td>
<td>Moves</td>
</tr>
<tr>
<td><strong>Population coverage</strong></td>
<td>State school-age pupils</td>
<td>All people</td>
<td>NHS GP registered patients</td>
</tr>
<tr>
<td><strong>Spatial coverage</strong></td>
<td>Postcode to higher</td>
<td>Output areas to higher</td>
<td>Districts to higher</td>
</tr>
<tr>
<td><strong>Temporal coverage</strong></td>
<td>Annually from 2002</td>
<td>1980-81, 1990-91, 2000-01</td>
<td>Quarterly from 1975 for Health Authorities; Annually from 1999 for LA districts</td>
</tr>
<tr>
<td><strong>Attributes recorded</strong></td>
<td>Age, sex, language, ethnicity, free school meal status</td>
<td>Age, sex, ethnicity, family status, limiting long term illness, economic activity, socioeconomic class, tenure, household composition</td>
<td>Age and sex</td>
</tr>
</tbody>
</table>

Source: Adapted (School Census information added) from Boden, Stillwell and Rees (1992, p.14).

The measurement of internal migration can be operationalised by a change in the postcode of a pupil when their School Census record has been matched over time. This could refer to the period between two consecutive years or over a longer period for which the data is available providing the pupil is present at both time points. This is referred to as a migration transition rather than a move because not all movements that might have been made will be identified. For example, if a pupil moves more than once during the period between two School Censuses only one movement will be recorded and if a pupil moves away and then returns to their original location between School Censuses they will not be recorded as a migrant.

The decennial Census also records migration in this way although it uses a retrospective question which asks whether a respondent had a different usual address one year prior to enumeration. The only difference between the Census and the School Census migration measure is that migration is self-reported in the Census whereas movement is inferred from a change of postcode in the School Census. The NHSCR, on the other hand, records all moves or transitions an individual makes when they re-register with a GP in a different former health authority. An update of the NHSCR is supplied to ONS each week and it is combined with the data from individual health authorities to produce official annual migration estimates at the local authority district level (ONS, 2010b). The data from individual health authority patient lists is referred to by ONS as the Patient Register Data System (PRDS). ONS receive an annual download of each health

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8 There were 104 HA in England and Wales in 2001, which include shire counties, metropolitan districts and aggregations of London Boroughs.
authority’s patient list including residential addresses, which allows the comparison of a patient’s postcode between consecutive years. The data used in this thesis referred to as the NHSCR is actually migration data produced using the PRDS which are constrained to higher level migration flows of NHSCR data. For further information about the combination process of the NHSCR and PRDS see ONS (2010b).

The main limitation of School Census migration data is that it only includes school-age children attending state schools. Therefore, the data will not reflect the movement of all people. This is because families with school-age children are less likely to migrate, and move to different types of places compared with other households (Bailey and Livingston, 2005; Meen et al., 2005). Moreover, the data do not reflect the movements of all families with school-age children, as there is no information for those in private education. In England, approximately 92% of school pupils attend a state school (see table 3.2). However, this varies between different parts of the country with the highest percentage of pupils in state schools in the North of England and the lowest in London and the South East.

| Table 3.2 - Pupils by type of school and Government Office Region, 2002-2003 |
|---------------------------------|---------------------------------|------------------|
|                                | Public sector schools (%) | Independent and special school (%) | All schools (thousands) |
| North East                     | 94.5%                       | 5.5%                          | 420.8                    |
| North West                     | 93.9%                       | 6.1%                          | 1,158.90                 |
| Yorkshire and The Humber       | 95.1%                       | 4.9%                          | 837.8                    |
| East Midlands                  | 93.9%                       | 6.1%                          | 701.8                    |
| West Midlands                  | 93.8%                       | 6.2%                          | 911.3                    |
| East of England                | 92.0%                       | 8.0%                          | 899.7                    |
| London                         | 88.1%                       | 11.9%                         | 1,172.80                 |
| South East                     | 87.6%                       | 12.4%                         | 1,302.50                 |
| South West                     | 91.2%                       | 8.8%                          | 782.4                    |
| England                        | 91.7%                       | 8.3%                          | 8,188.00                 |

Source: Adapted from ONS (2004, p.57)

ONS has produced a summary account of the potential of using the School Census for improving migration statistics. They highlight areas including Kensington and Chelsea, Barnet, and Richmond upon Thames which have a high proportion of children resident attending independent schools (ONS, 2009b). In contrast, the 2001 Census and the NHSCR are not limited to small subsets of the population and, in theory, should include almost all people.
However, the decennial Census does not capture all people that move because not everyone completes the Census form and, of those that do, the nature of the migration question has led to issues with item non-response and recall error. In 2001, the problem of non-response was addressed using the One Number Census Methodology (ONS et al., 2001). This process imputed data for both item and unit non-response using probabilistically matched data from completed Census records and the results of a Census Coverage Survey (Diamond et al., 2002). The issue with recall error is much more difficult to rectify. The 1991 Census Validation Survey found that about 10% of people who said they did not have a different address one year previously did actually move in the year before enumeration (Rees et al., 2002).

The NHSCR provides information for people of all ages but it only includes people registered with a NHS GP and migration data derived from the data source is dependent on people re-registering with another GP when they move. ONS have found that sex by age ratios for the PRDS to the 2001 Census show that young men are much less likely to re-register when they move (ONS, 2010b).

The release of the School Census with a postcode identifier for individual pupils means that data can be aggregated to any higher level geography. This is useful when one is interested in arbitrary geographies or movement between small areas. Small area analysis is also possible with the 2001 Census migration data which was released at Output Area (see chapter 4, section 2 for a description of 2001 Census geographies) at the lowest geographical level. However, to protect confidentiality ONS have used a procedure called Small Cell Adjustment Mechanism which can lead to data between the same released tables at different geographies not adding to a consistent figure (Duke-Williams and Stillwell, 2007). This can create noise in small area analyses. The finest spatial scale that data from the NHSCR is released is for migration between health authorities. Nonetheless, through the combination of PRDS, ONS have been able to produce annual migration estimates at local authority district level since 1999 (ONS, 2010b).

The School Census has only been collected since 2002. However, its annual release means that it can provide a more up-to-date and continuous measure of migration compared with the decennial Census which has asked a question about migration since 1961. The release of information for each academic year between January 2002 and January 2007 provides the necessary information to monitor trends and evaluate the short-term effects of policy interventions, for example. The School Census has been collected tri-annually since 2006 for
secondary schools and since 2007 for primary schools, and as a result future data releases will be able to provide even more detail of the residential movement of school-age pupils (Harland and Stillwell, 2007b). The temporal coverage of the NHSCR is much more complete than both the School Census and decennial Census, with migration data between former health authority areas being made available annually since 1975.

The recorded characteristics of migrant pupils in the School Census include age, sex, ethnicity, first language and free school meal status (an indicator of family socioeconomic status – see chapter 4 - section 3 for more detail). These breakdowns are limited in comparison with the variables available in the 2001 Census by migration including age, sex, ethnicity, family status, limiting long term illness, economic activity, socioeconomic class, tenure and household composition. However, all Census variables are recorded at the time of enumeration which makes it difficult to determine, for example, how many migrants were living in private rented accommodation one year before the Census. For certain variables, including age and sex it is possible to allocate migrants back to their status one year previously because these characteristics do not change or change sequentially. The additional information recorded in the NHSCR is even more limited than the School Census. Migrants can only be disaggregated by age and sex.

4. Empirical comparison with the National Health Service Central Register

This section empirically compares internal migration data which can be derived from the School Census and NHSCR using breakdowns of migrants by sex, age and geography. Table 3.3 compares the annual level of migration between local authority districts within England recorded by the School Census and NHSCR for each year between 2002 and 2006 by sex. The time points to which the data relate are not the same for the NHSCR and School Census. The NHSCR includes all moves between July of each year whereas the School Census is collected in January of each year. In order to provide the fairest comparison the data for the first year is taken from NHSCR for July 2001 to July 2002 and from the School Census for January 2002 to January 2003. The six-month lag between the two datasets is retained for each subsequent year of comparison. However, the averaging of five years of data in table 3.3 will largely offset the effect of this lag.
Table 3.3 shows that the NHSCR always records a higher number of moves between districts than
the School Census for both males and females. The ratio between the two datasets indicates that
the School Census accounts for, on average, 75% of the moves in the NHSCR for all people aged 6
to 15. This is not surprising because the NHSCR records all moves in a year when a patient re-
registers with a GP in a different Health Authority. A comparison of moves between districts for
people aged 6 to 15 (not shown here) using the 2001 Census and the NHSCR for the period 2000-
2001 shows that the Census accounts for a similar proportion of the moves in the NHSCR, 77%. It
is expected that the Census will account for a slightly higher proportion of moves recorded in the
NHSCR because the Census includes all people of compulsory school-age and is not restricted to
state school pupils unlike the School Census.

Table 3.3 - Ratio of School Census to NHSCR between district migration flows for people aged 6 to 15,
2002-2006

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th></th>
<th>Males</th>
<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NHSCR</td>
<td>PLASC</td>
<td>Ratio</td>
<td>NHSCR</td>
<td>PLASC</td>
<td>Ratio</td>
</tr>
<tr>
<td>2002</td>
<td>103,174</td>
<td>80,653</td>
<td>0.78</td>
<td>109,597</td>
<td>81,948</td>
<td>0.75</td>
</tr>
<tr>
<td>2003</td>
<td>102,893</td>
<td>77,886</td>
<td>0.76</td>
<td>108,744</td>
<td>78,516</td>
<td>0.72</td>
</tr>
<tr>
<td>2004</td>
<td>102,321</td>
<td>77,582</td>
<td>0.76</td>
<td>107,121</td>
<td>78,663</td>
<td>0.73</td>
</tr>
<tr>
<td>2005</td>
<td>94,035</td>
<td>68,582</td>
<td>0.73</td>
<td>99,167</td>
<td>69,618</td>
<td>0.70</td>
</tr>
<tr>
<td>2006</td>
<td>93,052</td>
<td>75,011</td>
<td>0.81</td>
<td>97,975</td>
<td>74,963</td>
<td>0.77</td>
</tr>
<tr>
<td>Average</td>
<td>99,095</td>
<td>75,943</td>
<td>0.77</td>
<td>104,521</td>
<td>76,742</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Source: National Health Service Central Register, 2002-06

Figure 3.1 shows the average number of flows between districts during the period 2002-2006 by
age. The age is shown on the horizontal axis. The chart shows the number of moves recorded, on
average, is greater in the NHSCR than the School Census for each year of age. This is not unexpec-
ted as it has already been shown that the NHSCR records more moves for all people aged
6-15. The difference between the two datasets is fairly constant for all primary school-age pupils
(aged 6-10), but not for secondary school-age pupils (aged 11-15). In both datasets, the number
of moves gradually declines during primary school-age. The number of moves during secondary
school-age appears to remain fairly constant in the NHSCR except for slight peaks at age 12 and
14 when there were larger cohorts of school-age people. In the School Census, the number of
moves falls quite markedly at age 12 and continues to fall until age 15. The different pattern in
the number of flows during secondary school-age is probably a result of more children attending
non-state schools at this age. The higher proportion of children not attending state schools is
reflected in a lower ratio of pupils in the School Census to people recorded in ONS mid-year
population estimates (MYE) at secondary school-age. In both datasets, the number of flows is
lowest at age 15 which is not unexpected as children and their parents may not want to move and disrupt the final year of compulsory schooling.

Figure 3.1 - Average annual between district migration flows for 6 to 15 year olds by year of age for School Census and NHSCR, 2002-06

Figure 3.1 shows the degree of association between inflows and outflows of migration between each individual district in England in the School Census and NHSCR. The charts show the average number of each type of flow for compulsory school-age children (6-15) between 2002 and 2006. Figure 3.2 indicates a strong positive relationship between the inflows and outflows in each dataset. The correlation coefficients for average inflows and outflows between 2002 and 2006 were all above 0.94.

The outliers in each scatterplot for inflows and outflows include districts where the compulsory school-age population is higher or lower in the School Census compared with the ONS MYE for the area. For example, in-migration flows are greater in the NHSCR than the School Census, even after accounting for the generally higher levels of migration recorded in the NHSCR, in Waverley, Windsor and Maidenhead, and Horsham. These districts contain a relatively high number of private boarding schools which may explain the higher levels of inflows into these areas by people of school-age measured by the NHSCR. All boarding schools in England are obliged to register pupils with a local GP for potential medical attention (DoH, 2002). Migration flows to and from private boarding schools will not be accounted for in the School Census as it only includes state school pupils.

9 The ONS Mid-year estimates use the NHSCR to estimate migration flows between local authority districts
Conversely, there are greater in-migration flows recorded in the School Census than the NHSCR in Barking and Dagenham, Enfield and Sandwell. These districts are adjacent to areas which have traditionally attracted large numbers of international migrants, for example, Barking and Dagenham is adjacent to Newham, a London Borough with very high levels of international immigration (Catney and Simpson, 2010). The higher number of inflows into these areas could be a result of dispersal from initial settlement areas by recent immigrants. Simpson et al. (2011) have shown that pupils likely to be immigrants tend to be very mobile after settlement compared with all other pupils. Moreover, recent international immigrants may not be counted in the NHSCR because they are less likely to have registered with a GP (Boden and Rees, 2010b).

Internal out-migration flows are lower in the School Census than the NHSCR, even after allowing for the higher number of moves recorded in the NHSCR, in Elmbridge, Wandsworth, and Kensington and Chelsea. In these districts, the MYEs suggest the compulsory school-age population is higher than the population of the School Census. This is probably a result of a high proportion of children attending private boarding schools in these districts but who live outside the district during non-term time. On the other hand, there are a much higher number of outflows recorded in the School Census than the NHSCR in Birmingham. This is likely to be a result of high numbers of people moving to this very large district from abroad and then moving away soon after, but not registering with a GP during this time.

Figure 3.2 - Relationship between School Census and NHSCR average annual inflows and outflows for each district in England for 6 to 15 year olds, 2002-06

Source: National Health Service Central Register, 2002-06
5. Empirical comparison with the 2001 Census

This section provides an empirical comparison between internal migration data derived from the School Census and 2001 Census similar to the comparison with the NHSCR. Comparison between migration data available from the 2001 Census and School Census is constrained by different time points for which each dataset is available. The 2001 Census records migration between April 2000 and April 2001 whereas the School Census can only be used to record annual pupil migration from January 2002. Nonetheless, comparison is worthwhile because it can be made at a lower spatial scale than the NHSCR. The 2001 Census migration data can show flows within districts, which accounts for almost 70% of total migration recorded by the School Census and the 2001 Census (see table 3.4).

Table 3.4 provides a comparison of the distribution of migration flows recorded in the School Census and 2001 Census for moves between districts and within districts by sex for pupils aged 6-15 in each dataset. The data from the School Census shows the number of flows between and within districts between January 2002 and January 2003. This is the closest period to the migration period used in the 2001 Census. Table 3.4 shows that the School Census records a higher number of migrant flows than the Census for both males and females. This is because there is a much higher level of within district flows derived from the School Census compared with the 2001 Census. The number of between district flows is very similar for both males and females in the School Census and 2001 Census. Therefore, the percentage of within district flows is greater in the School Census (75%) compared with the 2001 Census (70%).

The higher level of within district flows in the School Census compared with the 2001 Census is not unexpected as it is thought that not all people who move will state that they have done so in the decennial Census as a result of recall error and selective reporting (Rees et al., 2002). These moves are most likely to be short distance as people are more likely to consider it significant to report or remember a long distance move. It is more likely that short distance moves will be reported in the School Census than the 2001 Census, as parents are likely to inform their child’s school of a change of address soon after they move house. This is to ensure emergency contact details, which schools routinely ask parents to update, are correct. On the other hand, the difference between migration flows recorded in the School Census and 2001 Census could, in part, be due to the different time points over which each dataset was collected and therefore when the migration took place.
Table 3.4 - Distribution of migrants aged 6 to 15 by type of flow for School Census and 2001 Census

<table>
<thead>
<tr>
<th>Type of flow</th>
<th>Census (2000-01)</th>
<th>PLASC (2002-03)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within district</td>
<td>179,027</td>
<td>69.9%</td>
</tr>
<tr>
<td>Between district</td>
<td>77,020</td>
<td>30.1%</td>
</tr>
<tr>
<td>All flows</td>
<td>256,047</td>
<td>343,731</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within district</td>
<td>185,243</td>
<td>69.5%</td>
</tr>
<tr>
<td>Between district</td>
<td>81,426</td>
<td>30.5%</td>
</tr>
<tr>
<td>All flows</td>
<td>266,669</td>
<td>352,473</td>
</tr>
<tr>
<td>Persons</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within district</td>
<td>364,270</td>
<td>69.7%</td>
</tr>
<tr>
<td>Between district</td>
<td>158,446</td>
<td>30.3%</td>
</tr>
<tr>
<td>All flows</td>
<td>522,716</td>
<td>696,204</td>
</tr>
</tbody>
</table>

Source: 2001 Census Commissioned Table C0527

Figure 3.3 compares the migration flows within districts from the School Census between 2002 and 2003 and the 2001 Census in the year leading up to April 2001 by year of age. There are more flows within districts recorded in the School Census compared with the 2001 Census for each year of age. The distribution of migrants is similar across the compulsory school-age range in each dataset except at age 11. In the School Census, there are a much higher number of migrant pupils at age 11. This may be a result of pupils who did not inform their school at time of moving updating their records when they change school and fill new administrative forms. It could also reflect a convenient time for parents to move home during a break in their child’s education. However, it is more likely that the greater number of moves at the age when pupils change from primary to secondary school is a result of administrative data entry errors. If during the process of wholesale updating of a cohort’s address details’, on entry to secondary school, some postcodes are entered incorrectly those pupils would be wrongly identified as a mover in the current analysis. This is the most likely cause of the peak because it is not as high in later one-year periods of the School Census e.g. 2002-2003 compared with 2006-07 (Simpson et al., 2010). Other authors have noted a general improvement in the quality of data recorded in the School Census over time (Ewens, 2005; Harland and Stillwell, 2007a). Moreover, the accuracy of migration data derived from the School Census is likely to improve because a pupil aged 11 in 2007 will have been in the dataset since age 6 whereas a pupil aged 11 in 2002 will have entered the dataset for the first at this point because no data was collected before 2002.
Turning to between district migration flows, figure 3.4 shows these are greatest at the youngest compulsory school-age and there are fewer flows for older children in both datasets. The decline in migration by age of children was also found to be the case in an analysis of 1991 Census data by Dobson and Stillwell (2000). The number of between district moves is very similar in each dataset for each year of age except for a slight divergence during secondary school-age. Between the ages of 12 and 15 there are slightly higher flows of between district moves recorded by the 2001 Census. This is likely to be a result of higher levels of secondary school-age children attending non-state schools.
Figure 3.5 shows the relationship between within area flows for each individual district in England recorded by the School Census and the 2001 Census. The chart shows there is a very strong positive relationship between the two datasets for within district flows. This suggests that although the School Census records a higher number of moves within districts the patterns of these moves are very similar to those based on the 2001 Census.

**Figure 3.5 - Relationship between within district migration flows in England for 6 to 15 year olds for School Census and 2001 Census**

![Graph showing relationship between PLASC and Census flows](image)

Source: 2001 Census Commissioned Tables C0366a-C0366d

### 6. Internal migration of school-age population compared with total population

This section compares the migration data derived from the NHSCR and 2001 Census for the compulsory school-age population (aged 6-15) with the total population in each dataset. The aim of this comparison is to determine how representative migration flows recorded by the School Census for compulsory school-age pupils are likely to be for the total population (i.e. including not only people aged 6-15 in non-state schools but also 0-5 year olds and all people aged 16 and above).

Table 3.5 shows that compulsory school-age people accounted for, on average, 8.7% of all moves between districts recorded by the NHSCR between 2002 and 2006. This is lower than the percentage of the total population that the compulsory school age population accounted for in the mid-year population estimates during 2002-2006 (13%). This suggests that compulsory school-age pupils are less likely to move between districts than the population as a whole.
The compulsory school-age population may account for fewer moves between districts, but what is more important for determining the impact on area change is whether the patterns of their flows are representative of the total population. Table 3.6 shows the correlation coefficients for inflows and outflows between districts from the NHSCR for the compulsory school-age population and each five-year age group. There is a fairly strong positive correlation between the inflows and outflows of the compulsory school-age population and each five-year age group.

Nonetheless, the relationship is not as strong for inflows as it is for outflows for each age group. The relationship is weakest for inflows of people aged 15-29 and outflows of people aged 20-24. The correlation between inflows for the compulsory school-age population and people aged 15-29 is weaker because young adults, largely students, tend to disproportionately move to a relatively small number of districts from all other districts in the country. This is because young people tend to move to selected urban areas where universities are located. The relatively low correlation coefficient for outflows of the compulsory school-age population and people aged 20-24 is likely to be a result of students moving away or returning home from these selected districts that contain higher education establishments after their studies are complete.

The correlation is strongest for both inflows and outflows for the compulsory school-age population compared with other children aged less than 15 and adults aged over 30. It is not surprising that flows of children younger than school-age have similar patterns of migration as compulsory school-age children. The families which contain pre-school children will probably want to move to areas popular with families of school-age children and some of these families are also likely to contain children of compulsory school-age. Adults aged over 30 are likely to be the parents of school-age children which probably explains why the relationship for the between district flows is stronger. The correlation is strongest for inflows and outflows of adults aged 45-49 (0.904 and 0.963).
Table 3.6 - Correlation coefficient of NHSCR average annual migration inflows and outflows for each
district in England between people aged 6 to 15 and five-year age groups, 2002-06

<table>
<thead>
<tr>
<th>Age</th>
<th>Inflows</th>
<th>Outflows</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>.919</td>
<td>.972</td>
</tr>
<tr>
<td>5 to 9</td>
<td>.974</td>
<td>.993</td>
</tr>
<tr>
<td>10 to 14</td>
<td>.976</td>
<td>.994</td>
</tr>
<tr>
<td>15 to 19</td>
<td>.417</td>
<td>.867</td>
</tr>
<tr>
<td>20 to 24</td>
<td>.556</td>
<td>.701</td>
</tr>
<tr>
<td>25 to 29</td>
<td>.543</td>
<td>.877</td>
</tr>
<tr>
<td>30 to 34</td>
<td>.650</td>
<td>.879</td>
</tr>
<tr>
<td>35 to 39</td>
<td>.787</td>
<td>.917</td>
</tr>
<tr>
<td>40 to 44</td>
<td>.877</td>
<td>.951</td>
</tr>
<tr>
<td>45 to 49</td>
<td>.904</td>
<td>.963</td>
</tr>
<tr>
<td>50 to 54</td>
<td>.813</td>
<td>.935</td>
</tr>
<tr>
<td>55 to 59</td>
<td>.607</td>
<td>.882</td>
</tr>
<tr>
<td>60 to 64</td>
<td>.525</td>
<td>.895</td>
</tr>
<tr>
<td>65+</td>
<td>.642</td>
<td>.858</td>
</tr>
<tr>
<td>All people</td>
<td>.749</td>
<td>.888</td>
</tr>
</tbody>
</table>

Source: National Health Service Central Register, 2002-06

Table 3.7 compares the number of people in the total population and the compulsory school-age
population that moved within and between districts as measured by the 2001 Census. It shows
that the school-age population accounted for 12% of the total flows within districts recorded by
the 2001 Census which is similar to the percentage of the population which are compulsory
school-age recorded in the 2001 Census (13%). The school-age population accounted for a similar
level of the internal migration between districts in the 2001 Census (7.5%) as the NHSCR (9.0%).
This suggests that the school-age population is almost as equally mobile as the total population
locally. However, they are less mobile between districts.

<table>
<thead>
<tr>
<th></th>
<th>All people</th>
<th>School-age</th>
<th>% school-age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within district</td>
<td>3,041,429</td>
<td>364,270</td>
<td>12.0%</td>
</tr>
<tr>
<td>Between district</td>
<td>2,115,209</td>
<td>158,446</td>
<td>7.5%</td>
</tr>
<tr>
<td>All flows</td>
<td>5,156,638</td>
<td>522,716</td>
<td>10.1%</td>
</tr>
</tbody>
</table>

Source: 2001 Census Commissioned Table C0527

Table 3.8 shows the correlation coefficients for the relationship between the compulsory school-
age population and age groups available from Census Commissioned Table C0366a-C0366d for
within district flows, and inflows and outflows between districts in the 2001 Census. There is a
strong positive relationship between the school-age population and each age group for within
district flows except for people aged 20-24. This age group, which contains a high proportion
of students, will move much more frequently within districts where they are highly concentrated
compared with other districts. This is because they are likely to change residence from year to
year whilst studying in the same place. The correlation between the compulsory school-age population and other age groups for between district flows is stronger for outflows compared with inflows, which is similar to the patterns shown by the NHSCR in table 3.6.

Table 3.8 - Correlation coefficient of 2001 Census migration within area flows, inflows and outflows for each district in England between people aged 6 to 15 and five-year age groups, 2000-01

<table>
<thead>
<tr>
<th>Age</th>
<th>Within</th>
<th>Inflows</th>
<th>Outflows</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 4</td>
<td>.985</td>
<td>.892</td>
<td>.954</td>
</tr>
<tr>
<td>5 to 9</td>
<td>.998</td>
<td>.969</td>
<td>.993</td>
</tr>
<tr>
<td>10 to 14</td>
<td>.999</td>
<td>.974</td>
<td>.994</td>
</tr>
<tr>
<td>15 to 19</td>
<td>.955</td>
<td>.427</td>
<td>.851</td>
</tr>
<tr>
<td>20 to 24</td>
<td>.776</td>
<td>.442</td>
<td>.813</td>
</tr>
<tr>
<td>25 to 29</td>
<td>.868</td>
<td>.398</td>
<td>.817</td>
</tr>
<tr>
<td>30 to 34</td>
<td>.925</td>
<td>.567</td>
<td>.848</td>
</tr>
<tr>
<td>35 to 39</td>
<td>.957</td>
<td>.732</td>
<td>.908</td>
</tr>
<tr>
<td>40 to 44</td>
<td>.972</td>
<td>.830</td>
<td>.941</td>
</tr>
<tr>
<td>45 to 59</td>
<td>.956</td>
<td>.759</td>
<td>.916</td>
</tr>
<tr>
<td>60+</td>
<td>.931</td>
<td>.606</td>
<td>.871</td>
</tr>
<tr>
<td>All people</td>
<td>.952</td>
<td>.631</td>
<td>.920</td>
</tr>
</tbody>
</table>

Source: 2001 Census Commissioned Table C0366a-C0366d

7. Comparison of School Census school-age and primary school-age population

A data quality issue with the migration flows derived from the School Census is that a considerably higher number of flows are recorded at age 11 when all pupils change school and their address details are updated comprehensively. This would affect time series analysis that compared migration data from the School Census year on year. Moreover, the migration flows of secondary school-age pupils also appear to be less representative of the school-age population as a greater number of children attend independent schools at this age.

To mitigate this issue the subsequent chapters in this thesis use data only for primary school-age pupils. Table 3.9 compares the number of migration flows within and between districts for primary school-age pupils and all compulsory pupils using the School Census between 2002 and 2006. There would be an expectation of a ratio of 2:1 for the migration flows because primary school pupils account for approximately half of all pupils in the compulsory school system. However, primary school pupils account for more than their expected share of within district migration flows and even more for between district migration flows. For every between district migrant of primary school-age, there are 1.78 compulsory school-age between district migrants.
rather than an expected 2. This is not surprising as families are likely to be less inclined to move long distances, which require a change of school at later stages in their child’s school career.

Table 3.9 - Ratio of School Census compulsory school-age to primary school-age migration by type of flow, 2002-2006

<table>
<thead>
<tr>
<th>Persons</th>
<th>6 to 15</th>
<th>6 to 10</th>
<th>Ratio</th>
<th>6 to 15</th>
<th>6 to 10</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>533,603</td>
<td>277,364</td>
<td>1.92</td>
<td>162,601</td>
<td>92,701</td>
<td>1.75</td>
</tr>
<tr>
<td>2003</td>
<td>503,492</td>
<td>261,942</td>
<td>1.92</td>
<td>156,402</td>
<td>88,229</td>
<td>1.77</td>
</tr>
<tr>
<td>2004</td>
<td>491,827</td>
<td>256,524</td>
<td>1.92</td>
<td>156,245</td>
<td>87,786</td>
<td>1.78</td>
</tr>
<tr>
<td>2005</td>
<td>441,563</td>
<td>231,520</td>
<td>1.91</td>
<td>138,200</td>
<td>76,448</td>
<td>1.81</td>
</tr>
<tr>
<td>2006</td>
<td>475,559</td>
<td>250,558</td>
<td>1.90</td>
<td>149,974</td>
<td>83,719</td>
<td>1.79</td>
</tr>
<tr>
<td>Average</td>
<td>489,209</td>
<td>255,582</td>
<td>1.91</td>
<td>152,684</td>
<td>85,777</td>
<td>1.78</td>
</tr>
</tbody>
</table>

Figure 3.6 shows the relationship between within district flows for all compulsory school-age pupils against primary school-age pupils by individual district in the School Census between 2002 and 2006. The relationship is strong suggesting the pattern of within district migration flows is very similar.

Figure 3.7 shows the relationship between the average inflows and outflows for the compulsory school-age pupils and primary school-age pupils for individual districts from the School Census between 2002 and 2006. The pattern of between district migration flows is also very similar for these school-age groups as there is a strong positive relationship between the flows of the compulsory school-age population and the primary school-age population.
8. Discussion

The School Census certainly has potential to provide new insights into the levels and patterns of internal migration in England. The data can provide a more up-to-date measure of migration than the decennial Census and more detailed information about the socioeconomic characteristics and geographical location of migrants than the NHSCR. This can provide evidence for important policy issues that existing datasets struggle to provide answers to. For example, the effect of internal migration in neighbourhoods targeted by ABIs requires recent data with a detailed geographical and socioeconomic breakdown. The UK Statistics Authority (2009) have reported that internal migration is not sufficiently well measured at present and have encouraged the exploration of administrative sources to fill this gap. However, data from the School Census are limited to the measure of movement of school-age pupils attending state schools. This means that it is difficult to make inferences about the internal migration patterns of the population as a whole, because families with children of compulsory school-age are less likely to move and, move to certain places compared with people as a whole. However, this chapter has shown that school-age migration is only different in its patterns compared with the movement of young people. The patterns of within and between district migration flows are similar for all ages except people aged 16-29.

Comparison with migration data from the NHSCR and 2001 Census shows that migration data derived from the School Census records similar patterns and trends. Levels of migration between districts are similar in each dataset when allowing for the different way in which migration is measured in the NHSCR. Differences between the School Census and NHSCR appear to be due to the population included in each dataset. For example, migration levels are different in some areas which have a lower proportion of school-age pupils in state schools and in other areas where
school-age children are not registering with the NHS. Levels of migration within districts appear to be greater in the School Census compared with the 2001 Census. This is probably because of the undercount of within district migration recorded by the 2001 Census.

The School Census does appear to over count the number of moves which take place at age 11, which is when children move between primary and secondary school. The updating of records at this transition point may account for a higher number of moves being mistakenly recorded at this age. Therefore, this thesis will use data for primary school-age pupils (aged 6-10). The spatial pattern of migration is very similar for pupils aged 6-10 as pupils aged 6-15. As a result, excluding secondary school-age pupils should not alter substantive findings of the effect of migration on socioeconomic area change. However, it will enable the difference in migration during each one-year period since the School Census has been collected to be more accurately measured. The following chapters will explore the potential of the School Census as a dataset that can provide answers to substantive research and policy questions in the field of migration studies starting in the next chapter with the how much migration contributes to overall change and how this might vary at different spatial scales.
Chapter 4 – The components of socioeconomic area change at varying spatial scales

1. Introduction

This chapter uses the School Census which was introduced in chapter 3 to explore how the effect of internal migration of primary school-age pupils compares with other components of area change in the concentration of Free School Meals (FSM) pupils in England. The components analysed are the net effect of residential movement within England (internal migration), entry and exit to and from the primary school system (school turnover), late entry and early exit to and from the primary school system (a proxy for international migration), and improved and declined socioeconomic status of those who do not move (in-situ change). The analysis is conducted at different spatial scales using the FSM indicator recorded for each pupil in the School Census, which has been widely used in educational research as a measure of low socioeconomic status (Hobbs and Vignoles, 2010; Styles, 2008). Change in the concentration of FSM pupils due to each component is measured at Local Authority District, Statistical Ward, Lower Super Output Area and Output Area levels. Data at each spatial scale is compared using deciles of areas using the Townsend deprivation index\(^{10}\). The Townsend deprivation index is used because it presents a clear definition of deprivation based on an explicit theoretical model which is not subject to double counting (Fahmy et al., 2011; Townsend, 1987; Townsend et al., 1988).

The aims of this chapter are two-fold. First, to determine whether internal migration has a varying effect at different spatial scales. Second, to set in context the impact of internal migration compared with other components of socioeconomic area change. The chapter begins by outlining the geographical levels of analysis and discusses why the effect of internal migration and other components of area change might be different at varying spatial scales by reviewing the modifiable area unit problem. This is followed by an explanation of how the measures used to test the effect of each component of socioeconomic area change are calculated. The validity of FSM as an indicator of socioeconomic status is discussed. The penultimate section presents research findings and the final section provides conclusions.

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\(^{10}\) The Townsend Index was devised by Townsend et al. (1988) to provide a material measure of deprivation and disadvantage. The index is based on four census variables: unemployment, non-car ownership, non-home ownership, and household overcrowding.
2. Spatial scales of analysis

The effect of internal migration on the change in the concentration of FSM pupils is likely to vary between different spatial scales because certain families are more likely to move over longer distances and across larger administrative boundaries than others. For example, Finney and Simpson (2008) have shown that individuals are more likely to move longer distances if they are white, younger, not employed, highly qualified and with no dependent children. These characteristics are often associated with the different motivations for longer and shorter distance moves. In the economic migration literature, movement between larger administrative boundaries in the UK is often associated with aspect of labour market changes (Boheim and Taylor, 2002) whereas localised movement between smaller spatial scales is often associated with housing aspirations and family (dis)unification (De Jong and Graefe, 2008). This distinction has been challenged by the family migration literature (see chapter 2, section 3.4) which emphasises family dynamics as an important determinant of long distance migration. The varying nature of selectivity of migration and different motivation for moving between larger and smaller geographical scales is likely to result in a different effect on area socioeconomic change if the selective migration flows are imbalanced.

The modifiable area unit problem refers to the issue that occurs when inferences are different when the same data are analysed at varying spatial scales (Flowerdew et al., 2008; Manley et al., 2006; Schuurman et al., 2007). For example, much of the variation in an outcome of interest at one spatial scale can be lost when data is aggregated to a higher spatial scale. This will affect the inference of area change components that sum to an aggregate total, notably, the number of pupils in an area that change their FSM status but do not move between areas. Schuurman et al. (2007) tested the effect of modifiable area unit problem for spatial inequalities in health at three geographical scales in Vancouver, Canada using a census deprivation index. They suggest that researchers should use the smallest geographical scale available as deprivation indices are susceptible to spatial granularity. This refers to the ability of smaller spatial units to capture greater geographical variation in the outcome of interest.

Another component of the modifiable area unit problem is the artificial nature of boundaries placed on data. It is suggested that larger spatial inequalities will be observed when data boundaries reflect socioeconomic homogeneity (Manley et al., 2006; Stafford et al., 2008). However, Stafford et al. (2008) find that definitions of area based on administrative or
homogenous data boundaries do not have substantively different effects on the measurement of spatial health inequalities. Their study was limited to areas in London and therefore might yield different results if applied to the whole country.

The inclusion of the postcode of each individual pupil in the School Census allows enormous geographical flexibility for area change analyses. Figure 4.1 shows the selected scales of administrative and data boundaries used in this chapter. The highest scale analysed is Local Authority Districts (LADs). These include London Boroughs, Non-Metropolitan Districts, Metropolitan Districts and Unitary Authorities. The London Boroughs, Non-Metropolitan Districts and Metropolitan Districts were initially established by the 1974 two-tier administrative structure of counties and districts. Following further Local Government reorganisation in the 1990s a number of Unitary Authorities were established. The London Boroughs, Metropolitan Districts and Unitary Authorities are responsible for all areas of local government whereas the Non-Metropolitan Districts have split responsibilities with their respective County Council. In England, there were 354 LADs before the 2009 Local Government Reorganisation. These LADs will be referred to as districts henceforth.

In England, the next lower building block of administrative geography is Electoral Wards which are used to elect local government councillors for districts. These boundaries frequently change to reflect eligible voters and are created largely on the basis of population size. However, features such as roads, railways and rivers are considered as well as community identity (ONS, 2010a). In 2003, the Office for National Statistics (ONS) introduced Statistical Wards to minimise the analytical impact of boundary changes. They reflect the Electoral Wards as at May 2003, but for 28 districts they also included boundary changes that were not operational until June 2004. Therefore, for any given year Statistical Wards in some districts were different to the statutory Electoral Wards because of the varying time lags between promulgation and operation dates of boundary changes (ONS, 2009a). There are 7,932 English Statistical Wards used in this chapter which will be referred to as wards henceforth.

Lower Super Output Areas (LSOAs) are a geographical hierarchy designed by ONS to improve the reporting of small area statistics. Unlike wards, LSOAs are of consistent population size (approximately 1,500 people) across the country and will not be subjected to regular boundary change. The 32,482 LSOAs in England were built from groups of Output Areas (see below) and constrained by the boundaries of the 2003 Statistical Wards used for 2001 Census outputs. They
do not necessarily reflect socioeconomic homogeneity as population size was the only determinant of their creation within the constraints of existing ward boundaries. LSOAs have been used extensively as a neighbourhood level geography in both academic and government research (Bailey and Livingston, 2008; Robson et al., 2008). They were used as the geographical unit for most recent releases of the government’s Indices of Multiple Deprivation (CLG, 2008b, 2011a; ODPM, 2004).

2001 Census Output Areas (OAs) were built from clusters of adjacent unit postcodes and reflect the characteristics of the 2001 Census data. They were designed to have similar population sizes and be as socially homogenous as possible (based on tenure of household and dwelling type). They had approximately regular shapes and tended to be constrained by obvious boundaries such as major roads. The OAs were required to have a specified minimum size to ensure the confidentiality of data (ONS, 2007a). In England and Wales 2001 Census OAs are based on postcodes as on Census Day and fit within the boundaries of 2003 Statistical Wards. If a postcode straddled a ward boundary, it was split between two or more OAs. The minimum OA size is 40 resident households and 100 resident persons but the recommended size was larger at 125 households. In total there are 165,665 OAs in England.

**Figure 4.1 - English administrative and data geographies**

Source: adapted from Norman (2006, p.5).
3. Free school meals as a measure of socioeconomic area status

In order to test the effect of the various components of change in the concentration of Free School Meals (FSM) pupils in an area, the FSM indicator recorded in the School Census is used to disaggregate pupils at each spatial scale. The indicator provides a binary measure of socioeconomic status (claimant or non-claimant) recorded each year a pupil is in the School Census. Some authors argue that FSM is limited as a measure of socioeconomic status because its binary nature does not allow one to distinguish between different levels of deprivation (DfES, 2006; Hobbs and Vignoles, 2007). Nonetheless, FSM status has been used widely as a proxy measure of poverty in educational research (Hobbs and Vignoles, 2007; Machin et al., 2006; Styles, 2008). To be eligible for FSM, a child must be living in a household claiming a means tested income benefit (Hobbs and Vignoles, 2010). Hobbs and Vignoles (2010) found that the vast majority of pupils claiming FSM live in low-income families, but not all pupils living in low-income families claim FSM. This is because not all low-income families are eligible and some are unwilling to claim the means-tested benefits which allow them to access FSM for their children.

Aggregate data for FSM status is strongly correlated with other deprivation measures at every spatial scale used in this chapter. Table 4.1 shows the relationship between the rank of areas by the percentage of pupils claiming FSM and the Townsend deprivation index score. The Spearman’s rank correlation coefficients indicate there is a strong positive relationship between the relative ranks of areas for the two measures at every spatial scale. The relationship is strongest at district level and weakest at OA level. This may reflect the different time points when the data was collected for each measure. The School Census data is averaged during 2002-2007 whereas the Census data was collected in 2001. There is likely to be a greater level of change at the smallest spatial scales where, for example, a construction of the new housing development might have a large change in the socioeconomic composition of an OA. The lower level of association at the OA level might also reflect the absence of primary-age pupils in some deprived areas which will therefore have a zero FSM rate. However, the Townsend index uses data for all people and an OA which has no primary school-age pupils might be relatively deprived. This is unlikely to be the case at higher spatial scales.
Table 4.1 - Spearman’s correlation coefficient for ranks of % FSM pupils and Townsend deprivation index score for different geographical scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Spearman’s coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>0.923</td>
</tr>
<tr>
<td>Ward</td>
<td>0.881</td>
</tr>
<tr>
<td>LSOA</td>
<td>0.884</td>
</tr>
<tr>
<td>OA</td>
<td>0.739</td>
</tr>
</tbody>
</table>

Note: Townsend deprivation index score calculated from the 2001 Census, CAS tables.

A pupil’s parent has to verify their eligibility for FSM status using appropriate documentation which is reviewed by their Local Education Authority on a rolling basis. Should a pupil’s parent cease claiming the means tested benefit which makes their child eligible for FSM status they will become ineligible for FSM. A pupil’s parent is also required to reapply for FSM status when they move school. The outcome of this process should result in no pupils claiming FSM that are not eligible. However, it does mean that some pupils that are eligible will not claim FSM status. This could be a result of unwillingness to claim due to stigma at school or lack of knowledge of eligibility (Plewis and Kallis, 2008; Styles, 2008). Hobbs and Vignoles’ (2010) analysis of the Family Resources Survey shows that about 11% of pupils that are eligible for FSM do not claim.

A variable is created for this chapter, which takes into account whether a pupil’s FSM status changed over each one-year period between 2002-03 and 2006-07 where two consecutive School Censuses are merged. This measure is not cumulative and refers to all pupils in the School Census between each one-year period between 2002-03 and 2006-07. Pupils were categorised into four groups. Those with FSM status at the start and end of a one-year period, those that did not have FSM status at the start and end of a one-year period, those with FSM status at the start but not at the end of a one-year period (improve), and those that did not have FSM status at the start but did at the end of a one-year period (decline).

Table 4.2 shows the proportion of primary school-age pupils by each category for each one-year period between 2002-03 and 2006-07. The proportion of pupils in each category remained fairly constant over time. There were a lower proportion of pupils claiming FSM at the start and end of a one-year period in later years. This is consistent with findings from the British Household Panel Survey which suggest the proportion of low-income households has fallen during the period 1991-2007 with the largest reductions for families with children since 2001 (DWP, 2009).
Table 4.2 - Free School Meal status over one-year periods, 2002-03 to 2006-07

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FSM</td>
<td>15.2%</td>
<td>15.4%</td>
<td>15.4%</td>
<td>14.6%</td>
<td>14.2%</td>
</tr>
<tr>
<td>Non-FSM</td>
<td>78.9%</td>
<td>79.0%</td>
<td>79.0%</td>
<td>79.5%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Improve</td>
<td>3.3%</td>
<td>2.7%</td>
<td>3.1%</td>
<td>3.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Decline</td>
<td>2.7%</td>
<td>2.9%</td>
<td>2.4%</td>
<td>2.4%</td>
<td>2.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,921,342</strong></td>
<td><strong>2,885,737</strong></td>
<td><strong>2,863,447</strong></td>
<td><strong>2,830,071</strong></td>
<td><strong>2,797,135</strong></td>
</tr>
</tbody>
</table>

Note: see text for description of FSM status categories.

4. Measures of the components of socioeconomic area change

How the change in the concentration of FSM pupils as a result of each component, from the district to output area level, is measured is described below. The components analysed are internal migration, school turnover, international migration, and in-situ socioeconomic status change. These are comprehensive in the sense that they together constitute all the change in the concentration of FSM pupils. Each component is presented as its net impact on the concentration of FSM pupils. A small net impact may be the result of large changes for each component.

The change in the concentration of FSM pupils due to *internal migration* is derived by comparing the percentage of FSM pupils at the start of each one-year period with the end of the period after allocating residentially migrant pupils into destination areas. Internal migration refers to pupils who moved address within England and is isolated from international migration. Figure 4.2 represents the effect of internal migration during a one-year period for an example area. At the start of the period the area had ten pupils including one that had FSM status which means the concentration of FSM pupils was 10%. During a one-year period one FSM pupil moved in, one non-FSM pupil moved in, and two non-FSM pupils moved out. This means the net effect of internal migration was +1 FSM pupil and -1 non-FSM pupil. Therefore, at the end of the period there were ten pupils in the area including two that had FSM status which means the percentage of FSM pupils was 20%. The absolute change in the concentration of FSM pupils is therefore +10 percentage points in this area during the period when only taking into account internal migration.
Pupils that were in their last year of primary school at the start of a one-year period and pupils that were in their first year of primary school at the end of a one-year period are identified as school leavers and school starters to calculate a measure of school turnover. These pupils are disaggregated by their FSM status which was only measured once as they are only present at either the start or end of a one-year period. A measure of net change of those that entered and left the primary school system is calculated by FSM status (just as the effect of internal migration is measured) and then added to the pupil population by FSM status at the start of each one-year period. The result is then used to calculate a percentage of FSM pupils had only school turnover occurred, which is subtracted from the baseline percentage of FSM pupils to give the percentage point change in the concentration of FSM pupils.

There are some pupils that were only in the dataset once during a one-year period representing pupils who had entered or left the primary school system at a non-compulsory primary age (i.e. entering after age 5 or leaving before age 11). For the purposes of this chapter they are referred to as proxy international migrants. Simpson et al. (2010) have used a similar method to identify this group of pupils as international migrants. They suggest that although this method will capture the vast majority of school-age international migration it will include some pupils transferring between state and independent schooling as well as pupils moving between countries within the UK because some will be internal migrants from other UK countries or transfer to and from non-state schools.
The rate of late starting and early leaving pupils was about 1% nationally which is more than twice the rate of primary school-age immigrants and emigrants measured over a similar time period (2002-2007) using estimates from the International Passenger Survey\textsuperscript{11} for the UK. The International Passenger Survey estimates are subject to large sampling error as a result of the small sample size and only record international migrants who enter or leave the UK for at least twelve months (Boden and Rees, 2010b; Hatton, 2005). Nonetheless, the proxy measure of international migration as measured by the School Census is likely to over-estimate the number of immigrants and emigrants for the reasons mentioned above. Therefore, the measure should be treated with caution when used to identify international migrants.

The net effect by FSM status for pupils that entered and left at a non-compulsory school-age (proxy international migration) is added to the pupil population at the start of each one-year period in the same way the effect of school turnover is calculated.

The final individual component of area change measured is \textit{in-situ change} in socioeconomic status. This refers to the pupils that changed their FSM status but did not move. The effect of in-situ status change is measured by the net change of pupils that improved and declined their socioeconomic status over each one-year period. The net effect is then added to the population at the start of a one-year period to give a measure of the number of pupils disaggregated by FSM status at the end of a one-year period. This is used to calculate the percentage of FSM pupils had only in-situ change occurred. This is subtracted from the percentage before net in-situ change is added to give a change in the concentration of FSM pupils.

Almost a quarter of pupils that changed their socioeconomic status over an average one-year period also moved within England during the same period. The effect of this type of change is isolated from internal migration and in-situ change so as not to distort either effect. It is not unexpected that internal migration and socioeconomic status change would occur at the same time. For example, if a parent begins or ends a relationship this is likely to prompt a move and a change in socioeconomic status as might starting or ending employment. The net effect of this component is calculated in the same way as the effect of internal migration is measured.

The average percentage point change of FSM pupils for each component between 2002-03 and 2006-07 is used for the rest of the analysis in this chapter and is referred to as the change in

\textsuperscript{11} The International Passenger Survey (IPS) is a survey of a random sample of passengers entering and leaving the UK by air, sea or the Channel Tunnel.
concentration of FSM pupils. An average is taken to simplify the analysis but also to take account of change over a longer period of time than one-year. It will also avoid the impact of distorting effects like construction of new housing estates or demolition of old housing (ONS, 2007b). Given that the impact of each component on area change is isolated from other effects, the percentage of FSM pupils at the end of the average one-year period does not refer to the actual percentage of FSM pupils but the percentage if only one of each of the components of change had occurred.

5. Change in the concentration of FSM pupils by component of change and spatial scale

Figure 4.3 shows the number of pupils by socioeconomic status at the start of an average one-year period between 2002-03 and 2006-07 (shown by shaded bars) and the average annual percentage point change of FSM pupils for each one-year period by the component of change between 2002-03 and 2006-07 (shown by shaded lines) for all primary school-age pupils by each spatial scale.

Figure 4.3 - Average annual number of pupils and average annual percentage point change in FSM pupils by component of change and spatial scale, 2002-03 to 2006-07

a) Local Authority Districts
b) Statistical Wards

![Graph showing number of pupils by deprivation level and type of change.]

Non-FSM pupils: □
Internal migration: →
Internal migration & status change: ▲
International migration: ▲

 FSM pupils: □
In situ change: —
School turnover: —

% point change in low income pupils

C) Lower Super Output Areas

![Graph showing number of pupils by deprivation level and type of change.]

Non-FSM pupils: □
Internal migration: →
Internal migration & status change: ▲
International migration: ▲

 FSM pupils: □
In situ change: —
School turnover: —

% point change in low income pupils
d) Output Areas

Figure 4.3a shows that the more deprived deciles of districts using the Townsend index include a greater number of FSM and non-FSM pupils than less deprived districts. The poorest 20% of districts included over a third of the total pupil population during 2002-2006 (54% of FSM pupils and 30% of non-FSM pupils). The component responsible for the greatest level of change in the concentration of FSM pupils in districts is in-situ change. In-situ change decreased the concentration of FSM pupils in each decile of districts. The greatest change is in the most deprived decile where this component decreased the concentration of FSM pupils by 0.5 percentage points. This is a result of more pupils improving their FSM status than declining their FSM status which has the effect of improving the aggregate socioeconomic composition in these areas.

The effect of pupils changing their FSM status and moving at the same time also decreased the concentration of FSM pupils in all deciles of districts. This is a result of more pupils that moved and changed their FSM status improving rather than declining their socioeconomic status. The decreased concentration of FSM pupils due to this component is greatest in the most deprived decile of districts where it decreased the concentration of FSM pupils by almost 0.2 percentage points. This is because more pupils improved their FSM status and moved away than declined their FSM status and moved in. Moreover, fewer pupils declined their FSM status and moved
away than improved their FSM status and moved in. Overall, this has the effect of disproportionately increasing the non-FSM population and decreasing the FSM population in the more deprived compared with less deprived districts when only taking into account this component.

The impact of internal migration is also greatest in the most deprived districts. However, this component increased the concentration of FSM pupils in the most deprived decile of districts by 0.2 percentage points. This could be the result of three different migration dynamics. Firstly, if FSM pupils are moving into an area and non-FSM pupils are moving out there would be a greater concentration of FSM pupils in that area. Secondly, if FSM pupils are moving in and non-FSM pupils are moving in, but FSM pupils are moving in at a faster rate the concentration of FSM pupils would rise. Thirdly, if FSM pupils are moving out of an area and non-FSM pupils are moving out, but non-FSM pupils are moving out at a faster rate the concentration of FSM pupils in the area would increase. By comparing the net migration rates by FSM status the dynamic that is responsible for the change in the concentration of FSM pupils can be uncovered, as shown in figure 4.4.

Figure 4.4 shows the average annual net internal migration rate for primary school-age pupils between 2002-03 and 2006-07 by FSM status and for each spatial scale. Figure 4.4a shows the net internal migration rates for districts are negative for FSM pupils and non-FSM pupils in the most deprived decile of districts. However, there is a greater net outflow of non-FSM pupils compared with FSM pupils for districts in this decile. This results in the increased concentration of FSM pupils in these areas when only taking into account internal migration. The effect of school turnover and international migration was marginal at the district level as well as every other spatial scale analysed. Therefore, their effects are not discussed in detail in this section.
Figure 4.4 - Average annual net migration rate by FSM status and spatial scale, 2002-03 to 2006-07

a) Local Authority Districts

Net migration rate (%)

-3.0%  -2.0%  -1.0%  0.0%  1.0%  2.0%  3.0%

Least deprived 2 3 4 5 6 7 8 9 Most deprived

Non-FSM net rate  FSM net rate

b) Statistical Wards

Net migration rate (%)

-3.0%  -2.0%  -1.0%  0.0%  1.0%  2.0%  3.0%

Least deprived 2 3 4 5 6 7 8 9 Most deprived

Non-FSM net rate  FSM net rate
c) Lower Super Output Areas

![Graph showing net migration rate for FSM and non-FSM pupils in different deprivation deciles.]

Notes: the relative difference between FSM and non-FSM net migration rate indicates the effect on the change in the concentration of FSM pupils shown in Figure 4.3 due to internal migration. A lower net migration rate (positive or negative) of FSM pupils compared with non-FSM pupils indicates increased concentration of FSM pupils.

d) Output Areas

![Graph showing net migration rate for FSM and non-FSM pupils in different deprivation deciles.]

Notes: the relative difference between FSM and non-FSM net migration rate indicates the effect on the change in the concentration of FSM pupils shown in Figure 4.3 due to internal migration. A lower net migration rate (positive or negative) of FSM pupils compared with non-FSM pupils indicates increased concentration of FSM pupils.

Census Statistical Wards

Figure 4.3b shows that for wards there is a similar relationship as districts between the Townsend deprivation deciles and each component of change in the concentration of FSM pupils. As with districts there are also higher numbers of pupils living in the most deprived wards compared with the less deprived wards. This is because less deprived wards and districts tend to be located in
rural areas and have smaller populations compared with deprived wards and districts which tend to be located in metropolitan areas and have much larger populations.

In the most deprived deciles of wards the change in the concentration of FSM pupils is greatest. As with districts, the in-situ change component has the largest effect. In the most deprived decile of wards, in-situ change decreased the concentration of FSM pupils by almost 0.6 percentage points. This is the equivalent of five more FSM pupils improving their income status than declining their income status in an average ward in the most deprived decile. The effect of pupils changing their FSM status and moving is very similar at the ward level as with the district level. In the most deprived decile of wards, this component decreased the concentration of FSM pupils by almost 0.2 percentage points.

The second largest component of change is the effect of internal migration which increased the concentration of FSM pupils in the most deprived decile of wards by 0.3 percentage points. The effect of internal migration had a gradually larger increase in the concentration of FSM pupils from the seventh to the most deprived decile of wards. This is unlike the effect at district level which only had a noticeable change in the most deprived decile.

Figure 4.4b shows that increased concentration of FSM pupils in the more deprived deciles of wards due to internal migration is a result of net outward movement by non-FSM pupils compared with net in-migration of FSM pupils. There is an exception in the most deprived decile of wards which had net outward movement for both socioeconomic groups. However, the net out-migration rate is higher for non-FSM pupils.

**Lower Super Output Areas**

Figure 4.3c shows that the total number of pupils is much more evenly distributed across deciles of LSOAs using the Townsend deprivation index than wards or districts. This is because LSOAs were designed using the 2001 Census output to create even sized population areas. Nonetheless, there is a much higher proportion of FSM pupils in the more deprived LSOAs compared with the least deprived. Almost 50% of pupils living in the most deprived decile of LSOAs have FSM status compared with 2% in the least deprived decile of LSOAs.
The diverging effect of in-situ change and internal migration is even greater in LSOAs by decile of deprivation than wards or districts. In the 40% most deprived LSOAs, in-situ change decreased the concentration of FSM pupils by 0.5 percentage points with the effect strongest in those most deprived LSOAs. The effect of internal migration is also more severe than for wards or districts increasing the concentration of FSM pupils in the 40% most deprived LSOAs by at least 0.2 percentage points. Figure 4.4c shows that this is a result of net outward movement by non-FSM pupils compared with lower net outward movement or net inward movement of FSM pupils.

**Output Areas**

The effect of each component of change in the concentration of FSM pupils is very similar for OAs and LSOAs by deprivation deciles. The distribution of the pupil population is also much more even for OAs compared with wards and districts. There is also a much higher proportion of FSM pupils in the more deprived OAs compared with the less deprived OAs. The only difference in terms of the effect of each component in OAs compared with LSOAs is that the impact of in-situ change and internal migration on the concentration of FSM pupils are both slightly more severe. This indicates the effect of spatial granularity by highlighting the greater variation in area change at the finest geographical scale. Table 4.3 shows the spatial granularity for the average percentage point change in the 20% most deprived areas at each spatial scale. The effect of internal migration, in-situ change and internal migration combined with FSM status change is greatest at the OA scale. The effect of school turnover and international migration is fairly negligible at each spatial scale. The overall change suggests the 20% most deprived areas are becoming marginally less deprived over an average one-year period between 2002 and 2007.

<table>
<thead>
<tr>
<th>Component of socioeconomic area change</th>
<th>District</th>
<th>Ward</th>
<th>LSOA</th>
<th>OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal migration</td>
<td>0.15</td>
<td>0.26</td>
<td>0.37</td>
<td>0.40</td>
</tr>
<tr>
<td>In-situ FSM status change</td>
<td>-0.44</td>
<td>-0.53</td>
<td>-0.65</td>
<td>-0.69</td>
</tr>
<tr>
<td>Internal migration and FSM status change</td>
<td>-0.15</td>
<td>-0.17</td>
<td>-0.19</td>
<td>-0.19</td>
</tr>
<tr>
<td>School turnover</td>
<td>0.05</td>
<td>0.03</td>
<td>-0.04</td>
<td>-0.03</td>
</tr>
<tr>
<td>International migration</td>
<td>0.05</td>
<td>-0.02</td>
<td>-0.08</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>Total change</strong></td>
<td>-0.34</td>
<td>-0.44</td>
<td>-0.59</td>
<td>-0.60</td>
</tr>
</tbody>
</table>

Note: totals may not add due to rounding
6. Discussion

This chapter has uniquely analysed the component mechanisms of socioeconomic neighbourhood change using data from the School Census in England during 2002-2007 with the aim of contextualising the impact of internal migration. The second aim of this chapter is to determine whether change in the concentration of primary school-age FSM pupils, as a result of each component mechanism, differed at varying spatial scales from District to OA level. The components measured which contribute to overall change in the concentration of FSM pupils are internal migration, in-situ status change, school turnover and international migration. In-situ status change had the greatest effect which supports the findings from similar studies which have decomposed the component mechanisms of socioeconomic area change (N Bailey, 2009; Cooke, 2010; Rosenbaum, 1995; Strait, 2006). In-situ change, which refers to pupils improving or declining their FSM status without moving, decreased the concentration of low-income pupils in each deprivation decile and at each spatial scale. This is a result of a national trend of fewer pupils claiming FSM in the later years of the period 2002-2007.

Moreover, decreased concentration of FSM pupils as a result of in-situ change was greatest in the most deprived areas. This might reflect a greater level of intervention to improve socioeconomic conditions in the most deprived neighbourhoods in England during this period. The Neighbourhood Renewal Fund (subsequently renamed Working Neighbourhoods Fund) has financed a number of spatially-targeted programmes that aim to improve socioeconomic outcomes in the poorest neighbourhoods relative to the national average (CLG, 2010). Although the Neighbourhood Renewal Fund programmes have only covered a small proportion of deprived neighbourhoods in England the model of spatial targeting has been used in non-Neighbourhood Renewal Fund local authority areas through Local Area Agreements (CLG, 2008a).

The effect of internal migration is also greatest in the most deprived areas at each spatial scale. Although the effect is not as strong as in-situ change it increases the concentration of FSM pupils in these areas. In the most deprived decile of areas, this is a result of greater net outward movement of non-FSM pupils compared with FSM pupils. This supports existing theories about internal migration for deprived areas that presuppose those most able to move away will be more likely to do so (see chapter 2, section 4). However, poor households will find it more difficult to escape the most deprived areas because even if they move they will not have the resources to move to less deprived areas.
The effect of internal migration is isolated from socioeconomic neighbourhood change due to pupils changing their FSM status and moving within England at the same time. The latter component reduced the concentration of FSM pupils in the poorest neighbourhoods. It completely counterbalanced the isolated effect of internal migration in the 20% most deprived areas at the district level and halved the effect at the ward, LSOA and OA levels. These two separate components should be added together and considered as the overall effect of internal migration. This combined measure is used in the subsequent chapters of this thesis.

The effect of in-situ change and internal migration are moderately accentuated at smaller area scales which supports findings that variation in outcomes are more pronounced at finer geographical levels (Schuurman et al., 2007). Nonetheless, the substantive findings did not alter at varying spatial scales. The patterns are most consistent between the spatial scales which have been previously used as neighbourhood level geography including, wards, LSOAs and OAs. The findings at the OA level should be treated with some caution as there are a substantial number of these areas which contain zero or very few primary school-age pupils. Therefore, a measure of change in the concentration of FSM pupils is not as reliable at this scale.

The size of the effect of each component of change is always relatively small at each spatial scale. In-situ change never decreased the concentration of FSM pupils by more than 0.7 percentage points and internal migration did not increase the concentration by more than 0.5 percentage points in an average one-year period in any deprivation decile and at any geographical level. In an average ward, for example, the effect of FSM status change is the equivalent of five more pupils improving compared with declining their FSM status. Moreover, the effect of the other components of change in the concentration of FSM pupils including school turnover, international migration and internal migration combined with socioeconomic status change are relatively small in all deciles of areas by deprivation status and at each spatial scale.

Nonetheless, if the effect of internal migration continues over time, all other effects of socioeconomic area change held constant, the poorest areas will become increasingly poor and depopulated which will concern policy makers. The small average change across areas will also mask large changes in the socioeconomic status of individual areas. The following chapters in this thesis will aim to identify the characteristics of neighbourhoods where the effect of internal migration on socioeconomic area change is greatest.
Chapter 5 – Modelling socioeconomic neighbourhood change due to internal migration using a growth curve analysis

1. Introduction

This chapter extends the descriptive analysis reported in chapter 4 by modelling the change in the concentration of primary school-age Free School Meals (FSM) pupils over each one-year period during 2002-2007 due to internal migration. The change over time in the concentration of FSM pupils is modelled using a multilevel growth curve framework. The analysis addresses the research question: are internal migration flows increasing the concentration of poor pupils in the most deprived neighbourhoods? The use of a statistical model adds to the analysis in chapter 4 by determining whether this process is moderated by the region and district type a neighbourhood is located in over each individual one-year period between 2002 and 2007.

Chapter 4 has shown at various spatial scales, from district to output area, that internal migration flows are increasing the concentration of FSM pupils in the poorest areas\textsuperscript{12}. Prior research has also shown that internal migration acts to reinforce the concentration of deprivation (see chapter 2, section 4). Bailey and Livingston (2007, 2008) have shown that this effect varies in both direction and size by region because of the different nature of housing and labour markets across England. In the North and Midlands, they found that internal migration increased the concentration of deprivation more rapidly compared with London where internal migration flows were reducing concentrations. There is also a suggestion that internal migration is acting to increase the aggregate deprivation levels in the largest central metropolitan areas throughout the UK (Champion and Coombes, 2007; Champion et al., 2007; Champion and Fisher, 2003). This is because, in aggregate terms, people are choosing to move away from large cities when migrating within the country in favour of suburban areas\textsuperscript{13}, a process referred to as counterurbanisation (see chapter 2, section 4.2). However, settlement in suburban areas is more likely to be realised by more affluent households because low cost and social housing is not widely available in these areas. This leads to increased polarisation between poorer urban neighbourhoods and relatively affluent suburban and rural neighbourhoods.

\textsuperscript{12}Internal migration when not accounting for pupils that move and change their FSM status at the same time.

\textsuperscript{13}There was net inflow of 16-24 year olds for the largest city-regions between 2000-2001 but net outflows for all other ages.
This has implication for any policy maker that wishes to stem spatial inequalities. For example, area-based initiatives (ABI) including the previous Labour government’s New Deal for Communities (NDC) programme which aimed to narrow the gap between the most deprived neighbourhoods and the national average on a range of socioeconomic outcomes (Beatty and Cole, 2009). The neighbourhoods which have received this type of funding include some of the most deprived in England although the funding has been distributed across all parts of the country. It has been recognised that what works in one part of the country, in terms of achieving the overarching objectives, might not work in another (Meen et al., 2005). The effect of internal migration on the ability to meet the desired policy objectives is also likely to vary in different parts of England. Moreover, it is difficult without evidence to appreciate the barriers to meeting policy objectives some neighbourhoods will face in different regions and within urban districts compared with more suburban and rural districts.

This chapter analyses the change in the concentration of FSM pupils due to internal migration using a growth curve model at the Lower Super Output Area (LSOA) neighbourhood scale in England. The analysis focuses on neighbourhoods because ABIs tend to be delivered at this level (Atkinson and Kintrea, 2001; Bailey and Livingston, 2008). Neighbourhoods, although inconsistently defined, are also used in the housing market to demarcate areas by price and quality (Bramley et al., 2008; Galster, 2001). LSOAs are widely used in policy and academic literature as a unit of neighbourhood scale (see chapter 4, section 2). On average, a LSOA neighbourhood contained 120 primary school-age pupils in 2002.

An alternative to a growth curve model would be to use difference scores i.e. the difference between the concentration before and after the effect of internal migration is added. This approach limits analysis to only two points in time and assumes change is linear for all areas. An innovative approach to modelling the change over time involves predicting trajectories over repeated measures which makes more use of the data when it is available at more than two time points (Goldstein, 1986). The School Census was collected on an annual basis between 2002 and 2007. This allows change in the concentration of primary school-age pupils at the neighbourhood level to be analysed for each one-year period when only taking into account internal migration. It allows analysis of whether more deprived neighbourhoods become poorer over time as a result of internal migration. Goldstein and Noden (2003) have used this approach to model socioeconomic segregation in schools for the period 1994-1999 but the author understands that
longitudinal analysis of internal migration data using a multilevel modelling framework has not been conducted in this way before.

The chapter is structured as follows. The second section explains the measures used in the analysis. Section three introduces the growth curve model and section four provides results of the statistical analysis. The results are presented using two nested models. The first provides estimates of a simple growth curve model and the second model includes all explanatory variables discussed in section two. The final section summarises the findings and discusses implications for policy.

2. Measures of the dependent and independent variables

The percentage of FSM pupils in a neighbourhood is used as the dependent variable in this chapter. The change over time in this measure is calculated using a similar approach as described in chapter 4, section 4. The percentage of FSM pupils is calculated using School Census data for each neighbourhood in 2002. Net migration by FSM status of all primary school pupils for each one-year period during 2002-2007 is added to the primary pupil population for each neighbourhood in 2002. A concentration of FSM pupils is then calculated for each year after 2002 and until 2007 after accounting for the effect of internal migration. This measure also accounts for the 12% of pupils that moved during an average one-year period between 2002 and 2007 and changed their FSM status during the same period. In chapter 4, the effect of internal migration and internal migration combined with a FSM status change are analysed separately. However, to gain a full picture of the impact of internal migration on socioeconomic neighbourhood change both of these components are added together and referred to as the effect of internal migration throughout the rest of this chapter and thesis.

The measure of change in the concentration of FSM pupils in this chapter differs from the one used in chapter 4 by taking account of the effect of internal migration in a neighbourhood over each one-year period cumulatively rather than the average one-year period between 2002 and 2007. Data for all primary school-age pupils is used in each one-year period between 2002 and 2007 and the isolated effect of internal migration is added to the primary-age pupil population for each one-year-period. However, it is not entirely possible to isolate the effect of other components of socioeconomic change between one-year periods because the primary pupil population will change due to school turnover, international migration and in-situ change. This
could be overcome by using one cohort, for example, pupils aged 5 in 2002 for the analysis and therefore removing the impact of other components. This was considered but was not implemented because there were less than 20 pupils of this age, on average, in each neighbourhood in 2002.

To limit the impact of that part of change over time, which was not a result of internal migration, neighbourhoods which had more than a 50% change in the population between consecutive years are excluded from the analysis. In these neighbourhoods change in the percentage of FSM pupils is likely to be a result of disproportionate entrants or leavers of the primary school system. A disproportionate level of entrants or leavers is likely to change the composition of FSM pupils in a neighbourhood and dwarf the effect of internal migration. A 50% limit is used because there were no neighbourhoods that increased or decreased their population due to internal migration by more than this amount during an average one-year period between 2002 and 2007. Neighbourhoods with a population of less than 30 pupils between 2002 and 2007 are also excluded from the analysis because the small denominator might lead to bigger changes in the percentage of FSM pupils than would be expected in similar neighbourhoods with larger populations. The result of these conditions is an exclusion of 3% or 974 LSOA neighbourhoods. Similar exclusions were used by Pillinger (2009) to model ethnic segregation in schools over the same time period.

Figure 5.1 shows the average percentage of FSM pupils in neighbourhoods in England in 2002 and the percentage in each subsequent year until 2007 when the effect of internal migration is added. It is expected that the percentage of FSM pupils should not change as a result of internal migration. This is because pupils can only move to another neighbourhood in England. However, as a result of the limitations discussed above and the fact that some pupils that change their FSM status move during the same one-year period it is possible for the percentage of FSM pupils to change year on year. In 2002, almost 17% of pupils were claiming FSM and this remained constant over time for England as a whole. It is unlikely to be the case that every neighbourhood will have a uniform trajectory over time and it is more likely that trends will vary for certain neighbourhoods as described below.
Explanatory variables are included in a model to explore how variability in the concentration of FSM pupils between neighbourhoods might accentuate or moderate neighbourhood trajectories over time. The main variable of interest is whether the neighbourhood is considered deprived. To test this effect a dummy variable is included that had the value of one if a neighbourhood is ranked within the 20% most deprived LSOAs on the Townsend deprivation index and zero if not. Neighbourhoods were dichotomised in this way because chapter 4 showed that, on average, neighbourhoods in this quintile have a higher change in the concentration of FSM pupils than any other quintile as a result of internal migration. These neighbourhoods are likely to reflect the poorest in the country and will include the vast majority of areas that were eligible for ABIs, especially the NDC programme. A dummy variable is used rather than the rank or score of deprivation for the neighbourhood to aid interpretation of the model coefficients, particularly the intercept value.

Dummy variables are also included in the model for the region and the district type that a neighbourhood is located. London is used as the reference category for the region variable using Government Office Region (GOR) boundaries. Bailey and Livingston (2008) found that the more deprived a neighbourhood located within the London city-region, the more likely it is to decrease its concentration of deprivation as a result of internal migration. In all other regions they found that migration flows act to increase the concentration of deprivation. The more deprived the neighbourhood, the greater the increase in concentration caused by internal migration. They used low educational attainment\textsuperscript{14} as a measure of deprivation of those aged 25-74 (see chapter

\textsuperscript{14} CSEs only, 1–4 O-levels/GCSEs or NVQ Level 1 or below.
2, section 4.3). The different measure of deprivation and to a greater extent the use of a different age group in their analysis might lead to different findings compared with the analysis in this chapter. The results in this chapter can also be expected to differ from Bailey and Livingston’s findings because they divide England into amalgamations of GORs except for London where they use a city-region definition developed by Coombes (1996). This definition of the London city-region is not used in the analysis for this chapter because it would limit the relevance to policies which take account of London in terms of its GOR\textsuperscript{15}. The London GOR is the boundary of the Greater London Authority.

A district type variable is collapsed from an Office of Population Censuses and Surveys classification produced to distinguish between neighbourhoods located in urban and rural districts in England (Champion, 2005). The metropolitan district type is used as the reference category with other neighbourhoods located in town and rural district types. Champion and Fisher (2003) found that from the results of the 1991 Census the larger metropolitan conurbations in the UK were becoming less concentrated with professional and managerial workers because of internal migration (see chapter 2, section 4.2). Results from the 2001 Census confirmed that this migration process was still operating for most metropolitan areas with the notable exception of London. London is described as experiencing an ‘urban renaissance’ because it was attracting a high number of young professionals from the rest of the UK (Champion et al., 2007). Champion et al. (2007) used the city-region boundary to define London and found that migration was increasing the concentration of managerial and professional workers because of the impact of young professionals (aged 16-24) moving in. For all other age groups more people were leaving each of the largest metropolitan areas than were moving in.

### 3. Growth curve linear model framework

The measurement of the outcome variable, the percentage of the FSM pupils, for each year within each neighbourhood provides a hierarchically structured dataset where repeated measures of the concentration of FSM pupils for each year (level 1) are nested within each neighbourhood (level 2). Figure 5.2 provides a representation of this structure.

\textsuperscript{15} The use of London city-region rather than London GOR attenuated the difference between London and other regions in the current analysis but it did not alter the substantive findings (results not shown here).
Longitudinal data lends itself to analysis using multilevel modelling because it can take account of the hierarchical data structure. Unlike a difference scores analysis it can produce trajectories for each neighbourhood and estimate the amount of variability in each trajectory (slope) and baseline (intercept). By adding covariates one can see how much variation is explained at each level using a stepwise approach. All statistical analysis is carried out using MLwiN 2.21. A basic growth curve model is specified as follows:

\[
\begin{align*}
Y_{ij} &= B_{0ij} + B_{1j}(\text{year centred }_{ij}) + B_{2j}(\text{year centred }_{ij})^2 \\
B_{0ij} &= B_0 + u_{0j} + e_{0ij} \\
B_{1j} &= B_1 + u_{1j} \\
B_{2j} &= B_2 + u_{2j}
\end{align*}
\]

Where \( i \) indicates the year units (level 1) within a neighbourhood unit \( j \) (level 2), \( Y_{ij} \) is the percentage FSM pupils in a neighbourhood, \( B_{1j} \) is the year centred on its grand mean, \( B_{2j} \) is a quadratic term for year centred included to take account of the neighbourhoods where change over time is not expected to be linear, \( u_{0j} \), \( u_{1j} \), and \( u_{2j} \) are neighbourhood level residuals, and \( e_{0ij} \) is a measurement year level residual. The year variable is centred to the grand mean to avoid collinearity with the year squared variable. Therefore the fixed effect of the intercept \( B_{0ij} \) indicates the mean percentage of FSM pupils in neighbourhoods between 2004 and 2005. The intercept value is allowed to vary between neighbourhoods represented by the random effect of \( u_{0j} \). The model also allows the slope to vary for the effect of year centred and year centred squared. This means that over time the rate of change in the concentration of FSM pupils for each neighbourhood \( B_1 \) could vary. The model is equivalent to a multilevel random slopes model, but for longitudinal analysis is referred to as a growth curve model.

The model above only predicts the rate of change over time in the percentage of FSM pupils and provides no information about moderating or accentuating effects. The explanatory variables described in section two are added to test for their effects as follows:
\[ y_{ij} = B_{0ij} + B_{1j}(\text{year centred})_i + B_{2j}(\text{year centred})_i^2 + B_{3j}x_j + B_{4j}\times\text{year centred}_i \]

\[ B_{0j} = B_0 + u_{0j} + e_{0ij} \]
\[ B_{1j} = B_1 + u_{1j} \]
\[ B_{2j} = B_2 + u_{2j} \]

Where \( B_3x_j \) indicates the difference in the concentration of FSM pupils when year centred equals zero as a function of a range of covariates (deprived neighbourhood status, region, and district type) and \( B_4x_j\times\text{year centred}_i \) indicates differences in the change rate in the concentration of FSM pupils as a function of the same covariates. The latter effect is simply an interaction term of year centred and each covariate.

4. Statistical analysis of linear growth curve model

The results of the basic growth curve model predicting the percentage of FSM pupils conditional on year centred and its quadratic term are shown in table 5.1. The intercept value shows that the percentage of FSM pupils when year centred equals zero is 16.6%. The fixed effect of year centred indicates an increase in the concentration of FSM pupils for each increase in year (average slope) when only taking account of internal migration. The positive value of 0.062 is small but significant. It indicates that over time neighbourhoods will become marginally more deprived, on average, as a result of internal migration. Over six years an average neighbourhood would expect an increase in its FSM rate of 0.4 percentage points (i.e. 0.062*6). This reflects the slight increase in the percentage of FSM pupils shown descriptively in figure 5.1. The negative estimate for the quadratic term shows that the average rate of increase in the percentage of FSM pupils will become smaller in later years and therefore suggesting a non-linear change over time.

The random estimates from the model show that there is a large amount of variation between the intercept for each neighbourhood at level 2. The value of 253.6 dwarfs the variation at level 1 between each year which was 1.9. Therefore, over 99% of the variation in the outcome variable is between neighbourhoods rather than within neighbourhoods over time. This suggests there is small change over time within neighbourhoods but large differences between neighbourhoods. The random effect for the variation in the average slope for the year centred effect is significant and shows that 95% of the slopes lie between -1.7% and 1.8%. This is calculated using two standard deviations of the random slope \( \sqrt{0.754} \) plus or minus the average slope 0.062 + -0.007 (Snijders and Bosker, 1999). The variation suggests that some areas could become 10 percentage points poorer (or less poor) in terms of the concentration of FSM pupils when accounting for
internal migration during 2002-2007. The variance for the slope of the quadratic term is also significant as is the covariance between the intercept and slope for both of the random effects included in the model. The positive covariance between the intercept and year centred random slope effect suggests that neighbourhoods with a higher intercept value will have a higher rate of change in the concentration of FSM pupils over time. This indicates an increased divergence between poor and less poor neighbourhoods as measured by FSM status of a pupil.

**Table 5.1 - Basic multilevel linear growth model of neighbourhood FSM rate, 2002-07**

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed effects</strong></td>
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<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>16.589</td>
<td>0.090</td>
</tr>
<tr>
<td>Year</td>
<td>0.062</td>
<td>0.005</td>
</tr>
<tr>
<td>Year²</td>
<td>-0.007</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Random effects</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2: Neighbourhood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept variance</td>
<td>253.592</td>
<td>2.049</td>
</tr>
<tr>
<td>Intercept-year covariance</td>
<td>2.485</td>
<td>0.085</td>
</tr>
<tr>
<td>Year variance</td>
<td>0.754</td>
<td>0.007</td>
</tr>
<tr>
<td>Intercept-Year² covariance</td>
<td>-0.614</td>
<td>0.031</td>
</tr>
<tr>
<td>Year-Year² covariance</td>
<td>0.007</td>
<td>0.002</td>
</tr>
<tr>
<td>Level 1: Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept variance</td>
<td>1.872</td>
<td>0.009</td>
</tr>
</tbody>
</table>

-2*loglikelihood: 949,981
Level 2 units 31,315
Level 1 units 187,890

Diagnostic checks are used to test the assumptions of normality for the residuals from the model. The residuals were inspected using normal probability plots shown in figure 5.3 and figure 5.4 for the year level and neighbourhood level respectively. The residuals represent a fairly straight line for the level 2 (neighbourhood) residuals (figure 5.4). However, the level 1 (year) residuals deviate from the expected straight line diagonal distribution suggesting the normality assumptions does not hold (figure 5.3). This is because of the large minority of neighbourhoods with zero percentage of FSM pupils which remains constant over time. A logarithmic transformation of the outcome variable does not improve the distribution of the errors. The binomial distribution of the errors and the outcome variable suggest a logistic model might be more appropriate. The results of a logistic model including all the explanatory variables described above are shown in Appendix B. It produces substantively similar results to those of the full linear model described below. However, it also produces non-normally distributed residual values. The logistic model assumes
that the residuals are distributed normally at the neighbourhood level and this requirement is not met. This is because of the large minority of neighbourhoods that have zero proportion of FSM pupils over all periods. The logistic model is fitted using a 2nd order penalized quasi-likelihood estimation procedure as suggested by Rasbash et al. (2009b).

Figure 5.3 - Q-Q normality plot for level 1 (year) residuals from basic multilevel linear growth model
A common problem with fitting growth curve models for longitudinal data is that the values over time might not be independent, for example, a neighbourhood that has zero percentage of FSM pupils will continue to do so year on year. This is a critical assumption of the model which is often not met because some data collection intervals are close to one another. In the model described above the intervals of the points of data are equal. However, the independence assumption is questionable because the data used to create the concentration of FSM pupils overlaps between each year. The problem can be tested by checking for autocorrelation of residuals at level 1 (within neighbourhoods over time). An autoregressive term is included in the model using a procedure outlined in the MLwiN Manual supplement (Rasbash et al., 2009a). Table 5.2 shows that the inclusion of this parameter improved model fit, as indicated by a reduction in the -2 log likelihood (Rasbash et al., 2009b), and its effect was significant.

The inclusion of the autoregressive term has very little effect on the value of fixed effects for the intercept and year centred. However, the quadratic term for the year centred variable which has a small significant negative effect in the original model became insignificant with the inclusion of the autoregressive term. The random effects are largely unchanged except for the measure of variance at level 1 which is 4.0 compared with 1.9 in the original model. This indicates there is
more variation within neighbourhoods over time when accounting for auto correlation between time periods.

### Table 5.2 - Basic multilevel linear growth model of neighbourhood FSM rate with autoregressive term

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed effects</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>16.577</td>
<td>0.090</td>
</tr>
<tr>
<td>Year</td>
<td>0.063</td>
<td>0.005</td>
</tr>
<tr>
<td>Year(^2)</td>
<td>-0.002</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Random effects</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2: Neighbourhood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept variance</td>
<td>253.225</td>
<td>2.046</td>
</tr>
<tr>
<td>Intercept-Year covariance</td>
<td>2.521</td>
<td>0.084</td>
</tr>
<tr>
<td>Year variance</td>
<td>0.562</td>
<td>0.007</td>
</tr>
<tr>
<td>Intercept-Year(^2) covariance</td>
<td>-0.362</td>
<td>0.030</td>
</tr>
<tr>
<td>Year-Year(^2) covariance</td>
<td>0.009</td>
<td>0.002</td>
</tr>
<tr>
<td>Year(^2) variance</td>
<td>0.022</td>
<td>0.001</td>
</tr>
<tr>
<td>Autoregressive error term</td>
<td>2.000</td>
<td>0.031</td>
</tr>
<tr>
<td>Level 1: Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept variance</td>
<td>3.956</td>
<td>0.038</td>
</tr>
<tr>
<td>-2*loglikelihood:</td>
<td>944,882</td>
<td></td>
</tr>
<tr>
<td>Level 2 units</td>
<td>31,315</td>
<td></td>
</tr>
<tr>
<td>Level 1 units</td>
<td>187,890</td>
<td></td>
</tr>
</tbody>
</table>

An alternative to the growth curve model with autocorrelated errors at the measurement occasion level is a multivariate model with a response variable for each year. The results of a multivariate normal model with continuous response variables for each year are shown in Appendix C. The constant is allowed to vary across neighbourhoods with all the other variables fitted as fixed effects. The fixed estimates show that change over time is as expected from the results of the full multilevel linear growth model shown below and the multilevel logistic growth model shown in Appendix B. The disadvantage of a multivariate framework is that it is not possible to state whether there has been statistically significant change over time in the percentage of FSM pupils as a result of fixed effects.

The rest of the analysis reported in this chapter uses the linear multilevel growth model results including an autocorrelated term for errors at level 1. However, the issue with the non-normally distributed errors remains unresolved. This will affect the precision of the fixed parameter estimates and variance components. However, the alternative approaches shown in the Appendices do not change the substantive findings from the data. This provides a robustness check of the multilevel linear growth model.
Table 5.3 shows the parameter estimates of the final multilevel linear growth curve model with the inclusion of main effects for deprived status, region and district type of the neighbourhood as well as interactions for each main effect with the year centred variable. These estimates indicate an effect on the intercept and rate of change in the concentration of FSM pupils over time. The value of the intercept represents the percentage of FSM pupils in a neighbourhood when year centred and all other variables equal zero. This refers to a non-deprived neighbourhood located in a metropolitan district in London. The inclusion of the added covariates at level 2 changes the estimates for the random part of the model. The variance at level 2 for the average intercept value is two and half times less compared with the basic growth curve model, which suggests the included variables explain a higher degree of the variation between neighbourhoods in the initial percentage of FSM pupils. This is largely due to the inclusion of the deprived neighbourhood status dummy variable.

Unsurprisingly, the effect of whether a neighbourhood is ranked within the 20% most deprived according to the Townsend index had the effect of increasing the average intercept by almost 30 percentage points when all other variables are held constant. This suggests that poor neighbourhoods according to the Townsend deprivation index are likely to have a higher percentage of FSM pupils at intercept. More interestingly, the interaction effect between deprived neighbourhood status and year centred is positive. The estimate of 0.14 suggests that deprived neighbourhoods will have a higher rate of change in the concentration of FSM pupils and therefore become poorer over time as a result of internal migration compared with non-deprived neighbourhoods. Both the main effect and interaction are significant but it is important to stress that the size of the effect on the rate of change is small. It suggests, on average, with all other variables held constant a deprived neighbourhood would become one percentage point poorer than a non-deprived neighbourhood after several years of internal migration.

The parameter estimate for the main effect of the region indicates that neighbourhoods located outside London will have a lower intercept value except for neighbourhoods in the North East and North West. The estimate for the East of England is also lower but is not significantly different from London. The effect of the interaction term between year centred and region suggests that neighbourhoods in all regions located outside of London are predicted to have a lower change in the concentration of FSM pupils as a result of internal migration. The significant estimates for each region are similar. They are also larger than the effect of deprived neighbourhood status.
This suggests that internal migration dynamics are more important in terms of increasing the concentration of FSM pupils over time in neighbourhoods in London regardless of deprived status.

The type of district in which a neighbourhood is located also has a significant effect on the intercept value. Neighbourhoods located in districts categorised as town and to a greater extent rural, have a lower percentage of FSM pupils compared with neighbourhoods in metropolitan districts when year centred equalled zero (intercept). A neighbourhood located in a rural district has an intercept value of almost 6 percentage points less than a neighbourhood in a metropolitan district when all other variables are held constant. The effect of the change in the concentration of FSM pupils is not very strong between district types of a neighbourhood, shown by the interaction between year centred and district type. Neighbourhoods located in towns and rural districts are predicted to have a slightly lower rate of change (-0.048 for rural districts and -0.066 for town districts) compared with neighbourhoods in metropolitan districts. Nonetheless, the effects are significant.
Table 5.3 - Multilevel linear growth model of neighbourhood FSM rate with deprived status, regional and district type effects

<table>
<thead>
<tr>
<th>Fixed Part</th>
<th>Estimate</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>13.930</td>
<td>0.165</td>
</tr>
<tr>
<td>Year</td>
<td>0.288</td>
<td>0.015</td>
</tr>
<tr>
<td>Year$^2$</td>
<td>-0.002</td>
<td>0.002</td>
</tr>
<tr>
<td>Deprived</td>
<td>28.000</td>
<td>0.153</td>
</tr>
<tr>
<td>North West</td>
<td>0.716</td>
<td>0.221</td>
</tr>
<tr>
<td>Yorkshire and The Humber</td>
<td>-1.980</td>
<td>0.234</td>
</tr>
<tr>
<td>North East</td>
<td>0.768</td>
<td>0.297</td>
</tr>
<tr>
<td>West Midlands</td>
<td>-0.979</td>
<td>0.236</td>
</tr>
<tr>
<td>East Midlands</td>
<td>-1.562</td>
<td>0.272</td>
</tr>
<tr>
<td>South West</td>
<td>-1.020</td>
<td>0.262</td>
</tr>
<tr>
<td>East of England</td>
<td>0.488</td>
<td>0.271</td>
</tr>
<tr>
<td>South East</td>
<td>-1.715</td>
<td>0.246</td>
</tr>
<tr>
<td>Town</td>
<td>-2.220</td>
<td>0.170</td>
</tr>
<tr>
<td>Rural</td>
<td>-5.616</td>
<td>0.173</td>
</tr>
<tr>
<td>Year*deprived</td>
<td>0.140</td>
<td>0.014</td>
</tr>
<tr>
<td>Year*North West</td>
<td>-0.306</td>
<td>0.020</td>
</tr>
<tr>
<td>Year*Yorkshire and The Humber</td>
<td>-0.322</td>
<td>0.021</td>
</tr>
<tr>
<td>Year*North East</td>
<td>-0.302</td>
<td>0.027</td>
</tr>
<tr>
<td>Year*West Midlands</td>
<td>-0.181</td>
<td>0.022</td>
</tr>
<tr>
<td>Year*East Midlands</td>
<td>-0.229</td>
<td>0.025</td>
</tr>
<tr>
<td>Year*South West</td>
<td>-0.292</td>
<td>0.024</td>
</tr>
<tr>
<td>Year*East of England</td>
<td>-0.232</td>
<td>0.025</td>
</tr>
<tr>
<td>Year*South East</td>
<td>-0.224</td>
<td>0.022</td>
</tr>
<tr>
<td>Year*Town</td>
<td>-0.066</td>
<td>0.015</td>
</tr>
<tr>
<td>Year*Rural</td>
<td>-0.048</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Random Part

<table>
<thead>
<tr>
<th>Level: Neighbourhood</th>
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<th></th>
</tr>
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<tbody>
<tr>
<td>Intercept variance</td>
<td>97.560</td>
<td>0.802</td>
</tr>
<tr>
<td>Intercept-year covariance</td>
<td>1.399</td>
<td>0.052</td>
</tr>
<tr>
<td>Year variance</td>
<td>0.542</td>
<td>0.007</td>
</tr>
<tr>
<td>Intercept-Year$^2$ covariance</td>
<td>-0.174</td>
<td>0.019</td>
</tr>
<tr>
<td>Year-Year$^2$ covariance</td>
<td>0.010</td>
<td>0.002</td>
</tr>
<tr>
<td>Year$^2$ variance</td>
<td>0.022</td>
<td>0.001</td>
</tr>
<tr>
<td>Autoregressive error term</td>
<td>2.005</td>
<td>0.031</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level: Year</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept variance</td>
<td>3.961</td>
<td>0.038</td>
</tr>
<tr>
<td>-2*loglikelihood:</td>
<td>914,821</td>
<td></td>
</tr>
<tr>
<td>Units: Neighbourhood</td>
<td>31,315</td>
<td></td>
</tr>
<tr>
<td>Units: Year</td>
<td>187,890</td>
<td></td>
</tr>
</tbody>
</table>
5. Discussion

This chapter has addressed the question of whether internal migration flows are increasing the concentration of primary school-age FSM pupils in the most deprived neighbourhoods and whether this effect is moderated by the region and district type a neighbourhood is located in. Modelling change in the percentage of FSM pupils during 2002-2007 shows that internal migration flows marginally increased the concentration in neighbourhoods as a whole. However, neighbourhoods ranked within the 20% most deprived according to the Townsend deprivation index are predicted to have a greater increase in the concentration of FSM pupils than less deprived neighbourhoods. This finding supports existing research and the results from chapter 4. In concurrence with chapter 4, the growth curve model analysis suggests that the size of the added increase in the concentration of FSM pupils for deprived neighbourhoods is not very large. A deprived neighbourhood is predicted to increase its concentration of FSM pupils by 0.14 percentage points more each year than a less deprived neighbourhood as a result of internal migration. Nonetheless, the trend of increased concentration of poor pupils in deprived neighbourhoods and the increased inequality between deprived and non-deprived neighbourhoods should concern policy makers.

The results of the model suggest there are greater differences between neighbourhoods in London compared with other regions than between those that are deprived and non-deprived. More specifically, neighbourhoods located outside London are likely to have a lower annual rate of change in the percentage of FSM pupils of at least 0.181 percentage points for neighbourhoods in the West Midlands to 0.322 percentage points for neighbourhoods in Yorkshire and The Humber. This suggests that neighbourhoods in London are becoming significantly poorer due to the internal migration of primary school-age pupils compared to neighbourhoods outside the capital. This contradicts findings from Champion et al. (2007) and Champion and Coombes (2007). It is likely to reflect the definition of London using the GOR rather than the city-region and the restriction of data to primary school-age pupils discussed below. The latter is likely to be the main factor responsible for this different conclusion. This is because Champion et al. (2007) show that for all age groups, except 16-24, more people are moving out of London than are moving in. However, outward movement from the capital tends to be selective of higher occupational status households which are not balanced by similar inward movements.
The effect of internal migration for primary school-age pupils in London is likely to reflect the higher level of dynamism in terms of migration from within the capital (Dennett and Stillwell, 2008). People of child-rearing age with or without children are tending to move away from Inner London areas in favour of suburban housing on the fringe of the Greater London administrative boundary (Andrew and Meen, 2006; Bate et al., 2000). The motivations for this movement are complex but moving to access better schools is likely to be one motivating factor for those with children (Dobson and Stillwell, 2000). Better schools and other local facilities are likely to be found in suburban areas where quality of life could be said to be higher (Boyle et al., 1998b). This effect appears to be much stronger in London than other metropolitan areas when controlling for the deprived status of a neighbourhood. The effect of the district type in the model indicates that metropolitan areas throughout England are predicted to have a higher change in the concentration of FSM pupils relative to town and rural districts. This is likely to reflect the restriction of a counterurbanising move to higher income households. However, the effect of the type of district a neighbourhood is located in is very small when taking into account the region and deprived status of a neighbourhood.

The precision of the model results described above are questionable because some of the assumptions of the multilevel model fitted are not satisfied. The residual values at level 1 are assumed to be normally distributed. It is shown in figure 5.3 that this is not the case. This is a result of a large minority of neighbourhoods with a zero proportion of FSM pupils over time. Nonetheless, the substantive effects of deprived status, region and district type on the proportion of FSM pupils in a neighbourhood over time remain largely unchanged when the model is fitted in a logistic or multivariate framework. This provides reassurance that the effects from the multilevel linear model are robust. However, caution should be exercised when interpreting exact predicted values from the model.

The findings have clear implications for policies related to programmes that aim to reduce spatial income inequalities. The ABIs of the previous Labour government attempted to narrow the gap between the most deprived neighbourhoods and the national average. The results of the growth curve model concur with a number of evaluation studies of the NDC programme by suggesting that practitioners are battling against internal migration to improve the aggregate socioeconomic condition of deprived neighbourhoods (Beatty and Cole, 2009; Beatty et al., 2009; Cole et al., 2007). However, the effect of internal migration on socioeconomic composition is small, on average, even in the most deprived neighbourhoods. Those programmes located in metropolitan
areas, particularly London, could be given special consideration because internal migration appears to be producing poorer neighbourhoods, in terms of the percentage of FSM pupils, compared with neighbourhoods located outside the capital.

Nonetheless, higher skilled young people moving to London for their first graduate job are likely to offset this effect. This is because they might move to relatively deprived neighbourhoods in London to take advantage of cheaper rental prices. Also, internal migration is only one component of socioeconomic area change. In-situ change is likely to offset the effect of internal migration during periods of economic growth. Nonetheless, if policy makers are concerned about the spatial concentration of low-income school children in the most deprived neighbourhoods then the impact of internal migration will be particularly worrying. Poorer pupils are being increasingly surrounding by other poorer pupils, particularly in London, and these pupils are unlikely to live in families with realistic hopes of moving out of the inner city.

The next two chapters will explore the factors that influence migration for neighbourhoods in England. This chapter has shown that the change in the concentration of FSM pupils in the most deprived areas, where its effect is anticipated to be greatest, is small. Therefore, the following empirical chapters will not attempt to explain the small amount of socioeconomic neighbourhood change as a result of internal migration but analyse what drives aggregate migration by socioeconomic status. An attempt to include further explanatory variables in the growth curve model explored in this chapter did not prove insightful. Modelling migration rates rather its effect on socioeconomic area change will provide useful information to policy makers trying to reduce net out-migration from the poorest areas and provide substantive evidence to why deprived areas change as a result of internal migration.
Chapter 6 – Modelling determinants of net migration in the most deprived neighbourhoods

1. Introduction

Socioeconomic neighbourhood change due to internal migration is driven by the action of migrants selectively moving between areas. There are numerous reasons why people move from place to place but the selection of an area of residence appears to be strongly related to a migrant’s own socioeconomic status (Bailey and Livingston, 2007; Ioannides and Zabel, 2008). Those with more economic resources are able to select more attractive locations where they surround themselves with others in similar circumstances. However, those with few economic resources can find themselves trapped in the least attractive locations with limited options for moving except to similar types of areas (see chapter 2, section 4). Chapter 5 shows that the most deprived neighbourhoods increase their percentage of Free School Meals (FSM) primary school-age pupils over time more than less deprived neighbourhoods. Chapter 4 has shown that this is because there is a greater level of net out-migration of non-FSM pupils relative to FSM pupils (see figure 4.4), which suggests higher socioeconomic status families, if they choose to, can move away from these areas more easily (Meen et al., 2005).

This chapter asks what are the area characteristics that are associated with net migration rates of primary school-age pupils by FSM status for the 20% most deprived neighbourhoods in England? These findings will interest policy makers that wish to address income inequality between neighbourhoods because of internal migration. In England, a key feature of neighbourhood policy under the previous Labour government was to rejuvenate deprived areas, in part, by persuading existing residents not to leave (SEU, 2001). An identification of the types of deprived neighbourhoods where this is more difficult to accomplish will be important in terms of evaluating the success towards this objective as well as the broader aim of reducing spatial income inequalities. The analysis of net migration by FSM status can provide some insight into the types of deprived neighbourhoods that are most attractive to pupils and their families by socioeconomic status.

Net migration rates are calculated by the average balance of in-migration flows minus out-migration flows between 2002-03 and 2006-07 divided by the average pupil population between
2002 and 2006\textsuperscript{16}. Fotheringham \textit{et al}. (2000) have criticised the use of net migration as a measure of area attractiveness because it does not take account of the spatial structure of areas. For example, an area which is surrounded by a large metropolitan centre is likely to receive more migrants than a coastal area that borders a rural area. Large in-migration flows to the former area may not reflect its attractiveness but its proximity to a population centre. This problem can be overcome to some extent by using a net migration measure rather than a measure of in-migration or out-migration as well as calculating net migration standardised by the population. Nonetheless, the spatial argument is still valid and will be addressed in chapter 7.

An alternative approach could be a spatial interaction model that takes account of the geographical situation of places in terms of their accessibility from all other places. However, it would only be feasible for districts in England (Congdon, 2010; Fotheringham \textit{et al}.., 2000). A spatial interaction model applied to all neighbourhoods\textsuperscript{17} in England would require analysis of a migration matrix of 32,482 by 32,482 areas which would create over one thousand million cases of migration flows. Moreover, the aim of this chapter is not to provide a measurement of intrinsic neighbourhood attractiveness but to analyse the actual pattern of migration and how it is changing the population within deprived neighbourhoods. Factors related to net migration based on the findings from previous studies are modelled to determine the characteristics of neighbourhoods that are most and least attractive to pupils by FSM status.

Most of the literature on internal migration tends to focus on flows between regions or districts (see chapter 2, section 4). The main predictors of regional migration flows are related to aggregate labour market indicators, for example, unemployment rate, (Coulombe, 2006; Gordon and Molho, 1998; Hamalainen and Bockerman, 2004). However, local movement between neighbourhoods tend to be dominated by residential choices (Boyle \textit{et al}.., 1998b). Therefore, the dominant factors related to net migration between neighbourhoods are more likely to be diverse and the importance of housing availability (public or private), local services, and physical neighbourhood characteristics will be higher.

The chapter is structured as follows. Section two explores the explanatory variables used in the analysis by drawing on evidence from existing literature. Section three presents regression

\textsuperscript{16} The migration flows of pupils that improve and decline their FSM status and move between neighbourhoods in a one-year period between 2002-03 and 2006-07 are added to the non-FSM and FSM flows respectively.

\textsuperscript{17} Represented by LSOAs (see chapter 4, section 2).
analysis of the independent effect of each selected variable. Section four provides a summary and discussion.

2. Explanatory variable selection for linear net migration model

In the UK, the most detailed coverage of data about the people that reside in neighbourhoods comes from the decennial census. Census data can be used to describe a range of demographic, socioeconomic and housing characteristics for neighbourhoods which will be related to area attractiveness or net migration. However, a number of factors which are likely to be related to net migration are not measured. The census does not include data on the physical characteristics of neighbourhoods, for example.

The English Indices of Multiple Deprivation (IMD) provide a more complete array of neighbourhood characteristics including environmental and physical attributes. The IMD 2004 was a breakthrough area deprivation measure in the UK because it did not solely rely on census data and was available at a sub-ward spatial scale. It has used a wide range of datasets and indicators to measure neighbourhood disadvantage (CLG, 2008b, 2011a; ODPM, 2004). The indicators are available via the ONS neighbourhood statistics website for each of the deprivation domains including barriers to services, crime, and living environment (ONS, N.d.). The data for the IMD 2004 was largely collected between 2001 and 2002.

An important gap in national data at the neighbourhood level which is likely to be related to migration concerns the measurement of perceived area quality. Perceived neighbourhood quality is perhaps more important in terms of a selection of a place of residence than objective measures (Dahl et al., 2010). Data for perceived area quality would be useful for migration analysis because objective and perceived measures may not always be perfectly correlated. Roosa et al. (2003) suggest that:

“by relying solely on objective indicators of neighborhood quality, most research may have eliminated an important source of individual and family differences in response to neighborhood conditions” (Roosa et al., 2003, p.60).

This is because people rarely have perfect information about crime levels, for example, and they have difficulty comparing one area against another objectively.
The rest of this section will introduce the factors included in the analysis and discuss why they are expected to be related to area attractiveness for all pupils, non-FSM pupils and FSM pupils. All variables were taken from the 2001 Census Key Statistics unless stated otherwise. The factors may not represent the pupil population living in a deprived neighbourhood. Nonetheless, they will provide an indication of the type of deprived neighbourhoods that are associated with net migration by FSM status. The variables used in this chapter are divided into five categories relating to: the housing in the neighbourhood (tenure, stock and condition); the socioeconomic profile; the demographic profile; the level of crime and environment; and the local services available.

The housing characteristics of a neighbourhood are expected to be important determinants of net migration. Almost three quarters of all moves recorded by the School Census are within a district (see table 3.3). These short distance moves are often motivated by housing related factors (Boyle et al., 1998b; Clark et al., 2006; Kleinhans, 2009; Parkes and Kearns, 2003; van Ham and Clark, 2009). One of the most important housing characteristics is the tenure profile of the neighbourhood. A large concentration of social housing and private rented housing is unlikely to be an attractive neighbourhood feature except for families that are dependent on these types of housing. These effects are therefore likely to vary for net migration of FSM and non-FSM pupils because the former will be more dependent on social and other rented housing (Hobcraft and Kiernan, 2001). The proportion of residents in social housing and private rented housing are included in the analysis.

The nature of the housing stock in a neighbourhood is also likely to be related to net migration. Detached housing is often the most favoured, which is reflected by its cost (Adair et al., 1996; Bramley and Pawson, 2002). This type of housing provides desirable features including private green space. However, it is only available at a premium (Bramley and Pawson, 2002; Loram et al., 2007). It is expected that detached housing will be positively related to net migration. However, this is much more likely to be the case for non-FSM pupils than FSM pupils because detached housing, on the whole, is likely to be out of the reach of low-income families.

Terraced housing on the other hand is often the least desirable housing type even when it is privately owned. Areas of low housing demand tend to include large proportions of terraced housing particularly in parts of the North and Midlands of England (Bramley and Pawson, 2002).
Bramley and Pawson (2002) point out that contemporary preferences have moved away from terraced developments in favour of semi-detached housing. There are neighbourhoods in large metropolitan areas, most notably London, where terraced housing is desirable and expensive (Hamnett, 2009). However, it is hypothesised that, on average, deprived neighbourhoods with higher levels of terraced housing will be negatively associated with net migration. This is more likely to be the case for non-FSM pupils than FSM pupils. The proportions of household spaces that are detached and terraced are included in the analysis.

The quality of housing stock regardless of its type and tenure is likely to be a feature that people will consider when moving. Neighbourhoods with a high proportion of houses in poor condition are unlikely to attract in-migrants. It is expected that FSM and non-FSM pupils and their families will avoid these neighbourhoods because not all low cost housing, including social housing is in poor condition. Data produced for the IMD 2004 modelled the proportion of social and private housing in poor condition for neighbourhoods using results from the English House Condition Survey. This data was also used by Fotheringham et al. (2004) to model out-migration from Family Health Service Areas in England and Wales. The proportion of houses in poor condition is included in the analysis. Other studies have used variables which indicate the facilities available inside the house including the proportion of households without central heating (Boyle et al., 1998b). However, the proportion of households without central heating in the 20% most deprived neighbourhoods is less than a third of one percent. Therefore, this variable is not included in the analysis.

An important requirement for a neighbourhood to increase or decrease its population considerably through internal migration is the construction or demolition of household spaces. Previous studies have found that newly built private housing is positively related with net in-migration flows at the local level (Boyle et al., 1998b). Unfortunately, there are no national datasets which provide the number of housing completions and demolitions at the neighbourhood level. However, the lack of suitable housing in a neighbourhood can be indirectly measured by the level of overcrowding (ODPM, 2004). A deprived neighbourhood with a large proportion of residents living in overcrowded housing is not likely to attract in-migrants regardless of FSM status. Overcrowding can be measured from 2001 Census data where there is one room too few for the number of occupants in the household (Wathan et al., 2004).
While, the nature of migration flows between neighbourhoods may be dominated by housing choices, the socioeconomic profile of a neighbourhood is also expected to be an important factor influencing net migration. South and Crowder (1997) suggest that high unemployment is an unattractive neighbourhood characteristic as it reflects limited employment opportunities. People that live within high unemployment areas will find it difficult to move away and others will avoid moving in. The 2001 Census measure of unemployment does not include a large proportion of working age people who are out of work. Worklessness, rather than unemployment, can provide a better indication of the employment opportunity available to a resident in a neighbourhood. This can be measured using the proportion of working age people claiming out of work benefits (Income Support, Incapacity Benefit or Job Seekers Allowance) using data from the Department for Work and Pensions. This will exclude working age people who have withdrawn from the labour market due to retirement, student status and family duties where their spouse is employed. It is expected that net migration will be negatively associated with worklessness. The relationship is expected to be stronger for non-FSM pupils than FSM pupils because poor families will find it more difficult to avoid neighbourhoods with limited employment opportunities. The proportion of working age people claiming an out of work benefit in 2001-2002 (worklessness) is included in the analysis.

There is a suggestion that those who have more choice about where they live will choose areas where they are surrounded by others in similar or better economic circumstances to their own (North and Syrett, 2006). Aspirations to live amongst higher socioeconomic groups are unlikely to be realised by poor households through their own means (see chapter 2, section 4). Therefore, it is unlikely that net migration of FSM pupils will be positively associated with the percentage of higher income earners in a deprived neighbourhood. There is no national dataset that measures income at the neighbourhood level directly. Model-based estimates have been produced by ONS using data from the Family Resources Survey, 2001 Census and administrative benefits data. The estimates are therefore highly correlated with measures in the census that are known to be strongly associated with income. One of the most common measures used by other authors from the census is car ownership (Johnson et al., 2010). Some studies have taken the ownership of one car or the total number of cars owned by the household as an indicator of higher income. However, the relationship between car ownership and income is likely to vary across urban and rural areas, and especially in central London. In central London and to a lesser extent other large cities in England, the need for a car is much less than in rural areas.
Car ownership is strongly correlated with another measure in the census that indicates the presence of higher income households, the proportion of residents employed in managerial and professional occupations. This measure is used to test the hypothesis of whether net migration is associated with higher income residents. Other measures of high income concentration that have been used by previous studies to predict migration are house prices and residents with a degree level qualification (Congdon, 2010; Fotheringham et al., 2000). House price data is not available for LSOA neighbourhoods but data is available at the ward level for houses that have changed ownership during a one-year period. Such house price data only reflects the value of properties sold during a given period rather than the value of all properties in an area. In the UK, large scale valuations of residential property or land prices are taken for local taxation bands. The last survey of this kind was in 1993 for Council Tax bands and therefore these records are now largely out of date. Measures of high income concentration including house prices, residents with a degree, and car ownership are all strongly correlated (analysis not shown here) with the proportion of residents aged 16-74 employed in managerial and professional occupations and therefore only the latter is included in the analysis.

The demographic profile of a neighbourhood is also likely to be an attractive feature. In general, migrants are attracted to areas with low population density. There have been a number of studies which have documented the process of counterurbanisation from UK cities which some argue has been motivated by a desire to move away from densely populated urban settlements (Champion, 1989; Halfacree, 2008). Boyle et al. (1998b) state that non-urban residential areas offer quality of life attractions, notably in terms of open space and better housing. These features are only available at a higher cost and therefore restrict low-income household’s ability to reside in these locations. Therefore, net migration of non-FSM pupils is more likely to be negatively related to population density than net migration of FSM pupils. Population density can be measured from the 2001 Census by the number of residents per hectare of the neighbourhood.

Other demographic features of the neighbourhood will be important to migrants. The age and ethnic profile of a neighbourhood have been considered as determinants of net migration in previous studies. Some authors have suggested that migrants are attracted by areas with an older age profile. However, these results are inconsistent (Fotheringham et al., 2000; Li et al., 2009). In order to test this hypothesis, the proportion of children (aged 15 or less) and elderly residents (aged 65 and over) in the neighbourhood are included in the analysis. Previous research has also shown that areas with a high proportion of single person households are related to migration.
because single people find it much easier to migrate (Boyle et al., 1998a). This is unlikely to be related to movements of primary school-age pupils and their families because most will contain at least one parent and a pupil.

A more contentious determinant of net migration is the ethnic profile of a neighbourhood. Fotheringham (2000) and Boyle et al. (1998b) have used the percentage of white and non-white residents as explanatory predictors of migration in the UK. In both studies the effect has been shown to be insignificant. However, Catney and Simpson (2010) have found that there is a selective movement away from areas of historic immigrant settlement in England and Wales where ethnic minorities remain concentrated. The probability of moving away was higher for higher occupational class individuals. The authors do not suggest that this out-migration is motivated by the high ethnic concentration but individual aspirations to live in more suburban surroundings. There are also a number of studies in the Netherlands and Sweden using register-based datasets that allow neighbourhood level migration analysis which have shown individuals are likely to move away from areas of high ethnic minority concentration (Feijten and van Ham, 2009; Li et al., 2009; van Ham and Clark, 2009; van Ham and Feijten, 2008).

It is hypothesised that higher levels of ethnic minority residents in a deprived neighbourhood will be negatively associated with net migration of pupils. This is more likely to be the case for non-FSM pupils than FSM pupils as more affluent families will be able to choose to avoid high ethnic concentration neighbourhoods. The proportion of residents identifying as Asian and Black are considered separately because these two groups tend not to be concentrated in the same neighbourhoods (Poulsen and Johnston, 2008). The proportion of residents that moved into a neighbourhood from outside the UK in the twelve months prior to the census is also included in the analysis. This is to test whether there is any difference in terms of neighbourhood attractiveness for areas of recent and historic immigrant settlement. According to the 2001 Census more than 50% of ethnic minority residents in England were born in the UK (Author’s own calculations).

A number of authors have suggested that neighbourhoods with high levels of crime will be unattractive places to live (Kearns and Parkes, 2003; Morenoff and Sampson, 1997; Sampson and Wooldredge, 1986). Most of the research that has tested this effect is from the US where serious crime is more prevalent compared with the highest crime areas in the UK. The measure used in this chapter is taken from the IMD 2004 crime indicator which was calculated by combining
standardised rates of violence, theft, burglary and criminal damage offences recorded by the
police using weights generated by factor analysis. These crimes are considered to be the most
aggravating to communities (ODPM, 2004). However, they only include recorded crimes which
often are inconsistently collected at the neighbourhood level across the country and do not
include offences not reported to the police. It is hypothesised that deprived neighbourhoods with
a higher value for the crime indicator will be negatively related to net migration.

The physical environment of a neighbourhood is largely synonymous with the wider local area
characteristics. There are a number of physical features which previous authors have identified as
related to area attractiveness. Congdon (2010) and Li et al. (2009) find that the proportion of
green space in an area is a positive predictor of migration. Fotheringham et al. (2000) find that
the more urban a district the less attractive to migrants it is. The proportion of hectares of a
neighbourhood covered by green space and non-domestic buildings are used to test these
hypotheses using land use data produced by the Office for the Deputy Prime Minister which use
Ordnance Survey maps to allocate space into nine land categories (CLG, 2007).

The classification of the district in which a neighbourhood is located in, based on an urban rural
typology, is used to categorise areas as described in chapter 5, section 2. Neighbourhoods were
separated by their district in terms of metropolitan, town and rural categories. Whether the
neighbourhood is located within London is also included in the analysis based on the findings
from chapter 5 which shows neighbourhoods in London are distinct from neighbourhoods in
other regions in terms of the effect of internal migration on socioeconomic neighbourhood
change. Almost a third of deprived neighbourhoods are located in London. Another feature of a
local environment related to area attractiveness is climate. A number of studies have found that
net migration between US states is strongly related to climate (Poston et al., 2009; Rebhun and
Raveh, 2006). However, climate is very similar within England and therefore it was not considered
in the current analysis.

Finally, it was expected that net migration would be related to the level of services and amenities
accessible from a neighbourhood. The IMD 2004 measured the straight line distance from a
neighbourhood population weighted centroid to a supermarket, GP premises and Post Office.
Each of these measures is included in the analysis. A crude measure of quality of local schools is
also included in the analysis rather than distance to a school. This is because migrants are unlikely

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18 Categorisation by each GOR did not provide significant differences.
to prioritise neighbourhoods if amenities, particularly schools, are close but have a reputation of poor quality. Burgess et al. (2006) found that less than half of secondary school pupils attend their nearest school and that non-FSM pupils are less likely to attend their nearest school if the quality of the local school is low. The average point score for GCSE results is included in the analysis to test this effect.

Table 6.1 shows descriptive data for each of the selected explanatory variables for the 20% most deprived neighbourhoods in England excluding those with a population of less than 30. A number of variables are negatively skewed, for example, deprived neighbourhoods had zero, or very close to zero, residents identifying as Black. The percentage detached housing, population density, percentage Black, percentage Asian, percentage immigrants, percentage non-domestic buildings, distance to GP premises, and distance to supermarket are all transformed using their natural logarithm. This reduces the influence of the small number of areas with extreme values for each variable and ensures a linear relationship with the net migration rate for deprived neighbourhoods in England.
Table 6.1 - Descriptive statistics of selected explanatory variables for 20% most deprived neighbourhoods

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Housing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Social</td>
<td>0.65</td>
<td>89.95</td>
<td>45.73</td>
<td>18.93</td>
</tr>
<tr>
<td>% Private rented</td>
<td>1.00</td>
<td>78.68</td>
<td>15.20</td>
<td>10.38</td>
</tr>
<tr>
<td>% Detached</td>
<td>0.00</td>
<td>83.64</td>
<td>4.22</td>
<td>3.59</td>
</tr>
<tr>
<td>% Terraced</td>
<td>0.00</td>
<td>95.00</td>
<td>34.82</td>
<td>21.13</td>
</tr>
<tr>
<td>% Poor condition</td>
<td>9.00</td>
<td>70.00</td>
<td>41.45</td>
<td>9.06</td>
</tr>
<tr>
<td>% Overcrowded</td>
<td>2.19</td>
<td>57.81</td>
<td>15.46</td>
<td>9.26</td>
</tr>
<tr>
<td><strong>Socioeconomic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Workless</td>
<td>1.41</td>
<td>74.40</td>
<td>28.31</td>
<td>9.51</td>
</tr>
<tr>
<td>% Managerial or professional</td>
<td>3.11</td>
<td>63.02</td>
<td>17.81</td>
<td>10.34</td>
</tr>
<tr>
<td><strong>Demographic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population density</td>
<td>0.60</td>
<td>837.70</td>
<td>70.83</td>
<td>50.69</td>
</tr>
<tr>
<td>% Children</td>
<td>2.09</td>
<td>41.29</td>
<td>22.02</td>
<td>5.73</td>
</tr>
<tr>
<td>% Elderly</td>
<td>1.00</td>
<td>40.60</td>
<td>13.34</td>
<td>5.52</td>
</tr>
<tr>
<td>% Black</td>
<td>0.00</td>
<td>62.17</td>
<td>7.58</td>
<td>10.43</td>
</tr>
<tr>
<td>% Asian</td>
<td>0.00</td>
<td>93.71</td>
<td>11.48</td>
<td>18.28</td>
</tr>
<tr>
<td>% Immigrants</td>
<td>0.00</td>
<td>9.60</td>
<td>1.01</td>
<td>1.16</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crime score</td>
<td>-1.60</td>
<td>3.13</td>
<td>0.82</td>
<td>0.62</td>
</tr>
<tr>
<td>% Non-domestic buildings</td>
<td>0.00</td>
<td>53.27</td>
<td>6.84</td>
<td>6.73</td>
</tr>
<tr>
<td>% Green space</td>
<td>0.00</td>
<td>95.83</td>
<td>25.95</td>
<td>19.29</td>
</tr>
<tr>
<td>London</td>
<td>0.00</td>
<td>1.00</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>0.00</td>
<td>1.00</td>
<td>0.81</td>
<td>0.39</td>
</tr>
<tr>
<td>Town</td>
<td>0.00</td>
<td>1.00</td>
<td>0.15</td>
<td>0.35</td>
</tr>
<tr>
<td>Rural</td>
<td>0.00</td>
<td>1.00</td>
<td>0.04</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance to GP premises</td>
<td>0.05</td>
<td>11.67</td>
<td>0.87</td>
<td>0.72</td>
</tr>
<tr>
<td>Distance to supermarket</td>
<td>0.15</td>
<td>9.01</td>
<td>0.92</td>
<td>0.55</td>
</tr>
<tr>
<td>Distance to Post Office</td>
<td>0.13</td>
<td>2.67</td>
<td>0.67</td>
<td>0.29</td>
</tr>
<tr>
<td>GCSE score</td>
<td>0.00</td>
<td>684.50</td>
<td>279.76</td>
<td>60.96</td>
</tr>
</tbody>
</table>

Deprived neighbourhoods   6,316

3. Determinants of net migration by FSM status

The variables that are expected to have a theoretical relationship with the net migration rate for deprived neighbourhoods are modelled for all pupils, FSM pupils and non-FSM pupils. Linear regression models are used where the dependent variable is the net migration rate. The results from each model are shown in table 6.2. The net migration rate for all pupils is significantly associated with variables in each of the five variable groups (housing, socioeconomic, demographic, environment and services). This model explains almost 20% of the variance in the
dependent variable (indicated by the value of R-squared statistic). For FSM pupils the net migration rate is significantly associated with housing, socioeconomic, demographic and environment variables. The R-squared statistic is 0.09 (9% of variance explained). This corroborates Nord’s (1998) suggestion that the poor do not respond to the same extent to common migration determinants. The results of the model for non-FSM pupils are very similar to those for all pupils.

There are a number of variables that are not significant predictors of net migration in any of the models. Population density, children, green space, and access to GP premises, supermarket and Post Office are all insignificant at the 90% level in each model.

The statistically significant housing influences of higher net migration for all pupils are lower rented housing (social and private), lower terraced housing, fewer houses in poor condition, and fewer households overcrowded. The socioeconomic influences of higher net migration are fewer workless and managerial and professional residents. The negative relationship between the net migration of all pupils and managerial and professional residents, after controlling for all other variables, may reflect a difficulty many families with primary school-age children face moving into these areas where house prices are higher than other deprived neighbourhoods. The avoidance is therefore likely to reflect a restriction rather than an unattractive feature as a place of residence. Congdon (2010) suggests that seeking out areas with lower house prices might be a component of counterurbanising moves.

The demographic influences on net migration for all pupils are as hypothesised. Higher net migration is associated with a higher proportion of residents aged 65 and over, and a lower proportion of Black residents and Asian residents in a deprived neighbourhood. Pupils, as a whole, are moving away from deprived neighbourhoods with a higher level of crime and higher proportion of non-domestic building land space. Deprived neighbourhoods in rural districts, relative to neighbourhoods in metropolitan districts, have lower net migration rates of all pupils. This may reflect the unattractive nature of deprived neighbourhoods located in rural surroundings. These neighbourhoods will not have the benefits of access to services which deprived urban neighbourhoods might have but all the negative effects that high levels of deprivation bring. The GCSE score is the only significant ‘services’ variable in the model for all pupils. Higher scores are associated with higher net migration rates as anticipated.
The similarities and differences between the model results for FSM pupils and non-FSM pupils are interesting. Both socioeconomic groups appear to be avoiding deprived neighbourhoods with higher levels of social housing, housing in poor condition, overcrowded housing, worklessness and non-domestic building land space. There is also an attraction of both FSM and non-FSM pupils towards deprived neighbourhoods with a higher proportion of elderly residents. Nonetheless, there are discriminating effects by FSM status. The proportion of detached housing is negatively associated with net migration of FSM pupils and positively associated with the net migration of non-FSM pupils. This is likely to reflect the fewer options families with FSM children have in terms of selection of a place of residence because they are restricted to low cost housing. In 2001, more than 50% of detached housing in deprived neighbourhoods was owned either outright or with a mortgage. The parents of children claiming FSM are unlikely to be able to purchase a house particularly when it is detached because it is more expensive than other dwelling types, on average. Net migration of non-FSM pupils is associated with lower levels of terraced housing and private rented housing. This is also likely to reflect the ability of non-FSM pupils and their families to make housing choices which FSM pupils and their families are unlikely to be able to match because they are more dependent on types of housing which are affordable.

The proportion of immigrants in a deprived neighbourhood has a contrasting effect on the net migration of FSM pupils compared with non-FSM pupils. Net migration of FSM pupils is positively associated with the level of recent immigrants living in the neighbourhood whereas net migration of non-FSM pupils is negatively related with this variable. The proportion of residents that are Black or Asian is significantly associated with the net migration of non-FSM pupils and FSM pupils. However, the association is only significant at the 90% level for FSM pupils. Therefore, it appears that non-FSM pupils are more able to move away from deprived neighbourhoods with higher concentrations of the largest ethnic minority groups in the UK. This finding corroborates Catney and Simpson’s (2010) suggestion that movement away from immigrant settlement areas is more likely for more affluent groups.

Two other factors that are associated with the net migration of non-FSM pupils but not FSM pupils are crime and average GCSE score. Deprived neighbourhoods with less crime and better secondary school-age examination performance are likely to be more expensive places to live because these characteristics, especially the latter, will add a premium to the cost of housing. Non-FSM pupils and their families will be more able to find the resources to pay for this premium. The net migration of FSM pupils is higher in deprived neighbourhoods in London compared with
all other regions. This is not the case for non-FSM pupils and perhaps reflects an attraction of the capital to lower income families.

Table 6.2 - Linear model results for neighbourhood net migration rate by FSM status

<table>
<thead>
<tr>
<th></th>
<th>All pupils</th>
<th>FSM pupils</th>
<th>Non-FSM pupils</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>S.E.</td>
<td>Sig.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>1.095</td>
<td>0.764</td>
<td>0.152</td>
</tr>
<tr>
<td>Social housing</td>
<td>-0.01</td>
<td>0.004</td>
<td>0.019</td>
</tr>
<tr>
<td>Private rented housing</td>
<td>-0.066</td>
<td>0.008</td>
<td>0.000</td>
</tr>
<tr>
<td>Detached housing (log)</td>
<td>0.058</td>
<td>0.067</td>
<td>0.386</td>
</tr>
<tr>
<td>Terraced housing (log)</td>
<td>-0.01</td>
<td>0.002</td>
<td>0.000</td>
</tr>
<tr>
<td>Poor condition housing</td>
<td>-0.02</td>
<td>0.005</td>
<td>0.000</td>
</tr>
<tr>
<td>Household overcrowding</td>
<td>-0.034</td>
<td>0.009</td>
<td>0.000</td>
</tr>
<tr>
<td>Worklessness</td>
<td>-0.02</td>
<td>0.006</td>
<td>0.022</td>
</tr>
<tr>
<td>Managerial or professional</td>
<td>-0.013</td>
<td>0.008</td>
<td>0.078</td>
</tr>
<tr>
<td>Population density (log)</td>
<td>-0.101</td>
<td>0.094</td>
<td>0.283</td>
</tr>
<tr>
<td>Children</td>
<td>0.008</td>
<td>0.012</td>
<td>0.499</td>
</tr>
<tr>
<td>Elderly</td>
<td>0.091</td>
<td>0.011</td>
<td>0.000</td>
</tr>
<tr>
<td>Black residents (log)</td>
<td>-0.119</td>
<td>0.043</td>
<td>0.006</td>
</tr>
<tr>
<td>Asian residents (log)</td>
<td>-0.112</td>
<td>0.04</td>
<td>0.005</td>
</tr>
<tr>
<td>Immigrants (log)</td>
<td>-0.037</td>
<td>0.058</td>
<td>0.525</td>
</tr>
<tr>
<td>Crime indicator</td>
<td>-0.184</td>
<td>0.068</td>
<td>0.007</td>
</tr>
<tr>
<td>Non-domestic buildings (log)</td>
<td>-0.214</td>
<td>0.043</td>
<td>0.000</td>
</tr>
<tr>
<td>Green space</td>
<td>0.002</td>
<td>0.003</td>
<td>0.542</td>
</tr>
<tr>
<td>London</td>
<td>0.365</td>
<td>0.183</td>
<td>0.046</td>
</tr>
<tr>
<td>Town</td>
<td>-0.108</td>
<td>0.122</td>
<td>0.375</td>
</tr>
<tr>
<td>Rural</td>
<td>-0.778</td>
<td>0.199</td>
<td>0.000</td>
</tr>
<tr>
<td>Distance to GP premises (log)</td>
<td>-0.061</td>
<td>0.082</td>
<td>0.458</td>
</tr>
<tr>
<td>Distance to supermarket (log)</td>
<td>0.019</td>
<td>0.081</td>
<td>0.82</td>
</tr>
<tr>
<td>Distance to Post Office</td>
<td>-0.042</td>
<td>0.148</td>
<td>0.775</td>
</tr>
<tr>
<td>GCSE score</td>
<td>0.002</td>
<td>0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.193</td>
<td></td>
<td>0.09</td>
</tr>
</tbody>
</table>

R-squared 0.193 0.09 0.192
An important step when fitting any regression model is to check the assumptions have been met. Diagnostic checks for normality and constant variance of residuals are shown in figures 6.1-6.3 for each model. There are a small number of outlying residual values, particularly for the FSM net migration model. However, the number of these cases is small enough not to unduly influence the results of the model.

**Figure 6.1 - All pupils model residual values**

a) Normal probability plot of regression standardised residuals

![Normal probability plot](image1)

b) Scatterplot of regression standardised residuals against predicted values

![Scatterplot](image2)
Figure 6.2 - FSM pupils model residual values

a) Normal probability plot of regression standardised residuals

b) Scatterplot of regression standardised residuals against predicted values
4. Discussion

The analysis in this chapter has shown that FSM pupils are not as able to select deprived neighbourhoods with characteristics that non-FSM pupils, and the migration literature suggests people as a whole, are prioritising when they move. Housing, socioeconomic, demographic, environment, and service features of deprived neighbourhoods are significant predictors of net migration rates for all pupils. The findings are very similar for the net migration of non-FSM pupils. The net migration of non-FSM pupils was negatively associated with social, private, terraced housing, and housing in poor condition. In contrast, it is positively associated with
detached housing which reflects the preference for neighbourhoods where this type of housing stock is more prevalent.

There is consistency in the relationship between worklessness and net migration for FSM pupils and non-FSM pupils. Net migration is negatively associated with higher rates of people claiming out of work benefits. This is not surprising, even for net migration of FSM pupils, as people are expected to move towards neighbourhoods where employment opportunities are greater. One of the strongest effects of net migration in all three models is the proportion of elderly residents in a deprived neighbourhood. It is unclear why primary school-age migrants and their families are attracted towards areas with an older age profile. It could be the case that elderly residents are perceived as more congenial neighbours. This could also reflect the more housing opportunities become available in neighbourhoods with a higher proportion of elderly.

All other variables held constant, FSM pupils are not moving towards neighbourhoods with high proportions of detached housing. The net migration of FSM pupils is negatively associated with this characteristic. This is likely to reflect a restriction of housing options rather than choice. The net migration of FSM pupils is negatively associated with public renting, household overcrowding and housing in poor condition which suggests there is an element of choice they can exercise within the low cost housing market. However, this choice is more limited than for non-FSM pupils. This does not mean that FSM pupils and their families are moving into housing which is not overcrowded or in poor condition rather that they are moving to areas where housing, on average, is less overcrowded and not in poor condition. The analysis in this chapter cannot provide inference to the individual because it is conducted at the area level.

The association of net migration and recent immigration produced different results for FSM pupils and non-FSM pupils. Non-FSM pupils are moving away from deprived neighbourhoods with a higher proportion of immigrants. However, FSM pupils are moving towards neighbourhoods with more immigrants. This suggests more affluent families are more likely to move away from these types of neighbourhoods. Crime is a significant predictor of net migration of non-FSM pupils. Unsurprisingly, higher levels of crime deterred pupils and their families moving into deprived neighbourhoods.

Deprived neighbourhoods in London are likely to have a higher net migration rate of FSM pupils than deprived neighbourhoods outside the capital. There was no effect of London for the net
migration rate of non-FSM pupils. However, there is a negative effect of the proportion of non-domestic building land space in a neighbourhood for non-FSM pupils. This suggests a pattern of counterurbanisation, or at least suburbanisation, of non-FSM pupils from deprived urban neighbourhoods. Another distinctive feature of the net migration rate of non-FSM pupils compared with FSM pupils is the association with GCSE score. Non-FSM pupils are moving towards deprived neighbourhoods with higher GCSE scores which may reflect their parents’ desire to place their children in better schools. This is not the case for FSM pupils which suggest their parents are unable to move to neighbourhoods with better schools.

These findings should not be considered causal because other factors may lie behind some of the associations. Also, the models only explain a small proportion of the total variance in net migration, particularly for FSM pupils. Nonetheless, they should be considered by neighbourhood-based regeneration programmes when evaluating success of the retention of residents. Deprived neighbourhoods characterised by low cost housing, worklessness, concentrations of ethnic minorities, high crime and commercial buildings will find it more difficult to retain residents than others. However, policy makers should bear in mind the caveat that the results are based on primary school age pupils attending state schools. Although the School Census appears to represent the migration patterns of the general population quite well (see chapter 3) it will exclude most young adults who are the most migratory age group. The migration of young adults might offset some of the out-migration of more affluent people from deprived urban areas because these areas are often attractive to young professionals.

Cole et al. (2007) find that the most common response to what improvements could be made to out-migrants origin area for those that moved away from New Deal for Communities (NDC) regeneration neighbourhoods was better housing. However, improvements to housing in deprived neighbourhoods should be balanced to meet demands from residents with different income levels. This is because the construction of detached housing in a neighbourhood, for example, is likely to attract affluent families but price low-income families out of the area. Reducing crime and better policing also featured highly as possible improvements mentioned by NDC area out-migrants (Cole et al., 2007). Higher crime was associated with lower net migration with FSM pupils and non-FSM pupils although not significant for FSM pupils. Crime reduction could therefore facilitate area attractiveness for all residents.
The variance which is not explained by the models is likely to be a result of omitted variables related to net migration, in particular, perceived neighbourhood characteristics and general area satisfaction. People do not always have perfect information to evaluate between neighbourhoods when moving and often rely on local reputation (Dahl et al., 2010; Roosa et al., 2003). However, there is no nationally collected data at the neighbourhood level for perceived neighbourhood quality. Moreover, opinion of neighbourhood quality can differ widely between people that live inside and outside of a neighbourhood which makes the effect of neighbourhood quality even more difficult to measure (Dahl et al., 2010; Whitley and Prince, 2005). It is also the case that not everyone is likely to perceive the characteristics described in this chapter in the same way (Parkes et al., 2002). Some people might disregard the fact that there are many business premises in the neighbourhood and their neighbours are recent ethnic minority immigrants because they prefer city living or balance characteristics in favour of those they prefer.

The factors used in the models are also limited to constant variables that do not vary over time. It could be the case that internal migrants are attracted to neighbourhoods that are improving on particular outcomes and avoid areas that are in decline in spite of their starting point or that there are threshold effects after which point a neighbourhood starts to loose or gain residents through internal migration (Meen, 2009; Schelling 1971). For example, a neighbourhood undergoing gentrification that has a high but declining proportion of poor quality housing may attract migrants. It was not possible to test for such effects during the time period that the School Census migration data is available (2000-07) because the vast majority of the explanatory variables used in this chapter are drawn from the census. It is also unlikely to be case that there would be much change in many of these variables based on the amount of change in the concentration of FSM pupils shown in chapters 4-5. Moreover, comparable data for neighbourhoods is rarely collected on a national scale between censuses. It may also be the case that people’s view of a neighbourhood is based on some objective measure, but that measure might be out-dated. Lagged effects are not tested directly in this chapter. However, the net migration rate used as the outcome variable in this chapter relates to a point in time at least two years after most of the independent variables are measured.
Chapter 7 – Modelling spatial variations in neighbourhood out-migration with Geographically Weighted Regression

1. Introduction

This chapter builds on the analysis reported in chapter 6 by taking account of the spatial nature of migration rates for all neighbourhoods in England. The aim is to determine whether the relationship between explanatory variables and migration rates of primary school-age pupils varies across the country. For example, is the effect of worklessness on out-migration greater in the South where the labour markets are more buoyant and enable families to move away from areas of high worklessness more easily? This type of effect is referred to as a spatial non-stationarity effect. The studies discussed in chapter 6 that have modelled internal migration rates on different predictor variables have tended to summarise relationships between migration rates and explanatory variables using global statistical methods or spatial interaction models. The latter require enormous data structures which are not feasible for modelling between neighbourhood migration flows (see chapter 6, section 1). Empirical studies using global linear regression have crudely taken account of the spatial structure of data using categorisations of areas within higher geographical units, for example, dummy variables for the region a smaller area is located in (Fotheringham et al., 2004). However, this imposes an apriori spatial structure on the effect of explanatory variables on the outcome which may or may not reflect reality.

This chapter compares modelling results from standard Ordinary Least Squares (OLS) regression (see chapter 6) and Geographically Weighted Regression (GWR) for out-migration rates. The application of GWR can take account of spatial non-stationarity and spatial dependency. Spatial dependency is the extent to which the value of an attribute in one location depends on the values of the attribute in nearby locations (Fotheringham et al., 2002). This is likely to be true for migration rates which are a result of people moving across space. Neighbourhoods that people are more likely to move from are likely to be spatially concentrated. Therefore, neighbourhoods are likely to share characteristics with their neighbours. This idea originates from Tobler’s classic first law of geography that states “everything is related to everything else, but near things are more related than distant things” (Tobler, 1970, p.236). The spatial dependency of out-migration and its relationship with explanatory variables might simply reflect regional or local housing markets. In this case a fixed effect in a global model would be appropriate if they represented
these boundaries. However, GWR allows an analyst not to have to set a priori boundaries. It therefore treats space as a continuous variable rather than categorical.

Out-migration rates are used rather than net migration in this chapter because the aim is to determine what is associated with aggregate migration flows rather than the net effect of migration on population change. Net migration can cancel out an effect of migration where both inflows and outflows are high. Out-migration is considered a preferred measure of aggregate migration flows to in-migration because people tend to move from a more evenly distributed cross-section of neighbourhoods than they move to (see chapter 3, section 6). Therefore, this chapter brings the analysis in this thesis full circle. It will add to the literature on migration modelling that has been used to describe the impact of migration on socioeconomic neighbourhood change in the preceding chapters by exploring the drivers of migration. In chapter 6, neighbourhoods with a small population are excluded because their inclusion produces non-normally distributed residual model values, particularly for FSM pupils. This is because neighbourhoods with no or few primary school-age pupils tend to have a zero net migration rate or very high (positive or negative) net migration rate. All neighbourhoods in England are included in this chapter as the distribution of out-migration rates for all pupils follows a normal distribution.

Figure 7.1 shows the location of the population weighted centroids for the 32,482 Lower Super Output Area (LSOA) neighbourhoods in England. These are used as the data points in the GWR model. Population weighted centroids were created from the results of the 2001 Census for LSOA neighbourhoods which act as summary points of local population distribution (Martin, 2002). There are clusters of neighbourhood centroids within the major population centres including Greater London, West Midlands, Greater Manchester, West Yorkshire, Merseyside, South Yorkshire, and Tyne and Wear.

The chapter is structured as follows. The next section discusses the GWR modelling approach and the variables selected for inclusion in the model. Section three presents results of comparable OLS and GWR models. Section four discusses the implications of the substantive results for policy and theory related to internal migration.
2. Geographically weighted regression model specification

GWR is a technique specifically designed to analyse spatial relationships that are not accounted for by standard OLS regression (Fotheringham et al., 2002). GWR is a form of ‘local’ modelling where the relationship between the dependent variable and independent variables is allowed to vary from place to place compared with a ‘global’ OLS model where a single parameter estimate is produced. GWR produces local parameter estimates for each regression point that are weighted by distance from every other data point. Observations that are located closer to one another are weighted more heavily than those further away.

The model can be specified as follows:

\[ y(g) = \beta_0(g) + \beta_1(g)x_1 + \varepsilon \]
Where $y$ is the dependent variable, $x_1$ is an explanatory variable, $b_0$ and $b_1$ are the parameters to be estimated, $\varepsilon$ is the random error term and (g) indicates a weighted scheme for the parameters.

An important decision when fitting a GWR model is the choice of the weighting function (the spatial kernel and its bandwidth). Figure 7.2 shows the weighting function graphically. It shows that the weighting ($w_{ij}$) of a data point on a regression parameter for a particular location ($X$) becomes smaller the further away in distance ($d_{ij}$) that data point is located. A weighting function is used to estimate the regression parameters for each location in the data.

**Figure 7.2 - Example spatial weighting function**

![Example spatial weighting function](image)

The weighting function can be fixed using a bandwidth that is constant throughout the study area. The study area refers to all neighbourhoods in England in this chapter. Alternatively, an adaptive spatial weighting function may be used, which adopts a variable bandwidth. That is to say, according to data density variations, higher weights are assigned where data are more scattered, and lower weights where data are denser or more abundant (Pineda Jaimes et al., 2010). There are two reasons for choosing an adaptive weighting function for neighbourhoods in England. Firstly, where neighbourhoods are dense relationships can be examined over shorter distance which might be missed with a larger fixed weighting function. Secondly, where neighbourhoods are sparse the standard errors with a fixed weighing function will be high because the number of data points used will be low (Fotheringham et al., 2002).

In practice, the results obtained through GWR tend not to be sensitive to the choice of weighting function, but they are sensitive to the determination of bandwidth. Consequently, when estimating a model it is necessary to determine the optimum bandwidth (Pineda Jaimes et al., 2010).
For a fixed weighting function the bandwidth will be a distance which is the same for each neighbourhood. If an adaptive weighting function is selected the bandwidth will be a count of the number of nearest neighbourhoods to include in the weighting function (Charlton and Fotheringham, 2009). The bandwidth could be applied directly to the model if it is known a priori. However, this is unlikely and in most instances a cross-validation estimate or Akaike Information Criterion (AIC) of minimum discrepancy estimation will be used. The AIC estimation has the advantage of being more generally applicable, as it can be applied to linear models and logistic or Poisson GWR models. It can also be used to compare whether the results from GWR present a better fit than the global model, taking both models’ degrees of freedom into consideration (Fotheringham et al., 2002).

The optimum weighting function and bandwidth can be determined by examining the model diagnostics. An adaptive weighting function and AIC bandwidth estimation are found to be preferable for the results of the GWR model in this chapter. It produces a bandwidth parameter of 833 nearest neighbourhoods to determine the regression parameters for each local regression point. This means that the regression parameters for each neighbourhood are estimated using a distance decay influence from 2.6% of the surrounding neighbourhoods in England. The effect of a larger bandwidth would be smoother regression results across space and they will appear to be closer to the estimates from a global OLS regression. This is because each regression equation produced for each neighbourhood would take account of a greater number of other neighbourhoods in England. Models are fitted using a fixed weighting function and cross validation bandwidth parameter selection. These models produce lower R-squared values and higher AICc\textsuperscript{19} statistics. Therefore, the methodological criteria indicate poorer model fit. The models are fitted using ArcGIS 10.0.

The variables used to explain variation in out-migration rates for neighbourhoods in England are selected from those described in chapter 6 (section 2) as measures related to net migration. The emphasis of the model in this chapter is best described as predicting migration rather than the net population change as is described in chapter 6. Nonetheless, the influences are expected to be very similar but opposite in the direction of effect. For example, worklessness is expected to be positively related to out-migration compared with negatively related to net migration. The percentage of people aged 16-17 in full-time education is used to replace the GCSE score variable from chapter 6 because this information was missing for almost 1,000 neighbourhoods in 2001.

\textsuperscript{19} AICc is a corrected measure of AIC taking into account sample size
This variable is highly correlated with GCSE score for neighbourhoods without missing data. A higher percentage of 16-17 year olds in full-time education within a neighbourhood suggests that resident pupils have attained high enough GCSE results allowing entry to further education.

The variables are used to fit an OLS model shown in table 7.1. All the variables are significant predictors of out-migration rates in English neighbourhoods with the exception of household overcrowding and distance to a Post Office. The variables are entered into a GWR model in order of their statistical significance from the results of the OLS model. They are entered in a stepwise process and only retained if there is a reduction in the AICc of more than 4 (Charlton and Fotheringham, 2009). The inclusion of some variables led to the model not converging because of local multicollinearity. Multicollinearity occurs when two predictor variables are highly correlated and can lead to changes in the direction of estimated effects. In a GWR model, multicollinearity can occur at the global and local scale. Wheeler and Tiefelsdorf (2005) and Wheeler (2007) have suggested that model diagnostics have been somewhat of an oversight in the application of GWR and that the method is particularly susceptible to multicollinearity.

The ArcGIS 10.0 software provides an error message when local multicollinearity is present in a model and does not converge if this is the case. Global multicollinearity can be tested using the variation inflation factor (VIF) statistic. None of the variables included in the final OLS model have a high level of multicollinearity. A value above 8 for the VIF indicates a problem with global multicollinearity (Field, 2005). The final variables included in the local GWR model are the percentage of private rented housing, terraced housing, worklessness, poor housing and non-domestic building land space in a neighbourhood. Geographic controls for the region and type of district a neighbourhood is located in are not considered for inclusion because this would undermine the GWR procedure.

It is expected that the degree of variation across neighbourhoods would be different for each variable. The effect of worklessness might operate at a larger spatial scale providing smoother results from the GWR model because neighbourhoods are likely to be similar within sub-regional labour markets. However, the effect of the other variables is expected to be more localised. The effect for the proportion of non-domestic building land space in the neighbourhood on out-migration rates might be separated zonally around urban centres. Moreover, the effect of private housing and terraced housing might be even more localised because neighbourhoods located close to one another might have differing housing characteristics. Nonetheless, the assumption
remains that neighbourhoods located close to one another will have more in common than equivalent neighbourhoods located further apart.

Table 7.1 - OLS regression results for neighbourhood out-migration rate

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>S.E.</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>9.771</td>
<td>0.239</td>
<td>40.949</td>
<td>0.000</td>
</tr>
<tr>
<td>Social housing</td>
<td>-0.022</td>
<td>0.002</td>
<td>-11.697</td>
<td>0.000</td>
</tr>
<tr>
<td>Private rented housing</td>
<td>0.198</td>
<td>0.003</td>
<td>61.978</td>
<td>0.000</td>
</tr>
<tr>
<td>Detached housing</td>
<td>-0.005</td>
<td>0.001</td>
<td>-3.859</td>
<td>0.000</td>
</tr>
<tr>
<td>Terraced housing</td>
<td>0.027</td>
<td>0.001</td>
<td>25.133</td>
<td>0.000</td>
</tr>
<tr>
<td>Poor condition housing</td>
<td>-0.024</td>
<td>0.003</td>
<td>-9.418</td>
<td>0.000</td>
</tr>
<tr>
<td>Household overcrowding</td>
<td>-0.003</td>
<td>0.006</td>
<td>-0.500</td>
<td>0.617</td>
</tr>
<tr>
<td>Worklessness</td>
<td>0.151</td>
<td>0.004</td>
<td>37.132</td>
<td>0.000</td>
</tr>
<tr>
<td>Managerial or professional</td>
<td>-0.028</td>
<td>0.003</td>
<td>-10.424</td>
<td>0.000</td>
</tr>
<tr>
<td>Population density</td>
<td>-0.005</td>
<td>0.001</td>
<td>-6.425</td>
<td>0.000</td>
</tr>
<tr>
<td>Children aged &lt;16</td>
<td>-0.042</td>
<td>0.006</td>
<td>-7.146</td>
<td>0.000</td>
</tr>
<tr>
<td>Elderly aged &gt;64</td>
<td>-0.023</td>
<td>0.004</td>
<td>-5.910</td>
<td>0.000</td>
</tr>
<tr>
<td>Black residents</td>
<td>0.044</td>
<td>0.004</td>
<td>9.951</td>
<td>0.000</td>
</tr>
<tr>
<td>Asian residents</td>
<td>-0.008</td>
<td>0.002</td>
<td>-3.873</td>
<td>0.000</td>
</tr>
<tr>
<td>Immigrants</td>
<td>-0.109</td>
<td>0.021</td>
<td>-5.067</td>
<td>0.000</td>
</tr>
<tr>
<td>Crime indicator</td>
<td>0.355</td>
<td>0.029</td>
<td>12.112</td>
<td>0.000</td>
</tr>
<tr>
<td>Non-domestic buildings</td>
<td>0.065</td>
<td>0.005</td>
<td>14.240</td>
<td>0.000</td>
</tr>
<tr>
<td>Green space</td>
<td>-0.009</td>
<td>0.001</td>
<td>-8.667</td>
<td>0.000</td>
</tr>
<tr>
<td>FE students</td>
<td>-0.018</td>
<td>0.001</td>
<td>-13.331</td>
<td>0.000</td>
</tr>
<tr>
<td>Distance to GP premises</td>
<td>-0.043</td>
<td>0.017</td>
<td>-2.599</td>
<td>0.009</td>
</tr>
<tr>
<td>Distance to Post Office</td>
<td>-0.034</td>
<td>0.034</td>
<td>-0.996</td>
<td>0.319</td>
</tr>
<tr>
<td>Distance to supermarket</td>
<td>-0.115</td>
<td>0.012</td>
<td>-9.483</td>
<td>0.000</td>
</tr>
<tr>
<td>East</td>
<td>0.490</td>
<td>0.090</td>
<td>5.430</td>
<td>0.000</td>
</tr>
<tr>
<td>East Midlands</td>
<td>-0.010</td>
<td>0.097</td>
<td>-0.103</td>
<td>0.918</td>
</tr>
<tr>
<td>North East</td>
<td>-0.226</td>
<td>0.106</td>
<td>-2.123</td>
<td>0.034</td>
</tr>
<tr>
<td>North West</td>
<td>-0.595</td>
<td>0.085</td>
<td>-6.966</td>
<td>0.000</td>
</tr>
<tr>
<td>South West</td>
<td>0.603</td>
<td>0.092</td>
<td>6.582</td>
<td>0.000</td>
</tr>
<tr>
<td>South East</td>
<td>1.107</td>
<td>0.082</td>
<td>13.498</td>
<td>0.000</td>
</tr>
<tr>
<td>West Midlands</td>
<td>0.068</td>
<td>0.086</td>
<td>0.793</td>
<td>0.428</td>
</tr>
<tr>
<td>Yorkshire and The Humber</td>
<td>0.528</td>
<td>0.089</td>
<td>5.962</td>
<td>0.000</td>
</tr>
<tr>
<td>Rural</td>
<td>0.734</td>
<td>0.058</td>
<td>12.741</td>
<td>0.000</td>
</tr>
<tr>
<td>Town</td>
<td>1.111</td>
<td>0.053</td>
<td>21.082</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Adjusted R-squared 0.493
3. Results of Geographically Weighted Regression model

The results from the local GWR model and its global OLS equivalent model are shown in table 7.2. They include the R-squared and AICc values from the GWR and OLS models as well as parameter estimates. The GWR model compared with the OLS model improves the amount of variance explained by the explanatory variables for the out-migration rates of English neighbourhoods by raising the adjusted R-squared value from 0.442 to 0.549. A preferred indication of goodness of fit is the AICc value which if lower in a nested model indicates better model fit (Charlton and Fotheringham, 2009). The AICc is 6,552 lower in the local model indicating better model fit. This suggests that there is a varying effect of some explanatory variables across space that has not been accounted for in the OLS model and that not taking account of this variation could lead to a wrongly specified model. This is because it is assumed that the relationship is constant over space in an OLS model. The interquartile range of the parameter estimates from the GWR model provides an indication of the spatial non-stationarity for each variable. If the interquartile range is greater than twice the standard error derived from the OLS estimate, the relationship exhibits a relatively high degree of spatial non-stationarity (Nelson, 2008) i.e. the effect of the variable varies across neighbourhoods in England.

Table 7.2 - Comparison of parameter estimates from global and local models for out-migration rate

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>Standard Error x 2</th>
<th>p-value</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>5.793</td>
<td>0.119</td>
<td>.000</td>
<td>-</td>
</tr>
<tr>
<td>Private renting</td>
<td>0.200</td>
<td>0.005</td>
<td>.000</td>
<td>1.777</td>
</tr>
<tr>
<td>Terraced housing</td>
<td>0.039</td>
<td>0.002</td>
<td>.000</td>
<td>1.236</td>
</tr>
<tr>
<td>Worklessness</td>
<td>0.146</td>
<td>0.004</td>
<td>.000</td>
<td>1.399</td>
</tr>
<tr>
<td>Poor housing</td>
<td>-0.034</td>
<td>0.005</td>
<td>.000</td>
<td>2.027</td>
</tr>
<tr>
<td>Non-domestic buildings</td>
<td>0.083</td>
<td>0.008</td>
<td>.000</td>
<td>1.319</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td></td>
<td></td>
<td></td>
<td>0.442</td>
</tr>
<tr>
<td>AICc</td>
<td></td>
<td></td>
<td></td>
<td>164,906</td>
</tr>
</tbody>
</table>
The estimates from the GWR model for each of the explanatory variables indicate the presence of a non-stationary effect on the out-migration rates across neighbourhoods in England. The global OLS estimate for private renting is positive which suggests in neighbourhoods with a higher percentage of private renting households there will be a higher out-migration rate when controlling for the other variables in the model. This is not surprising as people living in private rented accommodation tend to be highly mobile even when controlling for other individual characteristics (Champion et al., 1998; Finney and Simpson, 2008). This is because they have more residential flexibility than social renting tenants and owner occupiers.

The local estimates for the effect of the percentage of private renting on the out-migration rate in a neighbourhood ranged from -0.024 to 0.413. This suggests in some neighbourhoods there is a small negative effect of private rented households on the out-migration rate whereas in most other neighbourhoods there is a large positive effect. Therefore, if a policy maker was advised to reduce the number of private rented houses in a neighbourhood to reduce the out-migration rate they would find that this intervention would have a very different effect in different parts of the country. For example, if the two neighbourhoods at the extremes of the GWR model estimate range had 10% of households living in private rented housing the predicted difference between the out-migration rates would be 5% when all other effects are held constant.

Figures 7.3-7.7 show the distribution of each local estimate from the GWR model using the natural break classification in ArcGIS 10.0 (ESRI, 2008). Figure 7.3 displays the patterns of spatial variation in the effect of private renting on out-migration from the local model. Neighbourhoods

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20 Classes are based on natural groupings inherent in the data. ArcGIS identifies break points by picking the class breaks that best group similar values and maximize the differences between classes. The features are divided into classes whose boundaries are set where there are relatively big jumps in the data values.
with an insignificant local estimate are highlighted in the lightest shade of grey. These include all the neighbourhoods with a negative effect of private renting on the out-migration rate. The positive effect is strongest in the South East of England particularly along the Essex coast and the North Kent Marshes shown by the darkest shade of grey. The effect is also strongly positively associated with out-migration in neighbourhoods located in Leicestershire, Lincolnshire, Poole, Weymouth, Warrington and St Helens. It is not clear why a higher percentage of private rented households would be more strongly associated with high out-migration rates in this spatially separated selection of neighbourhoods. This requires localised analysis which is outside the bounds of this thesis.

The global effect of the percentage of terraced housing in a neighbourhood is also positive which suggests the greater its value the higher the out-migration rate in a neighbourhood. In chapter 6 (section 3), it is suggested that contemporary preferences have moved away from terraced housing in favour of semi-detached housing which would suggest this effect is not unexpected (Bramley and Pawson, 2002). However, in some neighbourhoods terraced housing can be expensive and desirable (Hamnett, 2009). Forthringham et al. (2002) suggest that within London terraced houses are viewed differently which indicates a non-stationary effect on house prices. The result of a global model would lead to an unsatisfactory answer to whether this was apparent.

The parameter estimates from the local model show that the effect of the percentage of terraced housing in a neighbourhood on the out-migration rate varies from -0.025 to 0.109. Figure 7.4 shows that the positive effect of terraced housing on out-migration is strongest in neighbourhoods across the North and Midlands of England. Bramley and Pawson (2002) have identified this part of the country as containing former industrial and mining areas which include neighbourhoods of low housing demand where late 19th century terraced housing is prevalent and of poor quality by modern standards. In contrast, the local coefficients for the effect of terraced housing show that in the majority of neighbourhoods in the South of England, particularly along the south coast, the effect of terraced housing is marginal (positive or negative) or insignificant.

The effect of worklessness on out-migration is positive when controlling for other variables in the global model. Therefore, a higher percentage of people claiming an out of work benefit in the neighbourhood is related to greater out-migration. This conforms to migration theory that
suggests people will move away from areas where economic opportunity is low (Champion et al., 1998). Nonetheless, empirical studies that have tested this effect have not shown consistent results. Some find that the higher percentage of people out of work can be associated with lower migration from the area (Fotheringham et al., 2004). This is qualified by the assertion that worklessness or unemployment is associated with greater economic deprivation which may limit individuals’ ability to move. One reason for this conflicting finding across previous studies might be a result of the non-stationary effect of worklessness on migration. For example, its effect might differ across broader labour markets which are more and less flexible.

The local parameter estimates for the effect of worklessness on out-migration rates vary from 0.003 to 0.360. This shows that the effect is positive in all areas with the exception of a small number of neighbourhoods in central London where the effect is not significant. Figure 7.5 shows that the effect is strongest in the South East of England (excluding London). The effect is much less strong in neighbourhoods located in parts of the North, particularly in Merseyside and Greater Manchester. This perhaps reflects the ability of households to move away from neighbourhoods of high worklessness more freely when the local labour market conditions are more buoyant. This is likely to be the case in the South East rather than the North of England and may confirm a hypothesis that higher levels of worklessness can both foster and hinder migration.

The parameter estimate from the global model for the effect of the percentage of poor quality housing in a neighbourhood on the out-migration rate was negative. This is unexpected as one might anticipate that neighbourhoods with a higher level of poor quality housing to have higher out-migration as families move towards neighbourhoods with better quality housing. A correlation between the percentage of poor housing and the out-migration rate shows that the bivariate relationship between these variables is positive. It is only when the private renting and worklessness variables are added to the model does the effect become negative. This is likely to reflect the fact that a high proportion of poor quality housing is privately rented and located in higher worklessness neighbourhoods. Therefore, the effect of a high percentage of poor quality housing over and above the effect of private renting and worklessness restricts families from moving away. This could be a result of an inability to afford a house in another neighbourhood with less poor quality housing in the public or private sector. In the private housing sector, a house located in a neighbourhood with a higher proportion of poor quality housing is likely to be worth less than an equivalent house in a neighbourhood with a lower proportion of poor quality housing.
The results from the local model show that the effect of the percentage of poor quality housing on the neighbourhood out-migration rate varies spatially. The local coefficients ranged from -0.201 to 0.130. This indicates that in some neighbourhoods the effect is clearly negative and in others the effect is clearly positive when controlling for other effects in the model. Figure 7.6 shows that the effect is most strongly positive in selected urban areas, particularly London. The effect in all of the largest urban centres in England is either slightly positive or not significant. This suggests that in neighbourhoods with a higher concentration of poor quality housing in urban centres families move away more freely. However, in remote rural areas, particularly North Yorkshire and Lincolnshire, the effect of the concentration of poor quality housing on out-migration is more strongly negative. In neighbourhoods in these locations it might be more difficult to sell houses located in areas of high levels of poor quality housing which restricts people from moving away. Alternatively, it could be the case that families are satisfied with these neighbourhoods even when there is a high level of poor quality housing as they balance this characteristic against other neighbourhood features in more rural areas.

The variable for the percentage of land space that was covered by non-domestic buildings was intended to give an indication of the urbanness of the neighbourhood. It provides a measure of the built-up environment rather than the residential population density. It was suggested in chapter 6 that people are favouring suburban areas which may not have low population density but do not have commercial premises covering the land space. The global parameter estimate for the effect of the percentage of non-domestic building land space in the neighbourhood on the out-migration rate is positive. This suggests that families are moving out of neighbourhoods with a higher proportion of this type of land space.

The local effect of non-domestic building land space on the out-migration rate varies considerably across neighbourhoods in England. In the GWR model, this parameter has the largest interquartile range for its local estimates. Figure 7.7 shows that the effect is slightly negative or insignificant in the largest urban city-regions in England, for example, Greater London, West Midlands, Greater Manchester and West Yorkshire. This suggests that non-domestic building land space does not motivate out-migration from these large urban centres. It might reflect the nature of the non-domestic building land space in urban areas which is more likely to include retail rather than large factories, for example. Families might be less willing to live near power plants but might compromise non-domestic building land space if there is a shopping centre nearby. The
effect tends to be insignificant in neighbourhoods located in city centres where the percentage of non-domestic building space is very high. Moreover, the strong positive effect of non-domestic building land space in neighbourhoods located in town and rural districts suggests families are more selective about this characteristic in these areas. This might reflect the fact that if a family has chosen to live in a more rural area they will not want to compromise on large proportions of non-domestic building land space in the neighbourhood. In neighbourhoods located in Kent, Hampshire, Devon and the Cotswolds, for example, a high percentage of non-domestic building land space in a neighbourhood is associated with higher out-migration when controlling for other variables in the model.

Figure 7.3 - Local private housing GWR coefficients predicting out-migration rate for neighbourhoods in England

Note: darkest shade indicates neighbourhoods with the strongest positive effect
Figure 7.4 - Local terraced housing GWR coefficients predicting out-migration rate for neighbourhoods in England

Coefficient for terraced housing
- -0.025 - 0.030
- 0.031 - 0.046
- 0.047 - 0.064
- 0.065 - 0.109
- Not significant at 95%

Note: darkest shade indicates neighbourhoods with the strongest positive effect
Figure 7.5 - Local worklessness GWR coefficients predicting out-migration rate for neighbourhoods in England

Coefficient for worklessness
- 0.042 - 0.141
- 0.142 - 0.193
- 0.194 - 0.262
- 0.263 - 0.360
- Not significant at 95%

Note: darkest shade indicates neighbourhoods with the strongest positive effect
Figure 7.6 - Local poor housing GWR coefficients predicting out-migration rate for neighbourhoods in England

Note: darkest shade includes neighbourhoods with the strongest positive effect
The GWR model can produce local R-squared values as well as local parameter estimates. These are shown in figure 7.8 for each neighbourhood in England. The R-squared provides a measure of the amount of variance explained in the outcome variable for the regression equation fitted for each neighbourhood. Low values of the R-squared statistic are clustered in central London. Therefore, the explanatory variables explain the least amount of variation in neighbourhood out-migration rates in the capital. This might reflect the unique housing and labour markets that exist in London. Average house prices and earnings tend to be higher in the capital than other parts of the country (Duranton and Monastiriotis, 2002; Holly et al., 2011). This means that the average family will not be able to be as selective regarding the characteristics of the area they reside in compared with neighbourhoods outside of London where housing costs are considerably lower. For example, a family might choose to live in a neighbourhood in London with a high level of
private rented housing, terraced housing, worklessness, poor quality housing or non-domestic building space so they can live in London. However, in neighbourhoods in Kent and Essex, for example, families might be more selective about characteristics known to be associated with moving and therefore the variables in the local model tend to predict a greater variation in the out-migration rates in these areas.

**Figure 7.8 - Local R-squared values for out-migration rate GWR model**

![Image of R-squared values map]

**Note:** darkest shade indicates greatest amount of variance explained

4. **Discussion**

This chapter has explored the spatial variation in the effect of five explanatory variables shown to be significant predictors of out-migration rates of primary school-age pupils for neighbourhoods in England using a standard Ordinary Least Squares regression model. Geographically Weighted
Regression results show that the effect of the percentage of private rented households, terraced housing, worklessness, poor housing and non-domestic building land space on out-migration rates all vary across neighbourhoods in England. This indicates how the standard linear regression model can be wrongly specified and if it was used to implement policies might not have the desired effect in all neighbourhoods across the country. For example, in neighbourhoods in the South East compared with other areas the level of people out of work is more strongly associated with out-migration. This is compared with parts of the Midlands and North of England where the effect is positive but weaker. Therefore, all other variables held constant, a successful intervention to reduce the worklessness in a neighbourhood which was initiated to discourage out-migration will have a greater effect in neighbourhoods in the South East compared with neighbourhoods in the North. The spatially varying effect of worklessness on out-migration might reflect the higher levels of economic dynamism in the South East where labour markets are more buoyant (Boheim and Taylor, 2002; Faggian and McCann, 2009; McCormick, 1997).

There are a number of limitations of the current analysis. Geographically Weighted Regression is described as an exploratory technique for identifying spatially varying relationships between outcome and explanatory variables and its parametric qualities as a statistical method have been questioned (Wheeler and Tiefelsdorf, 2005; Wheeler, 2007). The results are highly dependent on the selection of the bandwidth. The bandwidth is the distance from a regression point where other data points will affect that estimate. An adaptive bandwidth was chosen for the current analysis because some neighbourhoods are spatially concentrated (see figure 7.1) whereas others are fairly isolated in England. The larger the bandwidth the smoother the results appear to be. In the current analysis the weighting function for each local estimate is based on 833 or 2.6% of the nearest neighbours.

Moreover, the analysis in this chapter is based on aggregate data and therefore it does not enable inference to individual migratory flows. For example, the effect of worklessness on out-migration might reflect people who are already employed or who are returning to employment moving away from neighbourhoods where a high percentage of people are out of work rather than an effect of people moving to find work. This might explain why there is the spatially varying relationship between these variables in the South East compared with neighbourhoods in the Midlands and North of England. There is a higher percentage of people in the areas of highest worklessness that are in work in the South East compared with the Midlands and the North. To determine whether individuals with particular characteristics are more likely to move and
whether this varies across the country one would require individual level geocoded data. Individual geocoded data is available from the School Census. However, there are few contextual variables known to be associated with migration that could be used to predict whether a pupil moves or not. The specificity of the School Census migration data should also be acknowledged. Chapter 3 showed the propensity and pattern of migration is similar for school age children and the general population with the exception of young adults. Young adults account for a disproportionate amount of migration relative to the number of people they account for in the population. The findings from this chapter might change if the out-migration rates for the entire population were used.

Another limitation of the current analysis is that it treats England as a closed migration system and the estimates for neighbourhoods that border Wales and Scotland are only influenced by other neighbourhoods in England. In the UK, national boundaries might represent a real barrier to migration particularly within the social housing sector. However, within the private housing market there is nothing that would restrict a family moving across these boundaries. The inclusion of data for movement between neighbourhoods in Wales and Scotland might alter the findings in the current analysis especially for neighbourhoods on the borders.

In spite of these limitations this chapter has shown how GWR can provide a more nuanced empirical test of the correlates of internal migration. The analysis in this chapter will add to the small but growing migration literature which uses this technique. The user-friendly presentation of the results through maps will attract non-technical users including policy makers. Figures 7.3-7.7 provide a clear representation of where certain factors are more important drivers of out-migration of state primary school age pupils. Although it is not within the bounds of this thesis to explore every local variation, the detailed results might interest local policy makers by helping them to explain why their area is different from others and so plan more effective local interventions.
Chapter 8 – Concluding discussion

1. Introduction

The overall aim of this thesis is to measure the impact of internal migration on the socioeconomic composition of neighbourhoods in England. More specifically, does internal migration increase the concentration of pupils on Free School Meals (FSM)? In the UK context, there has been little research that has tested this type of effect because it requires longitudinal migration data with detailed spatial coverage. Data that meet these requirements are not widely available at the neighbourhood level. The decennial Census has enabled researchers to provide some evidence but it is limited by infrequent measurement and no time varying socioeconomic indicators (Bailey and Livingston, 2007, 2008; O’Reilly and Stevenson, 2003). The search for an alternative dataset is consequently a secondary aim of this thesis. This led to an evaluation of the School Census as a source of internal migration data (chapter 3). Data that is collected for an administrative purpose often requires extensive cleaning before it can be used for research purposes. The School Census is no exception. To measure migration, variables are derived using the postcode recorded for each pupil in the School Census.

In the UK, data limitations have meant the impact of migration on socioeconomic area change has often been measured at relatively large spatial scales. These scales are often administrative geographies, for example, regions and districts. This thesis explores the impact of internal migration at various spatial scales with a focus at the neighbourhood level (chapter 4). Furthermore, few researchers have been able to contextualise the consequence of internal migration in terms of other components of socioeconomic change. This thesis compares the impact of internal migration on socioeconomic area change with in-situ change, international migration and school turnover (chapter 4). The thesis also models the impact of internal migration against area characteristics using advanced quantitative methods: multilevel growth curve analysis, linear regression, and Geographically Weighted Regression (see chapters 5-7). This enables the factors which are most likely to contribute to an increased or decreased concentration of poor pupils in the poorest neighbourhoods to be identified.

The consequence of internal migration on socioeconomic area change has implications for public policy. The increased concentration of poor individuals in the poorest areas as a result of internal migration may require public services to be reconfigured. For example, poorer areas might
require greater provision of welfare and healthcare services. An impact of internal migration that increases the concentration of poverty may also compound the problems faced by individuals living in the poorest areas because some authors suggest an area of residence can have independent effects on an individual’s socioeconomic outcome (Atkinson and Kintrea, 2001; Galster, forthcoming, 2011). For example, living in a poor area might foster negative attitudes to employment through socialisation with unemployed neighbours. Moreover, employers might discriminate against people living in poor areas through ecological fallacy. In the US and western Europe, these and other mechanisms of neighbourhood effects have motivated policy makers to attempt to reduce concentrations of poverty (Galster, forthcoming).

This concluding chapter summarises the findings from the preceding analytical chapters (3-7) before discussing the thesis’ contribution to migration methods and theory, and addressing the wider policy implications within the current public policy framework in England. The limitations of the analysis and potential for future research are discussed prior to a final summary of the main contributions of the thesis.

2. Summary of findings

The School Census is introduced in chapter 3. The longitudinal migration data derived from the School Census is compared with two more established datasets, the National Health Service Central Register (NHSCR) and 2001 Census. By using the postcode of a pupil at discrete points in time to determine a migrant the measure of migration is similar to that in the 2001 Census. The measurement of transitions rather than all moves made means that the number of migrants recorded each year is lower in the School Census compared with the NHSCR which measures all moves a person makes. The School Census suggests there are more migrants that move within a district than indicated by the 2001 Census. This is likely to reflect an undercount in the 2001 Census as a result of people not remembering short distance moves or not thinking they were required to include them in the retrospective question about migration. The discrepancies between the School Census and the NHSCR and 2001 Census do not appear to affect the consistency in general patterns and trends of migration between each dataset. In, out and within-district migration flows are very similar across each dataset for the school age population. There are certain districts where the exclusion of non-state school pupils in the School Census may affect substantive findings for between-district flows including Wandsworth, Elmbridge, Waverley, and Windsor and Maidenhead. Moreover, chapter 3 shows that the propensity and
pattern of internal migration is similar for the school age population and most other age groups, with the exception of young adults aged 16-29. This suggests that the School Census can provide an indication of internal migration for the general population.

Chapter 4 compares the impact of internal migration on socioeconomic area change at varying spatial scales, from district to output area level, using Townsend deprivation index deciles. It also compares the impact of internal migration in relation to other components of socioeconomic area change. The FSM indicator as a measure of family socioeconomic status is introduced in this chapter. While not all pupils living in low-income families claim FSM the binary measure is shown to be strongly correlated with the Townsend deprivation index. FSM status is widely used in educational research as a measure of poverty (Hobbs and Vignoles, 2010; Machin et al., 2006; Styles, 2008).

The impact of internal migration consistently increased the concentration of FSM pupils in the most deprived areas at each spatial scale. The effect was accentuated at smaller scales. However, the effect is not large even in the deprivation deciles where it is strongest. For example, internal migration increased the concentration of FSM pupils by less than 0.4 percentage points in an average one-year period during 2002-2007 in the most deprived quintile of LSOA neighbourhoods. The analysis shows more non-FSM and FSM pupils are moving out of deprived areas than moving in. However, non-FSM pupils are moving out at a faster rate. The overall impact of internal migration in deprived areas is therefore to reduce the population of primary school-age pupils as well as marginally increasing the concentration of deprivation.

In-situ change had a larger and counterbalancing effect on socioeconomic change than internal migration. It reduced the concentration of FSM pupils in the most deprived areas. Its effect was also strongest at the smaller spatial scales. For example, in the 20% most deprived LSOA neighbourhoods, in-situ change decreased the concentration of FSM pupils by 0.7 percentage points in an average one-year period during 2002-2007. This suggests that more families living in deprived neighbourhoods have experienced socioeconomic improvement rather than decline during the period 2002-2007. The impacts of other components of socioeconomic area change including school turnover and international migration were marginal.

Chapter 5 extends the analysis from the previous chapter by modelling the impact of internal migration on the concentration of FSM pupils. It predicts neighbourhood trajectories of change in
the concentration of FSM pupils by deprived neighbourhood status. It tests for other moderating and accentuating influences of change over time in the concentration of FSM pupils including regional effects and district type effects. This is approached using a multilevel growth curve model which predicts the proportion of FSM pupils each year from a baseline in 2002 and up to 2007 when only accounting for the impact of internal migration. The results show that there is very little change over time in the percentage of FSM pupils as a result of internal migration even in the most deprived neighbourhoods. The average effect for a deprived neighbourhood is predicted to increase its concentration of FSM pupils by one percentage point more than a non-deprived neighbourhood over seven years. Although this effect is small it will widen socioeconomic inequalities between areas. Neighbourhoods in London are shown to increase their concentration of FSM pupils at a faster rate than neighbourhoods in other regions by 0.2-0.3 percentage points each year, on average. These results will have important implications for public policy which are outlined in section four of this chapter.

Chapter 6 tests for predictors of net migration for FSM and non-FSM pupils in deprived neighbourhoods. Variables are included in a linear regression model under the headings of housing, socioeconomic, demographic, crime and environment, and local services characteristics. It is hypothesised that FSM and non-FSM pupils will be attracted to different neighbourhood characteristics as FSM pupils and their families will find it more difficult to move towards neighbourhoods with features that require a high cost premium, for example, better quality schools. A significant finding is that the net migration of FSM and non-FSM pupils was negatively associated with social housing, household overcrowding, poor quality housing, worklessness, non-domestic building land space, and rural deprived neighbourhoods. This indicates that, contrary to some migration research, low-income families can and do exercise neighbourhood choice. However, that is not to say that low-income families have the same options as more affluent families. This is reflected by discriminating factors by FSM status. Net migration of non-FSM pupils is positively associated with detached housing and GCSE scores. For FSM pupils there is a negative association with detached housing and no significant relationship with GCSE scores. These are characteristics which typically attract a high cost premium in housing markets.

Chapter 7 builds on the analysis reported in the previous chapter by taking account of the spatial effect on neighbourhood migration rates for selected explanatory variables in England. The out-migration rate is used as the outcome variable in a Geographically Weighted Regression (GWR) model. The effects tested are private renting, terraced housing, worklessness, poor housing, and
non-domestic building land space. The model shows that each of these variables has a spatially varying effect on neighbourhood out-migration rates: private renting is shown to have its strongest positive effect in neighbourhoods in parts of Essex and Kent; terraced housing has its strongest positive effect in neighbourhoods in the North and Midlands; worklessness is more strongly positively associated with out-migration in neighbourhoods within the South East of England; poor quality housing is more negatively associated with out-migration in remote rural neighbourhoods, particularly in North Yorkshire and Lincolnshire; and non-domestic building land space has its strongest positive association with out-migration in town and rural areas including neighbourhoods in Kent, Devon and the Cotswolds. This suggests that policy makers should be sensitive to local context because interventions to discourage out-migration may have mixed effects in different parts of the country.

3. Contribution to internal migration research

This section discusses the contribution of this thesis to quantitative methods used to analyse internal migration and to migration theory. It aims to bring together the findings from chapters 3-7 with the background literature from chapter 2 by addressing the broad aims of the thesis.

3.1 Quantitative methods to study internal migration

In the UK, quantitative data on internal migration has been found to be deficient by academic researchers and policy makers (House of Commons Treasury Committee, 2008; UK Statistics Authority, 2009). This thesis has introduced a relatively new dataset called the School Census which has great potential to provide internal migration data for a certain subset of the population in England. The use of an administrative dataset in this thesis highlights the advantages in terms of coverage it can provide compared with other data sets used to measure internal migration. It provides more up to date information compared with the 2001 Census and greater geographical and socioeconomic detail than the NHSCR. This allows one to test the impact of internal migration on socioeconomic area change at the neighbourhood spatial scale during annual intervals. This means that the data can provide evidence required to evaluate short-term and localised policy interventions that aim to reduce socioeconomic concentrations. The 2001 Census was collected after the first few years of the New Deal for Communities (NDC) programme which makes the dataset less than ideal to assess the initiative’s impact on desired policy objectives. A major shortcoming of the School Census in the measurement of internal migration is the over-recording of
flows at age 11 when all pupils transfer from a primary to secondary school. This is likely to be a result of data entry errors in the earlier years of collection because the peak is not as large in later years of the 2002-2007 period (chapter 3).

Unfortunately, use of the School Census is now restricted by parliamentary legislation to research relating to educational attainment. A researcher with a focus on internal migration would no longer be able to access the same data, with information which allows identification of migration at small scales, as the author of this thesis. This appears to be a lost opportunity when considering the government’s drive toward administrative records as a replacement to the decennial census (Kean, 2010). Moreover, the use of administrative data would, in all likelihood, reduce the cost on the public purse and individuals’ time compared with national censuses and surveys. The almost complete coverage of the School Census for a particular age group provides a unique opportunity to researchers to document patterns of internal migration at detailed spatial scales. The results from this thesis demonstrate this potential and suggest the policy of access should be reconsidered.

It is only through having such longitudinal data that the research questions posed at the start of this thesis can be addressed using appropriate and innovative methods. The School Census lends itself to longitudinal and spatial data analysis because internal migration data that can be derived from it warrants investigation over time and between neighbourhood level boundaries. This is explored in chapter 5 by making use of the data between each one-year period rather than averaging out the impact as is applied in chapter 4 for descriptive purposes. A multilevel growth curve framework is used which enables the variation over time and between neighbourhoods to be accounted for. The results show there is very little variation within neighbourhoods over time and that over 95% of the total variance is unexplained at the neighbourhood level even when controlling for deprived status, region and district type of a neighbourhood. This type of longitudinal analysis is rare in the migration literature and therefore its application will pave a way for other researchers to add it to their methodological toolkit. It also plays to the strength of the School Census data.

The geographical detail of the School Census allows spatial analysis which can show localised variation in, for example, out-migration rates. A GWR model is used in chapter 7 which allows for the effect of explanatory variables on out-migration to vary over space by fitting a regression equation for each neighbourhood. Each regression equation is weighted by estimates for
surrounding neighbourhoods with those located closer having a greater effect than those further away. This enables a test of whether the effect of a variable on the out-migration rate is the same in all parts of the country and can provide a more nuanced empirical test of the correlates of internal migration. The effects tested are based on findings from chapter 6 that are shown to be related to internal migration. The results show that the effect of each explanatory variable varies over space and that the GWR model provides an improved model fit when compared with an equivalent OLS model. This is shown by a lower AICc value and a higher R-squared value. The maps shown in figures 7.3-7.7 are able to convey the results from the model in a user-friendly manner which will be accessible to non-technical users of the findings. The findings add to existing literature that applies GWR to the study of migration and its determinants (Jensen and Deller, 2007; Nakaya, 2001; Nelson, 2008).

3.2 Internal migration theory

Distinguishing by different types of boundary crossing (i.e. inter-regional and intra-regional moves) is an important way to describe internal migration. This is because many more people make localised moves compared with regionalised moves. Although the separate motivations for these different types of internal migration have become less distinct over time there is contemporary evidence to support the notion of employment related inter-regional moves and housing related localised moves (De Jong and Graefe, 2008; Niedomysl and Hansen, 2010). However, the analysis in this thesis has shown that the impact of internal migration of primary school-age pupils is consistent across different spatial scales and deprivation deciles in terms of the direction of change in the concentration of FSM pupils. The choice of administrative and data boundaries appears to make a minor difference in terms of this impact which is consistent with Stafford et al.’s (2008) findings for London. A notable difference by spatial scale is that the variation in the change in the concentration of FSM pupils is progressively accentuated at smaller spatial scales in the most deprived areas, which is anticipated based on the findings of Schuurman et al. (2007). This suggests that it is important to consider neighbourhood level internal migration when measuring its impact on socioeconomic area change because it is likely to be particular neighbourhoods within cities that are in decline or growth, which are likely to see the greatest impact of internal migration on socioeconomic area change (Champion, 2000).

Contrary to the neoclassical economic perspective the impact of internal migration of primary school-age pupils does not lead to a spatial equilibrium in terms of the distribution of FSM pupils. Rather, internal migration appears to widen spatial inequalities by increasing the concentration of
poor pupils in the most deprived neighbourhoods and having little impact in the least deprived areas. This is in accordance with the cumulative causation process whereby deprived areas become more deprived in the face of internal migration and less deprived areas become less deprived (Foulkes and Schafft, 2010; Greenwood, 1975, 1997; Peeters, 2008). The theory suggests poor families become trapped in the least desirable locations through a lack of choice because even if they move they are restricted to other poor neighbourhoods. Nonetheless, the notion of cumulative causation should not be overstated. This is because selective migration flows are balanced, at least to some extent, by counter-current migration streams (Gleave and Cordey-Hayes, 1977; Ravenstein, 1885). The findings in this thesis support this hypothesis and challenge the notion that selective internal migration is driving socioeconomic neighbourhood change. The results suggest the impact of internal migration is likely to be small at least in the short-term. This is supported by other work that has measured the impact of internal migration on socioeconomic area change (N Bailey, 2009; Bailey and Livingston, 2008; Cooke, 2010; Rosenbaum, 1995; Strait, 2006). However, the analysis goes further by measuring the impact of internal migration for all neighbourhoods in England rather than a sample of neighbourhoods which most other studies are limited to. This thesis argues that the process of migration in deprived areas cannot be described simply as poor residents finding themselves trapped and unable to move away whilst those with more economic resources are able to move away.

The results in this thesis show that net migration of FSM and non-FSM pupils is negative in the most deprived neighbourhoods suggesting that these places are unattractive to most families of primary school-age pupils that move. The families of poor pupils therefore exercise an element of choice to avoid or move away from the most deprived areas. However, location choice is greater for those with more economic resources because they can afford to pay house price premiums which are required when choosing to live in more desirable neighbourhoods. When neighbourhoods require a cost premium to enter, it appears that poorer pupils and their families are more restricted in terms of whether they can afford to select such areas. Neighbourhoods with a high proportion of better quality schools and detached housing provide an example of this.

A largely untested element of these associations is whether they vary over space. This thesis has made a significant contribution to migration theory by analysing spatial variation of area-level determinants of internal migration using GWR. The effect of worklessness, for example, is shown to have a different effect on out-migration rates between neighbourhoods in the North and South of England. The effect was positive across all neighbourhoods suggesting higher worklessness is
associated with higher out-migration. However, in the South East of England (excluding London) this effect is much stronger than neighbourhoods in the North. This is likely to reflect the dynamism of the labour and housing markets in the South which enable people to move away from neighbourhoods where employment opportunities are in short supply. In general, it might be harder for people to move out of low employment opportunity areas in the North of England because the labour markets are slow to create employment opportunities for people in high worklessness neighbourhoods (Boheim and Taylor, 2002; Faggian and McCann, 2009; McCormick, 1997).

Given that internal migration has a minor impact on socioeconomic area change, even in deprived areas where it is felt most strongly, it is important to contextualise its effect. The results in this thesis are consistent with the literature which has analysed the effect of various components of socioeconomic area change (N Bailey, 2009; Cooke, 2010; Rosenbaum, 1995; Strait, 2006). These studies theorise that internal migration will play a minor role in overall socioeconomic area change. This is because internal migration is only one component of socioeconomic area change and other components have stronger effects. Areas will also change as people remain in-situ, through natural change and international migration. In this thesis, the impact of natural change and international migration, although indirectly tested, are shown to have marginal effects on socioeconomic area change. In England, there are no existing studies to the author’s knowledge that comprehensively decompose the components of socioeconomic area change at the neighbourhood level. The impact of in-situ change appears to drive overall socioeconomic area change because it has twice the effect on socioeconomic area change compared with internal migration. In-situ change is driven by economic forces at the national and regional level which lead people to find and lose employment and, in turn, make areas richer and poorer over time (Cooke, 2010). This effect is therefore likely to be more volatile than the smaller effect of internal migration. Nonetheless, Cooke (2010) suggests that the effect of in-situ is always stronger in periods of economic growth and decline.

4. Public policy implications

The implications for public policy from this thesis are far-reaching. This section will discuss recommendations for the use of neighbourhood data before exploring the policy implications related to the substantive findings. These will be discussed in relation to the current policy framework in England.
A general recommendation from the findings of this thesis is that more neighbourhood level data held by government, including from the School Census as discussed above, should be made available to the public and researchers. Information made available to the public will help people make more informed decisions regarding migration and area choice. The creation of police.uk which provides information about local crime is a prime example (NPIA, 2011). Research tools such as this can also provide local people with a means to evaluate their public service provision and challenge decisions taken on their behalf. These data resources will enable researchers to provide better advice to policy makers in terms of the targeting, planning and evaluation of government interventions.

The substantive results from this thesis suggest the impact of internal migration should be considered in the planning and delivery of public services because not only does it increase the concentration of poverty in the most deprived areas but it is also leading to depopulation. This is because net migration is negative for FSM and non-FSM pupils in the most deprived areas. This is an important finding which will impact on area-based initiatives (ABI) that aim to regenerate deprived neighbourhoods. Programmes such as NDC will have fought a battle to improve aggregate socioeconomic conditions with respect to internal migration. However, this effect should not be overstated as it only explains a 1-2 percentage point decline, on average, in the socioeconomic status of a deprived neighbourhood over 10 years with all other components held constant. The deprived neighbourhoods which start poorer and neighbourhoods located within London are likely to find the impact of internal migration on increasing the concentration of deprivation to be greater. These factors should be considered when evaluating ABI programmes as well as the fact that in-situ status change, on average, has offset the impact of internal migration during the recent period of economic growth.

The consequence of increased polarisation between deprived and less deprived neighbourhoods appears not to be a priority of the current coalition government to the same extent as the previous Labour government. The current government’s desire to cut public spending to reduce the national debt has brought to a premature end existing ABIs including the Housing Market Renewal Programme (Long and Wilson, 2011) and no indication has been given of a renewal of programmes which have recently come to an end including NDC. Moreover, the redistributive effect of the population through internal migration is likely to be exacerbated by planned changes to Housing Benefit. The current government plans to reduce the costs of Housing Benefit by
introducing caps on the total amount payable to recipients. At present, Housing Benefit is paid on a means-tested basis to cover what is often a large proportion of the cost for private and social rented housing. Caps are likely to have the most dramatic effect on the private rented sector within London (Hamnett, 2010). Hamnett suggests the changes will:

“lead to the displacement of low-income tenants from the expensive parts of central and inner London and into lower rent areas further afield, with consequent upwards pressure of rent in those areas. The result is likely to be a higher degree of social class and income segregation in the capital between a rich, central and inner areas, and lower cost areas.” (Hamnett, 2010, p.2818).

Based on the findings of this research, future programmes to reduce the effect of socioeconomic concentration, if and when they become politically and financially feasible, should follow the aims of the National Strategy for Neighbourhood Renewal (NSNR) to reduce the gap between aggregate socioeconomic conditions in the most deprived neighbourhoods and the rest of the country. This will ensure that even if improvements are made to deprived areas a status quo is not sustained because all other areas have experienced a greater benefit from economic growth. Unlike the NDC programme, there might be a greater impact if interventions were not limited to a small selection of deprived areas. The various ABIs implemented by the previous Labour government only targeted a small proportion of the deprived areas in England. Policies need to be set in place that enable all deprived neighbourhoods to improve their socioeconomic character rather than remain as places of last resort. However, attempts to attract higher income residents to deprived neighbourhoods need to be balanced with the needs of existing low-income residents. Otherwise, improvements to a neighbourhood will only have the outcome of forcing low-income households out of a neighbourhood when market forces react and raise the cost of housing in that area.

The current government are proposing policy changes which may pave a way for more flexibility within the social housing sector that may in turn help break cycles of decline in the most deprived neighbourhoods. These and other changes are included in the Localism Bill (CLG, 2011c). These comparatively minor policy changes might not have the finance of NSNR but they will apply to all parts of England and will attempt to achieve similar policy aims. For example, reform to the social housing allocation systems will attempt to ensure that social housing is provided to those in most need and lessen the opportunity for some people within the system to pick the most desirable housing which does not reflect their needs. The introduction of a national online social housing
swap system will also enable people to escape areas which do not meet their needs more easily. New tenants’ power to scrutinise their social landlords will give people that rely on social housing the ability to force improvements which they might not otherwise feel they have the right to expect. The Localism Bill also contains elements which are likely to sustain a process of separation between less and more deprived areas. The attempts to provide rights for communities to shape their local area through neighbourhood planning and right to challenge planning decisions might benefit those people who are already located in the most desirable neighbourhoods. These residents are unlikely to agree to plans, for example, to build affordable housing in their neighbourhood. A return to a more centralised planning strategy, with flexibility to local context, may thus benefit those most in need.

It should also be recognised that what works in one part of the country in terms of attracting people to a neighbourhood might not have the same effect elsewhere. There might be regional and local influences which bound a neighbourhood’s fortune regardless of any intervention at the neighbourhood level. These issues were recognised at an early stage of the NSNR. However, as the programme developed it appears the prescription from central government became greater and this was followed readily by regeneration practitioners (CLG, 2010; Lawless, 2006). There needs to be a more innovative approach to local public policy making which is free from the control of higher level authorities. The current government’s Local Enterprise Partnerships (LEPs) indicate a potential example of this (Business Innovation and Skills Committee, 2011). The LEPs are not operating at the neighbourhood scale as they aim to take control of local economic development within a defined labour market area. However, there is little prescription, at present, from central government on the spatial scale they should cover. They will have the responsibility for delivering government objectives for economic growth and decentralisation but without a national performance management framework or set model of operation. The LEPs are one means through which areas can obtain support from the Regional Growth Fund which is a £1.4 billion resource to help areas which depend on public sector employment to make a transition towards private sector-led economic growth. Only time will tell if LEPs can act as a mechanism to provide a more equitable distribution of economic growth which in turn might lessen the impact of migration as people do not feel they have to move to find less depressed labour markets and, perhaps, neighbourhoods.

5. Limitations and future research
This thesis presents an innovative application of advanced quantitative methods to an administrative dataset. It supports a small but growing literature that suggests selective internal migration has an effect of marginally increasing the concentration of poverty in the most deprived neighbourhoods. However, there are issues with the analysis in this thesis which might be resolved with further research. This section will discuss these limitations and suggest potential solutions as well as questions for future research. There are two important limitations of this thesis which constrain the ability to draw wider inferences. They are the restriction of the data to state-school primary pupils and the relatively short period (2002-2007) the School Census is available.

It was noted in chapters 1-3 that there might be specific migration patterns for primary school-age pupils that make them different from the general population. Therefore, the findings from this thesis are unlikely to apply to all migrants but families with children at a particular stage in the life-course. This means caution should be taken in terms of the applicability of policy recommendations for the population as a whole. Nonetheless, chapter 3 shows that migration patterns are fairly similar across age groups with the exception of young adults aged 16-29. The migration prevalence of young adults is much greater than all other age groups and they tend to concentrate in particular areas, mainly urban, where higher education institutions are located. Graduates of tertiary education are a sought after section of the population that local policy makers have tried to retain. Graduate retention was an important policy concern for many of the former Regional Development Agencies which will be replaced by LEPs. Attracting graduates to live in an area is often considered a swift approach to improving the local skills base which will in turn attract high quality employment (Pollard et al., 2005). London is widely regarded as the most favoured destination of graduates because it offers greater opportunities for higher paid employment (Ball, 2008; Fielding, 1992; Findlay et al., 2008). This suggests that the increased concentration of FSM pupils in London, which chapter 5 shows is greater than any other region, is likely to be offset by young professionals moving into the capital to take advantage of cheaper rental prices for housing in relatively deprived areas.

The period 2002-2007 delivered sustained national economic growth which is reflected by the decline in the percentage of pupils claiming FSM during this time. Since 2007, the UK economy has experienced a severe contraction and unsurprisingly the claimant rate for FSM has risen (DfE, N.d.). There are also indications that the level of internal migration has declined since the economic crisis as a result of a tighter mortgage market (ONS, 2010c). These changes are likely to
have implications for the impact of internal migration on socioeconomic area change. However, it is not clear what effect more pupils claiming FSM and fewer pupils moving will have on the selectivity of internal migration. It is plausible that increased migration selectivity out of the poorest neighbourhoods will lead to a greater concentration of FSM pupils even though the level of migration has declined. It could also be the case that the financial crisis has forced some working families back into deprived neighbourhoods which will improve the socioeconomic status of these areas. Without access to more recent data it will be difficult for researchers to monitor the effects of the economic downturn.

The issue of inference to the population as a whole and to the current economic climate could be resolved by using different datasets to answer similar research questions as those posed in this thesis. The most anticipated source of internal migration data during the coming years will be the 2011 Census. It will face many of the problems of the 2001 Census in terms of socioeconomic characteristics observed at time of enumeration and not at the time of migration, but it will provide geographical detail for all people which will be unrivalled. The release of the 2011 Census will also provide longitudinal data for the Longitudinal Study (LS) which will include data from each census from 1971 to 2011. This will provide the ability to measure the longer term impact of migration compared with the aggregate data which can only indicate migration during the previous year. Migration data is also available from the British Household Panel Survey (BHPS) and Understanding Society which subsumed the BHPS in 2010. This provides an annual track of people’s lives including whether they move. Data from the LS or Understanding Society will not provide the geographical detail of the aggregate census data or the School Census. However, it could be aggregated to deprivation deciles or an urban-rural classification of neighbourhoods and then analysed to see how components of change effect socioeconomic area change. Understanding Society could give a measurement of income which is not available in the decennial census. This would have fewer limitations than FSM as a measure of socioeconomic status.

The longitudinal datasets, in particular, could also provide an opportunity to tackle research questions about the impact of migration during different phases over the life course. It would enable data to be aggregated to individual and household levels. Questions which could be addressed include: Does the migration of young adults offset change in the concentration by socioeconomic status for families with school-age children? Is there regional convergence in the impact of migration during economic recession by household type? Are young childless
individuals and families less concerned about negative neighbourhood features including high crime than families with children?

6. Summary

In summary, this thesis makes important methodological, theoretical and policy contributions. First, it presents an innovative use of an administrative dataset for internal migration analysis. This enables questions to be addressed which would not have been answerable with the other datasets available at the time this work began. Second, it applies advanced quantitative methods to the data and stated research questions providing empirical findings which add to migration theory. This will pave the way for other researchers to attempt similar work through refinement and added complexity. Third, it provides evidence to policy-based questions regarding the effect of internal migration on socioeconomic area change. This will help policy makers target, plan and evaluate future attempts to improve aggregate socioeconomic outcomes at desired spatial scales. It will also help to set in context other components of change which may offset any socioeconomic area change that is the result of internal migration.
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Appendix A: Department for Children, Schools and Families
Analytical Services Division’s Confidential of Personal and Commercial Data Statement

Introduction
The DCSF Analytical Services Division holds and processes various data which are confidential because they are either personal or commercially sensitive. Specific measures are taken to preserve their confidentiality and security:

- each set of confidential data is controlled by a data custodian who maintains written guidelines on the use of the data;
- legislation and codes of practice governing the collection, storage and use of confidential data are strictly observed;
- statistics are not published or otherwise released unless there is virtually no risk to confidentiality;
- confidentiality declarations must be signed by any external researches and contractors who may be allowed access to confidential data;
- all personal identifiers are stored separately from the data to which they correspond;
- enhanced security arrangements are considered where two or more data sets are linked;
- all confidentiality undertaking are respected when data are received from other organisations;
- SD staff receive appropriate training in IT security measures.

The following paragraphs expand on the measures opposite:

Responsibility for confidentiality
Each set of confidential data is controlled by a data custodian who is responsible for protecting confidentiality. This entails maintaining written guidelines governing the use and disclosure of the data. These guidelines are openly available. Where data are held on behalf of another Welsh Office division or an external authority, the data custodian is responsible for liaison on confidentiality matters. Data custodians are responsible for establishing, in any cases of doubt, whether or not data should be regarded as confidential.

The head of the Analytical Services Division responsible for ensuring the data custodians are appointed, and take all the appropriate steps.

Control of data use
Access to confidential data must be authorised in writing by the appropriate data custodian. Such data should be identified as being ‘Restricted’ and handled in a manner appropriate to their sensitivity, including appropriate physical security. Confidential data held for statistical purposes may not be used for other purposes, except where expressly permitted by legislation or where the prior permission of the data subjects has been obtained.

Legal and ethical obligations
ANALYTICAL SERVICES DIVISION will comply with all relevant legislation, protocols and codes of practice relating to the data it holds. Registration under the Data Protection Act will be kept up-to-date. ANALYTICAL SERVICES DIVISION will also obtain any necessary ethical approval for processing data.

Avoiding disclosure
ANALYTICAL SERVICES DIVISION will not publish, or otherwise release, statistics unless it is satisfied that there is virtually no risk to confidentiality. Outputs will be scrutinised with the aim of ensuring that the risk of identification, even indirectly, of individuals is effectively eliminated. Data custodians will be responsible for this scrutiny and for any steps needed to avoid identification of individuals. The guidelines maintained by data custodians will include details of the steps taken to achieve this.

Internal access
Within ANALYTICAL SERVICES DIVISION identifiable individual data are only available for access on a need to know basis and data custodians must keep a record of who has access and why.

External access for research

ANALYTICAL SERVICES DIVISION rarely provides access to confidential data that it holds. However, where it does so it will observe all appropriate legal, ethical and other constraints.

Identifiable individual data (and aggregate or anonymised data which are not publishable because they do not meet the criterion of virtually no risk to confidentiality) may be made available for appropriate and fully specified statistical research purposes, but only where:

- all legal, ethical or other constraints have been considered and observed; and
- the relevant data custodians have given their approval in writing.

All researches will be required to sign confidentiality declarations and to comply with relevant ethical guidelines. The data supplied will be the minimum needed to meet the agreed study objectives, may not be onwardly transmitted and may not be published without the approval of the data custodian. The declaration will require an undertaking not to attempt to establish the identity of any individual.

Consultants and contractors

Consultants and contractors employed by ANALYTICAL SERVICES DIVISION are subject to the same confidentiality constraints and disciplines as ANALYTICAL SERVICES DIVISION staff. They are required to sign a confidentiality declaration appropriate to the work on which they are employed.

Use of personal identifiers

Some ANALYTICAL SERVICES DIVISION activities require the collection and storage of names and addresses. Records that include names and addresses or other information that may identify an individual will be subject to controls to prevent unauthorised linkage with other data. The preferred control mechanism is to maintain the plain text information in separate files. Access to such files is restricted to those with a specific requirement for the plain information, and is authorised by data custodians.

Linkage

By combining data from separate sources it may occasionally be possible to meet new information needs without placing further demands on respondents. Subject to authorisation as necessary, ANALYTICAL SERVICES DIVISION may, for specific statistical purposes, link data sets that it holds. The authorisation will include specification of any enhanced security requirements for the linked data and will specify who may access the linked data and for what purpose the data may be used.

Linkage between plain text files and related files is controlled so that possession of a publicly available identifier does not enable unauthorised linkage to take place.

Intended use

ANALYTICAL SERVICES DIVISION informs those who directly provide it with personal and commercial data of the intended use of the data. Where data is received “second hand” from other organisations, any confidentiality undertakings given at the time of collection will be respected.

Administrative sources

Data initially collected for administrative purposes, and to which the ANALYTICAL SERVICES DIVISION has been granted access, may be used for statistical purposes provided that no undertakings have been given to the contrary and that all appropriate procedures to protect confidentiality are followed.

IT security

Staff will receive appropriate training in IT security matters, and standards and guidelines will be available to help ensure that IT security is maintained. ANALYTICAL SERVICES DIVISION will not release details of IT systems and security measures that might compromise the confidentiality or security of data it holds. IT security measures will be reviewed when significant changes occur to computing facilities. Independent advice will be sought as necessary.

These guidelines are consistent with the Government Statistical Service code of practice on the handling of data obtained from statistical inquiries (Cmnd 9270) and the Official Statistics Code of Practice.
Appendix B: Multilevel logistic growth curve model of proportion of FSM pupils

Table A1 - Logistic growth model of proportion of FSM pupils, 2002-07

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Part</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.260</td>
<td>0.019</td>
</tr>
<tr>
<td>Year</td>
<td>0.012</td>
<td>0.001</td>
</tr>
<tr>
<td>Year^2</td>
<td>-0.001</td>
<td>0.000</td>
</tr>
<tr>
<td>Deprived</td>
<td>1.994</td>
<td>0.018</td>
</tr>
<tr>
<td>North West</td>
<td>-0.053</td>
<td>0.026</td>
</tr>
<tr>
<td>Yorkshire and The Humber</td>
<td>-0.177</td>
<td>0.027</td>
</tr>
<tr>
<td>North East</td>
<td>0.019</td>
<td>0.034</td>
</tr>
<tr>
<td>West Midlands</td>
<td>-0.114</td>
<td>0.027</td>
</tr>
<tr>
<td>East Midlands</td>
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</tr>
<tr>
<td>South West</td>
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<td>0.031</td>
</tr>
<tr>
<td>East of England</td>
<td>0.13</td>
<td>0.032</td>
</tr>
<tr>
<td>South East</td>
<td>-0.234</td>
<td>0.029</td>
</tr>
<tr>
<td>Town</td>
<td>-0.171</td>
<td>0.02</td>
</tr>
<tr>
<td>Rural</td>
<td>-0.681</td>
<td>0.02</td>
</tr>
<tr>
<td>Year*deprived</td>
<td>0.010</td>
<td>0.001</td>
</tr>
<tr>
<td>Year*North West</td>
<td>-0.023</td>
<td>0.001</td>
</tr>
<tr>
<td>Year*Yorkshire and The Humber</td>
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</tr>
<tr>
<td>Year*North East</td>
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</tr>
<tr>
<td>Year*West Midlands</td>
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</tr>
<tr>
<td>Year*East Midlands</td>
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<td>0.002</td>
</tr>
<tr>
<td>Year*South West</td>
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<td>0.002</td>
</tr>
<tr>
<td>Year*East of England</td>
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<td>0.002</td>
</tr>
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<td>Year*South East</td>
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</tr>
<tr>
<td>Year*Town</td>
<td>-0.005</td>
<td>0.001</td>
</tr>
<tr>
<td>Year*Rural</td>
<td>-0.006</td>
<td>0.001</td>
</tr>
</tbody>
</table>

| **Random Part**        |          |      |
| Level: Neighbourhood   |          |      |
| Intercept/Intercept    | 1.293    | 0.011|
| Year/Intercept         | 0.014    | 0    |
| Year/Year              | 0.001    | 0    |
| Year^2/Intercept       | 0        | 0    |
| Year^2/Year            | 0        | 0    |
| Year^2/Year^2          | 0        | 0    |
| Units: Neighbourhood   |          |      |
| Units: Year            |          |      |
| 31,315                 | 187,890  |      |
Figure A1 - Logistic growth model normality plot for level 2 residuals
Appendix C: Multivariate linear model of FSM rate

Table B5 - Multivariate model of neighbourhood FSM rate fixed part estimates, 2002-07

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Intercept</td>
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<td>13.383</td>
<td>0.164</td>
<td>13.737</td>
<td>0.167</td>
<td>14.191</td>
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<td>14.332</td>
<td>0.171</td>
<td>14.625</td>
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<td>Deprived</td>
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<td>0.151</td>
<td>27.836</td>
<td>0.152</td>
<td>28.233</td>
<td>0.155</td>
<td>28.267</td>
<td>0.157</td>
<td>28.125</td>
<td>0.159</td>
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<td>-1.17</td>
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<td>-1.408</td>
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<td>-1.852</td>
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<td>-1.992</td>
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<td>0.269</td>
<td>0.658</td>
<td>0.274</td>
<td>0.208</td>
<td>0.278</td>
<td>0.038</td>
<td>0.281</td>
<td>-0.036</td>
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<tr>
<td>North East</td>
<td>1.48</td>
<td>0.294</td>
<td>1.3</td>
<td>0.296</td>
<td>1.087</td>
<td>0.301</td>
<td>0.519</td>
<td>0.305</td>
<td>0.197</td>
<td>0.308</td>
<td>0.047</td>
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<tr>
<td>North West</td>
<td>1.448</td>
<td>0.219</td>
<td>1.245</td>
<td>0.22</td>
<td>1.011</td>
<td>0.224</td>
<td>0.453</td>
<td>0.227</td>
<td>0.235</td>
<td>0.23</td>
<td>-0.036</td>
<td>0.235</td>
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<tr>
<td>South East</td>
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<td>-1.352</td>
<td>0.245</td>
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Table B2 - Multivariate model of neighbourhood FSM rate random part estimates, 2002-07

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<td>cons.fsmrate03/cons.fsmrate02</td>
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<tr>
<td>cons.fsmrate03/cons.fsmrate03</td>
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<tr>
<td>cons.fsmrate04/cons.fsmrate02</td>
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<td>cons.fsmrate04/cons.fsmrate03</td>
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<tr>
<td>cons.fsmrate04/cons.fsmrate04</td>
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<tr>
<td>cons.fsmrate05/cons.fsmrate02</td>
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<td>cons.fsmrate06/cons.fsmrate02</td>
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<tr>
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<tr>
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<tr>
<td>cons.fsmrate07/cons.fsmrate07</td>
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-2*loglikelihood: 913861.5
Units: Neighbourhood 31,315
Units: response_indicator 187,890
Figure B1 - Multivariate model normality plot residuals for each response (year)