Assessing Neighbourhood Deprivation: Understanding Local Spatial Context

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To my Mum, who encouraged me not to underestimate my abilities and to see the best in others

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Abstract

The neighbourhood provides a spatial context within which the well-being of individuals and households are shaped. Central and local governments recognise this essential role of neighbourhoods and often rely on deprivation indices to identify deprived areas and to guide policy actions. However, neighbourhoods are not confined to administrative boundaries, and looking at area-based deprivation on its own understate the significance of spatial context and the importance of what is nearby.

This thesis uses a spatial analytical approach to explore the impacts of neighbourhood spatial attributes on the measurement of deprivation. The aim is to improve the understanding of how these local spatial contextual differences could be integrated into the measurement of deprivation and why it matters.

Using different conceptualisations to define neighbourhood spatial context, modified versions of the 2015 English Index of Multiple Deprivation were produced to examine the effect of differences in neighbourhood spatial structure, spatial scale and spatial relations on the indices.

The findings of the research show that our understanding of deprivation in an area can be influenced by the spatial context of the neighbourhood. Accounting for neighbourhood spatial context within the measurement of deprivation significantly altered the IMD2015 rankings and decile classifications. The research also demonstrates that incorporating neighbourhood spatial attributes in assessing relative deprivation is methodologically feasible and can highlight areas which are deprived in terms of both within neighbourhood socioeconomic characteristics and characteristics of the wider local environment that forms part of its spatial opportunity structure. The approach developed here is intended as a contribution to knowledge with respect to how neighbourhood deprivation is conceptualised and measured.

TABLE OF CONTENT

List of Figures

LIST OF TABLES

List of Acronyms and Abbreviations

ABI	Area Based Initiatives
AIMD	Adjusted Index of Multiple Deprivation
BHS	Barriers to Housing and Services
CDP	Community Development Project
DCLG	Department of Communities and Local Government
DETR	Department of Environment, Transport and Regions
EC	European Commission
EPA	Environmental Protection Agency
EST	Education, Skills and Training
GEODA	GIS Program
GIA	General Improvement Area
GIS	Geographic Information Science (Systems)
HDD	Health Deprivation and Disability
HMR	Housing Market Renewal
ID	The English Indices of Deprivation
ID2015	The English Indices of Deprivation 2015
ILC	Index of Local Conditions
ILD	Index of Local Deprivation
IMD	Index of Multiple Deprivation
IMD	The Index of Multiple Deprivation (Overall Index)
IMD2015	The English Index of Multiple Deprivation 2015
LAD	Local Authority District

LEP	Local Enterprise Partnerships
LISA	Local Indicators of Spatial Association
LSOA	Lower-Layer Super Output Areas
LSP	Local Strategic Partnerships
MAUP	Modifiable Area Unit Problem
NDC	New Deals for Communities
ODPM	Office of Deputy Prime Minister
ONS	Office of National Statistics
SEU	Social Exclusion Unit
SIMD	Scottish Index of Multiple Deprivation
SS-IMD	IMD adjusted for Spatial Scale and Structure
TFL	Tobler's First Law
UDC	Urban Development Corporations
UP	Urban Programme
URC	Urban Regeneration Companies

1. INTRODUCTION

Socioeconomic inequality among individuals within neighbourhoods, between neighbourhoods and between different geographical spaces has remained a persistent problem in England and most countries. In fact, the gap between affluent and deprived areas continues to widen in England despite the plethora of socioeconomic policies which have been implemented to address the issue for decades (Dorling, 2013; Tallon, 2010).

Whereas it can be argued that spatial socioeconomic inequality is primarily a representation of the socioeconomic outcomes of individuals, families and groups within a specified geographic space (Ferrari, 2012), space is increasingly becoming recognised as the primary barrier to socioeconomic advancement (Galster, 2012). Individual personal attributes can be enhanced or reduced by the opportunities available to them within the geographic space(s) they are embedded in producing socioeconomic outcomes (Buck, 2001, Galster and Sharkey, 2017).

Inequality can therefore be seen as a product of the complex mix of people and places. Yet, the function of a place and its relationship with other places within the inequality discourse are often underplayed by the tools and techniques used in measuring relative deprivation (Rae, 2009a). This can affect the assessment of neighbourhood problems and the effectiveness of the subsequent intervention programmes.

This thesis uses a spatial analytical approach to examine the impact of neighbourhood spatial context on the measurement of deprivation. Specifically, it investigates the sensitivity of the 2015 English Indices of Deprivation (ID2015) to differences in neighbourhood spatial structure, varying spatial scales at which socioeconomic processes occur and spatial relations between neighbourhoods.

This chapter provides an overview of the rationale, aim, objectives and the methodological approach of the study.

1.1 **Background and Rationale**

Spatial inequalities and the clustering of deprivation and affluence have remained a phenomenon of interest among urban policy analysts, academics and policy makers around the world for decades (Dorling, 2013, Rae, 2012). Different terminologies and concepts such as poverty, deprivation and social exclusion among others have been used to describe what is primarily the inability of individuals, families and groups to participate in activities that are widely approved within the societies and communities of their belonging due to lack of resources (both tangible and intangible) (Townsend, 1987). Whilst these terminologies are sometimes used interchangeably and broadly considered to be referring to similar socioeconomic issues (Barry, 1998; Levitas, 1996), there are subtle analytical differences which tend to relate to the nature of activity of interest and the primary resource which is considered to be lacking (Levitas 1999).

An estimated 13.5 million people in the UK were considered to be in poverty in 2014/15 out of which 55% are in working families (Tinson et al., 2016). About 75%

of the most deprived areas in the England are concentrated in 18% of the 326 Local Authority Districts (LAD). Overall, 62% of LADs in England have 5 or less neighbourhoods[1] in the most deprived decile of the 2015 Index of Multiple Deprivation (IMD2015). The proportion of LADs with no neighbourhoods in the most deprived decile is 39% (Smith et al., 2015).

Furthermore, concerns about spatial inequalities have become more pronounced with rising interest in the neighbourhood effects agenda; the extent to which the local environment (economic, social, environmental, institutional, infrastructural among others) can influence the socioeconomic outcomes of the people within a given area (Galster and Hedman, 2013). Proponents of neighbourhood effects asserts that places have:

> "…fundamental impact upon an individuals' identity, value set and life experience and is critical in defining experiences of social exclusion, poverty and socioeconomic outcomes" (Tricket and Lee, 2010 p. 430).

Even though deprivation and inequality among people and places is the result of complex socioeconomic processes with various path dependencies, concentrations of poverty, unemployment, weakened social structures among others are more likely to deepen neighbourhood deprivation and negatively affect the life chances of individuals within these areas beyond what can reasonably be expected from the individual's personal circumstances (Brannstrom, 2004). "Despite the lack of consensus (in the literature) regarding

[1] The ID2015 uses Lower-layer super output areas (LSOAs) as neighbourhoods. These LSOAs are smaller areas with 650 households on the average.

the importance of area effects, there is sufficient evidence to support their existence" (Rae, 2009, p. 1859).

In the UK, successive governments through various initiatives and policies associated with buzzwords and terminologies such as urban reconstruction, renewal, renaissance and urban regeneration among others, have been implemented in an attempt to reduce spatial socioeconomic inequality with varying degrees of success (Tallon, 2010; Roberts and Sykes 2000). In spite of these efforts, neighbourhood inequalities and deprivation remain a problem in many urban and rural areas across the country. With the presence of neighbourhood inequalities, social exclusion and deprivation remain a long-term problem (Barry, 1998).

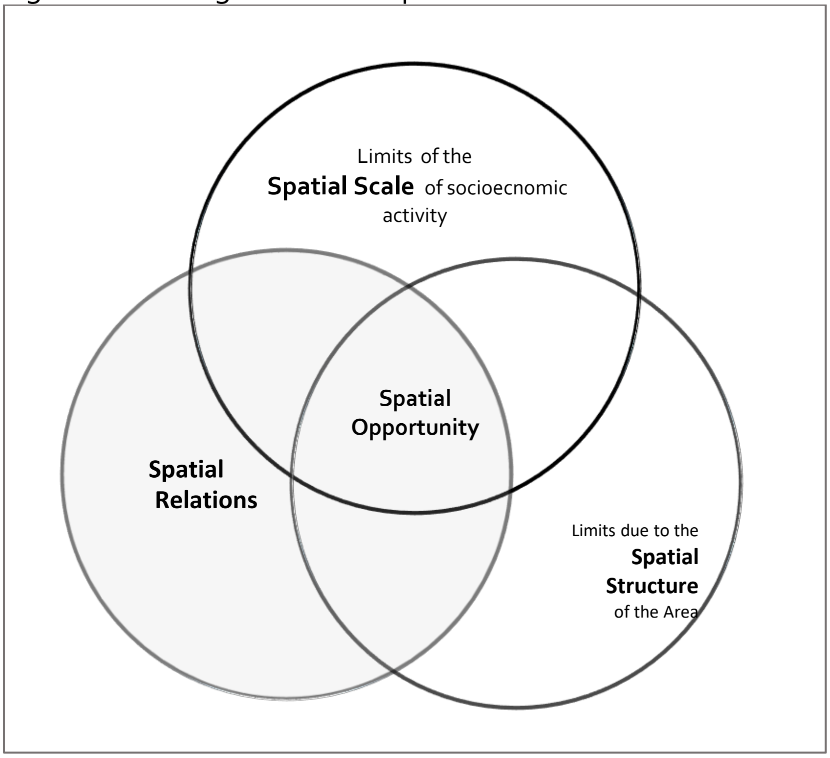
As posited by Harris and Johnston (2003), an essential prerequisite for the success of neighbourhood intervention policies, is not only the identification of places that need to be targeted for intervention but also understanding the complete context within which the identified issues have come into being in order to inform the appropriate intervention strategy. Zwiers et al. (2014) noted that spatial variations in socioeconomic and institutional structures coupled with differences in historical developments and other dynamics such as population composition make it difficult to assess the causes of neighbourhood decline. Tobler (1970 p. 234) also noted that "...everything is related to everything else but near things are more related than distant things". Neighbourhoods with similar characteristics but different spatial context are likely to face different challenges and those challenges need to be accounted for when assessing neighbourhood problems.

After years of refinements following the iconic works of Peter Townsend (1979 and 1987) "*Poverty in the United Kingdom*" and *"Deprivation"* respectively, the English Indices of Deprivation (ID) and its regional variations in Scotland, Wales and Northern Ireland have been the de facto means of assessing relative deprivation to identify areas in need of intervention programmes in the UK (Rae, 2009a; Deas et al., 2003). Despite the Indices of Deprivation being a relatively effective tool for determining neighbourhood inequalities, it has attracted several criticisms (see Schuurman et al., 2007; Deas et al., 2003; Rae 2009a). One such critique which forms the focus of this study is that the Indices of Deprivation underplays certain local spatial contexts which are critical to the understanding of neighbourhood socioeconomic variations (Rae, 2009a; Harris and Johnston 2003). For instance, a study reported in The Independent suggested that school children from poor backgrounds in London and the South are more likely to move up the social ladder than their counterparts in the Midlands and the North of England (Casidy, 2015). What accounts for these geographical variations in school outcomes? Whilst there may be several contributory factors to this observation, the role of the local spatial opportunity structure in shaping individual outcomes cannot be overlooked (Galster and Sharkey, 2017). Decision about life choices and behaviours which places individuals on different trajectories to the realisation of current and future socioeconomic outcomes are made within the context of payoffs and constraints perceived by the individual decision maker. However, as noted by Galster (2012) these constraints and payoffs differ markedly between places and have significant impacts on such choices and behaviours such as propensity to commit crime, acquiring higher education, aspirations and civic mindedness among others.

If spatial context matters and the evidence suggest it does (Galster and Sharkey, 2017; Lee, 1994; Rae, 2009a; Deas et al., 2003), then underplaying the role of local spatial context in the computation of the Indices of Deprivation could lead to problem misspecification, mis-targeting of urban policies and failure of intervention programmes to produce the relevant outcomes. There is therefore the need to explore the relevance of spatial contextual differences to people's experiences of poverty and deprivation. One way to achieve this is through the examination of the sensitivity of the Index of Multiple Deprivation, its domains and indicators to variations in neighbourhood local spatial context. As described by Harris and Johnston (2003), comprehensive and geographically fine scaled information on neighbourhood deprivation is necessary for effective policy targeting. The effectiveness of the tools and techniques used in the measurement of deprivation is central to this process.

It is worth noting that the intention here is not to diminish the utility of the IMD in accessing relative deprivation or to claim it is redundant but to explore the conceptual and applied issues relating to the contextualisation of location in the measurement of deprivation to improve the efficacy of the IMD in identifying deprived areas.

Figure 1. 1 – Neighbourhood Spatial Context



Source: Author

The conceptualisation of local spatial context being put forward in this research (illustrated by figure 1.1) includes all nearby and distant but well-connected neighbourhoods or locations from which individuals and household within the subject neighbourhood can and do engage in socioeconomic activities with. This is described as spatial relations within the context of this research. The spatial extent of such *spatial relations* and its effectiveness is influenced by the *spatial structure* of the neighbourhood in relation to its wider geographical area and the *spatial scale* of the socioeconomic activity of interest. The interaction between these three spatial attributes determine the local spatial context or what Galster and Sharkey (2017) refer to as the *spatial opportunity* structure for people within neighbourhoods. A detailed examination of the components shown in figure 1.1 has been provided in Chapters 3 and 4 of this thesis.

1.2 **Research Gap and Contribution**

The spatial concentration of deprivation and affluence can have a significant bearing on how people within different neighbourhoods experience deprivation. In addition, socioeconomic advantages and disadvantages established within certain neighbourhoods or wider regions, have the tendency to create path dependencies and spatial lock-in which can be sustained for long periods of time (Nygaard and Meen, 2013). Such path dependencies, which have significant influence on neighbourhood trajectories cannot be easily altered by market process. In most instances, some form of systemic shock or policy intervention is required to alter the underlying drivers of socioeconomic processes and to change the outcomes of people within these areas.

This thesis seeks to address gaps in relation to how deprivation is measured from the perspective of combining individual socioeconomic outcomes (as currently measured by The English Indices of Deprivation) and the spatial attributes of the local area or neighbourhood within which they are embedded.

Traditionally, debates around socioeconomic inequality have focused on the conceptualisation and understanding of the manifestation of poverty. Notable works on the subject matter include the works of Townsend's (1979) "*Poverty in the UK*", Townsend (1987) "*deprivation*" and Murray's (1990) "*The emerging British Underclass*". More recently the effectiveness of policy interventions in reducing deprivation and spatial inequality within the context of austerity and devolution (Hastings et al., 2017; Bywaters et al., 2017; Mackenzie et al, 2017; Rhodes et al, 2005) as well as the processes and techniques used in identifying deprived areas which are subsequently targeted with intervention programmes have been at the forefront of the neighbourhood deprivation – inequality discourse (see Kavanagh et al., 2016; Schuurman et al. 2007, Rae 2009b, Deas et al., 2003). This research work predominantly situates within the latter category.

In all these debates and arguments about deprivation and inequality, the role of geography and its potential influence on entrenched deprivation tend to lag the other aspects of the debate. Lee (1994) noted that whilst people automatically look to issues such as homelessness and declining-inner city areas when discussing poverty, debates around the theorization of poverty and exclusion ignore the role of housing and geographical space in general. However, interests in neighbourhood effects have given prominence to the importance of places within the deprivation and inequality discourse through the works of academics and urban policy commentators such as Brannstrom (2004), Buck (2001), Sairinen and Kumpulainen (2006), Lupton and Power (2002), and Galster and Sharkey (2017) among others.

Places have specific geographic, historic, environmental and economic circumstances that help to determine the prospects for growth for the area (HM Government 2010). These localised attributes of places influences issues like responsiveness to economic stimulants and shocks, and also provide the enabling environment within which individuals and household attributes are shaped into achieved socioeconomic outcomes. For instance, the Global Financial Crisis (GFC) and the economic downturn which followed impacted various parts of the UK differently. Whilst most parts of the country experienced some form decline in economic activities, evidence suggest that less economically diversified cities, towns and wider regions were severely affected and the number of disadvantaged households within these communities increased (Dolphin, 2009; Kitson and Michie, 2014).

The plights of people within disadvantaged neighbourhoods were also worsened by the significant budget cuts to the provision of services and welfare (Rowthorn, 2010). Even though these austerity measures impacted all areas of the country, its effects on deprived areas were more severe due to increased pressure on demand for resources. Globally, "the averaged income of the total population across the OECD countries stagnated between 2007 and 2010, while the average income of households in the lowest income decile experienced an annual decline" (Zweirs, 2014 p.2). This underscores the notion that although spatial contextual differences are important to the socioeconomic circumstances of people within both deprived and affluent neighbourhoods, it is more critical to deprived areas or people in poverty due to lack of resources to expand their spatial opportunity structure to engage in socioeconomic interactions such as commuting to different places for work and to access essential amenities and services.

People within deprived areas also tend to be associated with some form of spatial lock-in due to their inability to move in responses to labour market incentives to take advantage of favourable conditions elsewhere (Chan, 2001). Studies have also shown that the spatial concentrations of neighbourhood disadvantages beyond certain thresholds results in a disproportionate increase in the probability of negative neighbourhood effects on individual socioeconomic outcomes. Similarly, where there are concentrations of socioeconomic advantages, positive neighbourhood effects tend increase disproportionately (Quercia and Galster, 2000).

In spite of these developments, the spatial contextualisation of deprivation and how deprived areas are identified for policy targeting remain under-researched. Attempts have been made by academics and urban policy analysts such as Deas et al., (2003) Rae (2009a), Oakley and Logan (2007) and Rae (2012) to address some of these concerns, yet there are inadequate empirical studies concerned with how the existing measures of deprivation (the IMD) differentiates between deprived neighbourhoods within concentrations of generally deprived areas from pockets of deprived neighbourhood within generally affluent areas and how these spatial structural and relational differences influence experiences of deprivation.

This research attempts to fill this gap by addressing some of the applied and conceptual issues identified (and fully explored in Chapters 2, 3, and 4) through conceptual and methodological contributions to the spatial contextualisation of neighbourhood deprivation. This research will be relevant to the development of neighbourhood deprivation Indices in the UK and since small area deprivation indices like the IMD are not peculiar to the United Kingdom (Noble et al., 2006), this research will also be relevant to the development of similar measures in other countries.

1.3 Aim and Objectives

This research examines the relevance of neighbourhood spatial context in the measurement of deprivation at the local level. It does so in relation to the extent to which contextual differences in spatial structure, spatial scale and spatial relations influence experiences of deprivation and how these can be incorporated in the measurement of deprivation. The aim here is to improve the understanding of the role of local spatial context in the measurement of deprivation and to make methodological contributions to its conceptualisation and application.

The study has the following objectives:

I. To investigate the extent to which key domains and indicators of English Indices of Deprivation (ID) are spatially contextualised;
II. To investigate the impact of the relative differences in the spatial scale at which socioeconomic processes operate on the domains and the overall index scores of the Indices of Deprivation;
III. To investigate the impact of spatial relations between neighbourhoods on the ID domains and the overall index scores; and
IV. To investigate the impact of variations in neighbourhood spatial structure on the experiences of deprivation and the measurement of deprivation.

1.4 Methodological Approach

This research uses a spatial analytical approach to produce modified versions of the English Indices of Deprivation 2015 (ID2015). Global Moran's *I*, Local Indicators of Spatial Autocorrelation (LISA) and Network Analyst tools were the main applications used for the empirical study. These tools within GeoDA and

ArcGIS packages were used to analyse the domains and overall index scores of the ID2015, contextualise locational effects on deprivation and to create modified versions of the IMD which takes into account local spatial context. Not only does spatial analysis allow for such spatial impacts to be appropriately analysed and illustrated, it also presents a different approach to how most of the previous research which looks at the dynamics between deprivation and space were undertaken.

Relevant data for the study were drawn from various sources including but not limited to Indices of Deprivation data from the Ministry of Housing Communities and Local Government (MHCLG), Office of National Statistics (ONS) census 2011, and Edina UK Borders. To allow for consistency and to ensure data availability in similar format and spatial unit, England was chosen as the geographical scope of the study. However, the findings of the research would be applicable to the rest of the UK.

1.5 Thesis Structure

The content of this thesis is organised as outlined below:

Chapter 1 is the introductory chapter which provides an overview of the research project and provides a road map for the content of this thesis. The motivation for the study, aim and objectives and the methodological approach adopted for the study are outlined in this chapter.

Chapter 2 examines the theoretical underpinnings of spatial socioeconomic inequality and the measurement of neighbourhood characteristics. The evolution of terminologies such as poverty, social exclusion and deprivation as well as the techniques and tools used in assessing deprivation and understanding the extent to which some neighbourhoods are excluded from mainstream activities are also explored.

Chapter 3 explores the relevance of geography in the measurement of neighbourhood deprivation within the context of variations in socioeconomic, environmental, political and institutional advantages and disadvantages within the spatial opportunity structure and neighbourhood effects. The spatial distribution of deprivation and affluence in England as measured and published by the English Indices of Deprivation 2015 is also examined in this chapter.

Chapter 4 focuses on the research problem, research questions, the methodological approach adopted for the research project, the specific methods, data employed for the empirical analyses and the geographical scope of the study. Other relevant issues such as power and positionality, ethical considerations, challenges and limitation of the methods are also addressed in this chapter.

Chapter 5 is used to present the section of the empirical analyses which focuses on the contextualisation of the IMD to account for the role of local spatial relations in experiences of deprivation. It provides a step by step account of how differences in the spatial distribution of essential services and amenities, coupled with variations in the ability of people within different neighbourhoods to expand their spatial opportunity can influence experiences of deprivation. It also illustrates how these differences can be incorporated within the measurement of neighbourhood deprivation. A new version of the IMD2015 which is sensitive to these spatial contextual differences is produced and compared to the original IMD2015 to examine how the deprivation scores and decile classifications vary in different parts of the country.

Chapter 6 is the last of the analytical chapters and focuses on the impact of local spatial structure and scale on the measurement of deprivation. The clustering of deprivation and affluence in various parts of England and its potential impact on the measurement of neighbourhood deprivation is presented. Modified versions of the IMD based on different conceptualisations of neighbourhood spatial structure and spatial scale are presented.

Chapter 7 is the concluding section of the thesis. It reflects on the main findings of the research which were presented Chapters 5 and 6. The research questions are each reviewed and answered with the findings of the empirical analyses. The theoretical, policy and methodological contributions of the study are also discussed in this chapter.

2. Theory and Practice of Assessing Neighbourhood Characteristics

This chapter is the first of two chapters which situates the relevance of this research within the existing literature on socioeconomic inequality and the importance of geographical space as a medium through which inequality is organised, presented and perhaps more importantly, as a mediating factor through which individuals' attributes are translated into achieved outcomes.

In this chapter, I examine the theoretical underpinnings for evaluating neighbourhood characteristics within the context of socioeconomic inequality as well as the techniques and tools employed in this endeavour. I begin with the examination of potential drivers of neighbourhood decline and spatial socioeconomic inequality; the role of the state in reducing the gap between deprived and affluent areas; and the conceptual clarification of key concepts and terminologies such as poverty, social exclusion and deprivation. These will be followed by a review of the tools and techniques employed in assessing neighbourhood characteristics with focus on the development of the English Indices of Deprivation.

2.1 Theory and Policy Context of Assessing Neighbourhood Characteristics

Inequality has been a long-standing fundamental issue in society in general, and for local and central governments, it is a major concern. Academics, social commentators and urban policy analyst continue to debate the mechanism and pathways through which inequality manifest, the consequences of spatial concentration of deprivation and affluence and the perceived inability of urban policy actions to address the problem of inequality (Wei, 2015). At the centre of the inequality discourse is the notion that inequality constitutes injustice; the guarantee of basic rights and liberties for everyone within society hinges on addressing the root courses of inequality (Brucelli, 2017).

Analysis of poverty, economic growth and general socioeconomic developments are most often based on national level indicators through time. Whilst the use of such aggregate information to monitor a country's socioeconomic performance is necessary, it can be difficult to obtain meaningful insights about the spatial distribution of wealth or poverty from such national indicators (Noble et al, 2006). There is therefore an increasing demand for the use of local measures of socioeconomic and environmental conditions to provide an in-depth understanding of how various geographic units of the country compare to others and their contribution to the national economy (Deichmann, 1999; Noble et al, 2006).

At the local level, the spatial clustering of people with similar attributes or status (economic, social, political, and racial among others) within the society has been a persistent feature of many countries for centuries and has remained a subject of interest for decades (Louf and Barthelemy, 2016). However, what is more alarming is the extent to which socioeconomic disadvantages and poverty have become spatially concentrated in recent decades especially within suburbs of urban areas and inner city areas (Dorling, 2015; Daton 2013; Coulton and Pandey, 1992). The drivers for this trend differ from place to place and for different periods. Historical antecedents, decline of industrialisation, residential sorting and segregation, inadequate transportation networks, agglomeration, technological advancements and shifts in labour markets are some of the drivers considered to be responsible for the concentration of deprivation and affluence in certain areas (Deaton, 2013).

It can also be argued that spatial inequality is fundamentally inequalities among people within the society organised on a geographical space. In this regard, the basic sociological and economic foundations of society, which some claim are embedded with inequality, are considered to be the main drivers for the spatial concentration of deprivation and affluence (Ferrari, 2012).

Whilst some argue inequality is necessary to promote growth (see Gottschalk, 1997; Fischer et al, 2018), others believe it can impede growth (Deaton, 2013). In advocating for capitalism, the Economist (2006) suggests that inequality is not inherently wrong so long as society in general is getting richer, there are measures in place to protect the very poor and there are equal opportunities for everyone. This view was debunked by Gilbert (2007) who posits that inequality inhibits economic growth and action against poverty. In his view, "more equitable public policies are the only satisfactory antidote" to address poverty (Gilbert, 2007 p.422). Deaton (2013) and Dorling (2014) concurs with Gilbert's perspective. Even, among those who believe that inequality is a necessary part of development, there are debates and arguments surrounding what is an acceptable level of inequality within the society and which aspects of society should equality or inequality be more or less acceptable (Deaton, 2013). For instance, should income inequality be less undesirable than inequality in access to health (Haidt, 2012)?

In this section, I examine the phenomenon of spatial socioeconomic inequality and deprivation from the perspective of economics theories, residential segregation and the decline of industrialisation. This will help understand some of the potential drivers of the spatial concentration of economic activities which results in spatial socioeconomic inequality within and between neighbourhoods, cities and regions as well as the extent to which these necessitate the need to measure neighbourhood characteristics.

2.1.1 Economic Theories

2.1.1.1 **Neoclassical Economics**

Most writers describe neoclassical theory as the theory of perfect competition and it is considered to be the foundation of most capitalist economies (Hunt and Morgan, 1995). Neoclassical economics has been at the forefront of economic theory since it was propounded in the late 19th century through the introduction of marginalism as a central theme to classical economic theories (Aspromourgos,1986), yet, there is no single acceptable definition for neoclassicals economics (Dequech, 2007; Latsis and Repapis, 2016). In fact, some argue that neoclassical economics is imprecise, used in different ways and what is described as neoclassical economics has changed over time (Davis and Sanchez-Martinez, 2014; Roos, 2016, Latis and Repapis, 2016). Others suggest that neoclassical economics is not necessarily a theory which can be subjected to empirical testing, it is rather a methodological process for explaining economic phenomena through which theories can be developed (Hunt and Morgan, 1995; Arnsperger and Varoufakis, 2006, Latis and Repapis, 2016).

Most definitions of neoclassical economics rely on what is usually referred to as its fundamental principles. For instance, Arnsperger and Varoufakis (2006) describes what they refer to as the meta-axioms of neoclassical economics: methodological individualism, methodological instrumentalism and methodological equilibration. Methodological individualism refers to the neoclassical concept of focusing on individuals as rational agents of society in other to understand societal phenomena. Methodological instrumentalism refers to the notion that all individuals' actions are driven by the preference to maximise utility. The final element, methodological equilibration is the perceived inability of neoclassical economics to demonstrate the achievement of equilibrium through the rational choices of individuals, hence, equilibrium is assumed.

Colander et al. (2004) refers to rationality, selfishness and equilibrium as the main principles of neoclassical economics. Dequech (2007) highlights rationality and utility maximisation, the emphasis on equilibrium and the neglect of uncertainty as the three main characteristics of neoclassical economics. Other underlying assumptions of neoclassical economics are perfect competition, perfect knowledge and perfect foresight (Reinert, 2012).

Neoclassical growth theory considers spatial inequality to be a temporal disequilibrium inherent in the growth framework. Neoclassicals argue that in the long run, labour moves to more developed areas to take advantage of high wages, capital is switched to less developed areas to take advantage of lower wages and to maximise profit. Eventually, wages and capital achieves equilibrium in the long run and so does growth (Wei, 2015). For this theory to hold, the assumptions of efficient markets and perfect mobility of factors of production must hold true. However, the validity of these underlying assumptions and other principles of neoclassical methods which have been subjects of debate for decades remain questionable. For instance, Cohen and Win (2007) identified inefficient firms, the presence and impacts of externalities, flawed pricing mechanisms and information asymmetries as some of the prevailing conditions which violates neoclassical economic assumptions. Spatial inequalities can be attributed to these process which inhibits market forces.

One attribute which is common to most of the characteristics of neoclassical economics, earlier discussed, is the focus on individuals as rational agents whose aggregate preferences and decisions determine the direction of the general economy - methodological individualism (Colander, 2000). Methodological Individualism, as proposed by neoclassical economics, suggests that the fundamental characteristics and preferences of individuals is given, or at least shaped by some other factors which are external to the domain of economics (Arnsperger and Varoufakis, 2006). Within the context of this research some of these exogenous factors will include the social, institutional and environmental conditions at the exposure of the individual within the individual's neighbourhood or entire spatial opportunity structure.

Neoclassical economics also acknowledges that 'given' attributes such as talents, skills and access to capital which have significance influence on the individuals productivity within the market is unequal (Wei, 2015). This has the potential to render some individuals more susceptible to less productivity and poverty. Other drawback of neoclassical economics which justifies policy interventions are the potential for market failures or imperfect markets due to incomplete information, adverse selection and moral hazard (Latis and Repapis, 2016).

There is therefore an argument within neoclassical economics in support of the use of policies to ensure an enabling environment is created within all neighbourhoods to provide individuals with the relevant perfect knowledge and foresight needed to make rational choices and maximise their utility. The need to assess and compare neighbourhood characteristic to ensure areas which require improvements receive the necessary attention and resources is central to this objective.

2.1.1.2 **Behavioural Economics**

The difficulty in explaining certain phenomena observed within markets by the traditional neoclassical economic paradigm have resulted in development of other theories (Barberis and Thaler, 2003). One such theory is behavioural economics. Are all individuals within a given society rational and self-centred agents who make decisions based on a careful analysis of cost and benefits in line with their preferences in order to maximise utility at all times? Behavioural economics suggest the answer is no. According to behavioural economics, "…people are not always self-interested, cost-benefit-calculating individuals with stable preferences, and many of our choices are not the result of careful deliberation. Instead, our thinking tends to be subjected to insufficient knowledge, feedback, and processing capability, which often involves uncertainty and is affected by the context in which we make decisions" (Samson, 2015 p.1).

Alain (2014 p.1) defined behavioural economics as the "study of cognitive, social, and emotional influences in peoples' observable economic behaviour". Pete (2014 p.19) describes behavioural economics as the "the incorporation of psychological insights into the study of economic problems". Relative to the rational choice principle of neoclassical economics, Mullainathan and Thaler (2000) defined behavioural economics as "the combination of psychology and economics that investigates what happens in markets in which some of the agents display human limitations and complications".

To behavioural economics, the decisions and choices people make are influenced by the complete spectrum of the prevailing socioeconomic, environmental, political and psychological conditions affecting the individual. More importantly, elements of rationality such as preferences and skills that set the individual on a lifetime trajectory of decisions are largely dependent on the cognitive and non-cognitive abilities developed at early ages through family circumstances and neighbourhood socioeconomic and environmental conditions (Borgahams et al, 2008; Cunha and Heckman, 2009). Put it simply, our actions as individuals have limits. These limits are influenced by, among others, our motivational, cognitive, psychological and sociological abilities (Anand and Lea, 2011).

The spatial context within which people are embedded has a significant bearing on the development of these abilities and how they are translated into outcomes. The importance of spatial context to socioeconomic outcomes are reviewed in chapter 3. Here, it is worth noting that the complete comprehension of the circumstances within which such cognitive and non-cognitive abilities are developed provides a better and richer understanding of individual rationality and choice and also provides a better framework for understanding socioeconomic inequality and poverty. For instance, Bertrand et al. (2004) reported that about 10% to 20 % of American households do not hold bank accounts. Whereas the cost of opening and maintaining a bank account could be the main reason for this trend, the authors posited barriers such as "…a testy bus ride, challenging hours, or the reluctance to face a contemptuous bank teller" (Bertrand et al., 2004 p.420) could also be important. Developing a policy to address such a trend will be more effective if it addresses issues concerning the cost of opening and maintaining a bank account as well as the other issues. Similarly, understanding the complete socioeconomic characteristics of neighbourhoods in other to address the shortfalls in the relevant sectors is necessary to enhance the potential socioeconomic outcomes of people within the neighbourhood through the development of the necessary skills and capabilities.

2.1.1.3 **Urban Economics and New Economic Geography**

Theories concerned with why certain economic activities tend to be located within certain geographical spaces have been of interest to academics and urban policy analyst for centuries. Whilst some argue that the role of geographical space in economics has been confined to the periphery (Fujita et al., 1999), within the study of urban economics, geography is central. Urban economics is concerned with how individuals, households and firms choose where to live, work and produce (Richardson, 2013).

Von Thunen's (1826) agricultural location theory was one of the earliest attempts to explain why various economic activities are undertaken within certain geographical spaces. Whilst Von Thunen's model focused on agricultural production yield and transportation cost, William Alonso's (1964) introduced a similar model to explain land use patterns around a monocentric city. Alfred Weber's (1929) theory of the location of industries, and Christaller's (1933) central-place theory are also some of the other locational and urban economic theories which have evolved through the years. New economic geography is a continuation of this trend. Krugman (1991) and subsequently Fujita et al. (2001) sort to improve the understanding of the location of production and the determinants of trade through the integration of economies of scale and general equilibrium models. Its origin is believed to be from international trade theory (Ascani et al., 2016) and has been defined as an attempt "to explain the formation of a large variety of economic agglomeration (or concentration) in geographical space" through fundamental micro-economic decisions (Fujita and Krugman, 2004 p.140).

In "The spatial economy: Cities, regions and international trade", Krugman et al, (2001 p.9) ask two questions: (a) Under what conditions are the advantages created by the concentration of economic activity within a geographic unit sustainable and (b) under what conditions do small locational differences develop into larger differences over time, so that the symmetry between identical locations spontaneously breaks. They argue that these depends on "the balance between centripetal forces, forces that tend to promote spatial concentration of economic activity, and centrifugal forces that oppose such concentration". These were developed into two principles:

(1) Holding all other factors constant, producers of goods and services want to locate close to their suppliers of raw materials and their consumers. This is because of the centripetal forces such as linkages, thick markets knowledge spillovers and other external economies.
(2) There are also centrifugal forces such as the immobility of certain factors of production e.g. landed resources; and other factors such as congestion, increasing levels of pollution and rising cost of rents that oppose agglomeration fostered by the centripetal forces.

New economics geography suggest that these two forces are constantly competing against each other and are to some extent responsible for the spatial structure of an economy. Understanding the workings of these two forces within the regional or local economy of interest can enable governments to design the appropriate policies to foster both positive and negative externalities necessary to promote the desired responses within the area.

The concepts of spillovers and externalities which are integral to new economic geography theory are of much relevance to the spatial conceptualisation of neighbourhood deprivation proposed in this research. This is because it highlights spatial interdependencies; the notion that processes observed within a particular spatial unit are influence by some other processes taking place elsewhere (Wicht and Nonnenmacher, 2017; Tobler, 1999). As opposed to confining the measurement of neighbourhood characteristics to predetermined administrative units which are often treated as self-contained spaces, socioeconomic interactions between people of different places which are responsible for generating some of these externalities are not usually guided by boundaries (Wicht and Nonnenmacher, 2017).

From the above discussion, it can be seen that there is a substantial body of literature regarding the potential drivers of spatial socioeconomic inequalities. Whilst most of these theories make contributions to the understanding of the phenomenon of spatial inequality, no single theory appears to be sufficient in explaining the various dimensions and intersectionality of social, economic and political processes which result in differing neighbourhood characteristics (Roberts and Sykes, 2000; Davis and Sanchez -Martinez, 2015). However, most of the theories reviewed acknowledge that market forces and the "invisible hand" which are central to the allocation of resources and drive the organisation of socioeconomic activities across space are imperfect. There is the need for these market forces to be shaped by policies, institutions and regulations even though the extent to which intervention polices are used differ between theories and concepts (Stiglitz, 2013).

To address socioeconomic inequalities, stakeholders do have responsibilities to address the imperfections of the market by creating positive and negative externalities, and provide the necessary of skills, training and educational facilities aimed at improving individuals' abilities to enable them take advantage of opportunities. In examining "*The Economic Approach to Cities*", Glaser (2007 p.3) posits that "Economics' third pillar is the assumption that good policies increase the range of choices that an individual can make" resulting in an increased utility. Assessing neighbourhood characteristics is not only central to the identification of areas which require attention, but also necessary to inform the appropriate policy directions.

2.1.2 ***Residential Segregation***

The fundamental component of the spatial opportunity through which personal attributes of individuals are shaped and transformed into realised outcomes is the place of residence (Galster, 2012b). However, a prominent observable characteristic of most urban areas is residential segregation; the extent to which groups of people live in clusters and separately from each other within urban areas (Massey and Denton, 1988). It is usually measured by a dissimilarity index which the population groupings that make up neighbourhoods in a larger area or in some case the entire country. The index scores range from zero to hundred. A zero score indicates that the proportion of any selected population group is the same across all neighbourhoods within the larger area of interest. A score of hundred indicates that every neighbourhood is made up of the same group of people but different to the other neighbourhoods (Galster, 2012b). Massey and Denton (1988) describes these two extremes as 'complete integration' and 'complete segregation' respectively.

There are multiple and complex socioeconomic processes which results in residential segregation. Segregation can be on the basis of economic status, income, race, country of origin (in the case of immigrants), ethnicity, class and the interplay of individual choices among others (Emerson et al, 2001, Schelling, 1971). The Home office (2001, p.59) defines segregation as "the extent to which different groups are geographically, economically and socially separated".

Theories such as voluntary sorting conditioned by income, ethnic and racial segregation among others have been propounded in an attempt to explain why and how residential segregation arise (Louf and Barthelemy, 2016; Cheshire, 2007). Whereas the underlying processes of residential segregation and its potential causes are important, these are beyond the scope of this thesis. What is of interest here is neighbourhood decline through the concentration of multiple socioeconomic disadvantages and how they can be reinforced by residential segregation (Iceland, 2014).

For the most part, studies of residential segregation have focussed on racial and ethnic differences (Schelling, 1971; Galster, 2017). In as much as racial residential segregation persist within urban areas, neighbourhood segregation by economic status or income which is concerned with the degree to which low income and high income households live apart has been on the ascendency (Galster, 2017; Reardon and Bischoff, 2016; Galster, 2012). This phenomenon has also been associated with rising poverty rates within some segregated neighbourhoods (Jargowsky 2015; Gaslter, 2012). Even though economic circumstances through housing markets tend to be the primary pathway for residential segregation, perceptions about the role of neighbourhood effects on individual outcomes plays a significant role in residential segregation. As describe by Schelling (1971 p.145):

> "To choose a neighbourhood is to choose neighbours. To pick a neighbourhood with good schools is to pick a neighbourhood of people who appreciated schools (or people who want to be with the kind of people who appreciate schools)."

Segregated neighbourhoods characterised by concentrated socioeconomic disadvantages such as poverty, joblessness, and crime as well as infrastructural obsolescence tend to be associated with limited opportunities for people within these neighbourhoods (Wilson, 1996). Such neighbourhoods are considered to exude other negative area effects on individual outcomes over and above what can be associated with the individual's personal and family circumstances (Buck, 2001)[2]. People who have the economic capabilities tend to consciously or unconsciously avoid such places resulting in alienation and deepening neighbourhood problems (Schelling, 1971).

A review of neighbourhood effects and mechanism through which it can influence individual socioeconomic outcomes has been undertaken in Chapter 3 of this thesis. Here, it is worth noting that where the level of neighbourhood disadvantages exceeds a certain threshold[3], the probability that individual socioeconomic outcomes will be negatively influenced by such neighbourhood effects increases disproportionately (Quercia and Galster, 2000). Theories of collective socialisation suggest that through social interactions, social groups that become more powerful through spatial concentration can influence others to conform to its behaviours and norms (Galster, 2018). The nature of these behaviours and norms can induce positive or negative socioeconomic outcomes. There is therefore the need to assess neighbourhood socioeconomic characteristics to identify concentrations of disadvantages within

[2] The processes through which individual outcomes can be influence by neighbourhood effects are reviewed in Chapter 3.
[3] See Galster (2012).

neighbourhoods and other neighbourhoods which forms part of its spatial opportunity structure, in order to develop appropriated policies to reduce such concentrations and their potential effects.

*2.1.3 **The Decline of Industrialisation***

Neighbourhoods are constantly evolving and these changes affect the fabric of the neighbourhood and the people within these areas in diverse ways. For instance, increasing house prices within neighbourhoods can be considered to be economically desirable for home owners within these areas, but it can also result in gentrification and displacement of some residents (Zwiers et al., 2014). Neighbourhood level changes such as upgrading and downgrading can arise from both internal process such as ageing population, mortality and fertility as well as external forces such as general changes in the macroeconomic structure of the wider urban region or country (Glaeser and Gyourko, 2005). On a larger scale, several major cities, towns and regions have undergone major transformations within the past 5 decades (Glaeser, 2005). Whilst some of these developmental processes have resulted in positive outcomes for certain areas, they can also result in neighbourhood decline (Teernstra, 2014).

One such development which has had profound implications for various neighbourhoods, towns and city regions in the UK is deindustrialisation. Deindustrialisation can simply be defined as the "sustained decline in the share of manufacturing in both employment and GDP" (Tregenna, 2015 p.7). Transportation cost, which guided the development of most urban regional economic frameworks have seen consistent decline within the last few decades to the extent that transportation of goods and services is no longer as critical to the siting of manufacturing industries as it used to be (Glaeser and Gyourko, 2005). Instead the accessibility to the relevant skilled and cheap labour force as well as business-friendly regulations are becoming more important due to their impact on profit maximisation (Glaeser and Kohlhase, 2004, Ellison et al, 2010).

Industrial decline and economic structural changes are not only associated with the UK. Most advance countries have experienced some form of structural changes and decline in manufacturing outputs since the 1960s (Rowthorn, 2010). Established cities and towns which were once pillars of manufacturing due to the significant savings in transportation cost involved in producing goods within these places have since seen persistent decline in economic activities for the past few decades (Glaeser, 2005).

Some argue that decline in industrialisation is part of the natural processes of the evolution of advanced economies and should not necessarily be considered to be a problem (Martin et al., 2016). Proponents of this view suggest that among others, advanced countries tend to be more efficient in producing services which are knowledge intensive and requires advanced technology. There has also been a significant increase in consumption towards services in advanced countries which promotes the argument for advanced countries to focus on the production of services (where they appear to have a comparative advantage), whilst developing and less developed countries focus on manufacturing (Kitson and Michie, 2014).

Others argue that industrial decline in any economy is a concern because manufacturing is an essential element of the general economy through its linkages with other sectors of the economy. For instance, manufacturing drives innovation in technological advancements and outputs from manufacturing serves as inputs for other sectors. A well-developed manufacturing sector is also considered to be necessary to increase net exports and the long-term prosperity of any region or country is largely dependent on its net exports (Rowthorn, 2010)

Irrespective of the differences in understanding and theorizing the role of deindustrialisation in the national economic developmental framework, compared to other countries, the rate of industrial decline in the UK has been faster (Kitson and Michie, 2014). The contribution of manufacturing to UK Gross Value Added (GVA) has fallen from approximately 27% in the 1970s to about 10% in 2017 (Rhodes, 2018).

Whilst some elements of this decline can be attributed to the growth in other sectors of the economy such as the service sector, there has also been significant reduction in industrialisation. In 1982, manufacturing jobs accounted for 21% of the UKs total employment. In 2018, manufacturing accounted of just 8% of total jobs in the UK (Rhodes, 2018). Mining activities are virtually absent in Britain and there has been about 60% reduction in manufacturing employment since the 1970s (Rowthorn, 2010). Between 1970 and 1974, annual manufacturing job losses due to redundancy in Britain averaged about 180,000 and only about one in three of these jobs lost were replaced by jobs created in the manufacturing sector (Singh, 1977). Between 1987 and 1994, about 20% of manufacturing jobs in Britain were lost (approximately 900,000 jobs) (Graham and Spence, 2000).

Even though these developments affect the national economy in general, there are significant spatial variations in the manifestation of these structural changes within and between the various regions of England and the UK as whole. Areas in England with significant manufacturing industries such as the West midlands, and the North West lost about 18% and 22% of their manufacturing jobs respectively. The South East also lost about 32% of its total manufacturing jobs (Graham and Spence, 2000). These levels of decline have been attributed to deep-rooted structural weaknesses in the UK economy such as the lack of investment in manufacturing sector and the overreliance on financial services (Rubinstien, 2001; Kitson and Michie, 2014). Perhaps what is more crucial to this research is the extent to which deindustrialisation as a result of the relative decline in the manufacturing sector have significantly impacted the economies of various towns and cities in the UK built around certain types of industrial activities.

In an examination of structural difference between the north and south of England, Rowthorn (2010) posits that the industrial slump which characterised Thatcher's conservative administration was comparatively more severe in the north than it was in the south. Similarly, the economic recovery following this period was faster in the south, with employment levels exceeding the pre-1979 peaks whilst employment levels in the north remained significantly less than the pre-1979 peak in the same period. In addition, technological advancement and process of agglomeration have rendered some locations unsuitable or less favourable for advance manufacturing and the provision of in demand goods and services (Martin et al, 2016).

Previously industrialised cities and towns which have not been able to shift their economies to these in-demand services and productivity face persistent economic decline. British cities such as Birmingham, Glasgow, Sheffield, Newcastle and Liverpool among others which were largely industrial towns and cities have experience significant decline in economic growth compared to other cities which were less dependent on manufacturing (Martin et al, 2016). As industrial productivity declined and firms relocated to other places, average household income in such cities and towns dwindled resulting in concentrations of poverty and social distress within neighbourhoods (Glaeser, 2005).

Structural socioeconomic differences between the various regions of England and the relative impacts of de-industrialisation on these places have been well documented. This is evidenced in the substantial literature engaged in the north-south divided discourse (see Morgan, 2006; Dorling, 2010; Wales, 2000; Martin, 1988; Hacking et al., 2011). However, local spatial socioeconomic structural differences and its impacts on deprivation and other socioeconomic indicators have not received the same level of attention. Improvements in the understanding of these deep-rooted structural differences at the local level has the potential to improve neighbourhood problem diagnosis and the development of appropriate policy actions to address such problems.

In the UK, various policies have been employed for decades in attempt to address spatial socioeconomic inequality and deprivation through urban regeneration programmes with varying degrees of success. A summary of these policies has been provided in table 2.1. These policy developments will be reviewed in the next section in order to examine the changing phases of urban policy development in the UK as well as the evolution of the techniques and process employed to measure socioeconomic inequality.

2.2 The Evolution of UK Urban Policies and Implication for Assessing Neighbourhood Characteristics

Most UK urban policy directions aimed at addressing spatial socioeconomic inequality are known as urban regeneration programmes (Grieg et al., 2010). The Ministry of Housing, Communities and Local Government (formerly Department of Communities and Local Government) defines regeneration as "a set of activities that reverse economic, social and physical decline in areas where market forces will not do this without support from government" (CLG, 2008 p.6). Such regenerations programmes evolved from similar programmes captioned with different terminologies such as urban reconstruction, revitalisation, renewal, redevelopment, and renaissance. Although these buzzwords are frequently used interchangeably by institutions, policy analysts and academics; various authors (Tallon, 2010; Roberts and Sykes, 2000; Lees, 2003 among others) recognise subtle differences in these terminologies which tend to be reflective of the change in focus from physically oriented sectorial developments in the 1950s towards wider scope of environmental sustainability[4]. Table 2.1 presents a timeline for the evolution of urban regeneration in the UK.

Regeneration policies in the UK since the Second World War has evolved with about Five (5) identifiable phases which are briefly discussed below.

Post 1945: - The development of urban regeneration as policy action has its roots from post-world War II when governments had to clear slums and rebuild

[4] Roberts and Sykes (2000) identified that in Britain term urban reconstruction was associated with the 1950s urban policies, revitalisation in 1960s, renewal in 1970s, redevelopment in 1980s and regeneration post 1990.

physically dilapidated neighbourhoods in their bid to revitalise towns and cities. The task of reconstructing urban areas was the focus of 1950s urban policy through which governments used compulsory acquisition powers to acquire and demolish ruined properties. This era also saw the development of houses as well as health and education infrastructure with guidelines provided by central governments to local authorities (Cullingworth and Nadin, 2006; Roberts and Sykes, 2000).

By the 1960s, the clearing and rebuilding approach had been adjusted to focus more on refurbishing existing buildings and improving social services. This was mainly due to the increased unpopularity of the slum clearance approach (Cannon, 1999). The Community Development Projects (CDPs), Educational Priority Areas (EPA), and General Improvement Areas (GIA) were some of the first area-based policies to be introduced in Britain during this period (Champion, 1987). Urban policy actions during this period were characterised by the modernisation and general redevelopment of areas (Roberts and Sykes, 2000).

1970s: **-** The worsening socioeconomic and environment problems of the 1960s resulted in a significant change in the approach to regeneration. In 1968, the Urban Programme (UP) was initiated as a single source of funding aimed at "…urban areas which exhibited signs of 'urban stress', 'multiple deprivation' or 'additional social need'" (Batley and Edwards, 1974; p. 306).

Several other policy actions were introduced alongside Urban Programmes to promote co-ordination of socioeconomic and physical urban policy deliveries (Roberts and Sykes, 2000). The 1977 inner city white paper – '*Policy for the Inner Cities'* expanded the 1968 Urban Programmes from a budget of £30 million to

£125 million per annum with an emphasis on strengthening inner city economies, alleviating social problems, improve physical outlook and ensuring an appropriate balance between inner city areas and the rest of the city region (Home, 2007). Old industrial sites, factories and the general environment of run-down communities received greater attention. Most local authority activities were directed towards the improvement of these areas. There were significant public investments towards the improvement of housing in low income areas and small-scale housing developments were a prominent feature of this era (Turok, 1992).

***1980s and 1990s*: -** The 1980s saw the emergence of private sector property developments being at the forefront of urban policy. The property market was in boom both nationally and globally and seen as one of the driving forces towards the urban policies at the time (Turok and Shutt, 1994). Major development and redevelopment schemes such as Liverpool Albert docks and London Dockland schemes in England were among several others which were started during this period by Urban Development Corporations (UDC).

Urban development policies in the 1980s were market-led, the role of the state was limited to the provision of incentives through the creation of the necessary environment suitable for private sector investment. The concept of 'trickle-down' of benefits was the main idea behind this approach to urban regeneration (Turok, 1992). However, critiques argue that this approach led to an increase in the gap between deprived and affluent areas. Some neighbourhoods were severely disadvantaged whilst surrounded by more prosperous areas (Tallon, 2010). Others believe that the trickle-down approach was flawed because the mechanism through which private sector investment (mainly in property) translates into positive neighbourhood effects (especially social effects) was poorly understood (Turok, 1992).

By the early 1990s regeneration activities began to shift from the dominant property-led approach to a more integrated approach. The development of property remained a significant aspect of regeneration programmes with suggestions that the idea of self-sustainability should be seen as an integral part of regeneration programmes (Adair et al., 2003). Proponents of this view see increases in property values as an essential aspect of the regeneration process (Simons, 1998) although critics of gentrification (especially the type which caused displacement) hold a different perception regarding this (see Atkinson, 2000).

By the 1990s, local governments began to regain some of the roles they lost during 1980s and the Single Regeneration Budget (SRB) was introduced in 1994 to replace Urban Programmes as a way of reducing some of the complexities (Jones and Evans, 2008). However, this time, it was on a competitive bidding basis (Tallon, 2010). This was seen as a way of bringing out the best innovations from local authorities and to put them in control of their own urban development (Atkinson, 1998). It can also be argued that competitive bidding was more or less the order of the day in the UK and in other countries at the time (Oatley, 1995).

Another important feature of the 1990s urban programmes was the creation of partnerships between the public sector, private companies, voluntary organisations and communities. These were seen as key actors necessary for the delivering of effective and successful regeneration programmes. In some cases, these partnerships were necessary conditions to access central government funds (Tallon, 2010).

1997 – 2010: - *A* key stage in the evolution of urban regeneration in the UK was in 1997 with the election of New Labour government. This period saw the introduction of spatially explicit policy directions through the focus on social exclusion and neighbourhood renewal (Ferrari and Lee, 2007). Comprehensive Area Based Initiatives (ABIs) were adopted on the backdrop of the introduction of what became known as the 'social equivalent of the minimum wage'[5] (Lupton et al., 2013) and to address problems related to the rapid deterioration of neighbourhoods characterised by high vacancy rates and falling house prices (Lee and Nevin, 2003).

Urban policies moved towards the understanding that the socioeconomic and environmental context of urban problems are interrelated and needs to be tackled from all angles if the programmes are to be successful. As described by Lee and Nevin (2003 p. 67) within the context of housing market restructuring,

> "The emphasis on the promotion of home ownership as an end in itself and the focus on stimulating economic growth with limited regard for its distributional consequences was replaced by a new focus on the promotion of social cohesion, neighbourhood renewal and regional economic development."

The majority of the urban policies of the 1990s were maintained albeit adjustments in the form of emphasis on community participation and collaborations between organisations as well as local, regional and national policy co-ordination (Macgregor, 2006). Even though these programmes were not heavily dependent on the private sector, they maintained a balance between

[5] Set of minimum standards which the government proposed every neighbourhood should achieve.

public–private participation, encouraged voluntary funding from organisations and promoted an increased role for the local community (Macgregor, 2006).

Urban policies in the UK entered a new phase after the Global Financial Crisis (GFC). The shift from mostly state funded regeneration programmes to private-public partnerships meant that most urban regeneration programmes had to be economically viable for private firms to commit resources. The Global Financial Crisis and the subsequent recession led to significant reductions in regeneration activities especially those involving private sector funding due to the unavailability of finance coupled with the gloomy economic atmosphere (DCLG, 2009). Programmes such as Housing Market Renewal (HMR), Urban Regeneration Companies (URC), and New Deal for Communities were all negatively impacted. There were significant drops in residential property developments with some URCs reducing their work by about 75% whilst others stopped entirely (DCLG, 2009).

Table 2. 1 - Timeline of Urban Regeneration in Britain

Conservative 1951 -1964 | Labour 1964 - 1970 | Conservative 1970-1974 | Labour 1974-1979 | Conservative 1979 - 1997 | New Labour 1997-2010 | Conservative/Liberal Democrat Coalition 2010-2015

	1950s	1960s	1970s	1980s	1990s	2000s	Post 2010
Major Strategy	Reconstruction and extension of older areas of towns and cities based on master plan; suburb growth	suburban and peripheral growth; some attempts at rehabilitation	focus on neighbourhood schemes; development of periphery	flagship projects, out of town projects; major development and re-development schemes	integrated, comprehensive policy and practices	integrated, comprehensive policy and practices	Austerity Measures, finding new ways to finance regeneration projects, Devolution of fiscal and economic regeneration
Key Actors	National and local government	A greater balance between public and private sectors	Increasing role for private sector and decentralisation	Emphasis on private sector and special formed agencies; Partnerships	Partnership being the dominant approach	Partnerships the dominant approach, devolution of powers to local governments	Partnership and devolution of powers to local governments
Major Policies and Programmes	Town and country Planning Act 1944; New Towns Act 1945	Urban Programme (1968)	1977 Inner city white Paper - cities partnership programme inner urban areas Act (1978)	• 1989 The future of Development Plans 1989 Planning and Compensation Act • 1989 Planning and compensation Act • 1982 - Action for cities Programme- urban Development Grant • 1982-Inner city Priority category for derelict Land Grant • 1984 - Garden Festival • 1985 - city Actions Teams • 1986-87 - urban Task force • 1987 - Urban Regeneration grant • 1988 - City Grant • 1981- urban development corporation • 1981- enterprise zones • 1988 - Housing Action Trust	• Planning guidance notes • Regional Policy Guidance Notes • 1991- City challenge • 1994- single Regeneration Budget • 1998 - English Partnership • 1990-This Common Inheritance • 1990-Environmental Protection Act • 1997 - Building Partnership for Prosperity, sustainable growth, competitiveness and employment in English regions • 1998-our competitive future: building the knowledge driven economy • 1998-Regional development agencies • 1998 - New Deal for communities • 1995 - Estate Renewal Fund • 1998 - Action zones	• 2002 - Housing Market Renewal • 2001-National Strategy for Neighbourhood Renewal • City challenge continued • Regeneration Agencies continued -like English partnerships and New Homes and Communities Agency • Most programmes initiated in late 1990s continued in this era. At least until the financial crisis	• Schemes to encourage house building • Local Asset Backed Vehicles • Joint European Support for sustainable Investment in city Areas • Tax increment finance • Local Enterprise Partnership

Source: Adapted from Roberts and Sykes (2000)

Post 2010: - The two main policy documents which gives an indication of the current urban policy agenda are "*Regeneration to enable Growth: what the government is doing in support of community-led regeneration*" (DCLG, 2011) and "*Local Growth: Realising every place's potential*" (HM Government, 2010). Both policy documents indicate that devolution of socio–economic regeneration to regional agencies such as LEPs and local authority districts is set to continue. There is no discernible central government regeneration policy direction and LEPs are not specifically tasked to identify deprived areas and address spatial inequalities. Central government funding for major regeneration programmes more or less ceased after the Global Financial Crisis due to the implementation of austerity measures. Attention appears to be focused on infrastructure developments like London Crossrail, high-speed rail networks and new incentive schemes aimed at increasing housebuilding (Lupton, 2013).

From the above discussion, it is clear that the expected outcomes of urban policy actions have evolved from the need to address physical and functional obsolescence observed in places after World War II to a more sustainable development agenda and the need to address deep-rooted socioeconomic problems with multifaceted dimensions (Turok, 1992; Roberts and Sykes, 2000). Greig et al. (2010) highlighted the following as the UK government's objectives for regeneration:

- Improving economic performance and tackling worklessness, especially in deprived areas;
- Creating an enabling environment for business investment and growth;
- Creating sustainable places where people would want to live and work.

The Identification of areas which required targeted investment is an essential prerequisite for policy direction and allocation of resources (Greig et al., 2010). However as urban problems and expected policy outcomes evolved, so did the techniques or measures used in assessing neighbourhood characteristics and identification areas which should be targeted with various policy initiatives and resources. Consequently, there was the need to move away from the national level and often sectoral indicators used for assessing socioeconomic conditions of places to a more locally rooted assessment criteria (Roberts and Sykes, 2000). This led to the development of the Indices of Multiple Deprivation which is currently employed as the main tool for assessing neighbourhood socioeconomic characteristics (Greig et al., 2010). The methodological developments of the tools used in the measurement of neighbourhood characteristics are reviewed later in this chapter. Before this, key concepts such as poverty, social exclusion and deprivation which have been associated with urban policy actions are examined to identify any conceptual differences and similarities and their impacts on the measurement of neighbourhood characteristics.

2.3 **Conceptual Clarification of Poverty, Social Exclusion and Deprivation**

So far concepts and terminologies such as poverty, social exclusion, deprivation and inequality have been used in various sections of the thesis without necessarily paying attention to definitions of these terminologies and their implications on the measurement of neighbourhood socioeconomic characteristics. Peter Townsend (1979 and 1987) posited that in order to take a phenomenon seriously, collect adequate information and devise an appropriate method for its measurement, a consistent and comprehensive definition which aids the complete understanding of the phenomenon of interest needs to be devised. In this regard, it is necessary to consider in more depth some of the key concepts considered under the rubrics of deprivation, social exclusion or poverty and develop a working definition for deprivation suitable for the purposed of this study and consistent with the objectives of the English Indices of Deprivation.

Townsend (1987) posits that the concept of deprivation has to be distinguished from poverty. Barry (1998) suggests that social exclusion is just a contemporary label for poverty. Although these concepts overlap to a considerable degree, particularly spatially, they are not the same. The definitions of concepts are important to the analysis of results and the formulation of policies. What then, is social exclusion and how different is it from poverty and deprivation (if at all different)?

To Mowafi and Khawaj (2005), the symptoms of poverty are multi-dimensional, multivariate in its causes, complex and dynamic in trajectory. The Joseph Rowntree foundation defines poverty as “when a person’s resources (mainly their material resources) are not sufficient to meet their minimum needs (including social participation)” (Goulden and D’Arcy, 2014 p. 3). This definition highlights two main concepts: ‘resources’ and ‘needs’. The level of resources owned and controlled by the individual or family relative to their basic needs determines whether they are in poverty or not. These resources range from tangibles such as income to intangibles such as psychological (Tercali et al., 2004). On the other hand, ‘needs’, to some extent are relative as they differ from person to person and from place to place. The relativeness of ‘needs’ is highlighted by Townsend’s

(1979 p. 31) definition of poverty. He defined poverty as when individuals, families and groups "lack the resources to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or approved in the societies to which they belong".

A European Union joint report by the commission and the council on social inclusion states that:

> "People are said to be living in poverty if their income and resources are so inadequate as to preclude them from having a standard of living considered acceptable in the society in which they live. Because of their poverty they may experience multiple disadvantages through unemployment, low income, poor housing, inadequate health care and barriers to lifelong learning, culture, sport and recreation. They are often excluded and marginalised from participating in activities (economic, social and cultural) that are the norm for other people and their access to fundamental rights may be restricted" (The Council of the European Union, 2004 p. 8)

This definition focuses on the multidimensional nature of poverty and suggests poverty and social exclusion are interdependent. Most definitions of poverty highlight the role of income as a significant component of poverty and measures for assessing poverty levels have for a very long time used income as its basis.

Another term which is often used to describe socioeconomic inequality and neighbourhood disadvantage is 'social exclusion'. Social exclusion gained prominence in the UK political mainstream and subsequently in urban policy discussions in the mid to late 1990s (Lee and Murie, 1997). This was considered to be an attempt to emphasise that being disadvantaged goes beyond the realms of economic indicators such as low wages, unemployment and low income (Benn, 2000). Social exclusion is considered to be a multi-dimensional disadvantage that occurs in many areas of life such as education, employment, housing and participation in social networks among others. (Brannstrom, 2004; Buck 2001).

Over the years, various sophisticated definitions of social exclusion have emerged in an attempt to cover all the various aspects of society where social exclusion can arise. In a DCLG social exclusion task force report, Levitas et al. (2007, p. 9) defined social exclusion as:

> "...a complex and multi-dimensional process. It involves the lack or denial of resources, rights, goods and services, and the inability to participate in the normal relationships and activities, available to the majority of people in a society, whether in economic, social, cultural or political arenas. It affects both the quality of life of individuals and the equity and cohesion of society as a whole"

The Social Exclusion Unit (SEU), set up to focus on various problems in society such as unemployment in young people, education and training, prevalence of teenage pregnancy and truancy and to provide an approach in dealing with them, defined social exclusion as:

> "...what can happen when people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environments, bad health and family break down." OPDM (2004, p.2)

The Department of Social Services report - *"Opportunity for all: Tackling poverty and social exclusion"* did not provide an exact definition for social exclusion but it acknowledges that social exclusion is multi-dimensional. It highlights lack of opportunities to work, acquire education and skills, childhood deprivation, disrupted families, barriers to the elderly, poor housing, as well as the fear of crime and discrimination of various forms as some of the dimensions of exclusion which creates a cycle of disadvantage (UK Government, 1999).

The European Commission defines social exclusion as:

> "…a process whereby certain individuals are pushed to the edge of society and prevented from participating fully by virtue of their poverty, or lack of basic competencies and lifelong learning opportunities, or as a result of discrimination. This distances them from jobs, income and education opportunities as well as social and community networks and activities. They have little access to power and decision-making bodies and thus often feeling powerless and unable to take control over the decisions that affect their day to day lives" (The Council of the European Union, 2004 p.8).

Aalbers (2005) argues that social exclusion is a dynamic process which relates to a wide range of phenomena related to poverty, deprivation and hardship in people but also places. A principal element of the social exclusion discourse is whether it is only associated with the poor. Burchardt et al. (2002) suggests that an individual who does not participate in activities within the society is socially excluded. Barry (1998) also posited that social exclusion can occur between groups that are not economically different although he admits that in the absence of economic inequality, social exclusion does not remain a long-term problem. This suggest that social exclusion is not necessarily only a problem for the poor. People can be wealthy, yet socially excluded; this form of social exclusion has been branded voluntary social exclusion (Le grand, 2003; Barry, 1998).

One of the first attempts at defining social exclusion which is devoid of voluntary social exclusion was put forward by Burchardt et al. (1999 p. 229):

> "…an individual is socially excluded if (a) he or she is geographically resident in a society but (b) for reasons beyond his or her control he or she cannot participate in the normal activities of citizens in that society and (c) he or she would like to so participate".

This definition implies that to be socially excluded, you must be a member of the society geographically, have the desire and willingness to participate but restricted from exercising that desire or willingness by some reason(s) beyond your control. All the three conditions must be present for one to be socially excluded. Thus, voluntary social exclusion as described above is not social exclusion and should not be a cause for concern. Responding to the relevance of voluntary social exclusion, Barry (1998) emphasised that although the act of isolation or withdrawal may be voluntary, it has to be evaluated in conjunction with the choices available to the person or group and the context within which it occurs. For instance, choosing to withdraw in response to hostility or discrimination is a good case for social exclusion just as any other.

Another area of interest in the social exclusion debate is the case of 'normal activities of citizens' stated in the Burchardt et al. (1999) definition above. Such definitions assume a set of activities which are regarded as 'normal' or 'mainstream' and seen to be ideal activities which everyone should partake. Activities such as employment, education, health, socialization, civic participation, capacity to purchase goods and services (Burchardt et al., 2002; Burchardt et al., 1999; Levites et al., 2007; Cameron, 2006). Orr (2005) argues that such definitions allow room for activities which are not necessarily the concern of the state to be included so long as some communities regard it as 'normal' especially within the category of socialisation. One thing all of the above definitions appear to agree on is that social exclusion is associated with poverty. In other words, if you are poor, you are likely to be socially excluded and if you are socially excluded you are likely to be poor. Inequality between people and neighbourhoods is at the heart of social exclusion (Barry 1998).

Even though most analysis of poverty as discussed earlier focuses on material resources, capability approaches[6] suggest that poverty influences the ability of people to freely promote and achieve functions they consider valuable. Bucelli (2017) identified social relations, norm, access to public spaces and public goods and opportunities as some of the functions people in poverty are deprived off. Poverty is therefore closely related to deprivation. One of the earlier definitions of deprivation and most commonly referred to was proposed by Townsend (1987). He defined deprivation as:

> "…a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs". (Townsend, 1987 p. 125)

In an attempt to differentiate between deprivation and poverty, Townsend goes on to explain that people can be considered deprived if they lack:

[6] See Sen (1979)

> "…types of diet, clothing, housing, household facilities and fuel and environmental, educational, working and social conditions, activities and facilities which are customary, or at least widely encouraged and approved in the societies which they belong." (Townsend, 1987, p. 125).

The creators of the English indices of Multiple Deprivation do not provide a working definition for deprivation but subscribe to Townsend's (1979 and 1987) conceptualisation of deprivation in broad terms. It also acknowledges that deprivation goes beyond the lack of financial resources (the narrow definition of poverty (Smith et al., 2015). A joint report by the Prime Minister's Strategy Unit and the Office of the Deputy Prime Minister (2005) – *"Improving the prospects of people living in areas of multiple deprivation in England"* posited that area-based deprivation is caused by a combination of low levels of economic activity, poor housing, poor public services and poor local environment, unstable communities and ineffective support delivery systems. This description of deprivation highlights the multi-dimensional nature of deprivation and primarily sums up what has become known as the domains of the Index of Multiple Deprivation.

Returning to the initial question, how different is poverty from social exclusion and deprivation? When the all-encompassing definition of poverty as proposed by the European Commission is compared with the definition of social exclusion proposed by the same body, there is primarily no difference in both concepts. The role of resources (income) is considered to be relatively higher in the case of poverty than it is to social exclusion and by implication suggesting that not all issues relating to social exclusion can be resolved by an increase in income.

Some authors, like Levitas (1999) suggest that poverty and social exclusion can be described as being analytically separated although some definitions of poverty make reference to social exclusion and vice versa. For instance, poverty can result in social exclusion and being excluded can take the individual away from the necessary opportunities resulting in poverty. The difference between poverty and social exclusion is therefore one of definition. If the narrow definition of poverty is used where the focus is on income and material needs, then it is seen to be different to social exclusion because social exclusion goes beyond material inequality (Levitas, 1996).

What is clear in the literature is that, poverty, deprivation and social exclusion are interrelated. Deprivation and social exclusion are generally deemed to be concerned with the same socioeconomic, environmental and political issues, whilst poverty is considered to be a component of social exclusion and deprivation. Whereas there is not one acceptable definition of social exclusion, consensus in the literature is that it is a multi-dimensional concept which encompasses social, political, cultural and economic dimensions. To be socially excluded connotes a sense of something lost; be it social solidarity, capacity, identity, or personal autonomy (Cameron, 2006). Social exclusion is cyclical (OPDM, 2004) and self-reinforcing (Buck, 2001) just as poverty is cyclical and associated with the term 'poverty trap'. The focus on social exclusion from the late 1990s as opposed to poverty or deprivation has been propounded as a way to change policy response and can lead to a more efficient policy mix (Hills et al., 2002).

Whether it is poverty, social exclusion or deprivation, what is of utmost importance here is the presumption that living in a deprived area is likely to exude negative impacts on people within the area beyond what can be attributed to the individual's personal and family circumstances (negative neighbourhood effect). As described by the Prime Minister's Strategy Unit (2005, p.10), "People living in deprived areas are more likely to be worse off than similar people living in more prosperous areas". This was the driver behind the area-based policies embarked upon by the then labour government.

This study focusses on the measurement of neighbourhood deprivation as proposed by the creators of The English Indices of Deprivation and its regional variations in Scotland and Northern Ireland. In this regard, an all-encompassing definition which considers not only economic and material deprivation but also social and environmental deprivation is considered appropriate. This will ensure that problems associated with isolation, neighbourhood stigmatization and the lack of social capital among others which can diminish the potentials of individuals to achieve relevant outcomes can be taken into account. Townsend (1987) definition of deprivation which also forms the basis of the modelling of the current Indices of deprivation is considered to be adequate and is adopted for this study.

2.4 **Assessing Neighbourhood socioeconomic Characteristics**

The beginning of sustained academic interest in understanding the social composition of urban areas and places in general is usually credited to Robert Park's writings about *"The City"* in the early 20th century (Davies, 1978; Lenonoy,

2004) culminating in the publication of Park and Burges (1925), *"The City: Suggestions for Investigation of Human Behaviour in the Urban Environment"*. However, historical developments of methodological ideas of measuring neighbourhood socioeconomic characteristics and the identification of spatial variations was pioneered by the work of Charles Booth in 1893 - about "*Life and labour of the people of London"* and the other 16 volumes which were completed in 1902. In fact, Booth and Pfautz (1967) acknowledged that Charles Booths 17 volumes socioeconomic survey of the Life and labour of the people of London laid the foundation for Chicago School's "The City" series mentioned earlier.

Davies (1978) argues that Booth's attempts to capture street level socioeconomic characteristics of the people of London through the use of multiple indicators and the mapping of poverty made significant methodological contribution to the measurement of neighbourhood conditions. This view is shared by (Spicker, 1989). Charles Booth began his work with the analysis of the spatial distribution of poverty in London where he developed seven classifications of poverty and presented them in series of maps (See appendix I for a sample of Map):

- Lowest class (Vicious, semi-criminal)
- Very poor (Casual, chronic want)
- Poor (18 to 21 shillings a week for a moderate family)
- Mixed (some comfortable, others poor)
- Fairly comfortable (Good ordinary earnings)
- Middle class (well-to-do)
- Upper-middle and upper classes (wealthy)

Further to Booth's work in 1889, Seebohm Rowntree undertook a similar exercise in York in 1899 and published in *"Poverty: A study of town life" in* 1901*.* Rowntree used house to house surveys and observations to collect data relating to occupation, household sizes, and perceptions of cleanliness, respectability, living standards and general living conditions (Glennerster et al., 2004). Household income bands were generated from the survey responses to determine whether household incomes were above or below the minimum income required to purchase necessities - the poverty threshold (Townsend, 1979; Bernstein et al. 2000; Bradshaw, 2001; Glennerster et al, 2004). Rowntree went on to develop what is considered to be the first poverty line and the poverty life cycle of the average "labourer" (see Glennerster et al, 2004 for details).

The socioeconomic surveys of Booth and Rowntree led to a flurry of other survey studies in places like Southampton, Plymouth and Sheffield amongst others in the early part of the 20th Century (Bradshaw, 2001). Subsequently, the Family Expenditure Survey (FES) was introduced in 1953 to collect data about household income and expenditure which formed the basis for the creation of the Retail Price Index (RPI) and to assess poverty and household behaviour on a national scale (Banks and Johnson, 1997; Atkinson and Micklewright, 1983; Bradshaw, 2001). FES was primarily a survey of personal and household income, regular payments and a record of two weeks detailed expenditure (Bradshaw, 2001).

By the 1960s, the effects of World War II bombings on towns and cities, significant increase in population growth and increasing awareness of socioeconomic inequality between people and places made it necessary for the identification of "priority areas" to be a central part of the UK government's urban policy (Simpson, 1995; Deas et al., 2003). FES was critical to this development and became an annual survey in 1961. It continued until 2001 when it was replaced with the Expenditure and Food Survey (EFS) which was later replaced with the Living Cost and Food Survey (LCF) in 2008 (ONS, 2010).

The perceived limitation of the FES and other budget standard surveys in assessing poverty led to the inspirational work of Townsend (1979) “Poverty in the UK”. Townsend noted that the “Present national or social conceptions of poverty tend therefore to be inadequate and idiosyncratic or inconsistent, and the evidence which is collected about the phenomenon seriously incomplete. A new approach to both definition and measurement of poverty is called for. This depends in part on adopting some such concept as relative deprivation” (Townsend, 1979 p. 46). Townsend (1979) and Townsend (1989) laid the foundation for the recognition and articulation of multiple deprivation as the accumulation of different types of deprivation. This is considered to be the starting point for the creation of the Indices of Multiple Deprivation (Smith et al. 2015).

Table 2.2 shows a summary of most of the approaches used in measuring deprivation in the UK over the years. Whereas earlier attempts at measuring deprivation focused on groups of people, attention changed to places after the 1981 census resulting in what became known as the Index of Local Conditions (ILC) in 1991. This later became the Index of Local Deprivation (ILD) 1998 (Noble et al., 2000). Whilst the ILC used about 13 indicators in its calculation of local deprivation (Simpson, 1995), the ILD slightly modified these indicators with the majority maintained.

Table 2. 2 - Tools for the Measurement of Deprivation

Name	Main Domains or Indicators	
IMD 2007, IMD 2010, IMD 2015	• Income (22.5%) • Employment (22.5%) • Health and Disability (13.5%) • Education, Skills and Training (13.5%)	• Barriers to Housing and Services (9.3%) • Living Environment (9.3%) Crime (9.3%)
IMD 2004	• Income • Employment • Health • Education	• Living environment • Barriers to housing • crime
ID 2000	• Income • Employment • Health Deprivation and Disability •	• Education, Skills and Training • Housing • Geographical Access to Services
Index of Local Deprivation (1998)	• Unemployment • Dependent children of income support recipients • Overcrowding • Housing lacking basic amenities • Non-income support recipients in receipt of council tax benefit • Educational participation	• Long-term unemployment • Income support • Low educational attainment • Standardised mortality ratios • Derelict land Home insurance weightings
Index of Local Condition (1991)	• Unemployed adults • overcrowded household • people lacking amenities, children in flats • Households without a car, • 17 year olds not in education • income support	• long-term unemployed • standardised mortality • insurance area weightings • derelict land • Low GCSE attainment • Children in low earning households.
MATDEP and SOCDEP (1991)	• MATDEP • Overcrowding • Lack of Amenity • No central heating • No Car	• SOCDEP • Unemployment • Youth unemployment • Lone Parents • Elderly
Townsend Material Deprivation Score (1988)	• Unemployment • Car Ownership	• Home ownership • Overcrowding
Jarman Underprivileged Area Score (1983)	• Unemployment • Overcrowding • Lone Parents • Under 5's	• Elderly living alone • Ethnicity • Low social Class • Residential Mobility
Carstairs and Morris Scottish Deprivation Score (SCOTDEP) (1981)	• Overcrowding • Male Unemployment	• Social class IV or V • No Car

Source: Author

These earlier deprivation indices were constrained by the lack of appropriate data – they relied on the 1981 and 1991 census data which were not detailed enough. There was also the problem of how to deal with double counting. For instance, an area adjudged to have concentrations of low-income earners is likely to have a relatively high number of people with lower levels of educational attainment. Another form of double counting was the multiple uses of data from the same household in assessing the various indicators (McLennan et al., 2011).

After several consultations, and a review of the ILD 1998, the Department of the Environment, Transport and Regions (DETR) commissioned the 2000 indices of Multiple Deprivation (IMD2000). This focused on six main domains which included income, employment, health deprivation and disability, education, skills and training, housing, and geographical access to services. Each of these domains had sub indicators using ward level data (DETR, 2000). This was further modified in 2004 to include indicators for Crime resulting in what became known as the Index of Deprivation 2004 (ID2004) (McLennan et al., 2011). Since 2004, various indices have been produced at regular intervals using identified indicators which are deemed to 'best' describe each domain.

The IMD is recognised as a relatively good index for quantifying neighbourhood deprivation and have proved useful in pinpointing socioeconomically deprived areas necessary for targeting with policies and the allocation of resources (Deas et al., 2003). It also provides a uniform basis for consistent national measure of inequalities (Fischbacher, 2014). It is however not without its drawbacks and some of these critiques are discussed in the next section.

2.5 **Critiques of the Indices of Deprivation**

In spite of the advancement in its conceptualisation for the measurement of small area deprivation, the Indices of Multiple Deprivation suffers from a number of shortfalls and the degree of reliability of the information it provides has been a subject of debate in the literature (Deas et al., 2003). Some of these critiques, challenges and their impacts on the measurement of deprivation are discussed in this section.

The first and critical to the agenda of this research is that the IMD does not take into account local spatial context in the computation of neighbourhood deprivation (Rae 2009). In this regard, it violates Tobler's First Law (TFL) of Geography and ignores the effects of externalities and spillovers on neighbourhood socioeconomic processes as proposed by new economics geography. It also underplays the importance of the notion that the spatial opportunity structure within which individuals' cognitive and non-cognitive abilities are developed, as proposed by behavioural economics, may extend beyond the administrative boundaries of such 'neighbourhoods'.

As discussed earlier in this chapter, the spatial extent of socioeconomic processes are difficult to define (Glennerster et al., 1999; Darluaf, 2000) and interactions between people and places do not have definitive boundaries (Lupton, 2003). Restricting the measurement of neighbourhood characteristics within predefined boundaries (Lower Super Output Areas) created for different purposes can be misleading as it may fail to capture the full extent of problems within the neighbourhood's spatial opportunity structure for the socioeconomic activity of interest (Bradford et al., 1995; Rae, 2011).

Secondly, the methodological approach used in the computation of the IMD has also been criticised in several ways. For instance, the separate treatments accorded to different indicators of deprivation can result in double counting (Deas et al., 2003). If the IMD seeks to measure multiple deprivation, then a basis of deprivation identified in one form should be excluded from other deprivation indicators. Noble et al. (2000) suggested that the computation should rather be a combination instead of separate. Although attempts have been made to improve on the problem of double counting within domains, the effects of double counting between domains remain. This is due to the complex interrelationships between indicators (Briggs et al., 2008). A typical example is the relationship between the income and employment domains. In spite of the likelihood of a high correlation between income and employment, the IMD continues to treat them as different aspects of multiple deprivation.

Related to the above critique is the over reliance of the Indices of Deprivation on benefits data. The English Indices of Deprivation 2000 had about 50% of the data used in the computation from benefit related indicators (Deas et al., 2003). Although this has been reduced to 45% in the IMD2010 and IMD2015 weightings (Smith et al., 2015), it is still considerably high for a significant part of the reliability of such an important index to be based on one source of data. For instance, the take up rates for benefits tend to vary with geographical location, benefit type and demographics among others. There is no mechanism in the IMD or the benefit data to account for these differences which may render some of the analysis less meaningful (Noble et al., 2000).

There is also a question of whether the focus on inner city deterioration and deprivation by policy makers have placed rural areas at a disadvantage when accessing relative deprivation. Fecht et al., (2017) posits that the nature of material deprivation assessed by the IMD focuses on what is prevalent in urban areas. This tends to highlight urban deprivation at the expense of rural deprivation. Similar observations have been made by Bertin et al. (2014) and Farmer et al. (2001)

Another important critique of the Indices of Deprivation is the allocation of weights associated with the domains. With income and unemployment weighted at 45%, the economic element can be deemed over weighted relative to other aspects of deprivation e.g. Barriers to Housing and Services (9.3%) (Greig et al., 2010). This appears to suggest that certain types of deprivation are more important than others. However, as noted by Noble et al. (2001), the basis of such weightings is not very clear and invariably include some form of value judgment which may not necessarily be correct. For instance, an area with higher scores in the Barriers to Housing and Services domain but lower scores in the economic domains are likely to come second or even third when it comes to urban policy actions irrespective of the fact that housing is also a basic essential need[7].

Other critiques levelled against the Indices of Deprivation include its inability to provide useful information which can be used to identify individuals or families within (generally) affluent areas which may be social excluded (Fischbacher, 2014).

[7] Higher IMD scores indicate more deprived.

It also ignores the effects of the historical socioeconomic and environment context of the area which set people on various paths to socioeconomic outcomes. Other important aspects of deprivation such as community participation, social interaction and networking which are important to the realisation of individual socioeconomic outcomes (Galster, 2010; Tigges et al., 1998) are not measured by the Indices of Deprivation.

Whereas it can be acknowledged that there are practical challenges involving the production of a conceptually ideal deprivation Indices, the Indices of Multiple Deprivation can be improved to increase the robustness of the indices and its reliability as a true measure of deprivation and a tool which can be used to allocate resources more efficiently and fairly.

2.6 **Conclusion**

There is a general understanding within economics and other disciplines that market process which forms the basis of most societies do not work perfectly in the spatial allocation resources to the production of goods and services. This has resulted in significant spatial socioeconomic inequalities between countries across the world, between different regions of the same country and between neighbourhoods within cities or towns. The above discussion of economics theories and the understanding of other socioeconomic processes such as residential segregation and deindustrialisation highlights the need for some form of policy direction to correct the effects of the imperfections in market structures. Harvey (1985) in justifying the role of the state in a capitalist economy posited that the state acts as mediator and can enhance the capital switching process through policy directives and investments in major infrastructure. These external interventions necessary to provide the enabling environment for individuals within all areas to maximise their personal attributes and improve their life chances (Grieg et al., 2010; Latis and Repapis, 2016; Stiglitz, 2013).

However, some of these economic theories and economics in general, have not been good at understanding or dealing with space. Harvey (1974, 1978) were some of the earlier attempts to spatialize economic theories through urbanisation and capital switching. It is therefore unsurprising that this poor understanding of space is also a problem in the examination of socioeconomic processes such as poverty and deprivation and how we measure them. Is space integral to socioeconomic processes or is it external to these processes? Can people's experiences of deprivation vary with neighbourhood spatial contextual differences? These are some of the question that need to be explored to improve the understanding of the role of space in such processes. Ferrari (2007) posited that even though neighbourhood problems can look the same, the underlying causes differ from place to place depending on their spatial context. Proponents of neighbourhood effects also suggest that there is a feedback loop between people and neighbourhood characteristics through which individual outcomes can be influenced and neighbourhood characteristics can be altered (Galster, 2012; Galster and Sharkey, 2017).

Despite decades of regeneration polices and the practice of measuring neighbourhood socioeconomic characteristics in the UK, inequality remain very high and neighbourhood deprivation remain concentrated within certain parts of the country. One of the main challenges affecting neighbourhood deprivation and reducing inequality is the use of box standard designed programmes in different areas without considering the local spatial context (Rae, 2009). This has been attributed to the notion that neighbourhood disadvantage is primarily a collection of a higher proportion of deprived or poor individuals in a geographical location. This is described by Cemlyn et al, (2002) as the compositional meaning of deprivation. The notion that there could be high levels of deprivation over and above those attributable to individuals' abilities within an area due to possible 'area effects' are usually not taken into consideration (Noble et al, 2004).

As described by Rae (2011, p.322) "…the lack of a wider spatial framework within urban policies often lead to fragmented and piecemeal efforts which are poorly equipped in the face of larger structural inequalities". Socioeconomic and environmental processes concerned with neighbourhood deprivation operates on different spatial scales and the spatial structure of opportunity available to individuals within a given neighbourhood differ from place to place. With neighbourhood interventions being narrowly focused, such wider spatial structural and scalar issues can act as barriers to effective problem diagnosis and successful policy implementation and delivery (Rae, 2011).

Spatial socioeconomic intervention policies are essential to all governments in the quest to reduce inequality (Greig et al, 2010). In spite of suggestions that the UK is now considered to be in a post urban regeneration policy era with local and central governments seeking new policy directions to address spatial inequality and neighbourhood deprivation (O'Brien and Matthews, 2015), the government policy document "*Regeneration to enable Growth: what the government is doing in support of community-led regeneration*" suggests that urban regeneration remain an important policy direction in UK (DCLG, 2011). There is therefore the need to gain a deeper understanding of how to obtain the best possible outcomes from such policies by engaging with the concept of deprivation at the local level, reviewing the methods and techniques for identifying deprived areas and the underlying causes of problems. These can aid the design of appropriate policies with clearly defined causal pathways and implementation processes. The spatial contextualisation of neighbourhood deprivation is a step in the right direction towards the achievement of this objective.

The next chapter of this thesis focuses on the relevance of local spatial context to socioeconomic processes and the measurement of neighbourhood deprivation. The role of neighbourhood characteristics in influencing individuals' socioeconomic outcomes through potential neighbourhood effects are also discussed.

3. WHY SPATIAL CONTEXT MATTER

Neighbourhood deprivation is the result of complex multidimensional processes influenced by exogenous and endogenous factors within the context of space and time (Zwiers, 2014). Whilst most analysis of neighbourhood deprivation focus on the within neighbourhood deprivation, through spatial relations with other places, the wider spatial context of neighbourhoods can have significant impacts on the socioeconomic prospects of residents and their experiences of deprivation (Robson et al, 2009). Patterns of residential segregation also suggest that among others, people of similar socioeconomic characteristics tend to live closely to each other. This tends to reinforce deprivation or affluence within certain geographic boundaries (Ferrari and Lee, 2007).

This chapter focuses on exploring the relevance of geographical space – the neighbourhood, and its wider spatial context in the socioeconomic outcomes of individuals and households. I begin by attempting to address the question what is the neighbourhood and its spatial extent? This is followed by a discussion of the importance of spatial context to socioeconomic processes and the mechanisms through which such neighbourhood spatial contextual characteristics can influence the realisation of desired socioeconomic outcomes of individuals. The chapter ends with a detailed analysis of the spatial distribution of deprivation and affluence in England as measured by the 2015 English Indices of deprivation.

3.1 The Urban Neighbourhood

An important aspect of the conceptualisation of the modern neighbourhood is one of definition and boundary (Lupton, 2003). What is the neighbourhood and where does one neighbourhood begin and end? As a term it is difficult to define, but everyone knows what a neighbourhood is when they see it (Galster, 2001). It embodies people and places – it is the interaction between these two actors that create the character of the neighbourhood and for that matter its effects (Lupton, 2003). Whereas some authors focus on spatial characteristics and boundary limits when defining neighbourhoods (Keller, 1968; Golab, 1982; Morris and Hess, 1975), others emphasise the element of socioeconomic interaction (see Durlauf, 2000; Hallman, 1984; Warren 1981; Downs 1981).

Lupton (2003), referring to the work of Glennerster et al. (1999) argues that neighbourhoods are made up of evolving layers of interactions between overlapping social networks which are defined by the accessibility of areas for different activities. In other words, the neighbourhood could be anything from a few streets from your house to some miles from your house depending on what's of interest. Lupton (2003) suggests that people tend to simultaneously refer to wider issues such as atmosphere and facilities of the city centre, availability of job opportunities in the wider urban area as well as the good neighbourly spirit and friendliness in the local area when reflecting on the characteristics of their neighbourhood. These integrated interactions of complex locational and behavioural attributes make it difficult to conceptualise and understand what constitutes a neighbourhood.

Kearns and Parkinson (2001) drawing on other literature identifies three "scales" of neighbourhood as summarised in Table 3.1 below. The spatial scales are determined by the 'connectedness' of the place in question. Each of these levels presents their own problems which have to be addressed but simultaneously with the problems of the other levels.

Table 3. 1 - Scales of Neighbourhood

Scale	Predominant Function	Mechanism(s)
Home Area	• Psycho-social benefits (e.g. identity; belonging)	• Familiarity • Community
Locality	• Residential activities • Social status and position	• Planning • Service provision • Housing Market
Urban District or Region	• Landscape of social and economic opportunities	• Employment connections • Leisure interests • Social Networks

Source: Kearns and Parkinson (2001 p.2104)

Academics and researchers of urban policy and neighbourhood studies such as Forrest (2000), Lupton (2003), Buck (2001), Kearns and Parkinson (2001), and Massey (1994) all agree that the neighbourhood is still important in the ever-globalised world economy.

Forrest (2000) emphasised that the importance of the neighbourhood varies with who you are, what you are interested in and where you are. For the purpose of this work, an all-encompassing definition, proposed by Galster (2001 p. 2112) is adopted. He defines the neighbourhood as:

> "…the bundle of spatially based attributes associated with clusters of residences, sometimes in conjunction with other land uses".

He refers to the 'spatially based attributes' to consist of buildings, infrastructure, demographic characteristics, environmental characteristics, socioeconomic interactions, sentiments, public services and political characteristics, all of which are spatially based[8].

Contrary to the above definition of neighbourhoods, the measurement of neighbourhood deprivation are usually based on predefined geographic boundaries which are designed for other purposes and are inadequate to cover the full spatial extent of neighbourhoods. Rae (2011, p.335) posited that a review of policy interventions in the UK indicated that no "coherent spatial or conceptual framework for understanding urban problems has been consistently used to guide policy formulation". The complex nature of the socioeconomic, environmental, cultural and political interrelations between individuals, neighbourhoods and the wider urban area renders it difficult to identify the spatial extent of neighbourhood problems. This brings to the fore the concept of local spatial context – a mechanism through which spatial attributes which are relevant to the measurement of neighbourhood deprivation can be captured.

[8] For detailed explanation of the various attributes, see Galster (2001) *On the Nature of Neighbourhood*

3.2 Defining Spatial Context

Literature on the importance of neighbourhoods and the potential for neighbourhood or area effects to impact the socioeconomic outcomes of people is voluminous and has received significant levels of attention from most disciplines within the social sciences (Dietz, 2002; Rae, 2009). A detailed examination of neighbourhood effects is provided later in the chapter. What is of importance in this section and to this research in general is the socioeconomic circumstance of neighbourhoods within the context of other neighbourhoods or the wider geographic space – inter-neighbourhood effects.

The idea that an observation made somewhere on the landscape is dependent on or influenced by one or several other observations somewhere is not new (see Van Ingen, 2018; Wicht and Nonnenmacher, 2017; Tobler, 1970; Rae, 2009). In fact concepts such as spatial externalities and spillovers which are central to the development of new economic geography theory (discussed in chapter 2) were built around this notion of spatial interdependency (Wicht and Nonnenmacher, 2017).

Advancements in technology and the development of effective transportation systems and other infrastructure have made it even more complex to identify the spatial extent of socioeconomic influence on the lives of people within a given neighbourhood. In order "…to understand neighbourhood inequality, you have to study the neighbourhood itself and the location of the neighbourhood in the larger context" (Van Ingen, 2018 p.199).

People within a specified geographical boundary or place have relationships with people who belong to or identify with other geographical spaces, both within their immediate environs and those afar. The strength of the relationship between neighbourhoods depend on a variety of factors such as physical geographic or relief features of the space, the level of infrastructure available, economic factors, interpersonal relationships and social interactions.

Similar to the arguments of neighbourhood effects on individuals where Buck (2001 p. 2252) asked the question:

> "…does it make my life chances worse of if my neighbour is poor rather than rich or a large proportion of my neighbourhood are poor, or disadvantaged on some dimension?"

I ask the question: can the socioeconomic circumstances within a neighbourhood be influenced by the prevailing socioeconomic environment of other nearby and/or distant but well-connected neighbourhoods? A plausible answer to this question lies within what is regarded as the 'Second Law of Geography' proposed by Tobler 1999 (p. 87). "…phenomenon external to an area of interest affects what goes on in the inside". If this principle cannot be rejected, it implies that neighbourhood effects on the socioeconomic outcomes of individuals is not only a construct of intra-neighbourhood activities but also a construct of what prevails in other neighbourhoods which are connected to the target neighbourhood. In an analysis of youth transition from school to training in Germany, Wicht and Nonnenmacher (2017) found that the spatial zone of influence was not the neighbourhood or even the region, it was the entire country. In this regard, the measurement of deprivation has to be undertaken within the context of other neighbourhoods which are likely to influence the socioeconomic conditions of the target neighbourhood.

The local spatial context of neighbourhood deprivation can therefore be defined as the bundle of spatial attributes which are relevant to the socioeconomic, environmental, political and institutional processes within a specified neighbourhood. This spatial context differ from one place to the other and its largely dependent on the extent of *spatial relations* between the neighbourhood of interest and other neighbourhoods, the *spatial structure* of the neighbourhood of interest and the *spatial scale* of the socioeconomic activity being measured. A description of these terminologies and how they can influence the experience and measurement of neighbourhood deprivation are provided below.

3.2.1 ***Spatial Relations***

Smith (2011 p.21), posits that "The ability of cities to facilitate contacts and communication between populations is arguably the very reason for their existence". Spatial relations is at the core of the creation of cities and large urban centres or regions. However, the presentation of spatial data and places in GIS applications and maps in the forms of polygons tend to create the illusion that such places are self-contained (De Aguiar et al., 2003). This notion of self-contained places is not only limited to the geographic representation of places. Most often, processes involved with the measurement of neighbourhood deprivation tend to treat neighbourhoods as isolated entities (De Aguiar et al., 2003, Rae 2009) even though the socioeconomic processes people within these neighbourhoods engage with are “not necessarily guided by physical boundaries” (Wicht and Nonnenmacher, 2017). The argument here, which has also been advanced by Rae (2009) and Wicht and Nonnenmacher, (2017) is that neighbourhood socioeconomic processes such as access to labour markets, access to essential amenities and services as well as residential mobility or migration for example, which have significant impacts on the prospects of people, can be exacerbated or enhanced by the socioeconomic conditions of surrounding neighbourhoods.

As mentioned earlier, with the advancement in technology and effective transportations networks, the definition of neighbourhoods currently employed for the measurement of deprivation is not adequate to capture the full extent of places which can influence socioeconomic processes of other places and the outcomes of the people within these places (De Aguiar et al., 2003). Couclelis, (1997 p.166), argues that “Interactivity is essential for the exploration of options”. Probing the boundaries of possibilities and assessing probabilities within feasible regions are essential to the effective diagnosis of urban problems and the subsequent development of policies.

As proposed by De Aguiar et al. (2003) a definition of spatial relations between neighbourhoods should take into account nearby locations as well as distant but well-connected neighbourhoods. To provide an appropriate definition of spatial relations suitable for this research, I will take the above definition a step further by acknowledging that the perceived spatial scale of the socioeconomic activity of interest can make it necessary to impose distance limits on neighbourhood spatial relations. For instance, irrespective of how efficient the transportation networks between a neighbourhood of residence and a school in another neighbourhood might be, it is impracticable to expect pupils to travel beyond certain distances for school. On the other hand commuting to take advantage of employment opportunities in other neighbourhoods will have a higher distance threshold. Spatial scale and structure are reviewed in the next two sections.

3.2.2 ***Spatial Scale***

Scale is fundamental concept in geography and other disciplines (Atkinson and Tate, 2000). Delaney and Leitner (1997 p. 93) defines geographic scale "as the nested hierarchy of bounded spaces of differing sizes such as the local, regional, national and global" at which the investigation of socioeconomic and political processes are set. This is consistent with the definition provided by Agnew (1993 p. 251), "… the spatial level, local, national or global, at which presumed effect of location is operative", and Kearns and Parkinson's (2001) description of spatial scale for socioeconomic processes described earlier in this chapter.

Within the context of this thesis, spatial scale can be viewed from two perspectives: (i) the scale at which "neighbourhood-effects-like" processes operates (Johnston et al., 2005 p. 492) and (ii) the spatial extent of socioeconomic and political processes within a given geographic unit (Atkinson and Tate, 2000). In this regard, spatial scale can be defined as the size or extent of a process or phenomenon under investigation (Lloyd, 2014).

A long-standing problem in the analysis of socioeconomic processes can be attributed to differences in spatial scales (Atkinson and Tate, 2000; Rae and Wong, 2012). The results of an analysis undertaken at one spatial scale is likely to be different when it is undertaken at another spatial scale. This is popularly known as the Modifiable Area Unit Problem (MAUP[9]) (see Openshaw, 1984). For instance, in a study of the relationship between neighbourhood characteristics and social exclusion, Buck (2001) found that the operational spatial scale of neighbourhood effect depends on the outcome of interest. In terms of the measurement of neighbourhood deprivation, analysis of relevant indicators are undertaken within predetermined boundaries. Yet, the processes under consideration usually operate beyond such boundaries. Diagnosis of urban problems and subsequent policies to address the identified problems are more likely to be effective if they are undertaken at the appropriate spatial scale (Harris and Johnston 2003).

In a review of spatial targeting intervention, Rae (2011) posited that, whilst certain policy directions are well suited to be undertaken at the macro-spatial scale, others are well suited to the meso-spatial and micro-spatial level. For example, whilst problems such as physical environmental decline, poor housing conditions and crime are best suited to be addressed at the micro-spatial scale, policy directions aimed at providing labour market intervention, transport and infrastructure investments and employment generation incentives are best targeted at the meso-spatial scale. Micro-spatial solution are less likely to effectively address meso-spatial problems. Devising an approach to the measurement of neighbourhood characteristics which looks beyond a geographical unit for the analysis of neighbourhood deprivation in other to capture the full extent of the phenomenon under investigation is essential to

[9] Modifiable Area Unit Problem is fully discussed in chapter 4.

avoid policy–problem scalar mismatch and yield relevant outcomes (Rae and Wong, 2012).

3.2.3 Spatial Structure

Spatial structure is primarily the organisation of land uses on geographic space. There has been sustained interest in understanding the role urban structures and sizes play in the lives of people from academics, policy analyst and social commentators (Anas et al., 1998). Models based on monocentricity, polycentricity and agglomeration theories were all developed in recognition of the importance of urban spatial structure to socioeconomic processes (Alonso, 1964; Muth, 1969; Mills, 1972).

The development of urban form or structure involves a complex mix of social, political, economic and institution process which are also influenced by the technological advancements. New economic geography, discussed in Chapter 2 suggest that centripetal forces which promote spatial concentration and centrifugal forces favouring dispersion compete to determine the spatial structure of an area through the location of socioeconomic activities (Krugman, Fujita and Venables (2001).

What is relevant to the agenda of this research is the extent to which urban forms can be viewed as isolated self-contained units or integrated with other areas. Some neighbourhoods, especial rural ones can be distinct enclaves which are miles away from other neighbourhoods. On the other hand, within urban areas it can sometimes be difficult to determine where one neighbourhood ends and another begins. Differences in these spatial structures can increase or decrease the spatial extent of socioeconomic processes concerned with the measurement of neighbourhood deprivation (Rae and Wong, 2012).

In examining differences in socio-spatial structures of cities and health outcomes, Stewart et al., (2016) posited that people living in deprived areas surrounded by affluent neighbourhoods can have different health outcomes to people in deprived areas surrounded by equally or more deprived neighbourhoods. An explanation for such differences could lie with the concentration of deprivation which has the tendency to foster and strengthen poor health behaviours[10] (Livingston et al, 2013). Similarly, in exploring the relationship between deprivation and why mortality in Scotland is relatively high compared to England, Sridharan et al. (2007 p. 1951) concluded that "…the spatial patterning in deprivation can matter in understanding mortality rates. A focus on the spatial arrangement of deprivation might help explain part of the 'Scottish Effect'.

A major critique of area-based policies in the UK is that of spatial-scalar mismatch between problems and interventions (Bradford, 2007, North and Syrett, 2008). Most area-based interventions tend to focus on specific areas within predetermined geographical boundary limits and most often than not, these limits are not wide enough to cover the geographical scale of the problems (Rae, 2011). Accounting for the differences in neighbourhood local spatial structures within the measures of deprivation can improve understanding of the extent to

[10] Neighbourhood effects are examined later in this chapter.

which prevailing conditions of other neighbourhoods can influence within neighbourhood activities.

3.3 Spatial Opportunity and Neighbourhood Effects

The nature and characteristics of neighbourhoods have always been an important consideration when deciding on where to live (at least for those with the capacity to make such choices). This is usually evidenced in the premium people place on properties in certain neighbourhoods (Raaum, 2006) and the familiar slogan in the real estate market "location is everything" and "place matters" used by geographers (Buck, 2001). Most often than not, parents are prepared to pay a higher premium to enable them live in 'better neighbourhoods' for their children to be able to gain access to better schools (Gibbons and Machin, 2008). Whereas these concepts are seen to be pragmatic and acceptable, Buck (2001) suggests that the potential impacts of neighbourhood effects remain less compelling.

Neighbourhood effects have been described as "the degree to which local context independently affects outcomes for individuals" (Galster and Hedman, 2013 p. 473). This is based on a hypothesis that neighbourhoods with relatively higher levels of poverty, lack of role models, employment networks and weakened social structures among others do impact on the socioeconomic opportunities of individuals within such neighbourhoods (Brannstrom, 2004). Simply put, holding all other factors constant, a person is more likely to be poor if he or she lives in a poor neighbourhood.

Galster (2008) and Van Ham (2012) identified the difficulty in neighbourhood effects modelling and the identification of causal pathways as the main challenges of neighbourhood effects hypothesis. Others suggest residential sorting and selection bias are the main challenges to neighbourhood effects modelling and analyses of causality (Livingston et al, 2014; Upton, 2003 and Harding 2002). Several researchers have concluded that empirical evidence on the presence of neighbourhood effects in determining life chances of people remain inconclusive (Brannstrom, 2004). For instance, in a quantitative study, Raaum (2006) reported that community and neighbourhood effects tend to be less on adult outcomes such as educational attainment and earnings. In a study of neighbourhood effects on the life chances of children in Sweden, Brannstrom (2004) concluded that beyond family characteristics, growing up in poor neighbourhoods have insignificant impacts on their adult life chances.

In spite of these assertions, there has been a substantial increase in the number of studies investigating neighbourhood effects in the last few decades (Buck, 2001; Van Ham, 2012; Wheaton et al., 2015). Various theories have been propounded in an attempt to explain the presence of neighbourhood effects and their causal pathways. Galster (2012) identified 15 causal pathways of neighbourhood effects which were categorised into four main groups: social interactive[11], geographical[12], institutional[13], and environmental[14]. All of these mechanisms suggest different pathways through which neighbourhood effects can influence individuals. A congruent in the literature appear to be on the notion that neighbourhood characteristics affect people differently at different life stages (Brannstrom, 2004) with Steinberg et al. (1997) suggesting that it is more profound in the adolescent stage.

Urban policies, especially regeneration programmes are usually implemented on the basis that spatial socioeconomic inequalities are undesirable and that it could even exude significant negative impacts when certain thresholds are exceeded (Buck, 2001). Measures such as the production of the Indices of Deprivation at regular intervals to determine when and where an intervention is required have been put in place principally for this reason.

One of the main objectives of the Social Exclusion Unit (SEU) established in 1997 as part of the cabinet office was to look at neighbourhood inequalities and address them. In 2001, the National Strategy Action plan for neighbourhood renewal put together by the SEU had the objective "within ten to twenty years, no-one should be seriously disadvantaged by where they live" (SEU, 2001, p.8).

[11]This refers to the set of social process such as social contagion, collective socialisation, social networks, social cohesion and control, relative deprivation and parental mediation which are endogenous to neighbourhoods.
[12] This relates to aspects of spaces which may affect the life of residents. These include accessibility to jobs (transport networks) and availability of public services restricted by location.
[13] These are mechanisms whereby institutions may have certain stereotypical perceptions about some localities (stigmatization), the lack of or presence of institutional services such as day care, schools and hospitals and the presence or absence of localised markets e.g. drug markets.
[14] Natural and human made attributes which may affect people mentally and physically but not necessarily their behaviours e.g. decay in physical conditions of buildings, persistence violence and/or vandalism.

This reinforces the notion that an individual's life chances can be affected by their neighbourhood attributes.

The ascendency in attention for the urban neighbourhood is not only associated with the United Kingdom, parallels can be drawn from other countries. For instance, the US federal government launched the Empowerment Zones and the Enterprise Communities in 1994 to deal with the problems of urban decline by targeting specific areas such as healthcare, education, employment and safety (Painter and Clarence, 2000). Other examples of area-based initiatives designed with neighbourhood effects as basis include Kvarterloft in Denmark, Zones Urbaines Sensibles in France and Die Soziale Stadt in Germany (Rae, 2011).

Although, there are divergent views about the relevance of neighbourhood effect in the socioeconomic outcomes of individuals, there is sufficient evidence of their existence (Rae, 2009). People do not live in isolation but rather among other people within neighbourhoods and form relationships at various spatial scales within these boundaries and beyond. An examination of the potential pathways through which neighbourhood effects can influence the socioeconomic outcomes of people are provided in the following sections of this chapter.

*3.3.1 **Spatial Opportunity***

"Location Matters - for economic returns, quality of life and many other reasons" (Briggs, 2007 p.63). Despite the argument that the neighbourhood "has taken on the hue of ontological and epistemological irrelevance" within the interrelated forces of globalisation and mass culture, within the context of neighbourhood effects, poverty and deprivation, the neighbourhood remains important

(Whitehead, 2002). In the UK, the neighbourhood has received significant attention for decades (Lupton, 2003). This is evidenced in the plethora of urban polices such as New Deal for Communities, Neighbourhood Renewal funds, the National Strategy for Neighbourhood Renewal amongst others which were all target at neighbourhoods (these have been highlighted in chapter 2).

The neighbourhood serves as the mediating factor through which individuals' personal and family circumstances are translated into realised socioeconomic outcomes. This is achieved through the provision of opportunities within the geographical space necessary for the development of individuals' personal attributes and decision-making processes at various stages in life (Galster and Sharkey, 2017). However, as discussed in previous sections of this thesis, the distribution of resources across space is not uniform. This spatial inequality can be attributed to several socioeconomic and environmental factors such as those discussed in Chapter 2 as well as the deliberate efforts to fulfil the desires of people with similar economic status, race, and ethnicity amongst others to live close to each other (Drier et al, 2001). This results in variations in the distribution opportunities and threats across the neighbourhood, city, region or country which place people on different pathways to the realisation of socioeconomic outcomes.

Galster and Sharkey (2017), posits that these translation mechanisms operate in three main forms. First, by influencing within neighbourhood attributes such as pollution and violence over which the individual exercises, little or no volition. Secondly, the prevailing opportunities within the neighbourhood influences what individuals perceive to be desirable and achievable when making decisions about activities and attributes over which they exercise considerable volition. Finally, these neighbourhood conditions also influences the individuals family circumstance such as resources, behaviours and attitudes which have direct impacts on the individuals outcomes. At early stages in life, these family circumstances and individual decisions "lead people into various path-dependent trajectories of achieved socioeconomic status and subsequent life decisions, in cumulatively reinforcing processes that can stretch across lifetimes and generations" (Galster and Sharkey, 2017 p.2).

I will now take closer look at the mechanism through which neighbourhood effects influence individual socio economic outcomes.

*3.3.1.1 **Physical, Infrastructural, Institutional and Environmental Conditions***

Studies of neighbourhood effects rarely mention the physical and institutional characteristics of the neighbourhood or area. Instead, they tend to focus on population related dynamics (Lupton, 2003). Yet, on the very basic level, the neighbourhood is the space within which services such as healthcare facilities (GPs, dentist and hospitals facilities), schools and other educational facilities and institutions which provide essential services necessary to guarantee a certain level quality of life are provided (Wheaton et al., 2015). In addition, the neighbourhood, city or wider urban area should be able to sustain the vitality of life by ensuring adequate supply of water, food and appropriate housing stock but free of pollutants and other environmental hazards (Depro et al., 2015). People within neighbourhoods that cannot guarantee access to these life essentials are more likely to have poor quality of life compared to people in other places with better accessibility to these services.

In a study of neighbourhood effects on health and wellbeing, Wheaton et al., (2015) found that neighbourhoods with worsening physical and environmental conditions tend to be associated with worse health outcomes. Similar studies undertaken by Airaksinen et al. (2015) using longitudinal analysis found a causal relationship between neighbourhood socioeconomic conditions and interests in personal health as well has smoking and alcohol take-up rates.

Another area through which neighbourhood inequality can influence outcomes is differences in exposure to environmental toxins and hazards. At various spatial scales, exposure to harmful environmental conditions such as pollutants is tremendously heterogeneous (Hsiang, 2017). Studies have shown that through housing market dynamics, poorer and ethnic minority neighbourhoods tend to have disproportionately worse environmental conditions as result of emissions from the concentration of industrial facilities within their residential neighbourhoods (Downey and Hawkings, 2008; Campbel et al., 2010; Grant et al., 2010). Concentrations of hazardous waste sites and high polluting industrial facilities within certain neighbourhoods expose people within these neighbourhoods and nearby areas to significant health hazards (Ard, 2015; Galster and Sharkey, 20017).

As concluded by Depro et al. (2015) in an analysis of environmental justice and residential mobility, the importance of neighbourhood conditions and its effect on the well-being of people is usually evidenced in the willingness of people who can afford to pay a premium to move further away from the sittings of environmental hazards such as toxic storage and disposal facilities whilst poor income households remain. It is essential to understand the underlying determinants of spatial heterogeneity in the distribution of environmental hazards, the availability of essential institutions and differences in general environmental and living conditions across neighbourhoods. This is necessary for the development of appropriate policy actions necessary to avoid the potential effects of spatial overconcentration of neighbourhood problems within the spatial opportunity structure.

3.3.1.2 ***Labour Market and Jobs***

Spatial inequality in the availability of employment opportunities and well-paid jobs between neighbourhoods, cities, and commuting zones is on the ascendency (Hellerstein et al., 2014). This development, coupled with restricted mobility within the housing market tend to place individuals on different pathways towards the realisation of their socioeconomic outcomes and impedes upward mobility (Galster and Sharkey, 2017)

One of the most researched areas of spatial inequality is joblessness and mismatch theory (Galster and Sharkey, 2017). Spatial mismatch theory hypothesised by Kain (1968) in an attempt to explain the concentrations of joblessness among ethnic minorities within inner city deprived areas, is concerned with the spatial separation of employment opportunities from the unemployed. Although the validity of mismatch theory has been highly contested among academics (Blumenberg, 2004), several studies have highlighted the need to have a direct relationship between jobs and those who need them. Danziger and Allard

(2002) found that providing better access to employment for unemployed people on state benefits resulted in better outcomes. Similar conclusions were reached by Ong, (2002) and Cervero et al (2002).

In the UK, patterns of residential segregation, some which can historically be traced to the post 1945 housing policies where ethnic minority immigrants were housed in inner city industrial areas and mainly white households were provided with housing in the suburbs meant that there were concentrations of ethnic minorities within inner city neighbourhoods (Ferrari and Lee, 2007). Within the de-industrialised inner cities of the north of England and the Midlands, inner city neighbourhoods are faced with no suitable employment opportunities for residents within these areas because of the shift from industrialisation to out of town service centres (Beider, 2007).

In addition to these developments, polarisations in housing markets and the widening gap between high-end and low-end housing markets has created invisible barriers for mobility as people within deprived inner-city areas are unable to move closer to locations with employment opportunities and cannot commute due to high transportation cost (Holmans and Simpson, 1999). This creates a spatial lock-in and path dependence whereby people within these areas cannot escape the deteriorating neighbourhood conditions and its effects (Nygaard and Mean, 2013). On the other hand, affluent neighbourhood have the capacity to attract investments which generates employment opportunities. People within these neighbourhoods also tend to have the capacity to expand their spatial opportunity structure for employment by commuting to other places.

3.3.1.3 ***Crime and Violence***

There is substantial literature devoted to the examination of the correlation between neighbourhood conditions and neighbourhood vices such as crime, violence and juvenile delinquency (Galster and Sharkey, 2017; Livingston et al., 2014; Sampson and Lauritsen, 1994). Earlier works of Park and Burges (1925) as part of the Chicago school's "The City" writings discussed in chapter two are some of the earlier attempts to find correlations between neighbourhood effects and crime. Growing up in deprived neighbourhoods is considered to be one of the main means through which neighbourhood effects can influence individual life outcomes especially among children (Galster and Sharkey, 2017).

The British crime survey and police record data indicates that households within deprived areas of England are at higher risk of being victims of crime compared to the neighbourhoods within the least deprived areas. The risk of being a victim of crime is also higher in urban areas than rural areas (Higgins et al., 2009). MacDonald et al. (2009 p.1) assets that youths within "communities characterised by high rates of family disruptions, unemployment, concentrated poverty and inaccessibility to economic opportunities" are more vulnerable to violent behaviour and crime.

Whilst these observations can be made nationally and locally within towns and cities, the transmission mechanisms are not known or are poorly understood. MacDonald et al. (2009) suggest that crime and violence, tend to be concentrated within deprived neighbourhoods because conditions such as joblessness and poverty provide an atmosphere for gang culture and illicit drug markets to thrive. Concentrations of crime or criminal activity within neighbourhoods also tend to diminish the perceived consequences. Consequences such as potential for arrest, likelihood of a conviction and the stigma associated with criminal behaviour are underestimated in relations to perceived benefits (e.g. proceeds of crime and social status) (Livingston et al, 2014).

Damm and Dustoman (2014) found that young males within neighbourhoods with high proportion of criminals were more likely to become criminals later in life. They identified social interaction between the youth and criminals in the neighbourhood as the “principal channel through which criminal behaviour is transmitted” (Damm and Dustoman, 2014 p.35). In developing the epidemic theory of ghettos, Crane (1991 p.1227) posited that, “social problems are contagious and are spread through peer influence”. This is consistent with the findings of Damm and Dustoman (2014).

The prevalence of informal social control mechanisms within the neighbourhood is another means through which neighbourhood effects can influence individual outcomes. This process is popularly known as collective efficacy (Brunton-Smith, 2014). Collective efficacy is the “social cohesion among neighbours combined with their willingness to intervene on behalf of the common good” (Sampson, 2006 p. 918). Socially cohesive neighbourhoods tend to positively influence individuals’ perceptions of crime and have the capacity to informally control criminal and violent behaviour (Brunton-Smith, 2014).

3.3.1.4 ***Social Capital***

The relevance of social capital to both economic and non-economic outcomes of individuals and households is another area of neighbourhood effects that continue to receive attention in the literature (Putman, 2000; Darlauf and Fafchamps, 2005). The set of social process such as contagion, collective socialisation, social networks, social cohesion, control and parental mediation which are endogenous to neighbourhoods can have significant influence on individual socioeconomic outcomes (Galster, 2010; Galster, 2018). Putnam (2000, p.19) describes social capital as "connections among individuals- social network and the norms of reciprocity and trustworthiness that arise from them".

Studies of social capital tend to distinguish between two main forms of social capital: Bonding and Bridging. Bonding social capital, which is also considered as the traditional form of social capital is concerned with ties and relationships between people of similar demographic and socioeconomic characteristics (Kim et al, 2006). Bridging social capital, introduced by Putman (2000) is concerned with networks between heterogeneous groups.

Whilst there are arguments to suggest bonding social capital has the potential to promote exclusionary practices and other negative effects such as intolerance and sometimes hate towards people outside of the social group (Leonard, 2004), through shared norms and co-operation, bonding can be valuable for the promotion of collective interests, capacity building and the provision of safety nets for individuals within communities (Larsen et al, 2004). However, Putman (2000) argues that the development of strong bonds and solidarity within groups fostered through bonding capital can prevent members from reaching their full potential. This is because, benefits that accrue through bonding capital are limited. Bridging capital which allows people from different socioeconomic groups, neighbourhoods and communities to share knowledge has a wider scope of network and it is essential for "getting ahead" (Putman 2000, pp 23).

Even though some argue that bridging capital undermines the conditions of bonding capital (Leonard, 2004), there is evidence to suggest that both bonding and bridging capital play different roles within communities and can co-exist. Hawkins and Maurer (2009) found that whilst the bonding types of social capital were effective in providing immediate support for members, bridging social capital offered pathways to longer term sustainability and wider neighbourhood and community development. However, what is of utmost importance here is the extent to which social capital, both bridging and bonding social capital can influence individual socioeconomic outcomes.

Glaeser et al. (2002) found that effective or good stock of social capital can result in positive effects such as better employment prospects and higher wages, better health outcomes and better social relations. In a spatial mismatch analysis of access to employment by people within disadvantaged and ethnic minority communities, the unavailable of employment networks and discrimination were found to be more important than the sheer lack of jobs within the neighbourhoods (Hellerstein et al. 2008). Galster et al. (2008) also found that presence of role models and effective socialisation networks within neighbourhoods exerted positive influences on earnings of the less advantaged people within the neighbourhood.

Neighbourhoods with effective social capital tend to have improved socioeconomic indicators (Leonard, 2004). Access to employment networks and local social interactions have been found to be important in getting information about opportunities for employment and skills development (Bayer et al., 2008; Bertrand et al., 2000). On the other hand, research focusing on deprivation and poverty suggest that among others, disadvantaged neighbourhoods tend to be characterised with the lack of social and employment networks, inadequate positive role models and isolated households with less external ties with people who are considered to be of advantage social groups (Tigges et al, 1998; Harris, 1992). In the UK, Buck (2001) found that not have having employment networks (close friends in work) was related to higher neighbourhood unemployment rates.

3.3.1.5 ***Neighbourhood Stigmatisation***

Stigmatisation is another mechanism through which neighbourhood effects can influence socioeconomic outcomes. The conscious or unconscious bias people living in certain places face in search for employment, and other socioeconomic opportunities due to stigmatisation can have profound effects on the socioeconomic outcomes of such people. One of the earlier definition of stigma was propounded by Goffman (1963 p. 3). He described stigma as being "…reduced from a whole and usual person to a trained, discounted one". Besbris et al (2015) defines stigmatisation as the experience of suspicion and mistrust attributed to people from communities know for negative characteristics such as high crime, poverty and deprivation when interacting with strangers.

Neighbourhoods that are easily identified as deprived or disadvantaged tend to have poor reputation among outsiders and are subjected to stigmatization (Kelaher et al, 2009; Warr, 2005). Additionally, through the complexities of neighbourhood disadvantage, racial segregation and residential sorting by economic status, people from such neighbourhoods are not only subjected to the "stigma of race and class" (Van Ingen, 2018 p.198), they are also likely to be associated with certain stereotypical perceptions and discriminated against during competition for opportunities such as employment and resources, even from state institutions (Galster, 2012).

In an online classified market study involving the sale of the same product, Besbris et al. (2015) found that advertisements from sellers from disadvantage neighbourhoods received less responses than advertisement from sellers from advantaged neighbourhoods. Perceptions about people from disadvantaged neighbourhoods can influence the viability of economic activities.

In 2016, a BBC report - "Backlash after Ferguslie Park rated 'most deprived'" highlighted a situation where the residents felt the calculation of the Scottish Index of Multiple Deprivation (SIMD) inaccurately identified their neighbourhood as the most deprived neighbourhood in Scotland. The ranking of areas by the indices of deprivation have far reaching (unintended) consequences beyond the scope of identifying areas which needs to be targeted by intervention policies. The backlash in this case was the result of the stigmatization or at least the fear of stigmatization which tend to be associated with deprived places and its potential impacts on the socioeconomic outcomes of people.

The role of neighbourhoods in shaping socioeconomic outcomes of people and households continue to receive attention from academics and social commentators (Galster, 2018; Galster and Sharkey, 2017; Van Ingen, 2016; Keaher et al., 2009). Whilst some doubt the potential for neighbourhood effects to influence socioeconomic outcomes of individuals (Tunstall et al, 2014; Buck, 2001), there are substantial amount of literature which overwhelmingly supports their existence. As discussed above, neighbourhoods do not exist in isolation, they have relationships with other neighbourhoods and these relationships need to be accounted for within the metrics used as arbiters of social need.

In the next section, I review the 2015 indices of deprivation to understand the spatial distribution of deprivation and affluence in England and the extent to which the Indices of Deprivation is spatial contextualised.

3.4 The Spatial Manifestation of Deprivation in England: A Review of IMD2015

The Indices of Deprivation has been the de facto measure of deprivation in England since 1991 when the Index of Local Conditions was introduced to assess multiple deprivation following the works of Townsend (1979; 1987). It has proved to be effective as relative measure of deprivation and variants of the IMD are used in the other countries of the UK. As discussed in Chapter 2, as part of the quest to produce a robust deprivation index, the IMD has evolved over time. Changes have been made to the number of indicators used, the type of indicators and how the composite index is calculated (Smith et al., 2015). In this section, I review the 2015 English Indices of Deprivation (ID2015) to foreground and contextualise the relevant issues concerned with the measurement of deprivation and their spatiality. The objective here is to highlight some of the deficiencies of the Indices of deprivation this research seeks to address.

The index is created at the Lower-Layer Super Output Area (LSOA) level, which means that on average, indicators, domains and the overall index are computed for areas with a population of around 1,600 people (ONS, 2012). There are 32,844 LSOAs in England of which 5,598 (17%) are considered to be rural. Generally, the Office of National Statistics (ONS) defines urban areas to be settlements with more than 10,000 people. In England, approximately 82.4 % of the population live in urban areas with the remaining 17.6% living in rural areas (ONS, 2017).

The rural-urban typology is important in this study because rural and urban areas have different spatial structures and face different challenges; have different barriers to economic growth and the delivery of services; and have different opportunities. Similar neighbourhood disadvantages can manifest differently in rural and urban areas. The rural-urban classification is sub-divided into 8 typologies and are presented in table 3.2.

Table 3. 2 - Rural urban Typology

Rural Urban Typology	Percentage of Total LSOAs
Rural Areas	
Rural town and fringe	8.9%
Rural town and fringe in a sparse setting	0.4%
Rural village and dispersed	7.2%
Rural village and dispersed in a sparse setting	0.6%
Urban Areas	
Urban city and town	44%
Urban city and town in a sparse setting	0.2%
Urban major conurbation	35.1%
Urban minor conurbation	3.7%
Total	**100%**

Source: Defra Rural Strategies

The spatial unit of measurement is perhaps the most important element of the Indices of deprivation as far as the spatial contextualisation of deprivation is concerned. Whilst the geographical unit of analysis must be of an appropriate scale to avoid the impacts of data aggregation on inferences (Clark and Avery, 1976), the geographical scale or unit of measurement (LSOA) used by the IMD is smaller (in most instances) than what is generally referred to as the neighbourhood. Usually several LSOAs need to be combined to make up the neighbourhood which fits into Galster's (2001) definition of neighbourhood mentioned earlier. On the other hand, other LSOAs, particularly rural ones tend to remain a separate unit at the LSOA spatial scale and fit the definition of neighbourhood in general terms.

There is therefore the need to explicitly account for these spatial contextual differences in computing the IMD scores so that deprived LSOAs within affluent areas can be identified separately from deprived LSOAs within general deprived areas and separately from an isolated and deprived LSOA which is disconnected from other built-up areas.

3.4.1 Composition of the Index of Multiple Deprivation

The Indices of Deprivation 2015 considers several indicators of deprivation which are grouped into seven main categories referred to as domains. These domains are Income; Employment; Crime; Living Environment; Barriers to Housing and Services; Health Deprivation and Disability; and Education, Skills and Training. They are statistically combined to produce the Index of Multiple Deprivation (IMD) and have remained the same since the publication of the 2007 IMD although some of the indicators which make up the respective domains are different (Smith et al., 2015). The seven main domains of the IMD2015 and their respective weights are presented in Table 3.3. For the complete list of indicators, sub domains and domains of the IMD2015, see Appendix II.

The domains shown in Table 3.3 are designed to measure different aspects of deprivation although the index creators acknowledge that "…people experiencing multiple or single but very severe forms of deprivation are in almost every instance likely to have very little income and little or no other resources" (Smith et al., 2015 p.12). Income deprivation is therefore seen as the most important of all the seven domains, hence the allocated weight of 22.5% each to both the income and the employment domains.

Table 3. 3 - Domains of the IMD2015 and Weights

Domain	Weight (Percentages)
Income	22.5%
Employment	22.5%
Barriers to Housing and Services	9.3%
Education, Skills and Training	13.5%
Health Deprivation and Disability	13.5%
Living Environment	9.3%
Crime	9.3%

Source: MHCLG ID2015

In order to gain further insight into how the domains differ from each other, a correlation analysis between the 7 domains was undertaken and the result is presented in Table 3.4. It can be seen from the table that some of the domains are highly correlated. The degree of association between Income, Employment, Health Deprivation and Disability and the Education, Skills and Training domains are over 0.8. On the other hand, the correlation between these four domains mentioned above and the Living Environment and Barriers to Housing and Services domains are very low (less than 0.3). Incidentally, the four domains with over 0.8 correlation co-efficient are the most highly weighted domains (a combined total weight of 72%). In as much as these four indicators measure important socioeconomic characteristics, it can be argued that they are over weighted given their degree of association. This is consistent with the observations made by (Deas et al) 2003 and Noble et al. (2000) discussed in Chapter 2.

Although, the correlation between the crime domain and most of the other domains (except the Barriers to Housing and Services domain) are not as high as the correlation between income, employment, the health deprivation and disability and the education, skills and training domains, they are significantly high (greater than 0.5) and suggest a strong interrelationship between most of the indicators which are combined to produce the domains and overall index. This also affirms the assertion that all forms of deprivation are significantly related to income; any variable which has a bearing on income is likely to have a strong relationship with deprivation (Smith et al., 2015).

Another interesting revelation from Table 3.4 is that with the exception of the correlation between the health deprivation and disability domain and the Barriers to Housing and Services domain, all of the other domains have a positive correlation co-efficient. This suggests that LSOAs with high income, for example, also tend to have high incidence of crime as measured by the indicators of the crime domain. This is however inconsistent with assertion by MacDonald et al. (2009) which suggest that crime and violence tend to be concentrated within deprived neighbourhoods. In terms of spatial context, affluent LSOAs which are closer to highly deprived LSOA with high unemployment rates, gang culture and illicit drug markets are likely to experience higher crimes rates (Higgins et al., 2009).

The remainder of this section provides a detailed examination of the spatial distribution of deprivation and affluence as measured by the IMD2015 overall index and the 7 domains.

Table 3. 4 - Pearson Correlation between the Domains of the IMD2015 and the overall Index

ID2015 Domains/ Overall Index Score	Overall	Income	Employment	Education, Skills and Training	Health Deprivation and Disability	Crime	Barriers to Housing and Services	Living Environment
Overall	1	.966**	.950**	.847**	.843**	.671**	.227**	.386**
Income	.966**	1	.953**	.836**	.814**	.616**	.157**	.255**
Employment	.950**	.953**	1	.834**	.855**	.561**	.053**	.196**
Education, Skills and Training	.847**	.836**	.834**	1	.713**	.478**	.047**	.106**
Health Deprivation and Disability	.843**	.814**	.855**	.713**	1	.543**	-.037**	.260**
Crime	.671**	.616**	.561**	.478**	.543**	1	.089**	.416**
Barriers to Housing and Services	.227**	.157**	.053**	.047**	-.037**	.089**	1	.254**
Living Environment	.386**	.255**	.196**	.106**	.260**	.416**	.254**	1

** Correlation is significant at the 0.01 level (2-tailed).
Source: Author

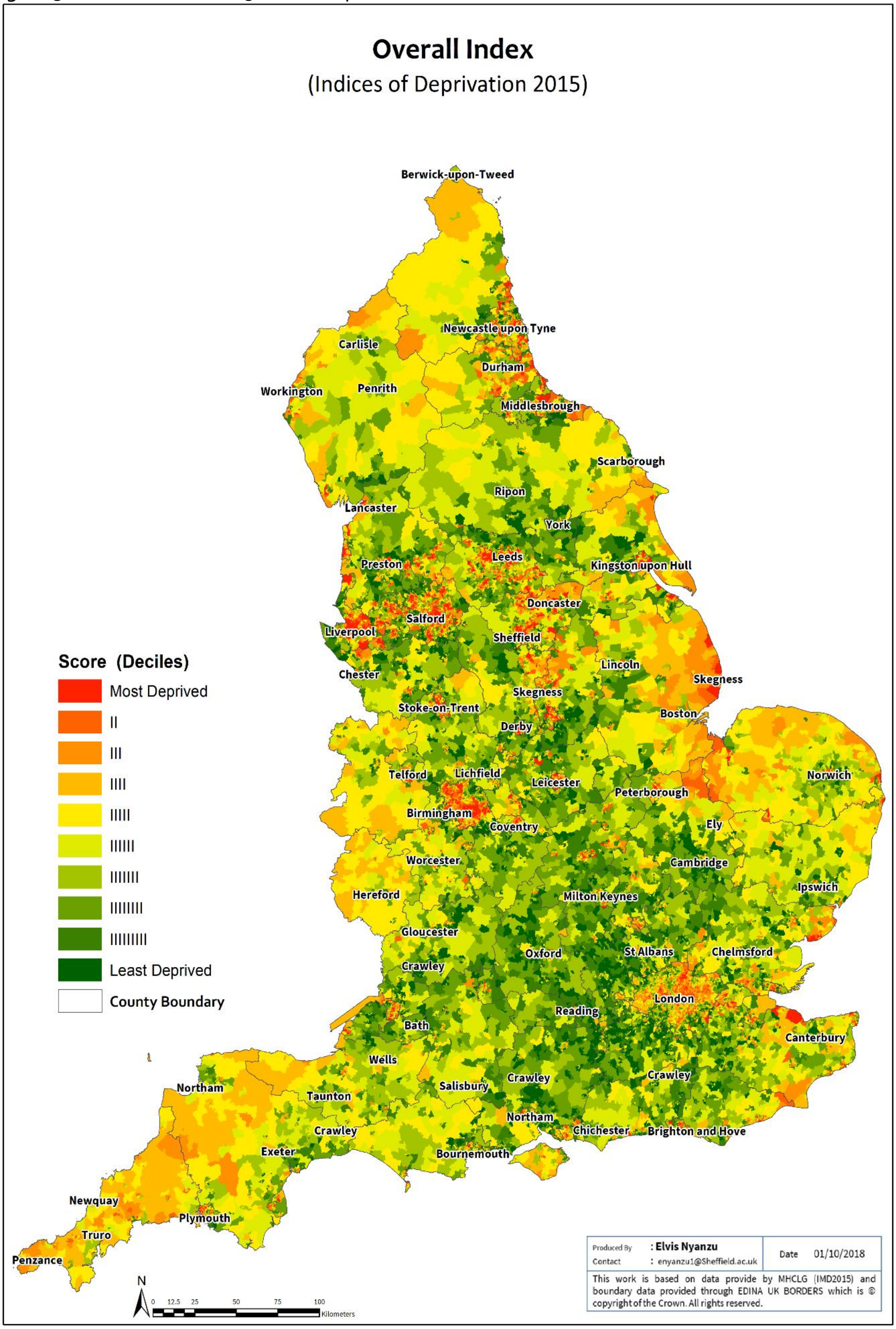
3.4.2 ***Overall Index***

Figure 3.1 shows the general outlook of relative deprivation in England using the IMD2015 scores grouped in deciles. Areas which are shown to have concentrations of the most deprived neighbourhoods are Merseyside, West Midlands, Manchester, South and West Yorkshire, Tyne and Wear, Durham, Stoke-on-Tees and part of London. There are medium to most deprived areas along the coastal areas of Lincolnshire, Norfolk, Cornwall, Kingston upon Hull and Cumbria.

Table 3.1 shows the ranking of local authority areas with high proportion of their LSOAs in the most deprived 10%. Although Birmingham has the highest number of deprived LSOAs, Middlesbrough has the highest percentage of its LSOAs in the most deprived decile. Middlesbrough, Knowsley, Kingston upon Hull, Liverpool and Manchester make up the top 5 most deprived LADs all of which have over 40% of their LSOAs in the most deprived decile. Birmingham is ranked sixth with 39.6% of its LSOAs in the most deprived decile.

With the exception of Birmingham and Nottingham in the midlands, the top 10 most deprived LADs are in the north of England with the first London borough ranked twenty-third (Tower Hamlets). This highlights the potential effects of deindustrialisation and the declining economic advantage these areas once held (Graham and Spence, 2000). Even though some London boroughs appear to be highly deprived in a number of domains, these areas also rank low in the domains with highest weights resulting in the relatively lower ranking in the overall index. Out of the top 30 LADs in the most deprived decile, 22 have over a quarter of their total number of LSOAs in this group. For the ranking of LADs with significant proportion of their LSOAs within the most deprived 20%, see appendix III.

Figure 3. 1 - Overall IMD2015 Index Map



Source: Author

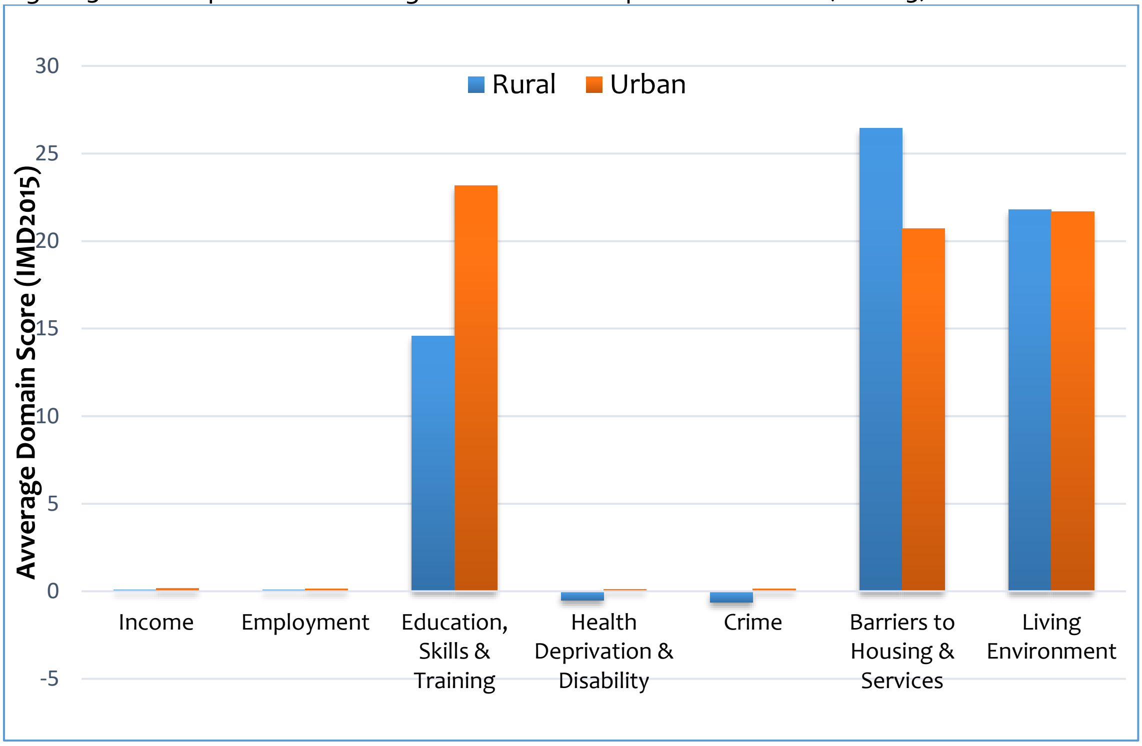
Table 3. 5 - Most Deprived 10% - Overall Index

		10% Most Deprived LSOAs (Overall IMD Index)				
Rank	*Local & Unitary Authorities*	*No LSOAs*	*Average Rank*	*Minimum Score*	*Maximum Score*	*Percentage of LSOAs in the Most Deprived 10%,*
1	Middlesbrough	86	9353	3.21	78.03	48.8
2	Knowsley	98	7056	10.32	77.30	45.9
3	Kingston upon Hull, City of	166	7650	7.99	82.60	45.2
4	Liverpool	298	7433	3.03	81.53	45.0
5	Manchester	282	6683	7.11	80.03	40.8
6	Birmingham	639	8140	3.10	79.03	39.6
7	Blackpool	94	6993	12.07	88.52	38.3
8	Nottingham	182	7469	5.21	77.59	33.5
9	Burnley	60	9503	7.07	82.32	33.3
10	Hartlepool	58	11101	5.59	71.68	32.8
11	Bradford	310	11057	1.67	79.00	32.6
12	Blackburn with Darwen	91	10066	4.14	81.85	30.8
13	Stoke-on-Trent	159	9584	4.69	74.31	30.2
14	Hastings	53	9611	8.89	75.84	30.2
15	North East Lincolnshire	106	12540	3.74	82.33	29.2
16	Salford	150	10442	3.09	78.17	28.7
17	Rochdale	134	10477	6.22	79.57	28.4
18	Pendle	57	11630	6.79	64.13	28.1
19	Halton	79	10972	6.34	68.25	26.6
20	Great Yarmouth	61	10676	7.38	81.77	26.2
21	Wolverhampton	158	9819	5.43	71.84	25.9
22	Hyndburn	52	10720	6.75	66.15	25.0
23	Leicester	192	9248	5.82	73.15	24.0
24	Tower Hamlets	144	7507	7.30	58.32	23.6
25	St. Helens	119	12022	5.02	77.28	23.5
26	Sheffield	345	14049	1.19	78.32	23.5
27	Oldham	141	12335	4.60	77.15	22.7
28	Sandwell	186	8020	8.11	69.12	22.6
29	Barrow-in-Furness	49	11477	6.17	74.56	22.4
30	Newcastle upon Tyne	175	13783	1.44	78.81	22.3

Source: Author - Data from MHCLG, ID2015.

Figure 3.2 illustrates the average ID2015 domain scores for rural and urban areas. With the exception of the Barriers to Housing and Services and the Living Environment domains, rural areas achieved better scores on the average than urban areas. Within the Health Deprivation and Crime domains, the scores of rural areas were about 120% better than the scores of urban areas.

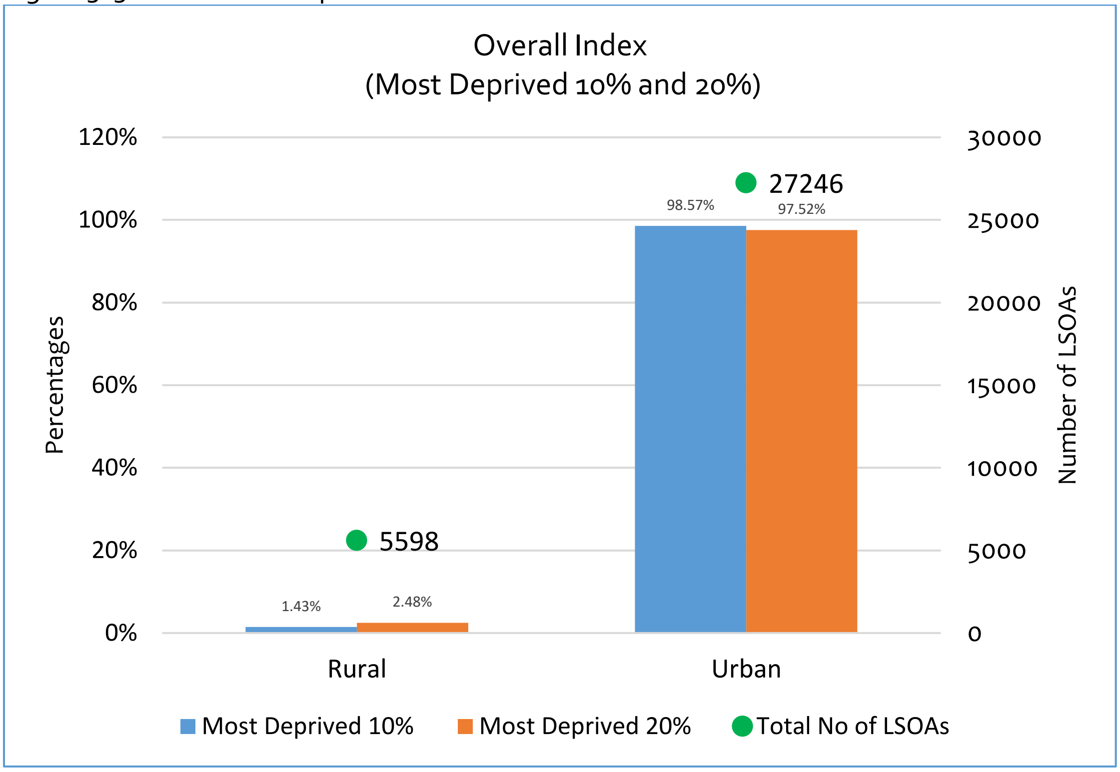
Figure 3. 2 - Comparison of Average Rural Urban Deprivation Scores (ID2015)



Source: Author - Data from MHCLG, ID2015.
Notes: Each domain has a different basis of calculation, scores are not directly comparable across domains. Higher scores indicate higher level of deprivation.

In the most deprived deciles of the overall index, rural LSOAs make up less than 2% whilst urban LSOAs make up over 98%. Overall, about 17% of all LSOAs in England are in rural areas with remaining 83% urban. This suggests that deprivation is not just high in urban areas because built-up areas of the country are mainly urban; it is disproportionately high in urban areas compared to rural areas (see Figure 3.3). However, observations by Fecht et al. (2017) suggest the composite indicators used in the production of the indices is biased towards identification of deprivation within urban areas.

Figure 3. 3 - Rural-Urban Split: Overall Index

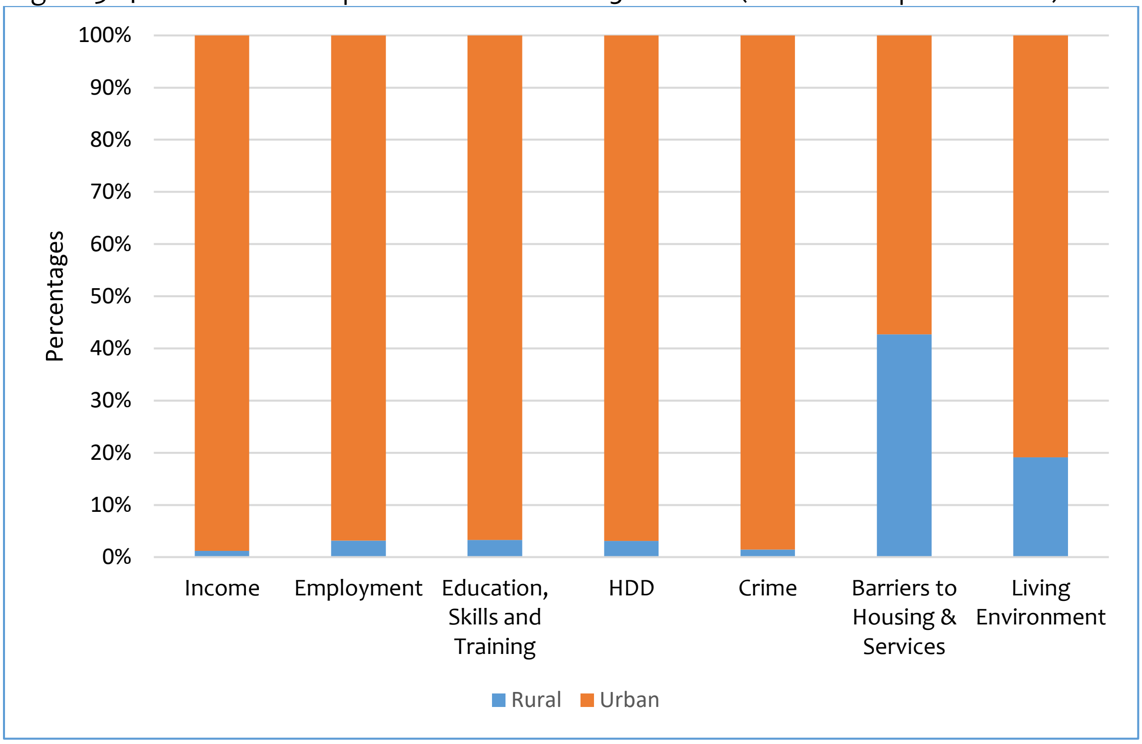


Source: MHCLG, ID2015.

Rural deprivation across the country is not evenly spread; County Durham has 10 deprived rural LSOA, which accounts for about 21% of the total number of deprived rural LSOAs in the most deprived decile of the overall index. This increases slightly to 22% in the most deprived 20% category.

An overview of the proportion of rural and urban LSOAs in the most deprived deciles of each of the 7 domains of the ID2015 is presented in Figure 3.4. It can be seen that whilst the rural–urban split remain under 5% for most of the domains, the proportion of rural areas within the Barriers to Housing and Services domain and the Living Environment domains are 43% and 19% respectively. Whereas this suggest that rural areas are significantly disadvantaged in these domains than the others, the methodological approach to the calculation of scores may account for some of these disparities and make some rural LSOAs appear more deprived because they are treated as isolated entities (Rae, 2009). The wider socioeconomic environment of neighbourhoods can influence people experiences of deprivation. Placing these neighbourhood deprivation scores within the appropriate spatial context has the potential to produce a more representative result. The detailed analysis of domain specific rural-urban classification is provided as part of the discussions of each domain within this chapter.

Figure 3. 4 - Rural-Urban deprivation across ID2015 domains (The most deprived decile)

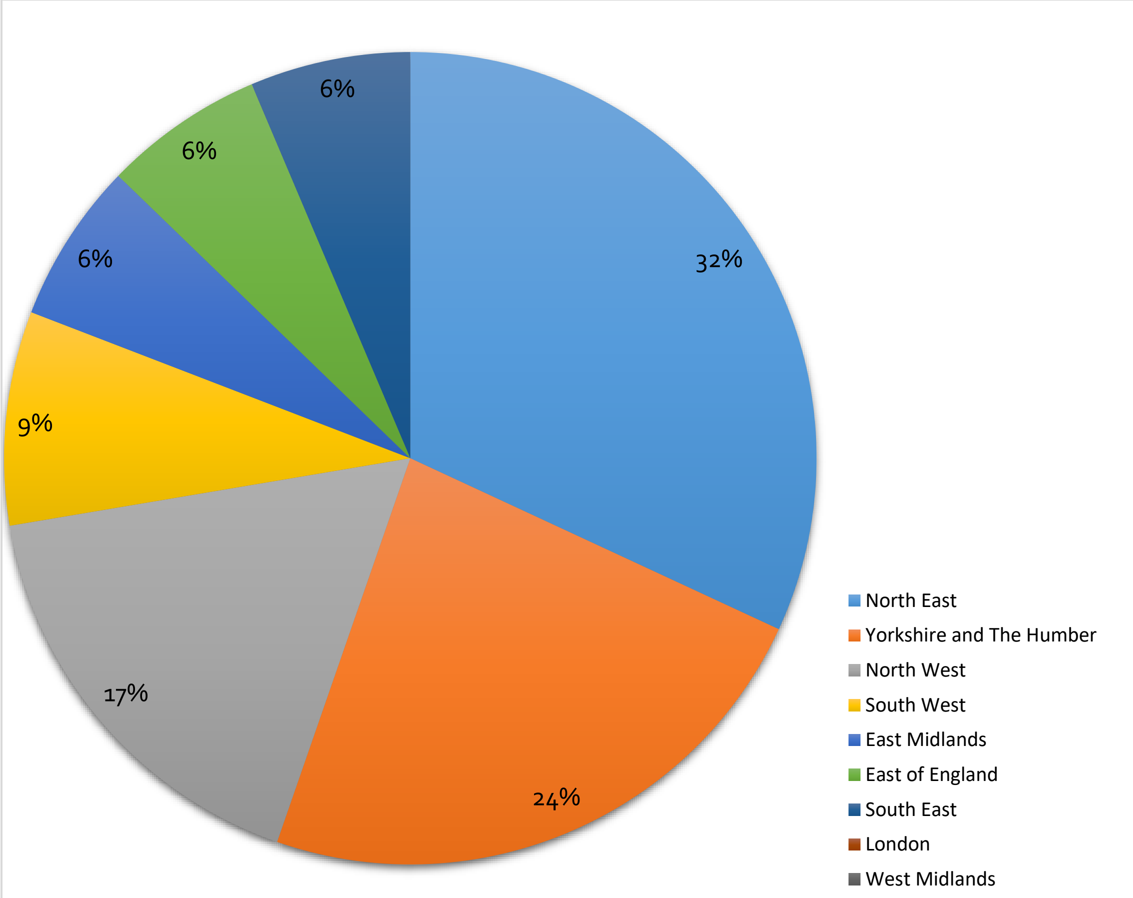


Source: Author - Data from MHCLG, ID2015.

Notes: This shows the proportion of rural and urban areas within the most deprived decile of the ID2015 domains.

The proportion of rural LSOAs within the most deprived decile of the IMD from each of the 9 administrative regions of England are illustrated in figure 3.5. It can be seen that the majority of the deprived rural areas are in the northern regions. The North East, North West and Yorkshire and the Humber regions of England make up 73% of all deprived rural LSOAs within the most deprived decile. Whereas this is disproportionately high compared to other regions, the level of urbanisation in other regions are relatively higher than these three northern regions. In terms of the combined rural and urban spatial distribution of deprivation within the most deprived decile, the three northern regions of North East, North West and Yorkshire and Humber accounts for about 54%; West Midlands account for 16.5% and the South East and South West regions account for 9.6%. These are shown in Figure 3.6

Figure 3. 5 - Regional Rural Deprivation: Most Deprived 10% of IMD2015



Source: Author - Data from MHCLG, ID2015.

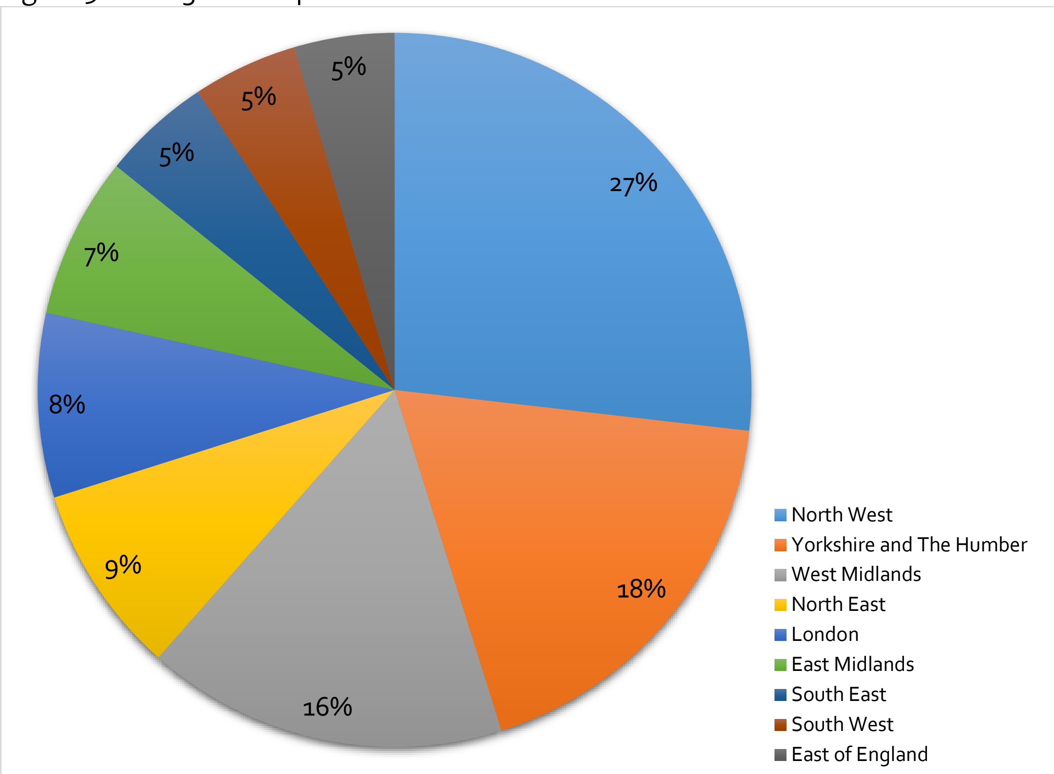
Notes: This shows the distribution of rural deprivation across the administrative regions of England as per the overall IMD2015 Index. There are 47 rural LSOAs in the most deprived decile of the IMD2015 overall index out a total of 3285 LSOAs.

This spatial distribution of deprivation underscores what has become knowns as "the North-South divide" in England which refers to the spatial socioeconomic inequality between areas of the North of England and of the South (Morgan 2006). Much has been written and discussed about the North-South divide among politicians, academics and urban policy analysts for decades (Dorling, 2010; Wales, 2000). Whilst some argue that there are no statistical evidence to support a systemic north-south divide, others argue in favour of the divide although the geographical boundary of the divide remain highly contested with areas around the midlands usually left out of discussions. (See Martin, 1988; Hacking et al., 2011; Green, 1988).

The evidence from the 2015 Index of Multiple deprivation indicates that deprivation in the northern regions of England is disproportionately higher than in the south. This supports arguments that the continuing deindustrialisation affecting areas of the North which took hold in the 1970s (Dorling, 2010) and the devolution of urban policies (Morgan, 2006) continue to put the North at a socioeconomic disadvantage.

Overall, the IMD show that deprivation in England is highly clustered regionally. Deprived LSOAs in urban areas are disproportionately higher than in rural areas with the majority of them clustered in large cities and towns. These observations are consistent with those made by Fecht et al (2017), Rae (2009) and Farmer (2001). The socioeconomic transformations such as deindustrialisation (discussed in chapter 2) that major town and cities have undergone within the last few decades have contributed to the spatial clustering of deprivation and affluence within certain parts of the country. This is evidenced by the clustering of deprivation in areas such as the midlands and the three Northern regions of England which were once industrial powerhouses of the world.

Figure 3. 6 - Regional Deprivation



Source: Author - Data from MHCLG, ID2015.

Notes: This shows regional distribution deprivation across the administrative regions of England as per the overall IMD2015 Index. There are 3284 LOSA in the most deprived decile of the IMD 2015.

The next line of enquiry is to unpack the IMD to examine the spatial manifestation of deprivation in each of the seven domains, how they contribute to the patterns observed in the overall index and how they differ from the overall index.

3.4.3 ***Living Environment Domain***

The living environment domain is one of the domains of the ID2015 which attempts to measure 'other' forms of deprivation people might experience which are not directly related to the economic circumstances of people. It makes use of a combination of indicators which focus on the circumstance of the home and the domestic sphere on one hand and other indicators which look at the external environment and neighbourhood in general. The indicators used here include measures of the concentration of pollutants in the atmosphere, rate of road traffic accidents which results in death or personal injury, heating cost and its potential impact on household budgets and the proportion of houses within the neighbourhood which do not meet the Decent Homes standard (DCLG, 2015). The indicators, sub-domains and the sources of data are presented table 3.6.

Table 3. 6 - Living Environment Domain Indicators and Sub-Domains

Description	**Data Sources**
Indoors Living Environment Sub-Domain	
Housing in poor condition	2011 English Housing Survey
Houses without central heating	ONS census 2011
Outdoor Living Environment Sub-Domain	
Air Quality	UK Air Information Resource 2012
Road Traffic accidents	Department of Transport

Source: Author

From the above table, it can be seen that these indicators and sub-domains have different spatialities. Whereas the indicators of the Indoors Living Environment sub-domain are concerned with the home and have little or no direct relevance to neighbourhood spatial context, spatial context is highly relevant to the indicators of the Outdoor Living Environment domain.

Even within the sub-domains, certain indicators may have different spatial scales. For instance, LSOA in urban areas are relatively small in size (Area) to have a distinctive air quality measure which is different to that of neighbouring LSOAs. Several LSOAs will need to be combined to gain an accurate measure of air quality which is significantly different to other areas. The spatial scale for the Air Quality indicator is also likely to be different to that of Road Traffic Accidents. There is therefore a case to spatially contextualise some of the indicators or at least the sub-domains separately before combining them to produce domain scores in order to achieve a more accurate measure.

Figure 3.7 illustrates the level of deprivation in various parts of the country in the living environment domain. In contrast to some of the other domains (such as income and employment), concentrations of deprivation in the living environment domain can be found in diverse areas such as Herefordshire, Shropshire, Cumbria, Northumberland, Devon, Cornwall and London. Certain areas along the coast of Lincolnshire, Norfolk and Suffolk also feature prominently as deprived areas.

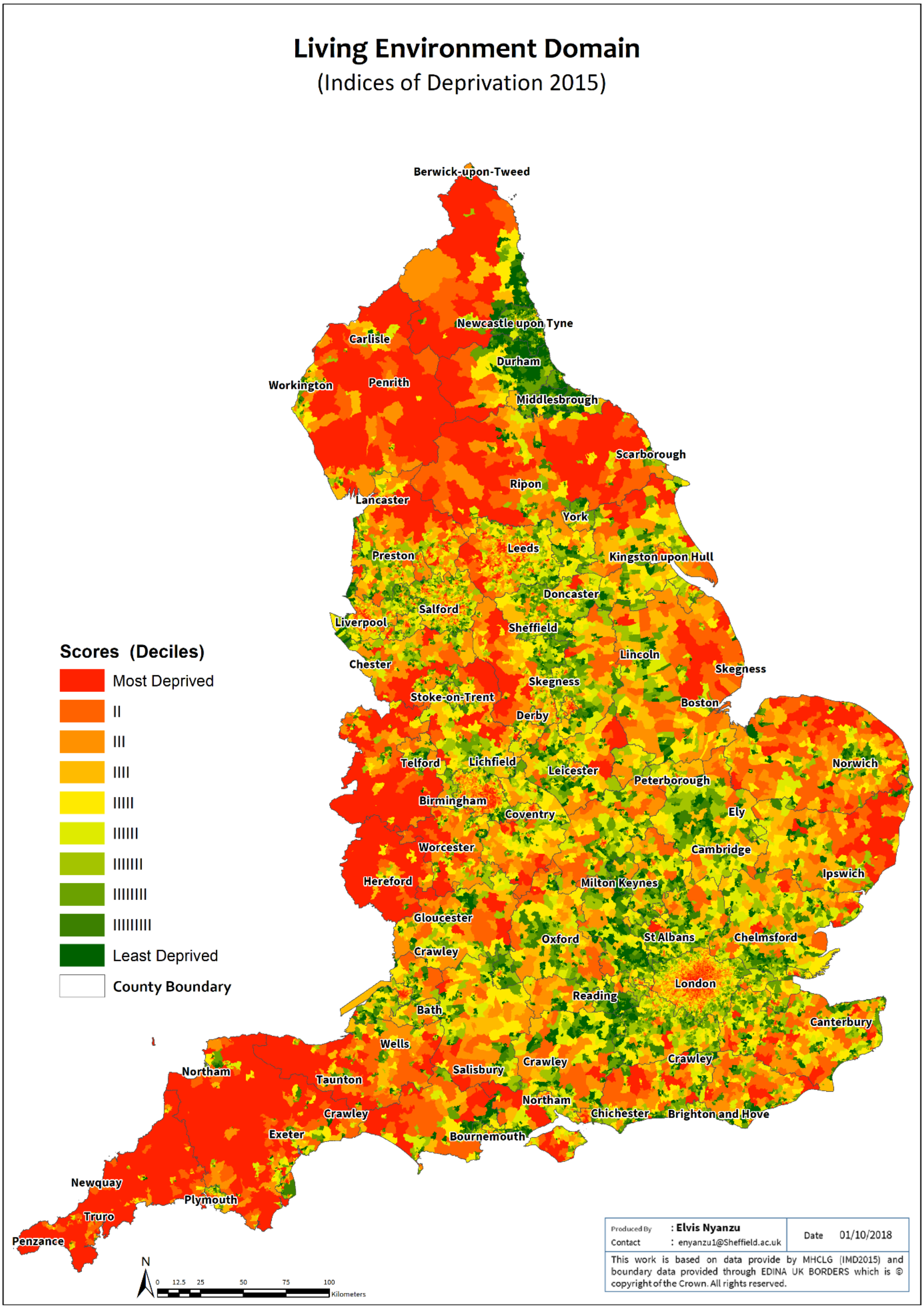
A closer examination of the results revealed that local authority areas such as Westminster, Kensington and Chelsea and City of London, most of which are considered affluent areas of the country have more than half of their respective LSOAs within the most deprived decile of the Living Environment domain. This highlights the prevalence of "hidden deprivation" and the potential for such problems to go unnoticed (Riphahn, 2001). Out of the 20 most deprived local authorities, eight are in London (see appendix IV). This increases to nine when the most 20% of deprived areas are considered (see appendix V). These local authorities have over a quarter of their LSOAs in the most deprived decile of the domain.

The high living environment domain scores for these generally least deprived areas can be attributed to higher weights assigned to the other domains which reduces the significance of deprivation in this domain. Whilst this has been highlighted as a critique of the IMD (Greig et al., 2010), the continuous rise in property values in such areas compared to other parts of the country (PWC, 2017) also suggest that certain indicators, such as those measured by the Living Environment domain may be of less importance to people and that the creators of the IMD may be justified in assigning relatively higher weights to the economic domains.

Despite the apparent rural nature of some local authorities, about 80% of the most deprived LSOAs in the Living Environment domain are urban. Analysis of the individual indicators presented in figure 3.8 show that rural areas have better air quality and less road traffic accidents (the lower the score the better). This is not surprising as urban areas tend to have the highest concentration of traffic and factories. On average, rural and urban areas have similar scores for houses without central heating but houses in urban areas performed better when general housing conditions were measured. The analysis also indicates that whilst the general outdoor living environment in rural areas are generally better than urban areas, indoor living environment tend to be better in urban areas.

Proportionally, the 628 rural LSOAs in the most deprived decile of the Living Environment domain represents 11% of the total number of rural LSOAs (5598). This is higher than the proportion of urban areas in the most deprived decile of this domain which is approximately 9.75%. The result suggest that either significant number of rural areas are failing to achieve the required standards within the domain in general or the approach used to calculated the domain scores places rural areas at a disadvantage.

Figure 3. 7 - Living Environment Domain Map (ID2015)



Source: Author - Data from MHCL, ID2015.

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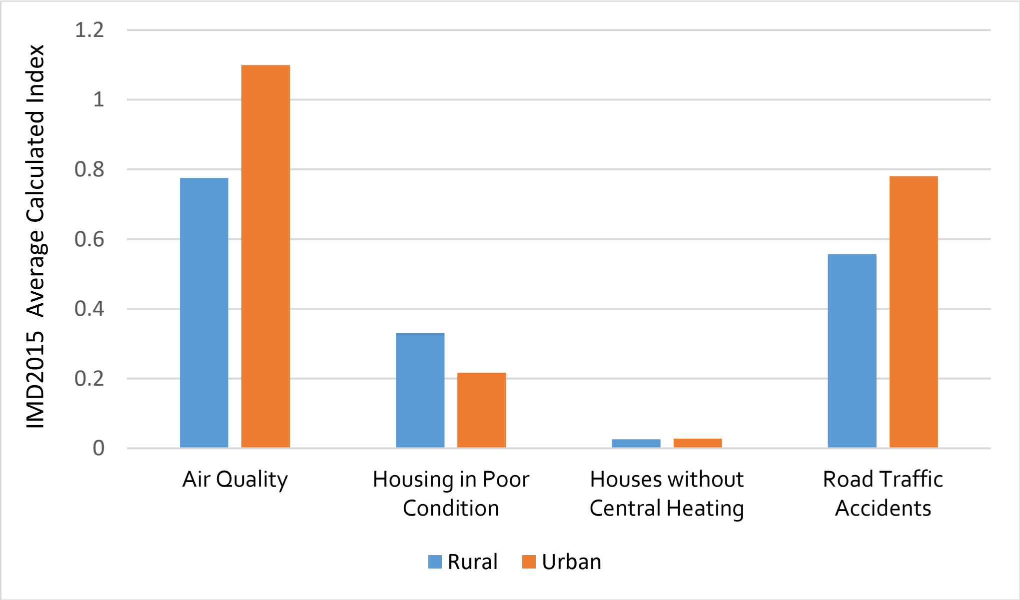
The results also show that different parts of the country face different problems. Whereas some urban areas such as London are notorious for issues related to increase in traffic, noise and air quality (Smith et al., 2017), other areas of the country have specific problems. For instance, decades of decline in economic activities in coastal towns and villages have resulted in poor housing stock, the conversion clusters of former B&Bs into low quality multiple occupancy houses, lack of economic opportunities and an ageing population. All of these have rendered such coastal areas highly deprived within the Living Environment domain and the overall index (House of Lords, 2019; Smith, 2012).

Figure 3. 8 - Rural-Urban Average Indicator Scores (Living Environment Domain)



Source: Author - Data from MHCLG, ID2015.

Problems associated with housing stock and conditions in coastal areas have been highlighted by both the present Conservative government and previous Labour governments in reports such as the Communities and Local Government Committee Coastal Towns report (2007) and the Conservative Party's "*No Longer the End of the Line: Our plan for Coastal towns*" (2009). After almost a decade since these reports were produced, these problems persist and at a time of austerity and significant reduction in regeneration programmes, the plight of such areas are more likely to remain challenging into the foreseeable future.

3.4.4 ***Barriers to Housing and Services***

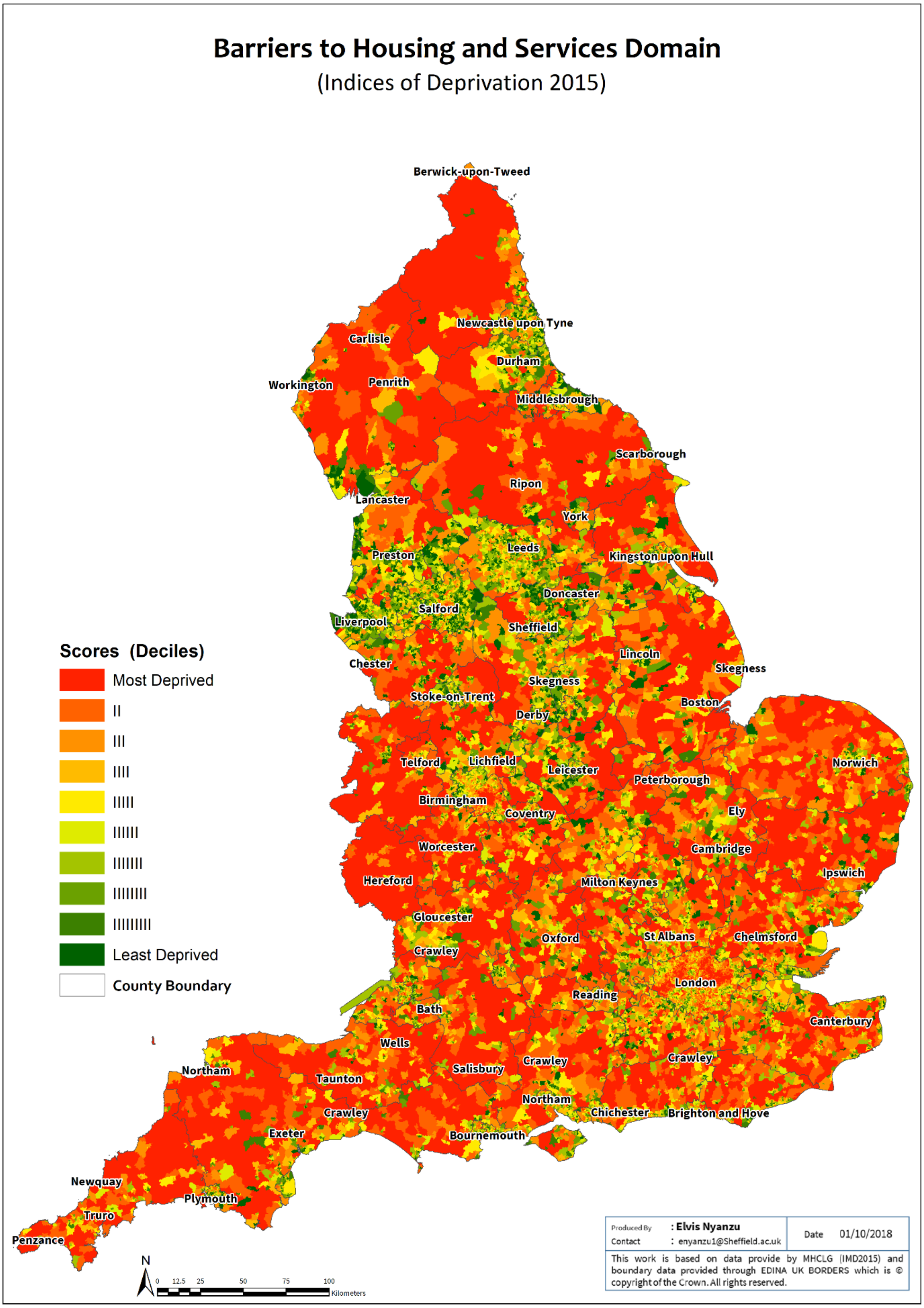
Shortcomings in the provision of adequate housing and housing affordability has been highlighted in the housing White Paper - *"Fixing our broken housing market"* with the prime minister saying, "Our broken housing market is one of the greatest barriers to progress in Britain today" (DCLG, 2017 p. 6). The Barriers to Housing and Services (BHS) domain of the ID2015 goes beyond the measure of housing stock, quality and affordability. It also takes into account homelessness and the accessibility to services such as GP surgeries, schools, and other amenities (Smith et al., 2015).

Figure 3.9 shows the relative levels of deprivation across England in the BHS domain of the ID2015. It can be seen from the map that most parts of the country have significant number of LSOAs in the two most deprived deciles. City regions in Merseyside, Greater Manchester, West Yorkshire, South Yorkshire, Derbyshire, Leicestershire, Tyne and Wear, Redcar and Cleveland and Nottinghamshire appear to have fewer barriers compared to the rest of the country. This could be partly due to the fact that services such as schools, health facilities and other essential amenities are usually sited with catchment areas in mind; major towns and cities are likely to have more service points than other areas. It could also be because by their very nature of having been in existence for a long time, major towns and would have historically attracted significant investments in such amenities for decades placing them in advantageous positions (Brueckner et al., 1999). However deindustrialization and outward migration from city regions such as those mentioned above and the relatively favourable access to the housing market in such areas compared to cities and towns of the south such as London and Oxford which have some of the highest average house prices in the UK could explain the results.

Birmingham has the highest number of deprived LSOAs in this domain with 260 LSOAs in the most deprived decile. Although, as a proportion of its total number of LSOAs (639), this represents 40.7% which is not as high as that of the London borough of Newham which has 82.5% of its 164 LSOAs among the most deprived. When ranked in order of the percentage of LSOAs in the most deprived 10% as shown in Appendix VI, the first 6 local authorities are in London with the top four having over 50% of their LSOAs facing significant arriers to housing and services. Herefordshire and Richmondshire are the only two local authority districts outside the top 10 most deprived LADs (in the most deprived decile) which are outside of London. Spatial patterns of the LSOAs within the most deprived 20% follows a similar pattern to the most deprived 10% (see appendix VII)

Local authority districts such as Knowsley, Liverpool and Middlesbrough which have some of the highest number of deprived LSOAs in the overall index rather have less than 4% of their LSOAs in the most deprived decile of this domain. This highlights the extent to which the relative weights assigned to the various domains to produce the overall index scores can reduce the positive impacts of some domains whilst projecting the negative results of other domains. It is also worth noting that even though the BHS domain scores are positively correlated to the overall IMD index scores, it is a weak correlation (See correlation matrix presented in Table 3.4). This suggests that an LSOA which performs better in this domain is not likely to achieve an overall IMD score which is significantly better.

Figure 3. 9 - Barriers to Housing and Services Domain Map (ID2015)



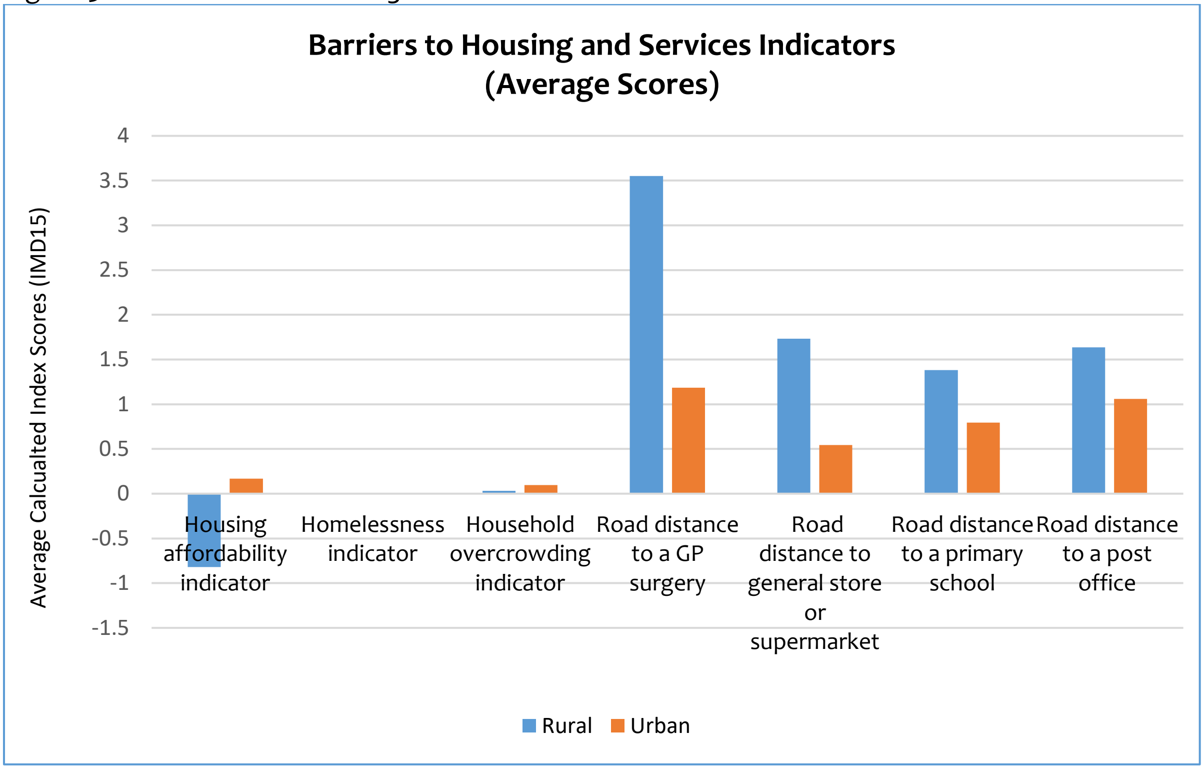
Source: Author - Data from MHCLG, ID2015.

Deprivation is higher in rural areas in this domain compared to the other domains. Approximately 43% of the most deprived 10% LSOAs are in rural areas and these represent a quarter of all rural LSOAs. Although 57% of the most deprived LSOAs are urban, this represents only 7% of the total number of LSOAs classed as urban (27,246). These results suggest that a higher number of rural areas are beset with problems associated with a combination homelessness, housing affordability, overcrowding and inadequate access to services such as schools, GP surgeries among others.

Another compelling reason for above results could be related to the methods employed in accessing deprivation within this domain. Some rural LSOAs, particular does at the fringes or town and cites, which accounts for approximately 16% of all LSOA in the least deprived decile of the overall Index, tend to be well connected to areas with improved access to most of the services and amenities concerned with this domain. People within such areas also tend to have the capacity to expand their spatial opportunity structure through spatial relations with other places and may not necessarily consider the unavailability of such services within their LSOA of residence as a form deprivation.

Further analysis was therefore undertaken to review the performance of both rural and urban areas when the individual indicators within the BHS domain were measured and this is presented in Figure 3.10. It can be seen that rural areas generally performed better in the wider barriers sub-domain which comprises housing affordability, homelessness and household overcrowding indicators. Even though homelessness is relatively less of a problem in both rural and urban areas with an average indicator score of 0.0015 and 0.0025 respectively, it is about 60% higher in urban areas than in rural areas.

Figure 3. 10 - Rural/Urban Average BHS Indicator Scores



Source: Author - Data from MHCLG, ID2015.

Urban areas in general scored lower in the geographical barriers sub-domain (the lower the score the better). This indicates that access to GP surgeries, supermarkets, schools and post offices are better in urban areas than rural areas. With the general scores within the geographical barriers sub-domain being relatively higher than the general scores in the wider barriers sub domain, most rural areas ended up with higher scores for BHS domain (the higher the score, the more excluded/or deprived the area within the domain).

Whilst it may be the case that more needs to be done to improve access to services such as those measured within the BHS domain for rural areas, this may not be the case for all rural areas currently ranked in the most deprived deciles.

The unavailability of these services within specific LSOAs or within a certain distance from the usual LSOA of residence may not necessarily imply the people are excluded from such services if they are able to access them from other places they usually commute. Variables such as car ownership and improved transportation network such as public transport services and good road networks can have a significant effect on rural deprivation and exclusion from services (Mattioli, 2017, Lucas 2012). In a situations whereby most people in rural areas have access to cars or effective transportation networks connecting them to other places with good levels of access to services, it can significantly reduce the perceived deprivation and exclusion from services in such areas to the extent that the people who live in these areas may not consider themselves to be deprived. Of course, this implies that the concept of 'forced car ownership' (see Mattioli, 2017; Dalton, 2017) and how it may affect the disposable household income of the people become a relevant issue which has to be controlled for as part of the analysis as it may affect deprivation in other domains.

Calculating the deprivation scores for such services should be conceptualised to take account for this and have the relative deprivation scores adjusted accordingly. This will not only allow for the appropriate level of deprivation for the domain to be quantified, it can also provide a more appropriate pathway through which the problems identified with this type of deprivation can be addressed. The conceptualisation of neighbourhood deprivation proposed in this research and methods employed can be useful in this endeavour.

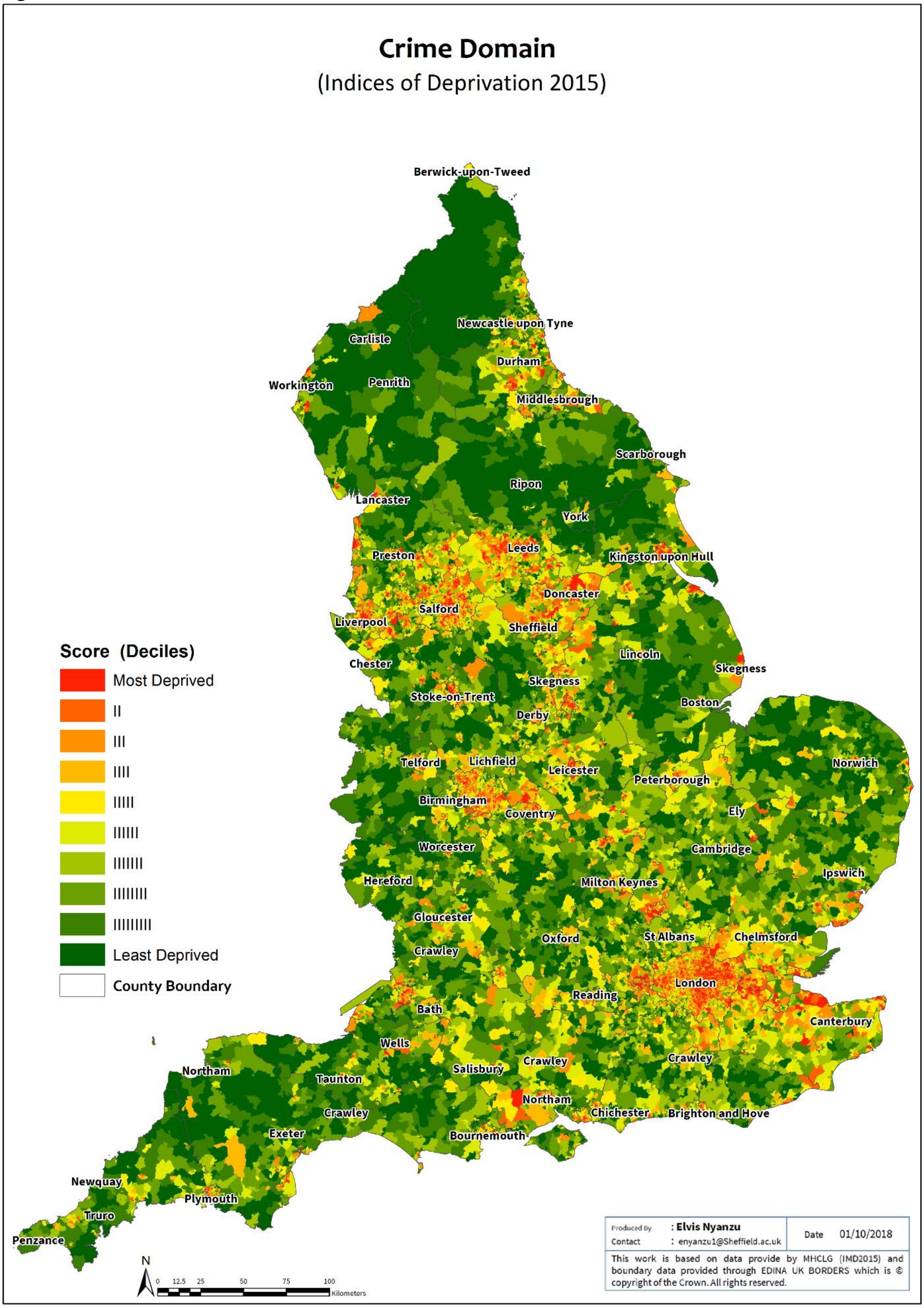
3.4.5 Crime Domain

The crime domain measures the rate of violence, burglary, theft and criminal damage per 1000 at risk population. It measures the risk of personal and material victimisation at the local level (DCLG, 2015). Figure 3.11 illustrates an overview of the crime domain scores in deciles across the country. Although deprivation in this domain is relatively low for most parts of the country, there are pockets of isolated deprivation in Cumbria, Herefordshire, Cornwall and the coast of Lincolnshire and North Yorkshire.

Areas which are in the most deprived decile of the domain are concentrated in major cities and city regions. Apart from London, the majority of the concentrations of deprivation are in the northern counties of West Yorkshire, South Yorkshire, Greater Manchester, Merseyside and the Midlands.

Appendix VIII shows the rank of local authority districts, in order of the proportion of LSOAs in the most deprived decile of this domain. Once again, London boroughs are highly ranked with 7 boroughs in the 10 most deprived Local Authority Districts (LAD). All of the 10 LADs have between 35% and 54% of their LSOAs being classed as deprived. Leeds, is the LAD with the highest number of LSOAs in the most deprived decile. It has 101 LSOAs representing approximately 21% of the total number of LSOAs within the Local Authority area. This is followed by Manchester, which has 99 of its 282 LSOAs within the most deprived decile of the crime domain (35.1%).

Figure 3. 11 - Crime Domain (ID2015)



Source: Author

In the 20% most deprived category (see appendix IX), 9 of the top 10 LADs are London Boroughs. Islington, Lambeth, Newham, Southwark and Barking and Dagenham all have over 70% of their LSOAs in the 20% most deprived group in this domain. Incidents of crime related to violence, theft, burglary and criminal damage are mostly in urban areas with just 48 rural LSOAs (approximately 1%) within the most deprived decile which is made up of 3284 LSOAs.

A notable observation is that unlike urban areas where LSOAs in the most deprived decile of the crime domain tend to be clustered, crime in rural areas are isolated and spread across the country.

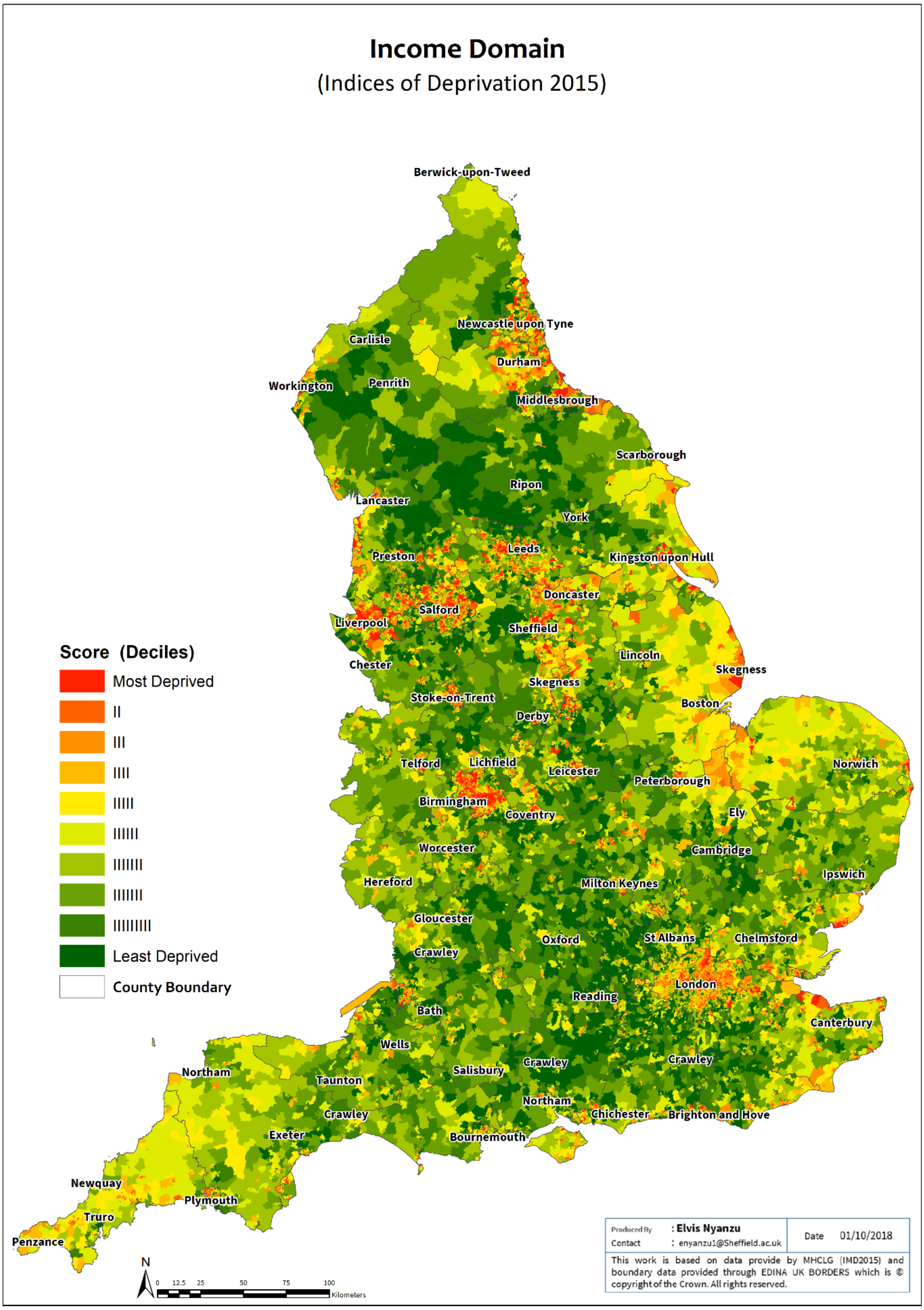
*3.4.6 **Income Domain***

The Income domain is arguably the most important domain of the IMD as most measures of deprivation can be related to the level of disposable income available to individuals and families. The scores of the income domain accounts for 22.5% of the overall index and it is about 97% correlated with the overall IMD scores. The domain measures the proportion of the population in a given area either earning no income or are in the low-income category when subjected to the government’s means testing criteria (Smith et al., 2015).

Figure 3.12 below is a map of the income domain in deciles with the first deciles being the most deprived group. The Majority of the most deprived neighbourhoods are concentrated in the north of England, London and the Midlands. There are significant clusters in Merseyside, Greater Manchester, West Midlands, Derbyshire, some parts of South Yorkshire and West Yorkshire. Towns and cities along the eastern coast of the country have a relatively higher number of LSOAs in the most deprived two deciles with significant concentrations of deprivation around the north-eastern coastal areas of the country. Again, Birmingham has the highest number of LSOAs in the most deprived decile. However, Middlesbrough is the most deprived LAD with almost 49% of its LSOAs in the most deprived decile of this domain. It is closely followed by Knowsley, Kingston upon Hull and Liverpool; all of which have over 40% of their respective LSOAs in the most deprived decile of the income domain. These are shown in Appendix X. Out of the top 10 LADs with high proportions of their LSOAs in the most deprived decile, eight are in the north, one in the midlands and one within London. In the most deprived 20%, the number of London boroughs in the top 10 most deprived LADs increased to two (see appendix XI) - Barking and Dagenham and Tower Hamlet lead with over 60% of their LSOAs in the most deprived two deciles.

About 1% of LSOAs in the most deprived decile of the Income domain are in rural areas. 10 of the 39 most deprived rural LSOAs are in county Durham, 4 in Redcar and Cleveland, 3 in Northumberland and 3 in Wigan. The remaining are pockets of deprivation across the country. Thus, income deprivation according to the results is mainly an urban problem although due to the nature of rural settings, where a rural neighbourhood is deprived, it can be entrenched if the area is isolated and disconnected from other areas.

Figure 3. 12 - Income Domain map (ID2015)



Source: Author

3.4.7 *Employment*

The Employment domain of the 2015 Indices of Deprivation (ID2015) is concerned with involuntary exclusion from employment. It specifically measures the percentage of working age population who are unemployed due to either the unavailability of relevant jobs or due to sickness, disability and caring responsibilities but are prepared to work (DCLG, 2015).

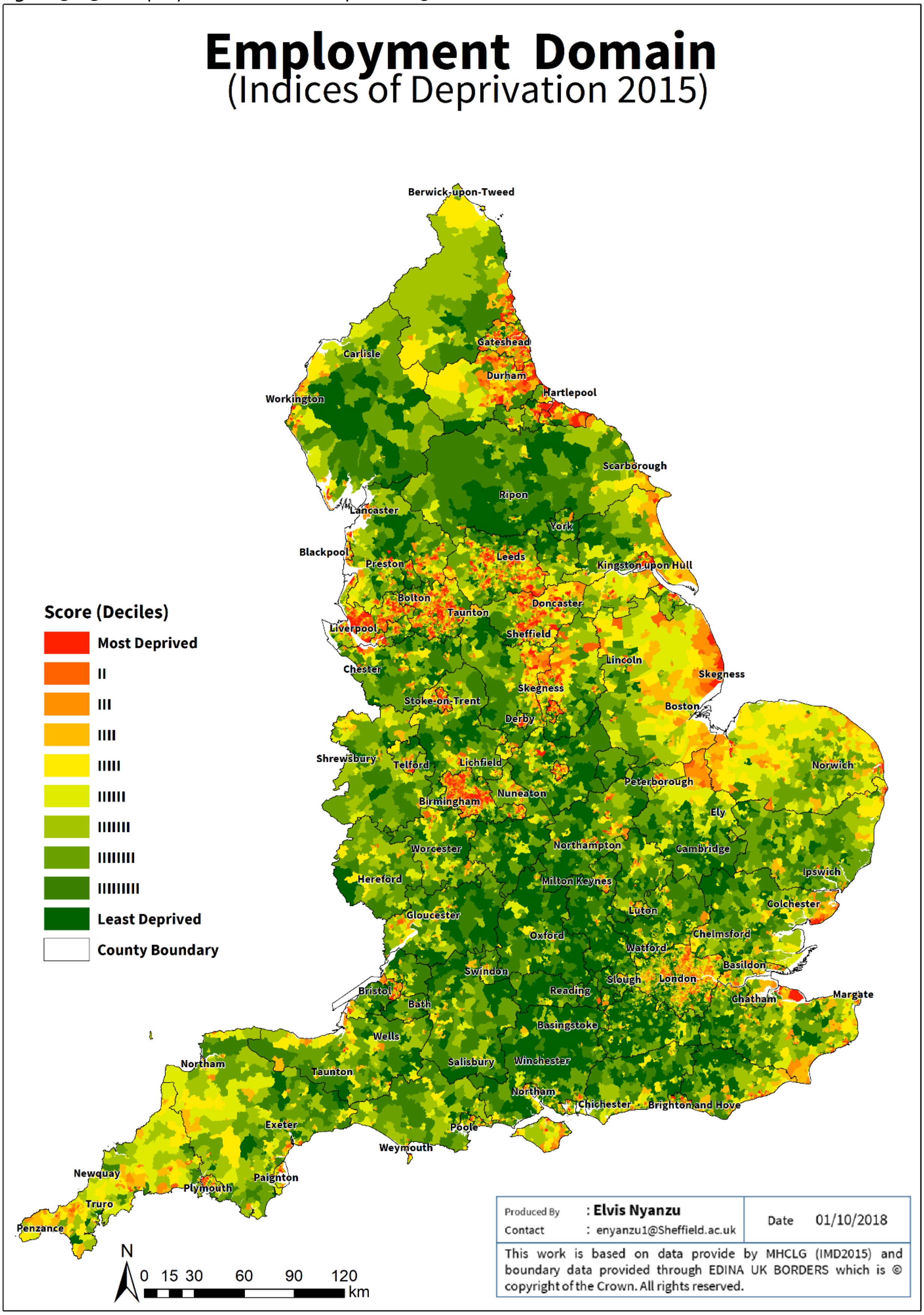
As confirmed by the correlation co-efficient shown in Table 3.4 earlier, the spatial manifestation of deprivation in the employment domain illustrated with Figure 3.13 looks similar to that of the Income domain (Figure 3.12) discussed earlier. It is also weighted 22.5% of the overall IMD Index and it is approximately 95% correlated to both the Income domain and the overall IMD Index. This highlights the critique of the IMD relating the over reliance of the overall index on the economic domains at the expense of the other domains (Greig et al., 2010). Concentrations of deprivation in this domain can be seen in Merseyside, Greater Manchester, West Midlands, South and West Yorkshire, Tyne and Wear as well as some parts of London.

Coastal areas such as County Durham, Lincolnshire, Norfolk, Suffolk, Essex and Northumberland are all in the medium to most deprived deciles of the employment domains. The same can be said of areas along the south coast such as Hastings, Folkestone, Torbay, Isle of Wight, Plymouth as well as Blackpool, Workington and Liverpool on the north-western coast. Traditionally, the economies of coastal areas in England rely on tourism to boost economic activities and employment. With the continuing decline of tourism affecting most seaside towns in England, such areas have become characterised with relatively high unemployment rates and low paid work (Corfe, 2017); this, in part, accounts for the relatively high level of deprivation scores seen in such areas.

One significant observation from the spatial distribution of employment deprivation which is distinct to deprivation in the income domain is the proportion of London LSOAs within the most deprived decile. Both appendices XII and XIII show that there are no London LADs in the top 20 LADs of the most deprived decile and the most deprived 20% category of the Employment domain when ranked according to the percentage of deprived LSOA within these categories. Yet, there were a number of London LADs in the corresponding categories in the income domain. This suggests that although most people in London may be in employment, the disparity between cost of living and wages may be too wide resulting in a relatively high level of income deprivation.

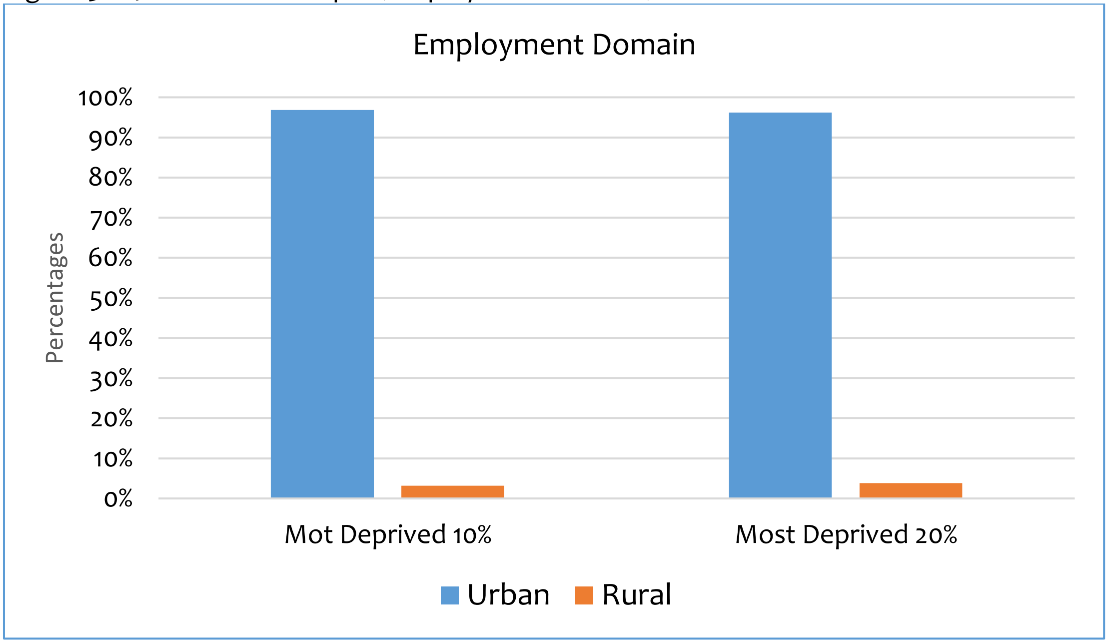
Figure 3.14 shows the proportion of rural and urban areas in the most deprived 10% and 20% groups of the employment domain. Just as the income domain, employment deprivation is largely prevalent in urban areas. Only about 3% and 4% of all rural LSOAs in England are in the most deprived 10% and 20% respectively. The majority of the rural LSOAs in the most deprived decile of this domain are in Durham with 35% of the total 109 located within the boundaries of the district. Urban areas on the other hand, have about 12% and 23% of LSOAs in the most deprived 10% and 20% categories respectively. Most of these areas in the Midlands and the North of England, areas of the country which have experienced significant deindustrialisation within the past few decades.

Figure 3. 13 - Employment Domain map (ID2015)



Source: Author

Figure 3. 14 - Rural-Urban Split (Employment Domain)



Source: MHCLG, ID2015.

3.4.8 *Education, Skills and Training*

The Education, Skills and Training (EST) domain seeks to measure the level of educational attainment in children at various stages of the education system. In adults, it measures the proportion of the working-age population with no or low qualification as well as the level of English language proficiency among the working-age population. Figure 3.14 shows the spatial distribution of deprivation within the EST domain in deciles. There are concentrations of deprivation in the West Midlands, parts of Nottinghamshire, Derbyshire, West and South Yorkshire, Manchester and Merseyside. The counties of Norfolk and Lincolnshire have large portions of LSOAs in the mid to high deprived areas of which most are rural. Again, higher number of LSOAs along the east coast of the country are within the three most deprived deciles.

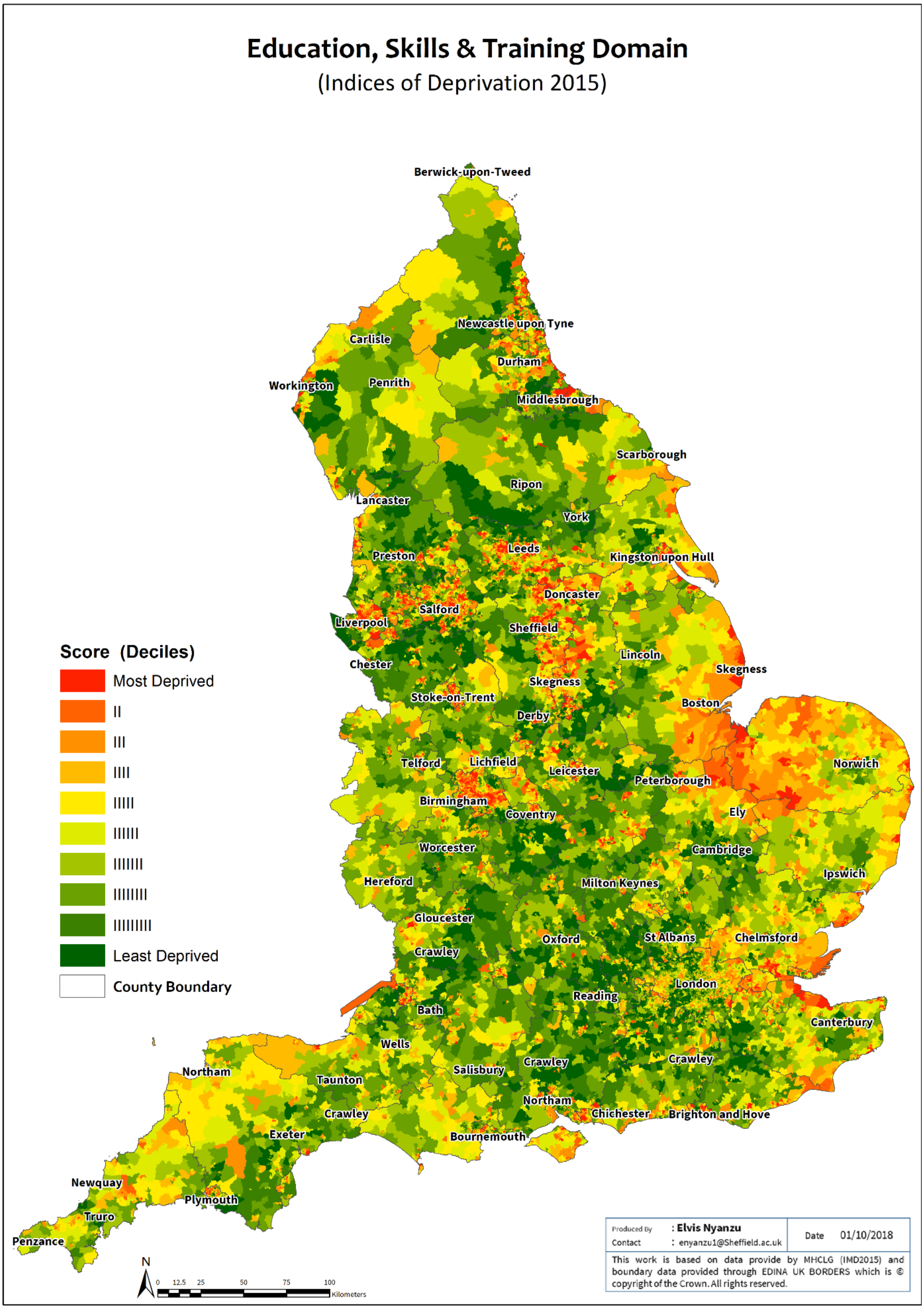
In the most deprived decile of the EST domain, Middlesbrough, Kingston upon Hull and Knowsley are ranked first, second and third respectively with over 40% or their LSOA in the most deprived decile (See appendix XIV). The top 20 LADs have more than a quarter of their LSOAs in the most deprived decile with over 50% of these 20 LADs in the north of England. There are no London boroughs in the 30 most deprived Local Authority Districts.

In the 20% most deprived neighbourhoods category (see appendix XV), Nottingham, Corby, Kingston upon Hull, Sandwell and Stoke-on-Trent make up the top five most deprived LADs of the domain. Middlesbrough and Knowsley are ranked 6th and 7th respectively. Each of the 10 most deprived LADs have over 50% of their respective LSOAs in the most deprived 20% of LSOAs in the EST domain.

There are relatively high proportions of urban areas are in the most deprived two deciles of the EST domain compared to rural areas. Figure 3.16 shows that whereas approximately 2% and 6.5% of all rural areas (5,598) are in the most deprived 10% and 20% groups respectively, 11.5% and 23% of all urban areas are in the most deprived 10% and 20% categories of the EST domain respectively. The high proportionate difference suggests a disparity in the availability of and accessibility to good services such as schools and other skills and training facilities.

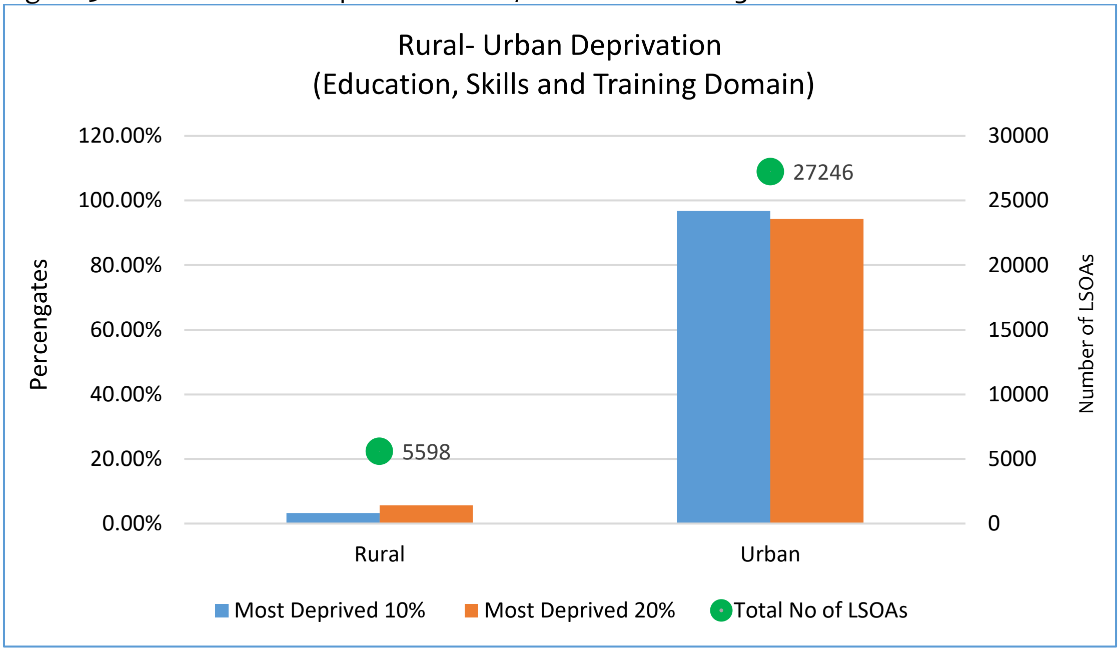
In the most deprived 10%, approximately 97% of the LSOAs are in urban areas with the remaining 3% being classed as rural. Rural deprivation in the EST domain are spread across 46 LADs, most of these LADs having no more than six deprived LSOAs. The exception is Wakefield, which has 12 LSOAs in the most deprived decile.

Figure 3. 15 - Education, Skills and Training Domain Map (ID2015)



Source: Author

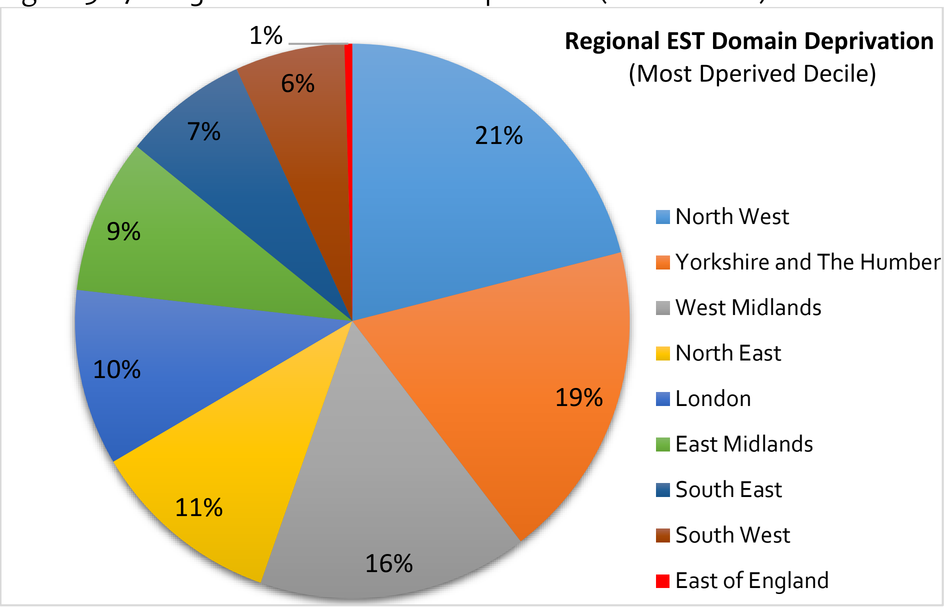
Figure 3. 16 - Rural -Urban Split: Education, Skills and Training



Source: MHCLG, ID2015.

Figure 3.17 shows how deprivation in the Education, Skills and Training domain are spatial distributed across the 9 regions of England. The three northern regions of Yorkshire and the Humber, North East and North West account for 47% of the LSOA in the most deprived decile; the midlands account for 27% whilst London accounts for about 0.5%.

Figure 3. 17 - Regional Distribution of Deprivation (EST Domain)

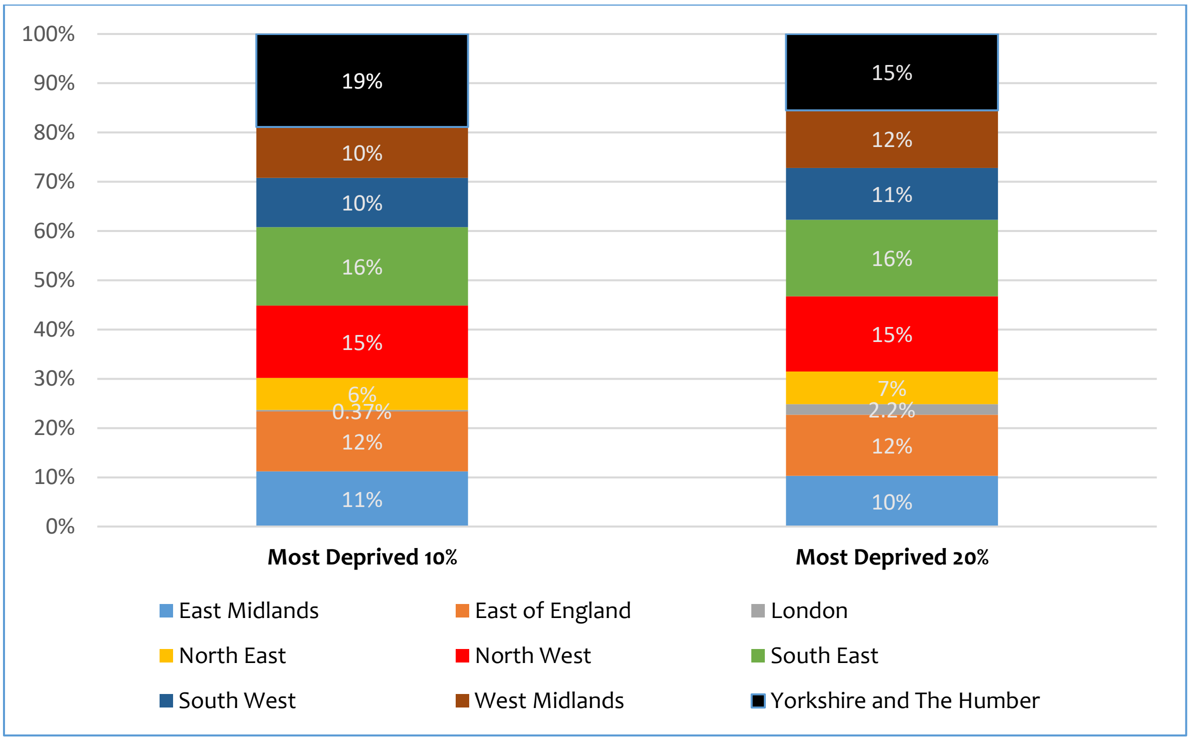


Source: MHCLG, ID2015.

The remaining regions account for the rest of the 25.5%. This result is consistent with deprivation patterns observed in some of the other domains of the IMD.

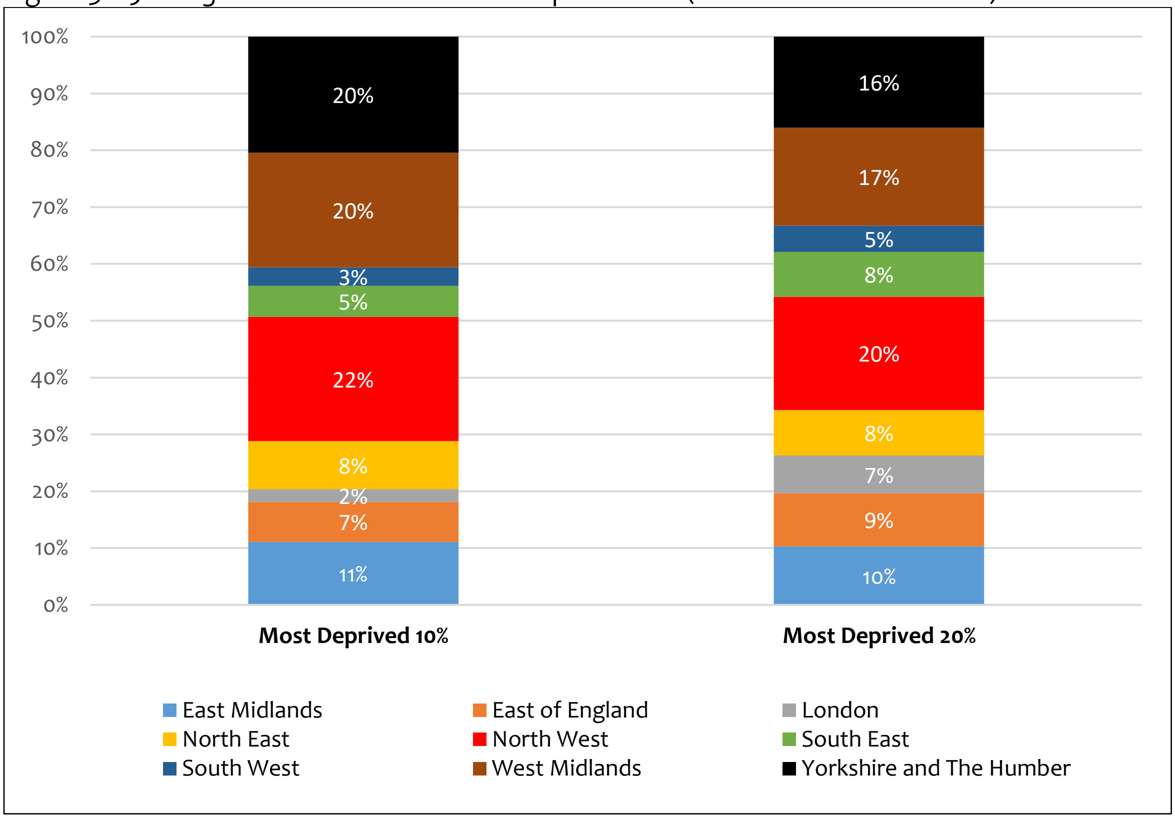
Further examination of the regional spatial distribution of deprivation within the children and young people and the adult skills sub-domains of the EST domain are presented in Figure 3.18 and Figure 3.19 respectively. In the children and young people sub-domain, Yorkshire and the Humber has the highest proportion of LSOAs in the most deprived decile (19%). This is followed by the South East and the North West with 16% and 15% respectively. However, when this category is expanded to include the 20% most deprived LSOAs, Yorkshire and the Humber drops to joint second with North West (15% each) whilst the South East remains at 16% and becomes the region with the highest percentage of its LSOAs in the 20% most deprived percentile of the Children and young people sub-domain of the EST domain. Once again, London has the lowest proportion of LSOAs within this sub-domain. Within the adult skills sub-domain of the EST domain, the three northern regions continue to account for the majority of the deprived LSOAs within the most deprived decile and the most deprived 20% categories, London and the south west have the least proportion their LSOAs in these categories (see Figure 3.19).

Figure 3. 18 - Regional Distribution of EST Deprivation – Children and Young People Sub – Domain



Source: MHCLG, ID2015.

Figure 3. 19 – Regional Distribution of EST Deprivation – (Adult Skills Sub-Domain)



Source: MHCLG, ID2015.

3.4.9 Health Deprivation and Disability

The Health Deprivation and Disability (HDD) domain of the ID2015 is concerned with issues such as potential life lost through risk of premature death (death before age of 75) as well as physical and mental disability through the use of indicators such as acute morbidity, mood and anxiety disorders, and comparative illness ratio (Smith et al., 2015).

Analysis of relative deprivation within this domain is presented in Figure 3.20. It can be inferred from the map that there are concentrations of deprived LSOAs in Merseyside, Greater Manchester, South Yorkshire, West Midlands, Tyne and Wear, West Yorkshire, County Durham and the coast of Lincolnshire. Other areas of significant clustering of deprived LSOAs are in the coastal areas of Cumbria and Lancashire as well as Stoke-on-Trent and Peterborough. Similar to most of the other domains, the north of England and West Midlands have more deprived LSOAs than the rest of the country. Although London has a number of LSOAs in the two most deprived deciles, compared to other domains of the ID2015, the level of deprivation in the HDD domain is relatively less.

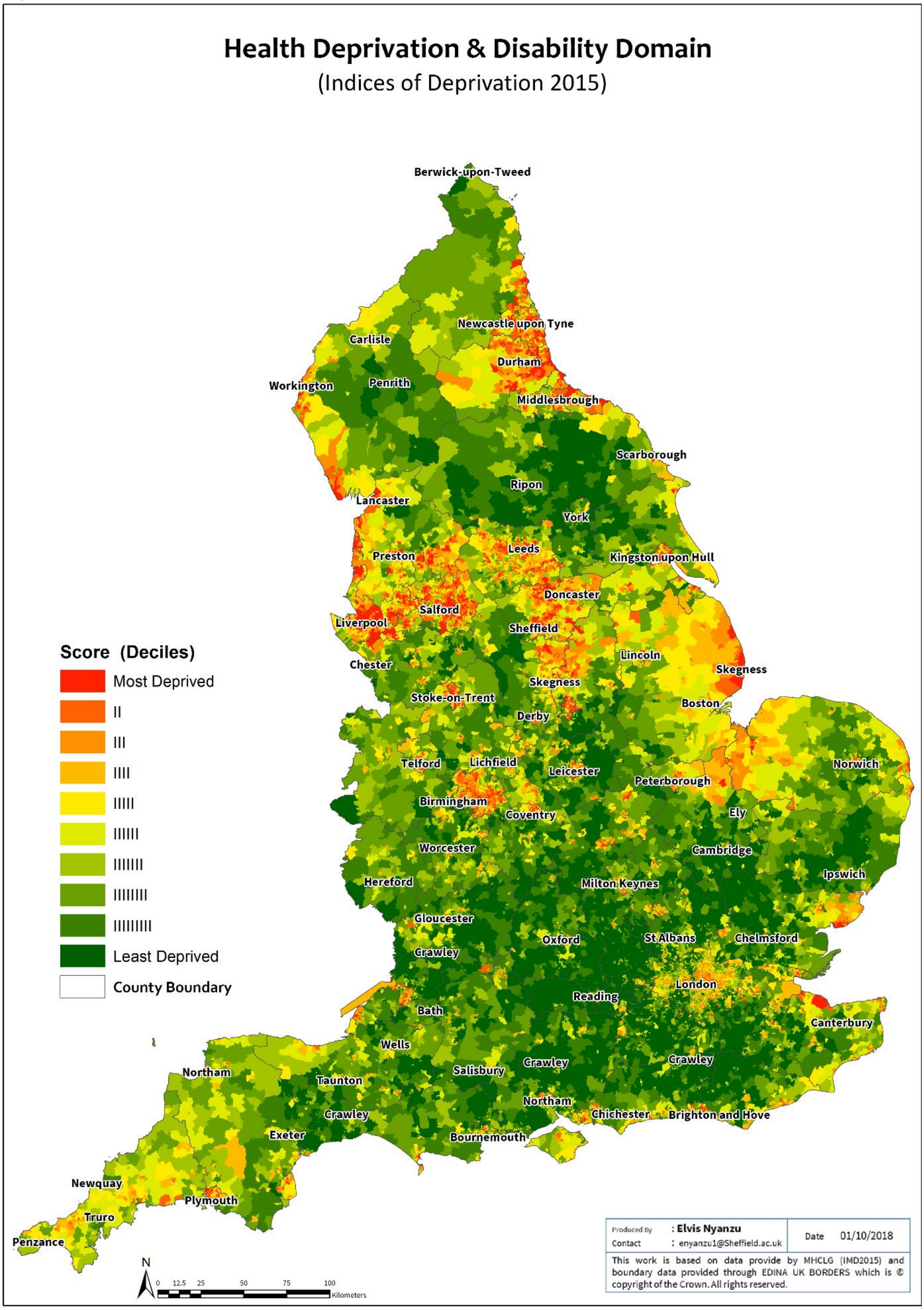
Manchester is the LAD with the highest proportion of its LSOA in the most deprived 10% and 20% LSOAs in the country with approximately 66% and 85% respectively (See appendices XVI and XVII). Knowsley, Liverpool, Blackpool and Middlesbrough completes the top 5 most highly ranked LSOAs in the most deprived decile with over half of their respective LSOAs falling within this category. The top 20 local authorities which are mostly located in the northern regions of England accounts for 37% of the total number LSOAs in the most deprived decile

All of the top 20 most deprived LADs in the 20% most deprived LSOAs have a minimum of 56% of their respective LSOAs in this category and accounts for about a quarter of the total number of deprived LSOAs in the HDD domain. Manchester, Blackpool, Liverpool, Knowsley and Burnley were ranked the top 5 most deprived LADs in this category.

The rural-urban split of deprived LSOAs in the Health Deprivation and Disability domain is similar to that of the other domains discussed earlier. Approximately 3% of LSOAs in the most deprived decile are rural with the remaining 97% being urban (see 3.20). In the most deprived 20% category, approximately 4% of the LSOAs are rural. Proportionally, only 2% and 4.5% of all rural LSOAs (5598) are in the most deprived 10% and 20% respectively.

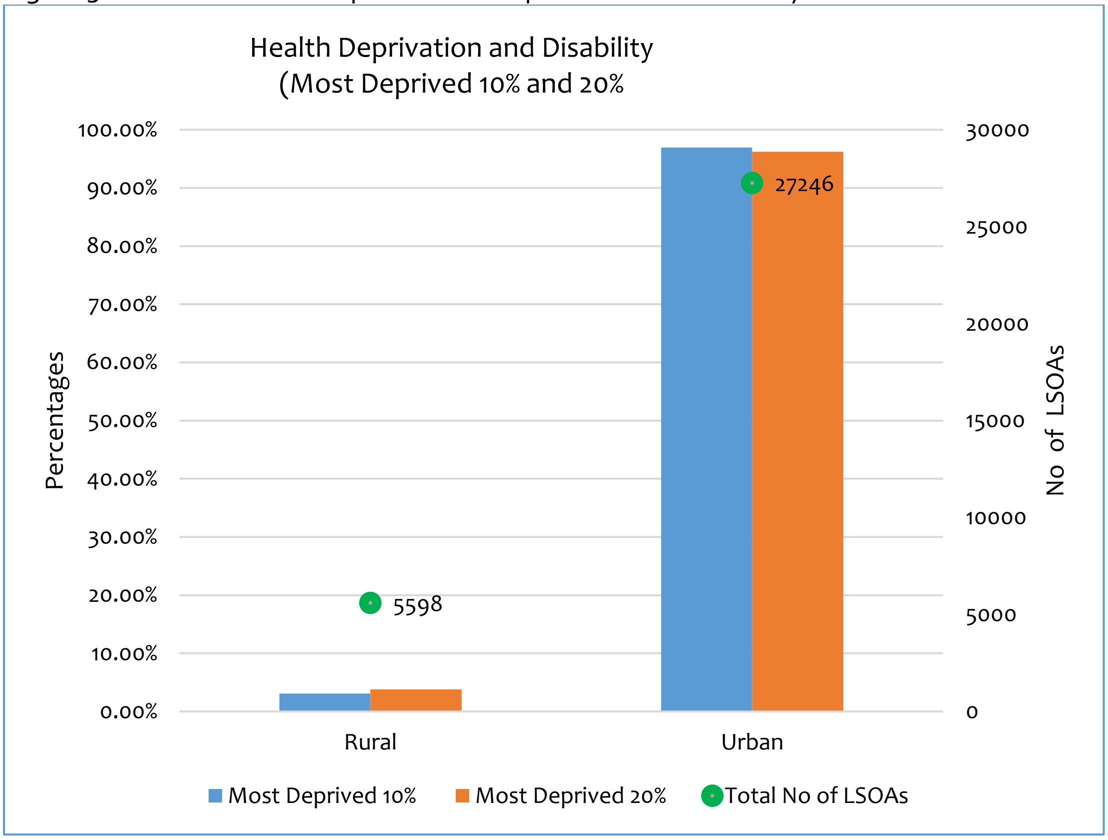
Deprived urban areas as a percentage of total urban LSOAs in the most deprived 10% and 20% groups are 12% and 24%. In as much as this is not population weighted and may not be an accurate representation of health deprivation and disability, if the average number of persons per LSOA is taken into account, the disparity is still high given that LSOAs fall within the same range of population sizes.

Figure 3. 20 - Health Deprivation and Disability Map (ID2015)



Source: Author

Figure 3. 21 - Rural – Urban Split: Health Deprivation and Disability



Source: MHCLG, ID2015

3.5 **Conclusion**

Differences in neighbourhood spatial structure, the multiple scales at which socioeconomic processes operates and the differences in spatial relations between neighbourhoods can influence experiences of neighbourhood deprivation and the socioeconomic outcomes of individuals through the spatial opportunity structure (Galster and Sharkey, 2017). Whereas there appears to be an appreciation for economic inter-scalar relations between local, regional, national and sometimes the global economic environment, the constantly evolving multi-directional and multi-dimensional nature of neighbourhoods' local spatial contexts and how it can impact urban policy formulation and implementation are not always recognised. Yet, these local conditions are very much relevant to the socioeconomic outcomes of people within the area (Jencks and Mayer, 1990).

Pathways through which neighbourhood effects can influence the socioeconomic outcomes of individuals can be summarized into four main categories as identified by Jencks and Mayer (1990). Contagion, collective socialisation, institutional processes and social competition. Contagion is concerned with potential influences through peers within the neighbourhood and other connected areas. Institutional processes concern the availability and resourcefulness of institutions such as schools, social and welfare services, policing and law enforcement as well as business within the neighbourhood. Collective socialisation refers to the networks and relationships among people, the availability of role models and the prevailing social cohesion. Social competition, within this context, is related to the need for people within deprived neighbourhoods to compete with others from affluent neighbourhoods for opportunities in higher education and employment among others.

The basis of assessing neighbourhood deprivation remain contentious. Whereas the nationally uniform platform provided by the IMD is lauded by various stakeholders, it has its limitations. The lack of or inadequate spatial contextualisation of deprivation scores, lack of clear causal pathways between indicators used and the problems on the ground, the over emphasis of economic elements, and the inappropriate generalisation of deprivation over political and statistical boundaries are some of the critiques which has been highlighted as the IMDs limitations. Although it can be difficult to reflect all aspects of the complex neighbourhood socioeconomic processes through quantification, a very weak conceptualisation of neighbourhoods can, in some cases, result in misleading findings (Lupton, 2003).

Urban policies aimed at addressing deprivation and the negative impacts of neighbourhood effects are usually formulated on the basis that deprivation is a by-product of neighbourhood inequalities. If neighbourhood inequalities are addressed, so will deprivation and the negative impacts of neighbourhood effects. After a plethora of spatial intervention programmes in various parts of the country to address inequality, neighbourhood inequalities and the potential dangers of deprivation are still prevalent with most commentators and analysts concluding that urban regeneration programmes are ineffective.

Regarding the spatial distribution of deprivation in England and the production of the Indices of Deprivation, several observation can be made from the above analysis. First, deprivation in England is highly clustered across most of the domains of the Indices of deprivation and the overall index. The majority of the most deprived neighbourhoods within all domains of the ID2015 are in urban areas. However, rural deprivation within the Barriers to Housing and Services domain and the Living Environment domain are relatively high compared to the other 5 domains. This is consistent with the assertion that the underlying indicators for measuring deprivation can influence or create an unintended bias towards urban or rural areas. It also supports the suggestion that the Barriers to Housing and Services and the Living Environment domains were specifically introduced to highlight rural deprivation (Fecht et al., 2017).

Secondly, urban deprivation is also clustered within major town and cities. Significant concentration of these neighbourhoods are in the three northern regions and the midlands. Places which have been significantly affected by deindustrialization such as Merseyside, West midlands, South Yorkshire, West Yorkshire and Tyne are not only home to some of the most deprived neighbourhoods but also have some of the large concentrations of deprived neighbourhood in England. Broader areas of concentrated deprivation are likely to require different solutions to deprived and isolated LSOAs within generally affluent wider areas (Rae, 2011). It will therefore be appropriate for these spatial structural difference to be accounted for in the measurement neighbourhood deprivation.

The third, relates to the use of LSOAs as the geographical unit of measurement. The relatively small sizes of some LSOAs coupled with the varying spatial scales of neighbourhood socioeconomic activities elevates the need to explicitly account for such differences in computing the IMD scores. In this regard, some isolated deprived rural LSOA in Cornwall can be identified differently from a deprived LSOA in the middle of an affluent area in Guildford and differently from a deprived LSOA in a generally deprived area in Manchester. These spatial contextual differences can significantly influence people’s experiences of deprivation and present different challenges for addressing the underlying neighbourhood problems.

The process of accounting for local spatial context is largely dependent on what the domain seeks to measure and the type of indicators being used. From the above analysis of ID2015 domains, it can be argued that neighbourhood spatial context is relevant in each of the domains. However, what is more accurate is that the case for neighbourhood spatial context is perhaps stronger for some domains than it is for others. For instance, the Barriers to Housing and Services domain, in part, examines geographic distances from place of residents to services points of schools, GP surgeries, supermarkets among others. Such services are usually sited based on catchment areas which may be larger than LSOAs. In this regard, assessing deprivation level of the BHS domain should be undertaken within the context of what is available within the wider area, not just the target LSOA. This makes neighbourhood spatial context critical to this domain.

The Health Deprivation and Disability domain on the other hand, measures mood and anxiety disorders, morbidity among others. Deprivation within this domain for a target neighbourhood has very little to do with the level of deprivation in connected neighbourhoods (at least not directly). The relevance of spatial context in this instance can be classed as low. Table 3.7 below summarises what can be perceived to be the relevance of spatial context for each of the 7 domains of the ID2015 based on what the domain seeks to measure and the type of indicators used in measuring the domain scores.

Table 3. 7 - Potential Impacts of Spatial context of Domains of ID2015

Domain	**Domain Weight**	**Potential Impact of Spatial Context**
Income	22.5%	High
Employment	22.5%	High
Education, Skills and Training	13.5%	Medium
Crime	9.3%	High
Barriers to Housing and Services	9.3%	High
Living Environment	9.3%	Medium
Health Deprivation and Disability	13.5%	Low

Source: Author

Notes: The potential Impacts of local spatial context have been chosen by considering the current domain indicators and what they seek to measure. Changes to the domain indicators can significantly alter the potential relevance of spatial context within the domain.

Having reviewed the existing literature relating to the measurement of neighbourhood socioeconomic characteristics and importance of local spatial context to this endeavour, it can be argued that the use of spatial interventions in addressing neighbourhood deprivation and spatial socioeconomic inequalities is a complex process. What is perhaps even more complex is the production of a deprivation index which captures the full extent of neighbourhood socioeconomic and environmental characteristics at the appropriate spatial scales.

There are several conceptual and operational challenges relating to the understanding of the manifestation of neighbourhood deprivation and the measurement of neighbourhood characteristics. A deeper understanding of these issues can provide a better comprehension of neighbourhood problems and aid the development of tools and techniques which can be used to improve the measurement of deprivation and capture neighbourhood problems effectively.

The spatial contextualisation of neighbourhood deprivation has the potential to achieve two things: Firstly, it will help identify areas where deprivation levels of neighbourhoods can be exacerbated because of the deprivation levels of the neighbourhoods within their immediate environs. Secondly, it will also allow for clusters of deprived areas to be identified at the appropriate spatial scales. Identifying clusters of deprivation from isolated deprivation areas will allow for intervention policies to be tailored to the type of deprivation. In the era of limited government resources and the implementation of austerity measures, taking into account neighbourhood spatial context will enable the most deprived and highly vulnerable areas to be targeted effectively with the appropriate intervention programmes

The conceptual framework within which this research is developed and provides a sound basis for fulfilling the task of providing a deeper understanding of neighbourhood deprivation and the spatial contextualisation of its measurement, as well as the methodological approach and the specific methods employed in this research to incorporate local spatial relations, structure and scale in the measurement of deprivation are provided in the next chapter.

4. CONCEPTUAL FRAMEWORK AND METHODOLOGY

In this chapter, I carve out the research problem, present the research questions and the methodology employed to examine the research questions. The chapter consist of three main parts. The first focuses on the conceptualisation of the research problem and the development of the research questions. In the second part, I present the methodological approach which guided this research in general and the specific methods employed to investigate the research questions to generate the relevant answers necessary to achieve the aim and objectives. Relevant issues relating to power and positionality, ethical considerations as well as the challenges and limitations of the study are discussed in the third and final part of this chapter.

4.1 PART 1 – Conceptual Framework and Research Questions

4.1.1 Research Problem

As discussed in previous chapters of this thesis, the geographical spaces within which individuals are embedded can influence their socioeconomic outcomes and their experiences of deprivation. The availability of institutional facilities and appropriate infrastructure, processes of social interaction, contagion, stigmatization and labour markets processes among others have been identified as potential pathways through which individual outcomes are influenced by their neighbourhoods (Galster and Sharkey, 2017; Van Ingen, 2016, Keaher et al., 2009, Rae, 2009). Consequently, urban policy makers and social commentators continue to place significant emphasis on neighbourhood socioeconomic and environmental characteristics; how to identify disadvantaged neighbourhoods and quantify the extent of neighbourhood problems (Fischbacher, 2014; Rae, 2011; Painter and Clarence, 2000; Morris and Carstairs, 1991).

In the UK, the need to address spatial socioeconomic inequality has been the bedrock of most urban policies for decades (Hincks, 2017; Green, 2011). The National Strategy Action plan for neighbourhood renewal put together by the Social Exclusion Unit had the objective "within ten to twenty years, no-one should be seriously disadvantaged by where they live" (SEU, 2001, p.8). The 2010 government white paper *"Local Growth: Realising Every Place's Potential",* noted that *"…*places have specific geographic, historic, environment and economic circumstances that help to determine the prospects for growth" (HM Government 2010, p.7) and echoed the need to address neighbourhood socioeconomic disadvantages. These policy objectives highlights the recognition within policy development that neighbourhood deprivation is about the interaction between people and places and that the socioeconomic outcomes of individuals and household are influenced by neighbourhood socioeconomic conditions.

Urban regeneration and other spatial interventions have remained an important 'weapon' in the armoury of local and central governments in the UK for the past 60 years when it comes to dealing with neighbourhood deprivation and social exclusion (Rae, 2009). However, most urban policy analysts, academics and social commentators suggest that urban regeneration programmes failed to achieve their expected outcomes (Jones and Evans, 2008; McCann, 2001; Imrie and Raco, 2003; Kearns and Parkinson, 2001). Whereas these apparent urban policy failures can be attributed to various issues, the means of assessing deprivation, the identification of deprived areas and the lack of clarity between policy objectives, neighbourhood problems and expected outcomes feature prominently (Buck, 2001; Rae 2009).

The government's implementation of austerity measures as a result of the Global Financial Crisis (GFC); the focus on the devolution of administrative powers including that of socioeconomic regeneration from central to regional and local governments; as well as the increased scepticisms about the effectiveness of urban regeneration programmes have resulted in the rapid decline of urban regeneration programmes amidst fears that urban regeneration in the UK as we have known is in its last days. Meanwhile, problems of neighbourhood inequalities, deprivation and their potential effects of exclusion persist.

The English Indices of Deprivation and its predecessors were developed to assess neighbourhood characteristics, highlight spatial socioeconomic inequality and help identify priority areas to be targeted with policy directions and the allocation of resources. Whilst it can be argued that the IMD has largely successful at identifying deprived areas (Rae. 2009), it has received several criticisms most of which have been discussed in Chapters 2 and 3 of this thesis. One such critique which is central to the agenda of this research is that in spite of the recognition of the importance geographical space in the socioeconomic outcomes of individuals and households, the Index of Multiple Deprivation (IMD) tend to underplay certain local spatial context which are critical to the understanding of neighbourhood socioeconomic variations and experiences of deprivation (Rae, 2009a; Harris and Johnston, 2003). This can result in understating, overstating or simply misunderstanding the relevant issues relating to neighbourhood deprivation and their spatial extents.

The 2011 Audit Commission report on Housing Market Renewal (HMR) posited that better understanding of the interactions between the issues of interest and its wider context is necessary to the effective delivery of intervention activities. As Ferrari (2007, p.133) noted, "Whilst many of the symptoms (of housing market failure) look the same, it is clear that some of the causes of the problem in the bigger, resurgent cities are different to those in the poorly-connected, economically-depressed sub regions". These allude to the fact that context, be it spatial or aspatial are very much important to the development, implementation and success of urban policy actions.

Within the context of assessing neighbourhood characteristics and identifying deprived areas, a similar argument is being put forward here. Neighbourhoods play a significant role in shaping the socioeconomic outcomes of the people within them. However, neighbourhoods do not usually exist in isolation and their spatial limits are not defined by administrative boundaries (Galster, 2001; Rae, 2009). Instead, neighbourhoods are made up of evolving layers of overlapping networks of different socioeconomic activities with varying spatial scales which serve as the spatial opportunity structure (Galster and Sharkey, 2017; Kearns and Parkinson,2001; Lutpon, 2003). These overlapping networks of neighbourhoods are important to the potential socioeconomic outcomes of individuals and households as well as their experiences of deprivation.

The measurement of neighbourhood deprivation, should therefore include an appropriate conceptualisation of neighbourhoods in order to explicitly account for variations in the spatial opportunity structure for different places. This will make it possible for neighbourhood problems to be identified within the relevant contexts and for the underlying problems to be addressed effectively. In the next section, I present the conceptual framework which guided the empirical analyses.

*4.1.2 **Conceptual Framework***

This research seeks to improve the understanding of what constitutes the "neighbourhood" and its spatial extent - what Galster and Sharkey (2017) refers to as the spatial opportunity structure, how it impacts individual socioeconomic outcomes; its effects on the measurement of neighbourhood socioeconomic characteristics and how it can be incorporated in the production of the English Indices of Deprivation.

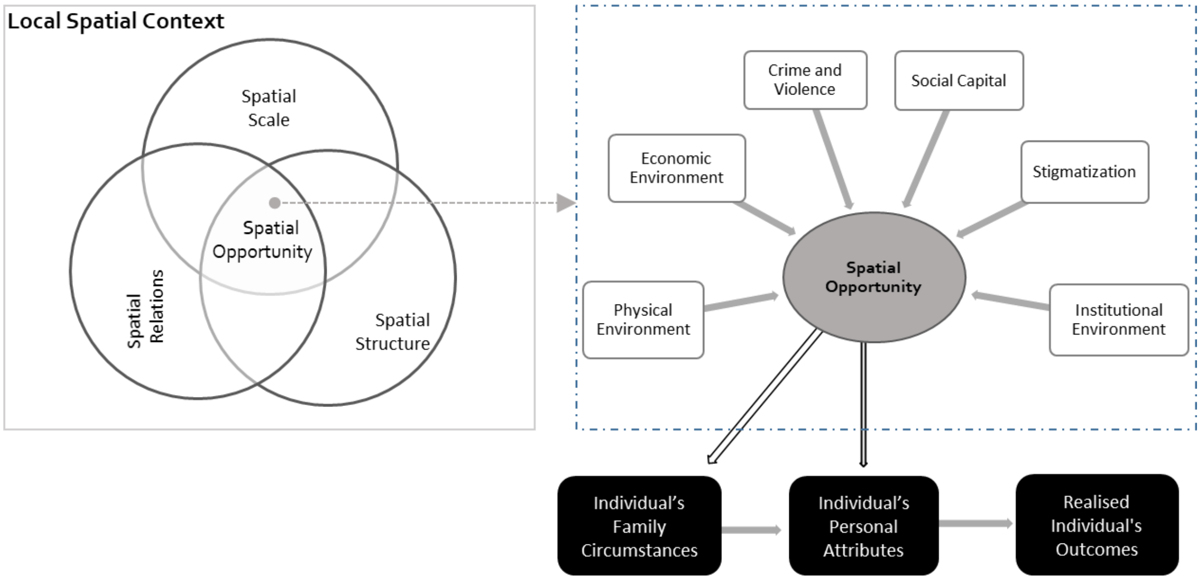
Key conceptual and applied issues identified in the literature are as follows:

- Impacts of the conceptualization of neighbourhoods on problem diagnoses.
- Spatial concentration of neighbourhood disadvantages and its impacts on peoples experience of deprivation.
- Differences in neighbourhood spatial relations to other neighbourhoods and how they impact the measurement of deprivation.
- Differences in neighbourhood structure and varying spatial scales of socioeconomic processes and their impacts on the spatial opportunity structure and the measurement of deprivation.

As discussed earlier in Chapters 2 and 3 of this thesis, some of the critiques of the English Indices of Deprivation relates to its spatial contextual inadequacies. Urban policy analysts and academics such as Rae (2009a), Oakley and Logan (2007) and Deas et al. (2003) have attempted to address some of the critiques or shortcomings of the Indices of Deprivation, yet there are inadequate studies which are concerned with making conceptual improvements to the IMD through the contextualisation of neighbourhoods' spatial opportunity structures and its operationalisation.

Galster's (2001) definition of the neighbourhood quoted in Chapter 3 of this thesis and adopted in this research defines the neighbourhood as the buildings, infrastructure, demographic characteristics, environmental characteristics, socioeconomic interactions, sentiments, public services and political characteristics which are associated with clusters of residences, sometimes in conjunction with other land use. In this regard, the spatial extent of neighbourhoods differ from place to place due to differences in spatial *structure*, the extent of *spatial relations* between people in different places and the *spatial scale* of the socioeconomic activity of interest (see chapter 3 for detailed description of spatial structure, scale and relations). It is the interaction between these 3 spatial attributes (scale, structure and relations) that determine the local spatial context of neighbourhoods and the spatial opportunity structure which influences individual socioeconomic outcomes and their experiences of deprivation. A visual representation of the local spatial context, and how it influences individual socioeconomic outcomes is shown in Figure 4.1.

Figure 4. 1 - Conceptual Framework



Source: Author

From the above illustration, the interaction of spatial scale, spatial structure and spatial relations shown on the left determine the spatial opportunity structure of neighbourhoods. Within this spatial opportunity, the interaction between negative and positive social, economic, institutional, political and environmental processes such as social capital, crime and violence, environmental hazards, labour market processes and pollution among others provide the enabling environment which serves as the framework within which individual personal attributes are shaped directly and indirectly through the socioeconomic circumstances of their households and caregivers. These are in turn translated into socioeconomic outcomes through the decisions and choices of individuals.

In as much as the importance of neighbourhood effects on individual outcomes and the mechanisms through which this is achieved remains an important part of this thesis, the main focus of this research is the conceptualisation of neighbourhood spatial context and its operationalisation in the measurement of deprivation. Put it simply, the spatial context or spatial opportunity for the socioeconomic development or well-being of people in any chosen neighbourhood consist of opportunities available within the neighbourhood itself, surrounding neighbourhoods and distant but well-connected neighbourhoods.

These opportunities can, however, be limited or exacerbated by the nature of the spatial structure of the neighbourhood in relation to other neighbourhoods and the perceived spatial scale of the socioeconomic activity of interest. For instance, whilst it may be acceptable to commute for distances up to 50km each way for work (Sandow and Westin, 2010), the same cannot be said for children going to school. The spatial scale for children educational opportunities is therefore smaller than adult employment opportunities.

Consideration must also be given to the combination of within neighbourhood deprivation scores and the scores of nearby and distant but well-connected neighbourhoods. In this regard the conceptualisation that reduces the potential effects of extremely higher or lower external deprivation scores (outliers) on the within neighbourhood deprivation scores is preferable.

The measurement of neighbourhood deprivation scores for specific neighbourhood i with respect to a specified socioeconomic activity of interest can be represented as:

$$A_i = (d_i)(B_i) \qquad \text{(Eq. 1)}$$

Where:

A_i is the adjusted neighbourhood deprivation score for neighbourhood i which accounts for the deprivation of other neighbourhoods within the spatial opportunity structure of neighbourhood i;

d_i is the within boundary deprivation score of neighbourhood i as computed by the creators of the English Indices of Deprivation 2015 and published by the Ministry of Housing Communities and Local Government; and

B_i is the weighted average deprivation score of all neighbourhoods within the spatial opportunity structure of neighbourhood i.

The approaches to the measurement of d_i and B_i depends on the socioeconomic activity of interest and the perceived spatial opportunity structure in relation to the specific socioeconomic process. The various approaches adopted by the creators of the English Indices of Deprivation[15] were deemed to be effective for the measurement of within boundary deprivation (d_i) as such I have not advanced any further methods in this regard. This research focuses on the relevance of deprivation within the spatial opportunity structure of neighbourhood i (places outside the administrative boundaries of neighbourhood i) to experiences of deprivation and affluence within the boundaries of neighbourhood i. It therefore focuses on the calculation of the B_i element of equation (1) and how it can be

[15] See Smith et al (2015) – The English Indices of Deprivation 2015, Technical Report.

combined with(d_i). This has been examined in detailed in Part Two of this chapter and its operationalisation has been illustrated in Chapters 5 and 6 of this thesis.

The above conceptualisation of the measurement of neighbourhood deprivation, allows for:

(1) The effect of technological advancements and effective transportation networks on spatial socioeconomic relations between geographically distant but well-connected neighbourhoods to be recognised in the measurement of neighbourhood deprivation.

(2) The potential impacts of the spatial concentration of disadvantages within the wider urban area in exacerbating neighbourhood problems to be accounted for in the measurement process.

(3) The various aspects of neighbourhood spatial context to be unpacked into identifiable components (scale, relations and structure). This makes it relatively easy to assess the potential impacts of these components on experiences of deprivation with techniques and methods described later in this chapter.

(4) Some of the conceptual and applied issues previously identified to be addressed.

There are however, several aspects of this conceptualisation of the measurement of neighbourhood deprivation which require further investigation in order to arrive at a more comprehensive spatially contextualised measure of neighbourhood deprivation. Even though these issues relating to the operationalisation of the above conceptualisation has been discussed throughout the thesis particularly in the limitations sections in this chapter and the final chapter, it is worth highlighting them here.

The first is related to the weighting of the appropriate components of neighbourhood deprivation. In the above formula, no spatial weight has been assigned to within neighbourhood deprivation, deprivation of nearby neighbourhood and deprivation of distant but well connected neighbourhoods. As it stands (as per the formula), there is a presumption of equal weights. Practically and as will be shown in subsequent sections of this thesis, various combination of weights will need to be adopted in order generate the appropriate measure of deprivation. These weights will, to a large extent depend on variables such as the socioeconomic activity of interest, the demographics of the target neighbourhood and the type of indicators use in the measurement among others.

The second is related to how to establish connectedness between neighbourhoods that considered to be within the same spatial opportunity structure. Whilst commuting to a place of work or areas within the same work place zones may be considered to be connected if what is of interest is employment, housing market areas may be more appropriate for assessing housing needs and another variable may be required to for assessing access to health and other outcomes. Put it simply, the choice of variables for establishing connectedness also vary with other factors such as the outcome of interest and the indicators being used.

4.1.3 **Research Questions**

Following the identification of the research problem and the formulation of the conceptual framework, the empirical questions which forms the basis of the research project have been formulated and outlined below:

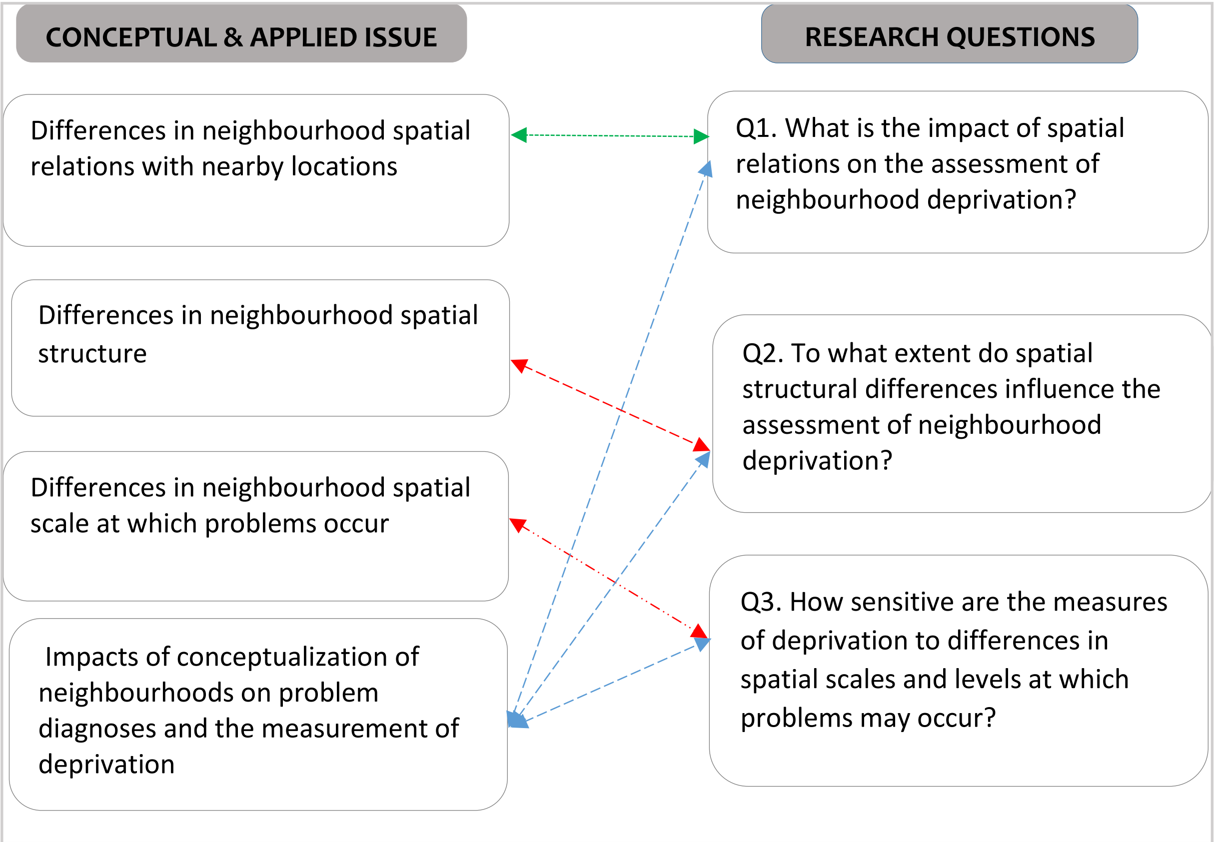
Q1. What is the impact of spatial relations on the assessment of neighbourhood deprivation?

Q2. To what extent do spatial structural differences influence the measurement of neighbourhood deprivation?

Q3. How sensitive are the measures of deprivation to differences in spatial scales and levels at which problems may occur?

Investigating the above outlined questions will lead to answers which will provide the necessary information needed to fill the identified gaps in the literature and the realisation of the research aim and objectives outlined in Chapter 1 of this thesis. The relationships between the questions and the themes previously identified are illustrated in Figure 4.2 below. Each research question is designed to examine at least one of the identified conceptual and applied issues relevant to the spatial contextualisation of deprivation identified.

Figure 4. 2 - Conceptual and Applied Issues



Source: Author

The complex multifaceted nature of neighbourhood problems require a sophisticated approach to accurately assess the relative levels of neighbourhood deprivation and quantify (Fischbacher. 2014). However, even at the highest level of sophistication, certain aspects of neighbourhood deprivation such as sentiments and other psychological and social outcomes do not lend themselves to quantification metrics such as the English Indices of Multiple Deprivation (Rae, 2009). Notwithstanding these complexities, attempts have to be made to ensure that the best achievable measures of deprivation are obtained and used in the ranking and classification of neighbourhoods.

The General methodological approach and the specific methods used in investigating the research questions outlined above are discussed in the next section.

4.2 PART 2 – Methodological Approach and Research Methods

Writers of research methodology have very often distinguished between the quantitative and qualitative methodological approaches and regarded them as the two main strands of research methodology (Bryman, 2012). The fundamental differences mostly alluded to included differences in epistemological position[16]; ontological orientation[17]; and the role of theory in the research process[18] (Bryman 2012; Mason, 2002). Epistemologically, quantitative approaches tend be aligned to positivism whilst qualitative methods mostly use interpretivism (Bryman, 2012). Ontologically, whilst quantitative approaches use objectivism, qualitative approaches use constructionism (Bryman, 2012). In terms of theory, qualitative approaches seek to generate theory (inductive) whilst quantitative approaches tests theories (deductive) (Mason, 2002).

These two main methodological approaches to research have their perceived strengths and weakness which have been subjected to academic debate for

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[16] Quantitative methods tend to be aligned to positivism. Qualitative methods mostly use interpretivism (Bryman, 2012)
[17] Whilst quantitative approaches use objectivism, qualitative approaches use constructionism (Bryman,2012)
[18] Whilst qualitative approaches seek to generate theory (inductive), quantitative approaches test theories (deductive).

decades with a number of authors championing the use of mixed methods as means of offsetting the weaknesses of one method with the strengths of the other (Sandelowski, 2013). Writers such as Tashakkori and Teddie (2010) and Layder, (1993) contend that, even the purist forms of quantitative and qualitative approaches contain shades of the other approach. The mixed method approach can also be seen as an epistemological dilemma of the two main strands of research methods (deductive and inductive) yet not achieving the thoroughness of either (Johnson or Onwuegbuzie, 2004).

Whereas qualitative methods can be very useful in exploring micro-sociological questions (Hastings, 2000), capturing diverse perspectives in depth and allowing for the researchers reflections on actions and other observations made in the field to be incorporated into the research in a useful way (Flick, 2009), quantitative approaches such as those employed by the creators of the English Indices of Deprivation are used because numbers and quantification are important, especially when these measures are used to target and justify direct policy actions (Miller, 2001).

Quantification is also necessary to demonstrate how alternative conceptualisations of subjects of interest, like deprivation, might manifest themselves in different numerical indices, as this could potentially suggest different policy actions (Rae, 2009a). Calculative practices are also important mechanisms by which governments govern, and the specific methods of measurement and calculation potentially matter a great deal (Miller, 2001).

As described by Sandelowski (2013), in as much as it is necessary to understand the strengths and weakness of each methodological approach in deciding on which approach to use, it is even more important that the choice of one or combination of methods are based on the extent to which the method can help meet the objectives of specific elements of the study.

In the context of this research and as discussed in earlier parts of this thesis, there are significant conceptual differences in how deprivation might be measured if one were to articulate spatial relations more explicitly within the measurement process. This research concerns using small area data on social and economic characteristics of neighbourhoods to highlight and test the implications of designing a set of alternative ways of measuring deprivation. Spatial analysis provides a convenient analytic environment within which the impacts of the deferring spatial attributes of places can be analysed and illustrated appropriately. Most importantly, by undertaking spatial analysis, the relative effect of conceptual differences arising from different calculative practices on the IMD scores and rankings can be illustrated. The geographical scope of the study and the detailed description of the various datasets used in the empirical work are discussed below.

4.2.1 ***Geographical Scope***

This thesis primarily concerns a critical analysis of the spatial element of the measures of deprivation in the United Kingdom and the process used in constructing the Indices of Deprivation. However, England as an administrative area is the focus of the study and The English Indices of Deprivation D2015 is the main point of reference.

Following the devolution of area based regeneration and its associated processes in 1997 to individual countries of the UK, there has been considerable divergence in the detailed policy and the delivery mechanisms; although there are significant similarities (Adamson, 2010). The continued pursuance of devolution by successive governments in recent years has entrenched some of these policy divergences between the home nations of the United Kingdom and this trend is likely to continue. By focusing on England, it will allow for consistency in the variables used as part of the study and all datasets will be available for each area in the same format and spatial unit.

In spite of the use of England as the geographical scope of consideration, it is expected that results obtained from this study will be applicable to the rest of the UK and generalisation can therefore be made which will not only be appropriate for England but also for the entire United Kingdom and beyond.

4.2.2 Spatial Unit of Analysis

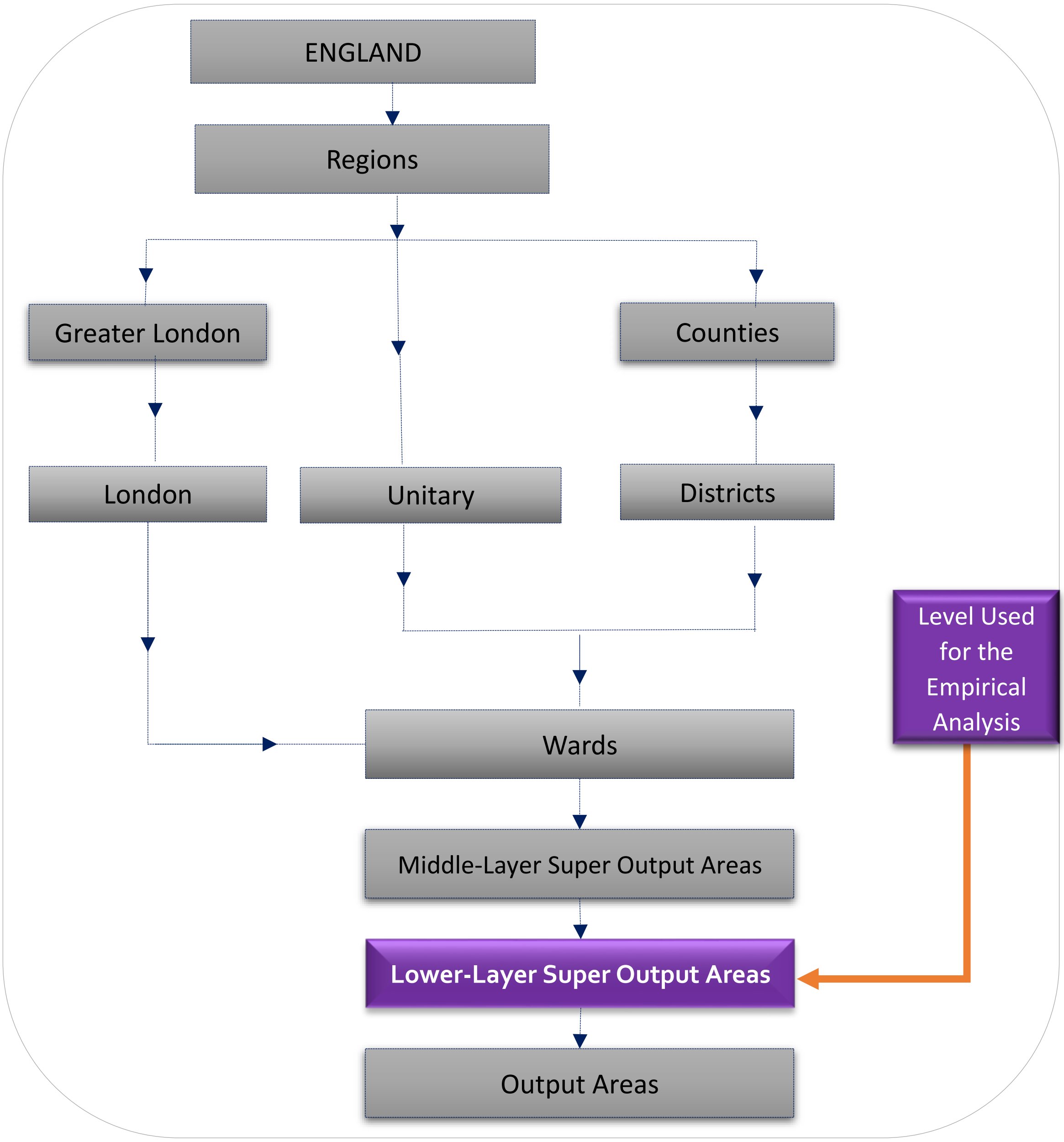
This thesis uses Lower Layer Super Output Areas (LSOA) as the spatial unit of analysis. As described by Rae (2009), to undertake an effective spatial analysis with significant explanatory powers, the unit of analysis need to have geographical logic. It also needs to be of an appropriate size to avoid the negative impacts of data aggregation (Clark and Avery, 1976) and reduce the effect of the modifiable area unit problem (Fotheringham and Wong, 1991). Although the LSOA is not the smallest geographic area in England, its size is at the level which allows for meaningful inferences and also reduces the effects of aggregation (see Figure 4.3).

There are 32844 LSOAs in England; they are built around population and household sizes and designed to improve the reporting of small area statistics. Each LSOA has an average population of 1600 people and about 650 households[19]. Other relevant factors taken into account in creating LSOAs are social homogeneity and mutual proximity (ONS, 2012). Spatially, LSOAs in densely populated areas are small in size (Area) whilst LSOA in sparsely populated areas are relatively large.

As discussed in Chapters 2 and 3, for neighbourhood effect analysis and general description of the everyday neighbourhood, LSOAs are imperfect. Most neighbourhoods especially within densely populated areas do extend beyond LSOA boundaries. In fact, in most urban areas, a number of LSOAs need to be combined to form what can effectively be described as neighbourhoods (this is illustrated in Figure 6.1).

[19] Each LSOA is designed be to have a minimum population of 1000 people and a maximum of 3000. The minimum number of household is 400 and maximum of 1200 (ONS, 2012).

Figure 4. 3 - LSOAs within the spatial structure of England



Source: Author

It has been posited that the spatial extents of neighbourhoods are dynamic; this is because socioeconomic processes constantly results in changes to the urban structure and neighbourhood boundaries (Norman, 2010; Hincks, 2017). New economic geography, discussed in Chapter 2 of this thesis, also reinforces the dynamic nature of urban structure through the interaction of centrifugal and centripetal forces (Krugman et al, 2001).

In spite of the above problems, the creation of LSOA took into account population sizes, social homogeneity and mutual proximity - these are important attributes of neighbourhoods as per the definitions of Galster (2001) and Glennerster et al. (1999). In practice, the Indices of Deprivation uses LSOAs as a proxy for neighbourhoods and since the objectives of the empirical study is to propose different conceptualisations of the measurement of deprivation, it is appropriate to adopt a similar spatial unit of analysis to allow for comparison of the results to the original Indices of Deprivation.

4.2.3 Description of Data

This thesis made use of secondary data for the empirical analyses and were mainly drawn from the Office of National Statistics (ONS), Edina UK Borders, Ordinance Survey, the Ministry of Housing, Communities and Local Government (MHCLG), the Highways Agency and the Department of Transport. The data selection process followed a structured approach and considered three main issues:

- The availability of the data and its relevance to the research objectives;
- The credibility of the data source; and
- The robustness of the data.

By employing a structured approach in deciding on the data to be included in the study, any data rejected or not included in the study will not be arbitrary but justifiable (Rae, 2011).

The three main empirical analyses required are: (i) the impact of spatial relations on the measurement of deprivation, (ii) the impact of local spatial structure on deprivation and (iii) the sensitivity of the measures of deprivation to different spatial scales. The selection of relevant data was therefore informed by these requirements.

Central to all three empirical questions is the English Indices of Deprivation (ID). As such, the data from the 2015 English Indices of Deprivation (ID2015) obtained from MHCLG was the main data set employed in the study. In other to use the ID2015 dataset in spatial analytical packages, relevant geo-spatial datasets of administrative areas of England and census areas were obtained from Edina UK Borders and the Office of National Statistics (ONS) 2011 census. Other supplementary data to aid the analysis such as OS open roads, travel to work data, Highways England journey times among others were also utilized in the study. A full list of the various datasets used in undertaking the empirical analyses, their respective sources and relevance are presented in Table 4.1 below.

Table 4. 1 - Datasets employed in the study

Data	Source	Relevance to Study
ID2015 • Overall Index • Domain Scores • Sub-Domains • Indicators	MHCLG	 Spatial Structure Spatial Relations Spatial Scale
Geo-spatial data: • Lower Layer Super Output Areas (LSOA) • County Boundaries • Districts and Unitary authority areas • Travel to work areas • Regional Boundaries • LSOA population weighted centroids • Local Enterprise Partnership Boundaries • Regional Development Agencies Boundaries	Edina, UK Borders	Spatial Structure Spatial Relations Spatial Scale
Usual place of residence and usual place of work	ONS Census, 2011	Spatial Relations
OS open roads	Ordinance Survey	Spatial Relations
Flow-weighted average weekday morning speed peaks by regions (CGN0902a)	Department of Transport	Spatial Relations
Highways England journey times	Highways England	Spatial Relations

Source: Author

4.2.4 *Spatial Analysis*

Wade and Sommer (2006) defined spatial analysis as the process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge. Spatial analysis has also been defined as a process through which raw data can be turned into useful information (Heywood et al., 2006).

There are two main types of spatial modelling – spatial form and spatial processes. Whilst spatial form deals with the modelling of geographical features, spatial processes deals with modelling interactions between features or places. The later – modelling of spatial processes is what is of interest in this thesis. Pragmatically, analytical process models are useful in presenting complex real-world phenomena in ways that can aid the understanding of the issues and guide the decision-making processes (Heywood et al., 2006). Another aspect of geo-spatial analysis which is relevant to this study is visualisation. Visualisation is the creation of maps, images, charts and diagrams using the associated tabular datasets (Longley et al., 2005).

As described by McInroy (2015), "places have relationships" and these relationships, however complex they might be, are essential to socioeconomic and political process taking place at any point in time. It is therefore essential that such relationships are incorporated in decision making processes. Through spatial analysis, the complex interrelations between people, places and processes at particular points in time can be examined (Stillwell and Clarke, 2004) and the potential impact of local spatial context on the IMD can be undertaken using various scenarios. It also makes it possible to compare socioeconomic, demographic and environmental structures of different places at specified periods within their spatial context (Stillwell and Clarke, 2004).

There are various spatial analytical techniques which can be used to model and analyse the impact of local spatial context on the measurement of neighbourhood deprivation. As suggest by (Haywood et al., 2006), the choice of a technique or model requires the understanding of a range of techniques available, those that are applicable to the phenomena under study, and their relative strengths and weaknesses. Longley et al. (2006) echoed this by asserting that the most important consideration in selecting an analytical tool is that it has to be fit for the purpose. To this end, the empirical questions to be investigated informed the choice of spatial analytical techniques to be utilized and are presented in the next section.

4.2.5 ***Operationalisation of Spatial Analysis***

This section focuses on the measurement of deprivation within the spatial opportunity structure $(B_i\ )$ in equation $A_i = (d_i\ )(B_i)$ provided earlier in this chapter as part of the conceptual framework. The selection of spatial analytical techniques used in this study is dependent on the research questions. The study has three (3) main empirical questions which have been outlined in Part 1 of this chapter. Spatial autocorrelation is the main analytical technique used to examine the empirical questions. The specific tools used are Global Moran's I (Moran, 1950) and Anselin's (1995) Local Indicators of Spatial Auto-Correlation (LISA). The operationalisation of these analytical techniques and why they have been adopted in this research presented below.

4.2.5.1 **Spatial Autocorrelation (Global Moran's I)**

In most statistical analysis tests such as t-test and chi-square are used to answer question about relationships between variables assuming the data is satisfies certain assumptions including independent observations, normal distribution and equal variances (Ping et al, 2004). In geography and spatial analysis, the notion of independent observations is rejected because spatial data are related by their distances and spatial arrangements and characterised by spatial dependence and spatial heterogeneity (Anselin, 1988). As described by Tobler (1979), observations in close proximity to each other spatially are likely to have similar properties – this has been substantially discussed within earlier sections of this thesis. Techniques employed in analysing spatial data must not only be capable producing relevant statistics such as such as the weighted averages of observations but must also be capable of examining the extent of spatial significance in these variable. Spatial autocorrelation techniques have the capacity to produce the relevant statistics of interest and test for the significance spatial relations between observations.

Spatial autocorrelation can be defined as the property of expected random variables taking on values at different pairs of locations that are different from what is expected of a random association (Legendre, 1993). It simply describes the degree of association between two or more locations (De Smith et al., 2007). Spatial association is central to the development of economic theories like new economic geography through processes of externalities and spillovers (Krugman et al, 2001) as well as theories of agglomeration (Marasteanu and Jaenicke , 2013). Spatial autocorrelation techniques are the means through which the extent and nature of association can be quantified.

Analytical techniques used in assessing spatial association include Geary's C (Geary, 1954), Getis-Ord's G (1996), Global Moran's I (Moran, 1950), Joint Count Statistics (Longley et al., 2007) and Local Indicators of spatial association (LISA) (Anselin, 1995). All of these techniques are effective in identifying spatial patterns (Rae, 2009a). However, after extensive review of literature and testing, Moran's I was adopted as the most appropriate for the analysis because of its effectiveness in handling computations across a range of dataset and weightings (Longley et al., 2007). In an extensive review of spatial statistical techniques, Bivands (1998) indicates a preference for Moran's I over other techniques. Rae (2009a), Mitchell (2005) and Melecky (2015) also posited a preference for Moran's I in spatial analysis to other analytical techniques.

The measurement of spatial autocorrelation through the global Moran's I technique involves the calculation of the Moran's I statistic or index value as well as a z-score and a p-value to test the significance of the Moran's I statistic based on the pairs of feature values and location attributes (the target feature and at least one other feature). It is simply the correlation between the value of target feature x and the average of all the values of neighbouring[20] features (the spatial lag). Mathematically, the formulae for global Moran's I is given as:

$$I = \frac{N \sum_i \sum_j W_{i,j}(X_i - \bar{X})(X_j - \bar{X})}{(\sum_i \sum_j W_{ij}) \sum_i (X_i - \bar{X})^2}$$

Where:

N is the number of cases;

X_i is the variable value at location i;

X_j is the variable value at location j;

$\bar{X}$ is the mean of the variables and;

W_{ij} is the weight applied to the comparison between location i and location j.

[20]Features or polygons to be used as neighbours are pre-determined through the spatial weight matrix.

The null hypothesis of no spatial autocorrelation is given as:

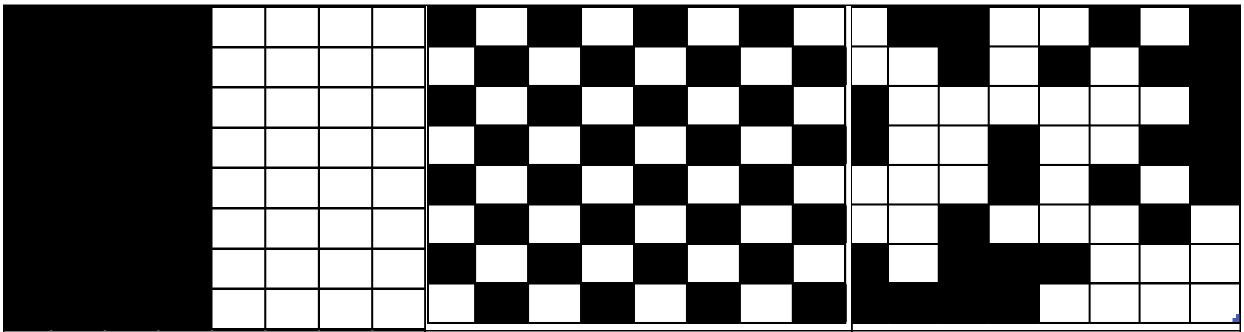
$$E(I) = \frac{-1}{N-1}$$

Moran's I index values usually fall between -1 and +1 and the null hypothesis cannot be rejected if the p-value is not statistically significant. If the p-value is statistically significant, a positive index value indicates the presence of spatial clustering beyond what would normally be regarded as random. If the Moran's I index value is negative and the p-value is statistically significant, it suggests a dispersed spatial pattern than what would normally be deemed to be a random process. Both scenarios suggest that a value observed at location X is dependent of values observed at other locations (which are included in the spatial weights) and that the null hypothesis of randomness may be rejected.

For this research, spatial autocorrelation analysis was undertaken using the Global Moran's I tool within Anselin's GeoDA software. As indicated above, GeoDA Moran's I statistics are between +1 (perfect clustering) and -1 (perfect dispersion). Positive Moran's I values greater than zero but less than 1 indicates the presence of positive spatial autocorrelation and negative values which are less than -1 indicates negative spatial autocorrelation[21]. Moran's I statistic of zero indicates no identifiable spatial patterns can be discerned from the study area and therefore suggest randomness (De Smith et al., 2007). See Figure 4.4 for an illustration of perfectly positive spatial autocorrelation, perfectly negative spatial autocorrelation and no autocorrelation.

Figure 4. 4 - Illustration of Moran's I Spatial Correlation Outcomes

[21] Although negative spatial auto correlation is possible, it is very rare (Levine, 1999).



Perfect Correlation ($I = +1$)	Perfect Dispersion ($I = -1$)	No Spatial Autocorrelation($I = 0$)

Source: Author

Whereas the Moran's I statistic, a single value which examines whether observations within the population or area in question (in the case of this research England) are clustered or not is relevant to the understanding of spatial relation between places, what is of utmost importance in the production of an adjusted neighbourhood deprivation score which takes into account deprivation within the spatial opportunity structure is the spatial lagged values for each observation calculated as part of the computation of the Moran's I statistic.

The spatial lagged values can be computed as weighted sum or weighted average of the neighbouring values for the relevant observation (LSOA) as specified in the weights matrix provided (Anselin et al, 2006). For observation i the spatial lag of d_i (weighted sum) can be given as:

$$B_i = \sum_{j=1}^{n} w_{ij} d_j$$

Where:

B_i is the spatial lag (weighted sum) of deprivation scores for other areas within the spatial opportunity structure of neighbourhood i

W_{ij} is the weight applied to the comparison between location i and location j; and

d_j is the deprivation score of location j

Typically, observations (LSOAs) do not have the same number of neighbours within the spatial weight matrix, it is therefore a good practice to use the row-standardized spatial weights to avoid scale differences (Anselin, 1995). For row standardized weights, with $\sum_j w_{ij} = 1$, the spatial lagged variables become a weighted average of the values at the neighbouring observations. (Anselin, et al., 2006).

The spatial lagged values within the Moran's I spatial autocorrelation was used in answering research question 1 and 3 relating to impacts of spatial relation and spatial scale (respectively) on the measurement of neighbourhood deprivation.

4.2.5.2 **Local Indicators of Spatial Association (LISA)**

Whereas global Moran's I (discussed above) gives an overview of the extent of spatial clustering or dispersion of values over the study area, Local Indicators of Spatial Association (LISA) also knowns as the Local Moran's I examines the target feature value within the context of its surrounding feature(s) value(s).

The LISA statistic or index value gives an indication of the extent to which the value of the target feature is similar to the values of its surrounding neighbours and determines its significance. Simply put, LISA determines the extent of clustering within various parts of the study area. The sum of all observed LISA statistics should be proportional to the global Moran's I indicator (Anselin, 1995).

As described by Rae (2009), in a situation where the global statistics suggest a strong positive spatial correlation, LISA helps in understanding how various parts of the study area (or country as in the case of this research) contributes to this global statistic.

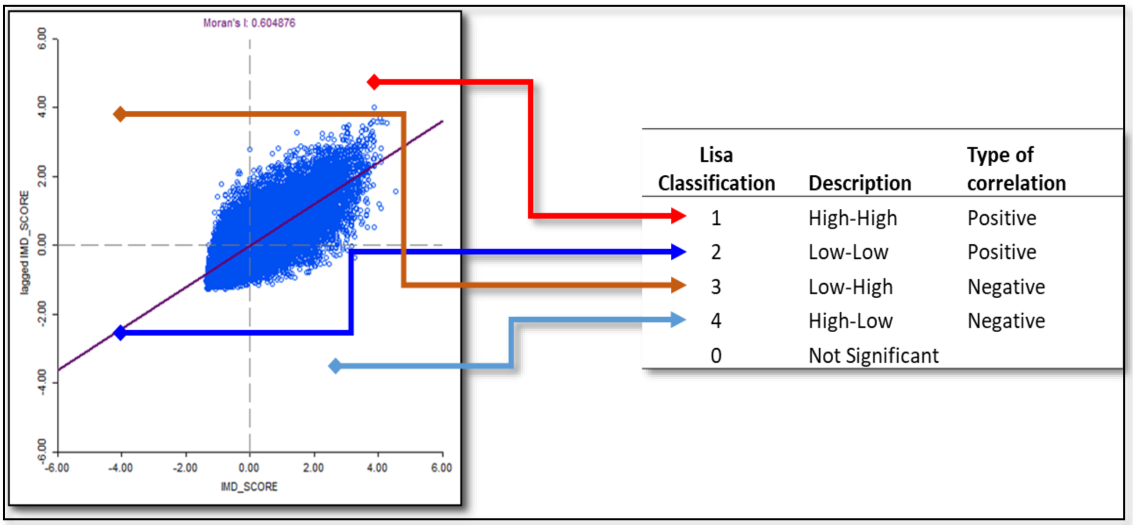
The formula for calculating the LISA index is given as:

$$I_i = \frac{(x_i - \overline{x})}{s^2} . \sum_i w_{ij} (x_j - \overline{x})$$

Where: x_i is the target feature value; x_j is the neighbour feature value; $s^2$is the variance; $\overline{x}$ is the mean value; and $w_{ij}$is the weight of the target feature and neighbour pair. The null hypothesis is that there is no local spatial autocorrelation.

The Local Moran's I *tool* within GeoDA was used to examine the impact of local spatial structure in the measurement of deprivation (research question 2). The Local Moran's I tool calculates the LISA statistics for each LSOA and also the p-value to test for the significance of the statistics. In addition, for each significant statistic, the tool classifies the LSOAs into one of four cluster types. The Four LISA significant clusters are high-high, Low-Low, low-high, and high-low. These clusters represent each of the four quadrants of the Moran's scatter plot as summarised in Figure 4.5. The local Moran's I tool within GeoDA allocates a classification of 1 to 4 to significant clusters and 0 is assigned to features with values deemed to be statistically insignificant in terms of spatial association. These are also shown in Figure 4.3 with the type of classification.

Figure 4. 5 - Moran's Scatter Plot and LISA Classifications



Source: Author

A LISA classification of 'high-high' is assigned to features (in this study, LSOAs) with high attribute values surrounded by LSOAs with similarly high attribute values. 'Low-low' is assigned to LSOAs with low attribute values within a cluster of LSOAs with low attribute values. LSOAs with lower values but among LSOAs with higher values are classified 'low-high'. The reverse, where an LSOA with higher attribute value within a cluster of LSOAs with lower attribute values is classed 'high-low'.

Through these LISA statistics and classification, LSOA within areas of spatially entrenched deprivation can be identified from other deprived LSOAs and these contextual differences can be taken into account when assessing deprivation levels.

4.2.5.3 **Modelling Spatial Relationships**

Central to the Global Moran's I and LISA techniques is the specification of appropriate spatial weights. Spatial weight is an expression of the relationship between the target feature and the other features which are considered when computing the index values or statistics for global Moran's I or LISA. In spatial analysis, the specification of spatial weight is perhaps the most important consideration and needs to be given significant thought prior to the analysis (Mitchell, 2005; Rae, 2009; Bivand, 1998). This is because the results of spatial association significantly depend on the specified spatial weights.

The three main approaches used in specifying spatial weights are K-nearest neighbour approach; adjacency criteria (also known as contiguity based approach) using rook contiguity, queen contiguity or bishop; and the distance approaches (Rae, 2009, De Smith 2007). Each of these approaches offer different advantages and have their limitations. Within these broad approaches, there are several techniques which can be used to model the nature of relationship. For instance, spatial weights can be specified using the inverse distance, fixed distance bands, zone of indifference (Mitchell, 2005) all of which are within the distance approach. The research question under investigation should be the catalyst for the choice of approach and specific technique to modelling the spatial relationship – spatial weight. The choice of techniques employed to specify the appropriate spatial weights used in this research are discussed below:

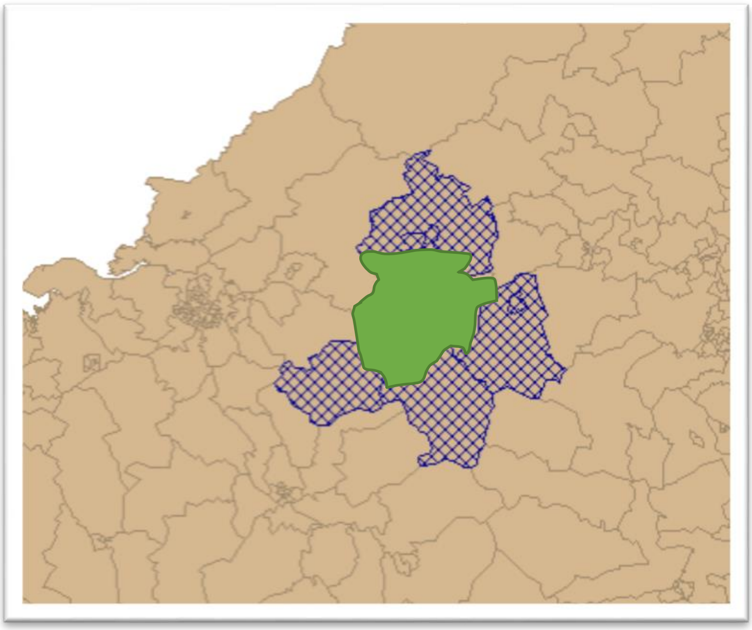
4.2.5.4 **Determining Area of Influence - Spatial Relations**

In other to examine the appropriateness of the approaches for specifying spatial weights suitable for analysing the impact of differing spatial relations on the measurement of deprivation, various approaches were tried using the dataset and are discussed below.

K- Nearest Neighbour Approach

This approach determines spatial association by considering how close a location is to the area of interest. The number of nearest (K) neighbours is pre-determined and their scores are combined in equal proportions to establish the projected score of the area of interest. After testing, this approach was considered inappropriate for establishing neighbourhood spatial relations because the K-nearest LSOAs to the target location may not necessarily take into account all LSOAs that are significant to the target LSOA. As illustrated below in Figure 4.6, the nearest eight LSOAs do not include some LSOAs which are bounded to the target LSOA. Secondly, nearest in terms of centroid distance does not necessarily indicate nearness in terms of travel time, network distance or accessibility. Thirdly, LSOAs which may not be nearer to the subject LSOA but are well connected through effective transportation links may be left out of the analysis.

Figure 4. 6 - Illustration of Eight nearest Neighbours

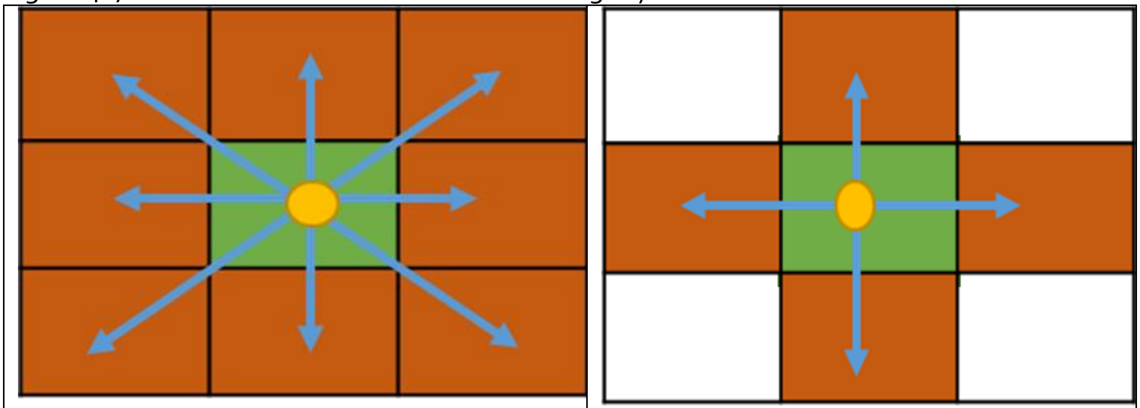


Source: Author - using data from Edina UK Borders

Adjacency Criteria

The adjacency criteria takes into account areas, which are physically bounded to the area of interest through either queen or rook contiguity as illustrated in Figure 4.7 below. Bishop contiguity which is the difference between rook and queen contiguity can also be used in determining spatial weights (De Smith, 2007). Weights based on contiguity can be computed on the basis of first order, second order, third order and so on. First order contiguity refers to LSOA which share common boundaries with the subject LSOA. Second order contiguity refers to those LSOA which share boundaries with the first order contiguity LSOAs. Further contiguity orders follow the same pattern.

Figure 4. 7 - Illustration of Queen and Rook Contiguity

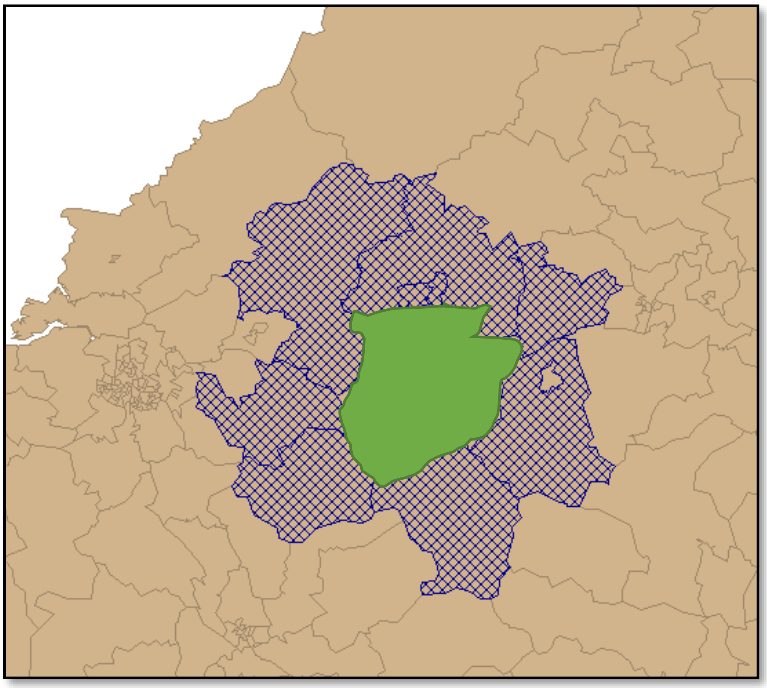


Queen contiguity	Rook contiguity

Source: Author

Whereas this approach can capture all LSOAs which are physically bounded to the subject LSOAs (as shown in Figure 4.8) and it is mostly used by spatial analysts, it does not give an indication of the strength of the relationship. It can therefore be misleading if it is assumed that all adjacent LSOA's have the same level of spatial relations with the subject LSOA. Secondly, LSOAs that are not bounded to the subject LSOA but have strong connectivity and relations with the target LSOA may be excluded from the analysis. An attempt to capture all connected LSOAs by increasing the order of contiguity can result in capturing other LSOAs that have little or no relationship with the target location. This results in diluting the effects of spatial dependency between LSOAs.

Figure 4. 8 - First Order Contiguity



Source: Author - using data from Edina UK Borders

Distance Approach

This approach considers all LSOAs with centroids within a specified distance of the subject LSOA. There are several ways of stating how the distances between LSOAs can be translated into spatial weights with the inverse distance approach being the most preferred option by spatial analysts (Smith et al., 2007). The distance approach was also deemed inappropriate because barriers such as rivers, highways, motorways, and mountains among others can be an obstruction and prevent or significantly reduce socioeconomic interactions between LSOAs (Mitchell, 2005). Secondly when dealing with large study areas, as in the case of this study, arriving at the appropriate distance threshold where all LSOAs have neighbours resulted in some LSOA having too many neighbours whilst others have very few.

Generating Spatial Weights for Connected Areas

In developing an approach to generate spatial weights suitable for assessing the sensitivity of the IMD to differing levels of relations between LSOAs, an approach that overcomes the limitations of the established methods for determining spatial connectivity had to be developed. The first step to achieving this objective was to define connectedness and identify connected LSOAs. In terms connectedness, an LSOA is considered to be connected to another LSOA if residents of the target LSOA have a relatively stronger spatial relationship with other LSOAs through access to socioeconomic activities and services.

The office of national statistics data on commuting flows was considered appropriate to serve as a proxy for connected LSOAs. Commuting flows were deemed appropriate because behavioural analysis suggest that choices of residential location and place of work are not exogenous to each other. Instead, they are interdependent (Waddell et al, 2007). People often make employment location decisions during job search with due regard to their location of residence and others search for places of residence are influenced by where they work or can secure a desired employment (Linneman and Graves, 1983; Gordon and Vickerman, 1982).

Whilst these two locations may be within the same LSOA or nearby LSOA, they can also be within two distant LSOAs which are well served with effective transportation infrastructure and services. Considering that not everyone within the LSOA of residence commutes to a different LSOA, the higher the number of commuters from the target LSOA to the connected LSOA, the stronger spatial relations between the LSOA and hence, the higher the spatial weight assigned to that relationship.

Table WF01BEW produced as part of the 2011 census and last updated in 2015 estimates population movements between LSOAs within England and Wales. The dataset is concerned with travel patterns from usual place residence to usual place of work by the proportion of the population who are aged 16 and above and in employment (ONS, 2011). Using this dataset will capture both nearer and farther LSOAs that are easily accessible to the target LSOA.

This helps overcome the challenges of capturing farther but connected LSOAs faced by some of the established approaches to determining spatial weights without the problem of over specification. The assertion here is that such commuters have an expanded spatial opportunity structure and can access some of the services and facilities (they would have otherwise been deprived off) from the LSOAs they commute to and do not necessarily need to have access to such services in their usual place of residence. This also implies that people in affluent areas with adequate services who commute to other locations potentially have access to additional facilities from the places they travel to if those areas are equally well served.

The second consideration in arriving at the appropriate spatial weights was to overcome the challenges of the distance approach such as the use Euclidean[22] distance which does not take into account obstacles such as rivers and unfavourable terrain. A road network model to estimate the average travel times between all 32,844 LSOAs was developed using ArcGIS network analyst tool. This required data from OS open roads, travel time and traffic flow data from the highways agency network as well as regional congestion and reliability statistics from the Department of Roads and Transport. With the model being based on an actual road network (see Appendix XXIV), the estimated distances and travel times take into account all the potential obstacles identified above.

The next stage of the process is to check the data for potential errors or anomalous flows and transform the data into a spatial data fit for analysis.

Data Processing and Error Correction

Just as most statistical datasets, the commuting data is susceptible to errors such as data inputting, processing and respondent errors arising from the lack of understanding of the questionnaires or specific questions. The potential effects of such errors on analysis and inferences cannot be understated (Kazak et al., 2015). As identified by Barchard and Pace (2011), human data entry error can result in a non-significant t-test when it should be significant. For instance, an employee recording a place of work address as that of the national headquarters

[22] Euclidean distance measures the straight-line distance between two points – in this case two LSOA centroids.

when it is supposed to be the local branch office can give an impression that the respondents commute to the national head office daily (Rae, 2016).

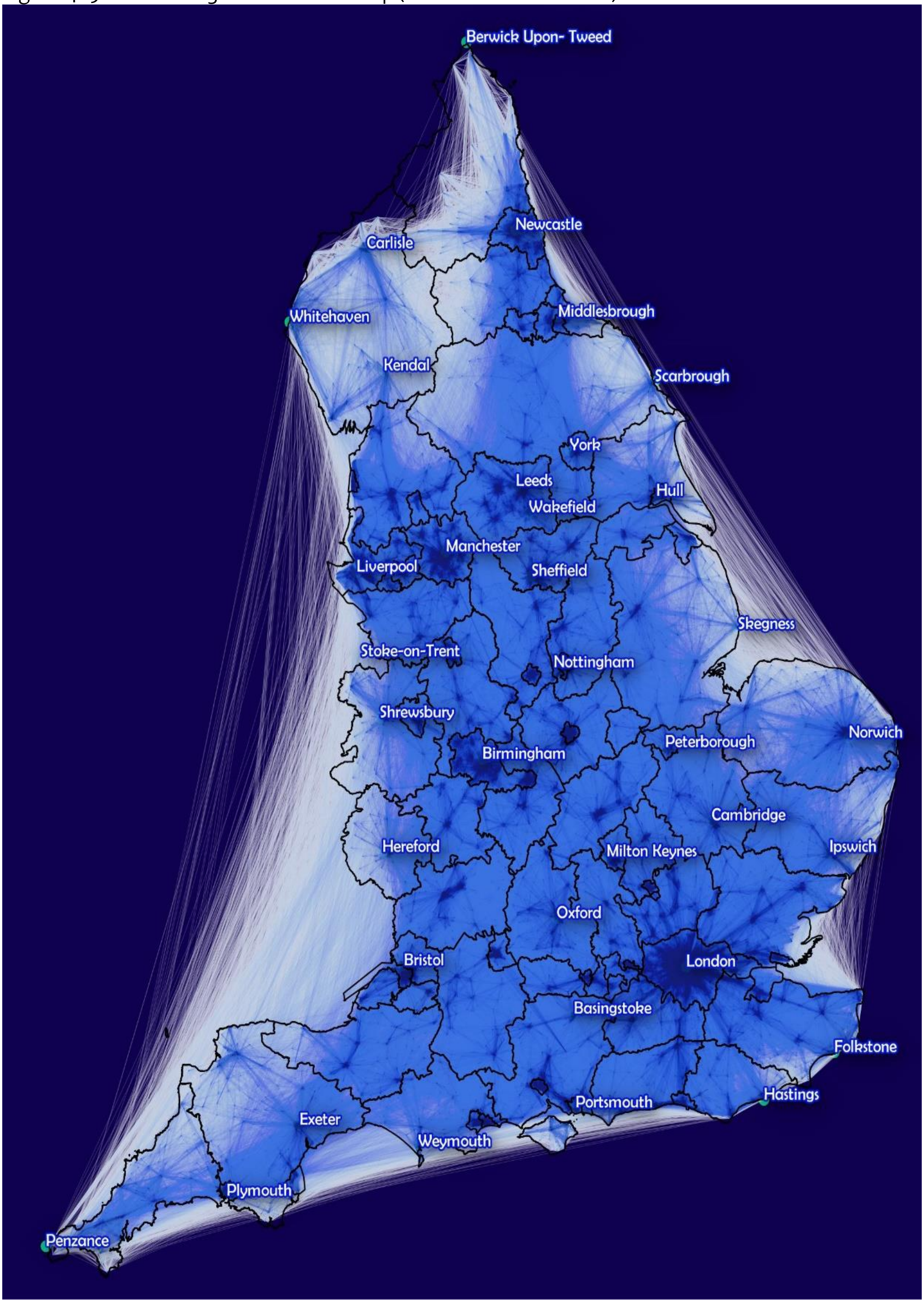
The Office of National *Statistics* (2014) paper on "*Incorrect flows within the 2011 census origin and destination statistics*" confirms there were errors in the commuting data collected and processed during the 2011 census affecting commutes between certain local authority areas in England. These errors have however not been corrected because ONS has not been able to identify all the errors in data and did not want to give an indication that the errors have been corrected. In effect, such errors remain in the data and has to be accounted for.

To correct some of the errors from the data, a number of steps were taken. The first step was to remove all flows with less than 5 commuters from the dataset. Such flows are not high enough to generate any significant neighbourhood effects. Secondly, the large nature of commuting datasets make it difficult to identify any potential anomalous flows and exclude from the dataset without first transforming it into a spatial data (Rae, 2016). Dealing with LSOA to LSOA commuting flows with over seven million records of origin and destination dataset, transforming that data into a spatial data to give it a visual aid was a necessary step to identify any potential errors. Using LSOA population weighted centroid X and Y coordinates, the remaining pairs of commuting LSOAs were mapped through XY to Line tool in ArcGIS. The resulting map is shown in Figure 4.9 below.

It can be seen from the map that there are some very long-distance flows, which are unlikely to be daily commutes but rather more likely to be errors. For instance, flows between LSOAs in the south-east of England and northern counties of

Cumbria and Northumberland, LSOAs in Norfolk and LSOAs in Northumberland among others. As shown in Figure 4.10 (map A), such commutes are over seven hours of travel time by car. Whereas such commutes may theoretically be possible, they are unlikely to be daily commutes and for the purpose of this analysis should be excluded from the data. In other to exclude such potential erroneous flows from the analysis, a maximum distance threshold had to be applied to the dataset.

Figure 4. 9 – LSOA Origin-Destination Map (number of Commuters)



Source: Author – using date from ONS, and Edina UK Borders

When it comes commuting distances, what constitutes an appropriate commuting distance differs between countries and in accordance with the availability of infrastructure and efficient transport facilities (Sandow, 2011). Expanding travel to work areas or labour-market regions have resulted in significant increases in individual travel to work distance (Sandow and Westin, 2010). Whilst these improved networks and expanded spatial opportunities can have positive economic effects for individuals and household, commuting over long distances can have detrimental impacts on health and general life satisfaction (Sandow et al., 2014). Backstorm et al. (2014) found that commuting distances over 50km had negative health impact on men and resulted in early retirement. Van ham et al (2001) suggests distances less than 45km are reasonable, Garmendia et al.(2011) considered distances over 50Km to be long distance commute and Sandow and Westin (2010) considers Euclidean distances of more than 30km to be excessive. Sandow et al (2014) found that long distance commutes were associated with high mortality rates for women. They defined long distance commutes as distances over 50Km each way. A report by the Office of National Statistics posited that compared to people who commute for less than 15 minutes to work, people commuting for longer than 61 minutes have lower life satisfaction and poor personal well-being in general. (ONS, 2014).

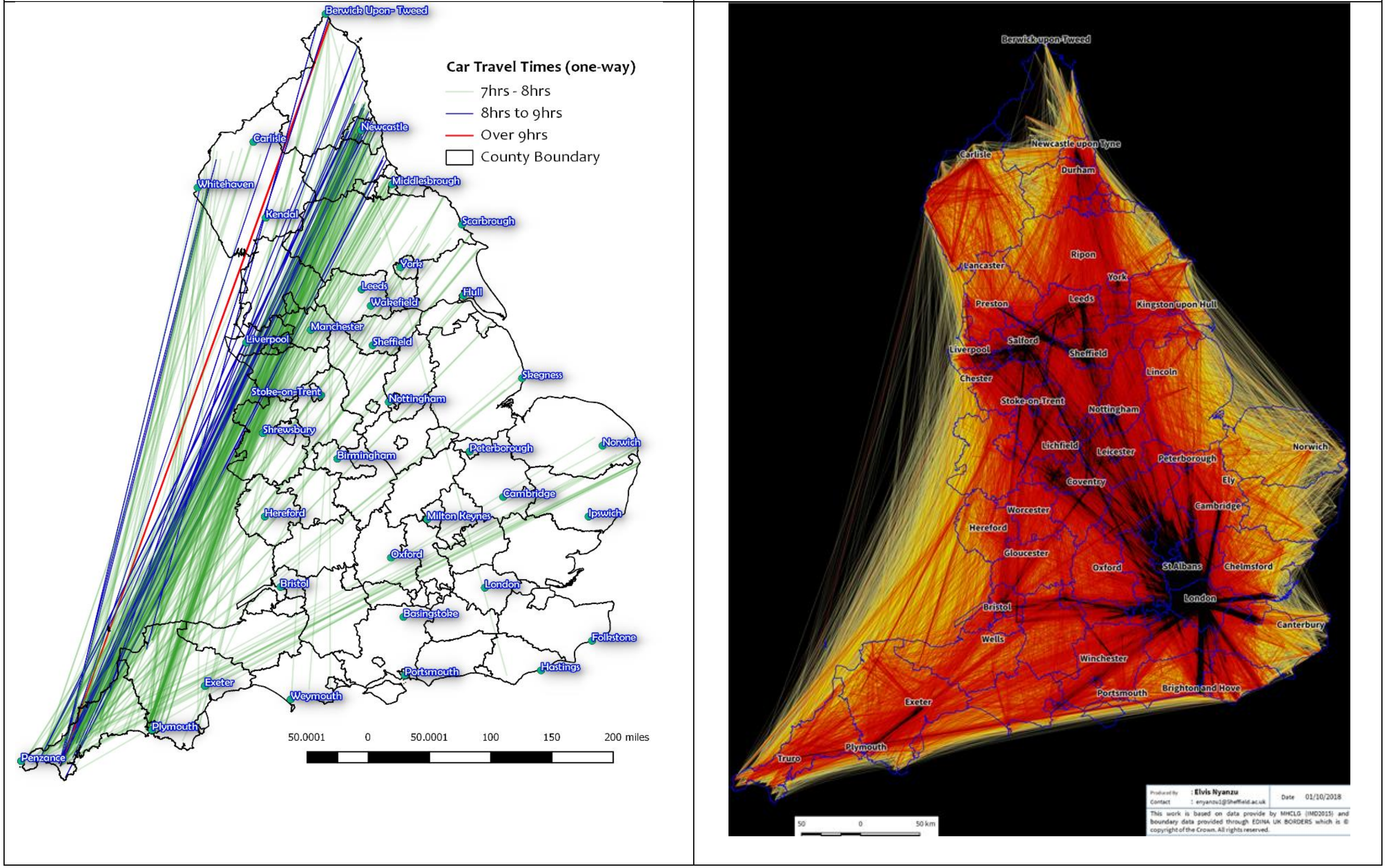
This part of the study is concerned with increasing the spatial opportunity structure of individuals through commuting. In this regard, a careful consideration has to be given to commuting distances which are considered to be reasonable and are not likely to have negative socioeconomic outcomes. A network distance threshold of 50km is therefore considered appropriate for the analysis of neighbourhood spatial relations.

To verify the potential number of commuters likely to be excluded from the datasets, maps A and B on Figure 4.10 were produced to show all commutes over 7 hours and significant commutes over 50km (commute with 5 or more commuters). It can be seen from the map that there are relatively very few significant flows beyond 50km network distance. Approximately 88% of all flows over 50km had only one commuter with approximately 97% having two or less commuters (see Appendix XVIII complete list of flows and number of commuters which were over 50km). The total number of flows excluded from the dataset at this point was 981,861 representing approximately 13.5% of the entire dataset. It can therefore be inferred that removing such flows from the data will not result in the loss of significant flows.

The next step was to remove all commuter flows with zero travel time from the dataset. Where the travel time is zero, commuters work within the LSOA of their usual place of residence. Since this analysis focuses on relations between LSOAs it was prudent to remove these records from the data. The remaining records formed the final dataset which was used for the specification of spatial weights.

Figure 4. 10 – Illustration of all Potentially Erroneous Flows

Map A - Over Seven Hours Commutes by Car	Map B - Commutes **over 50km**



Source: Author - Data from ONS2011 census and Edina UK Borders.

Strength of Connectivity

As highlighted in earlier chapters of this thesis, the strength of spatial relations between neighbourhoods differ markedly. These differences can also be observed in the number of people travelling between LSOAs for work. Affluent neighbourhoods are more likely to have high number of commuters resulting in an increased spatial opportunity structure. On the other hand, people in deprived neighbourhoods are likely to have less commuters to other locations and therefore a reduced spatial opportunity structure. To determine the level of influence each connected LSOA has on a target LSOA (spatial weights), the total number of people commuting from the target LSOA to the connected LSOA as a percentage of the total population of the target LSOA were used to represent the expected level of influence or strength of the relationship between each connected LSOA and the target LSOA. In this regard, the higher the proportion of the population commuting to a connected LSOA, the higher the potential for the connected LSOA to influence the socioeconomic activities of people in the target neighbourhood.

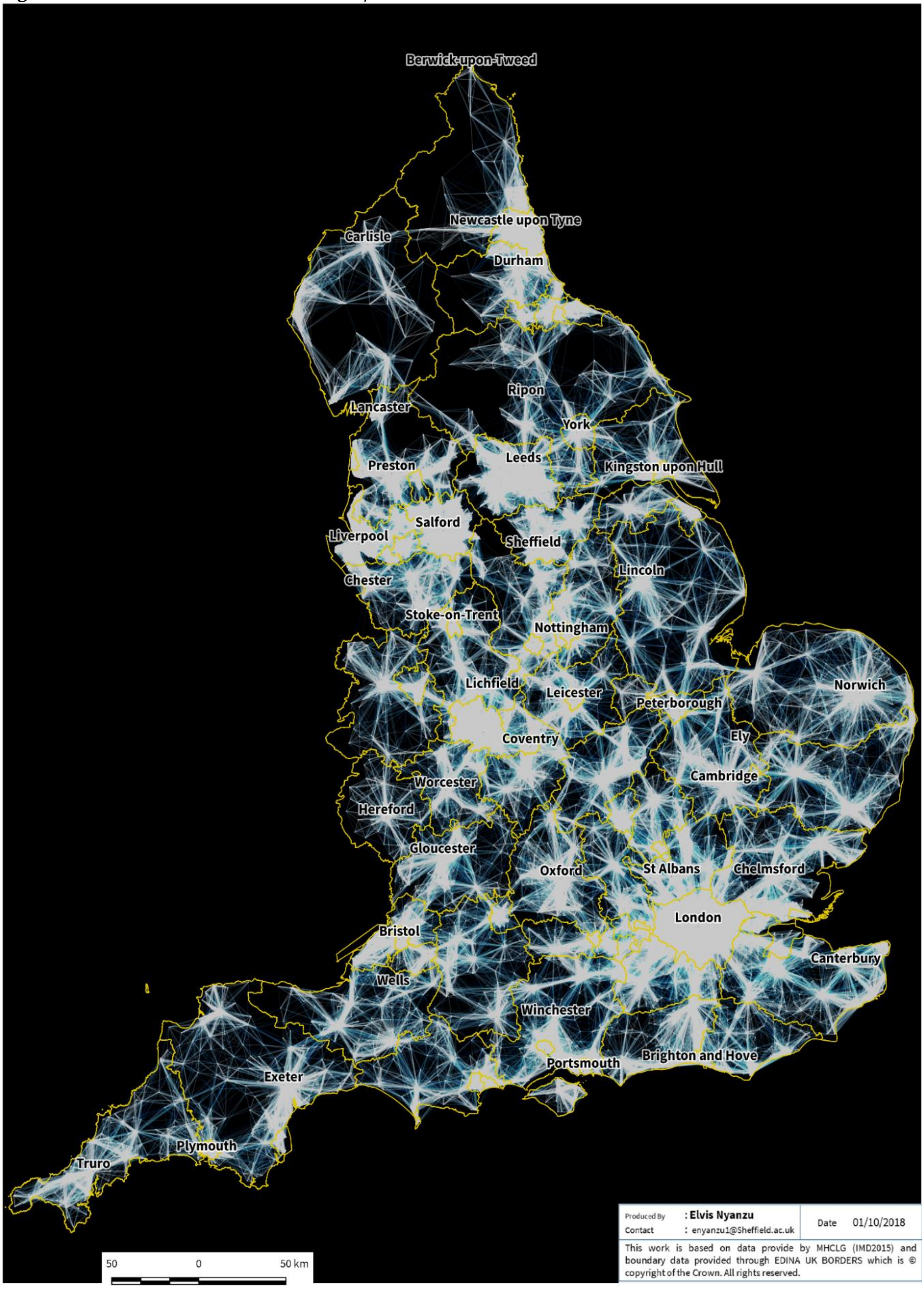
Figure 4.11 is a map showing the strength of connectivity between LSOAs using proportion of LSOA total population that commutes to connected areas and grouped in deciles. The map only shows pairs of LSOAs with at least 5 commuters and have a commuting network distance of less than 50 kilometres (approximately 60 minutes) each way. The top and bottom 20% commuter flows are presented in Figure 4.12. Concentrations of commuter flows within both the least 20% and the most 20% are within London, Birmingham, Liverpool, Manchester, Leeds, Newcastle and major towns and cities. It can be seen from map B of Figure 4.12 that commutes in the ninth and tenth deciles are mainly LSOAs within the immediate environs of major towns and cities commuting to and from LSOAs within such towns and cities. Commuters from areas in the top two deciles (areas with the least proportions of their population as commuters) shown in map A of figure 4.12 tend to have relatively longer commutes compared to LSOAs in the least two deciles. It also apparent from the maps that commuter flows are general high in the south than the north of England. It is exceptionally high for areas around greater London and within the M25 corridor.

From the above, it can be seen that this approach to specifying spatial weights overcomes most of the challenges associated with the traditional approaches to generating spatial weights. All connected LSOAs can be captured without the need for over specification. Using road networks to estimate network distances avoids the limitations associated with Euclidean distances. The strength of relations between the LSOAs, specified as the proportion of total LSOA population which commutes avoids the limitation of assigning similar weights to all connected LSOAs irrespective of the strength of relationship.

It is worth noting here that, in this research, the specification of the spatial weight does not take into account the availability of amenities within the other neighbourhoods of the spatial opportunity structure. This is because, as noted in the conceptual framework, the calculation of deprivation scores attributed to other neighbourhoods takes into account the within deprivation scores for each of the relevant neighbourhood that form part of the spatial opportunity structure. In this regard, if an LSOA has high number commuters to areas with inadequate supply of amenities, that area would have a poor score for within neighbourhood deprivation. This lower score is weighted by the relevant spatial weight before it is combined with the scores from other areas.

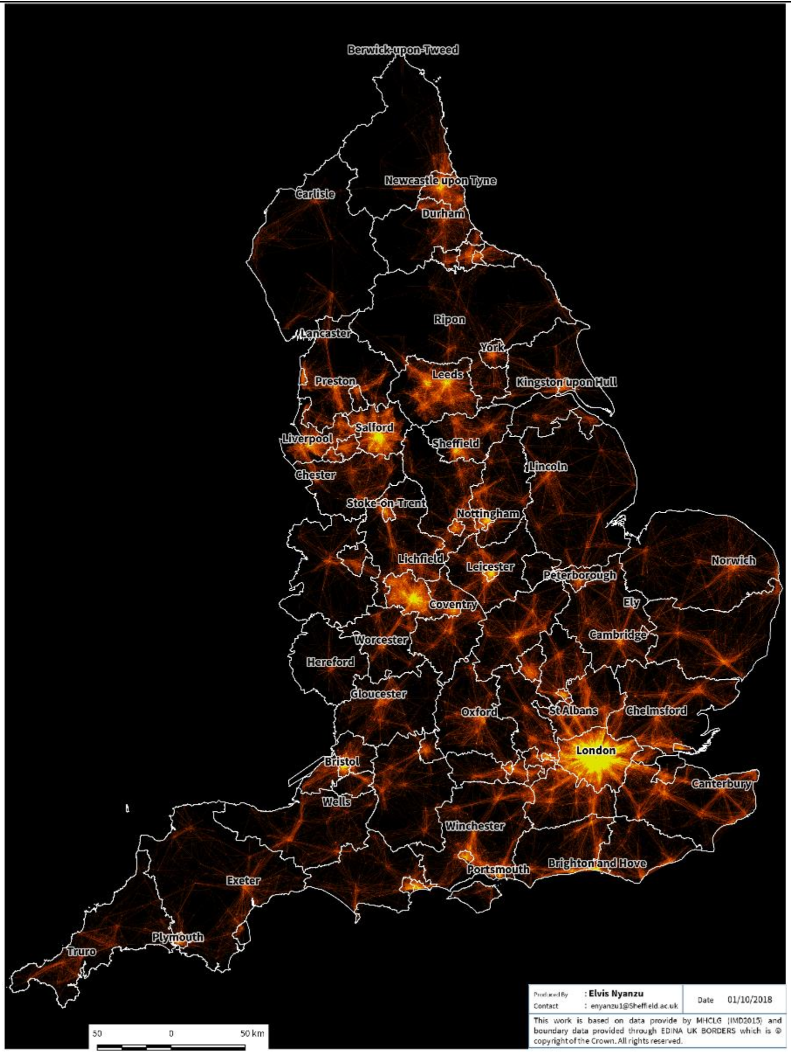
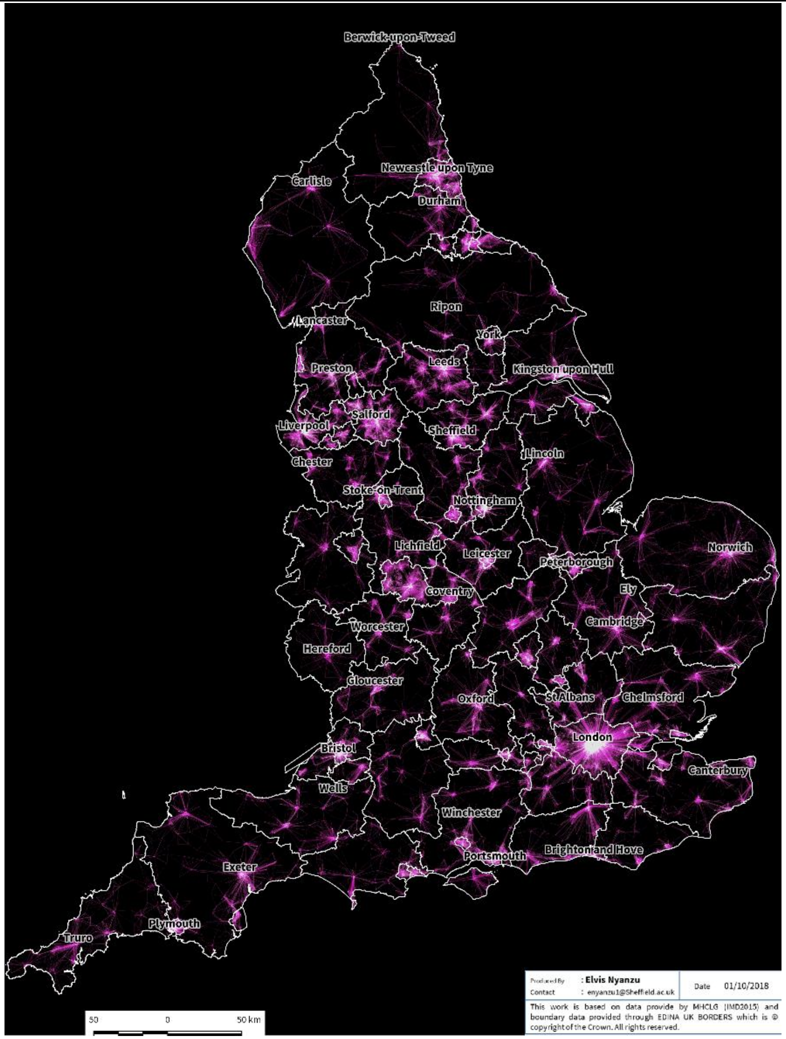
Thus far, the analysis has concentrated on the development of an appropriate approach to specify spatial weights suitable for the assessment of the impacts of neighbourhood spatial relations in the measurement of deprivation. The analysis of the potential impacts of neighbourhood spatial relations on the measurement of neighbourhood deprivation examined with the methods described in this section are presented in Chapter 5. I will now move on to the next section which focuses on generating spatial weights suitable for examining differences in neighbourhood spatial structure and the varying spatial scale of socioeconomic processes.

Figure 4. 11– LSOA to LSOA Connectivity



Source: Author - Data from ONS2011 census and Edina UK Borders.

Figure 4. 12– LSOA to LSOA Commutes

Map (A) Least 20% commutes	Map (B) Most 20% commutes
	

Source: Author - Data from ONS2011 census and Edina UK Borders.

4.2.5.5 Determining Area of Influence - Spatial Scale and Structure

This section focuses on the methods used in examining the impacts of differences in neighbourhood spatial structure and the difference in spatial scales of socioeconomic processes on the measurement of deprivation. As discussed earlier in this chapter, there are several approaches to assessing spatial association. Each of these approaches have specific benefits and limitations. The preference for global Moran's I and Local Indicators of Spatial Autocorrelation (LISA) is continued in this section for the examination of research questions 2 and 3 which relates to the potential impacts of spatial structure and scale on neighbourhood deprivation.

Within the global Moran's I and LISA techniques there are several ways of specifying relevant spatial weights as discussed earlier in this chapter. Various approaches such as adjacency, distance and nearest-K neighbour approaches were once again tested and each produced different results. This is expected because with analysis of spatial association, the approach used in determining the spatial weight significantly influences the results (De Smith et al., 2007). It is therefore recommended that the same approach to specifying spatial weights is used if a comparative study of results from different time periods are being undertaken for consistency (Rae, 2009).

Since spatial structural and scalar context of LSOAs and their environs are of interest in this part of the analysis, the approach to determine spatial weight has to be one which centralises the target LSOA within the context of its neighbouring LSOAs. As highlighted earlier in this chapter, nearest K-neighbour and the distance approaches do not always fulfil this requirement. Attempts to ensure this requirement is met through these two approaches leads to over specification of neighbours and overgeneralisation of the results. The adjacency criteria or contiguity approach was deemed appropriate because it is the only approach which guarantees that the target LSOA is centralised in all instances when specifying spatial weights (De smith et al., 2007). In addition, it ensures all LSOAs which are physically bounded to the target LSOA are included in the analysis (Rae, 2009).

An important consideration in spatial autocorrelation analysis using the adjacency criteria is the type of contiguity. Consideration must be given to the representation of the contiguity and the order of contiguity to use in the analysis. The choice of contiguity structure and order should be influenced by the knowledge of the spatial relationships between polygons (LSOAs) where possible (Flahaut et al., 2003). As discussed in earlier in this chapter, there are three main types of contiguity representations – rook, queen and bishops. Queen contiguity is considered the most appropriate option for assessing the impacts of spatial scale and structure as it ensures all adjoining LSOAs are included in the analysis. The results of the analysis of the potential impacts of differences in neighbourhood spatial structure and spatial scales are presented and discussed in chapter 6.

4.3 PART 3 – Challenges Limitations and Other Considerations

This section covers the methodological challenges and general limitation of the study as well as other relevant consideration such as ethics, power and positionality in research.

4.3.1 Challenges and Limitation of Spatial Analysis

Spatial analytical techniques have seen significant improvements in dealing with conceptual and technical challenges of dealing empirical analysis. Nonetheless, the application of spatial analysis to socioeconomic issues continue to face several challenges. Some of these challenges which are relevant to the study contained in this these are outlined below:

Spatial Statistics and Complex Human Interactions: - The first and perhaps the most important relates to using spatial statistics to explain human phenomenon. Spatial autocorrelation techniques which attempts to summaries complex, multifaceted socioeconomic interactions into a single value may not necessarily be able to capture all the important information within and between areas which may account for variations or similarities in observations (De Smith et al, 2007; Fotheringham and Rogerson, 1993). Although a careful approach to the development of the spatial weight function used within the spatial autocorrelation computation can capture some of the information responsible for variations or similarities, certain factors may well be too obscure or may not lend themselves to be statistically analysed and computations (Fotheringham, 2009, Rae, 2009).

Modifiable Areal Unit Problem (MAUP): - This refers to the sensitivity of spatial analysis to variations in the zoning systems used to collect data and the scales at which data are reported (Fotheringham and Rogerson, 1993). The lack of standardisation in the way areas are zoned or for spatial aggregation implies that geographical areas under study are modifiable, arbitrary and subject to the whims and opinions of the people undertaking the zones and/or aggregation (Openshaw, 1984).

As described by Fotheringham and Rogerson (1993 p.4), "Regions are perceived and defined in different ways by different people and the accurate partitioning of space by an individual is not nearly as obvious as the classification of brand types". The continuous nature of geographic space makes it possible for space to be divided into several ways /units, some which can exaggerate or understate the phenomena under study (Openshaw 1995; Fotheringham and Rogerson, 1993; Fotheringham and Wong, 1991).

The potential impacts of MAUP in overstating or understating the measurement of deprivation forms part of the basis of the research. All empirical analyses undertaken in this research fully engaged with the significance of MAUP and it is accounted for in the analytical techniques employed and also during the interpretation and discussion of the findings.

Ecological Fallacy: - "This is an error of deduction that involves deriving conclusions about individuals solely on the basis of the analysis of group data" (Miller and Brewer, 2003 p.3). Most often, due to the lack of relevant data and difficulty of analyses, aggregated data at different levels are used to make inferences which are intended to reflect individual behaviours or characteristics. Such generalisations have an inherent fallacy because not all individuals within the group are typical of the generalised conclusion (Schwartz 1994).

The consequences of ecological fallacy are well documented (Kramer, 1983; Miller and Brewer, 2003; Piantdosi et al., 1988; Seligson, 2002). However, the notion that individual-level models are more accurate than aggregate level models against the contention that aggregate level correlations are always substitutes for individual-level correlations remain a subject of debate in the literature (see Schwartz, 1994 and Peacre, 2000). Theoretically, individual level analysis is more likely to provide the most in-depth examination of questions to be investigated. Pragmatically, it is unrealistic to achieve especially within the context of analysis such as in the case of this research which is concerned with an entire country. As suggested by Openshaw (1995), data at levels of smaller units as possible should be used to reduce the errors of aggregation and to improve the explanatory powers of models.

Whilst the ONS Longitudinal Study (LS) data of 1% sample of the population of England could be used to overcome problems of aggregation, the data level employed by the creators of the English Indices of deprivation is the Lower Layer Super Output Area (LSOA). LSOAs level data was therefore considered to be more appropriate for this study to allow direct comparison of the study results to the Indices of the deprivation[23]. At the LSOA level, data aggregation is kept to a minimum and also reduces the effect of aggregation.

Tobler's First Law of Geography and Spatial Autocorrelation: - Waldo Tobler in developing an urban growth model presented in a paper "A computer movie simulating urban growth in the Detroit region" stated what later became known

[23] See the section on unit of analysis under part two of this chapter for full description of LSOAs

as the Tobler's First Law (TFL) of Geography – "*Everything is related to everything else but near things are more related than distant things" (Tobler, 1970 p. 236)* This 'law' suggest that there are general patterns and connections among things of interest to geographers (space and the activities that take place on them).Yet, there are other attributes local to certain areas which make them more closely connected and relatively different from other areas. As described by Sui (2004), whilst the first part of TFL relates to spatial dependence, the second part denotes spatial heterogeneity as a result of differences in local traditions and circumstances. The relevance of TFL to spatial analysis cannot be over emphasised as the concepts of 'near' and 'related' forms the basics of spatial analysis (Miller, 2004).

The challenge for spatial analysts has been to undertake analyses in ways that account for the impacts of TFL. As Geographic Information Science and its associated technologies gain prominence, there are models which can reduce the effect of spatial autocorrelation whilst accounting for the impacts of TFL (Fotheringham and Rogerson, 1993). This research primarily explores the relevance of TFL in the assessment of neighbourhood deprivation and its importance in the formulation of urban policies which seeks to tackle geographical disparities.

Other Limitations

Besides the general methodological challenges and limitation of spatial analysis described above, some of the techniques described within this chapter and used in examining the research questions have specific limitations.

An Inherent limitation of both global Moran's I and Local Indicators of Spatial Autocorrelation (LISA) which are the main techniques employed in this study is that the computed spatially contextualised Index scores are solely based on the scores of the polygons (LSOAs as in the case of this research) which have been specified as part of the spatial weights for the target LSOA. It ignores the scores of the target LSOA (Rae, 2009). In this regard, practical steps have to be taken to combine the spatially contextualised scores computed through LISA or Moran's I with the original scores of the target LSOA (where appropriate) in order to overcome this limitation.

Related to the above limitation is the challenge of deciding on the appropriate weights to be assigned to the scores of the target LSOA and the spatially contextualised scores computed through LISA or Global Moran's I. There is no one specific answer to this challenge. In my view, the choice of weights should be dependent on the question being investigated and the type or level of spatial interdependencies between the locations of interest. For instance, in a situation where the target LSOA is primarily a residential area, where the majority of the people who live here seek employment in other locations and where we are interested in investigating unemployment. The employment opportunities available in the nearby locations become more significant than the employment opportunities within the target. In this regard, higher weights should be assigned to the attributes of the nearby locations. However, within neighbourhood employment opportunities should remain an important consideration because not all resident would like to commute to other areas.

Within the context of this research, the relevance of spatial contexts differ with the subject of interest. As such, various combinations of weights ranging from 25% to 75% were used for the spatially contextualised scores to illustrate the potential impacts of neighbourhood spatial context. In practice, some background information about the area, generally spatial interdependencies of variables and the perceived relevance of spatial context will provide a useful guide for determining the appropriate weights.

*4.3.2 **Ethical Considerations***

Research ethics can be defined as sets of principles which seeks to preserve individuals' right to privacy, dignity, confidentially and to avoid harm. More generally it can be simply defined as principles of right and wrong acceptable to a specific group (Bresler, 1995). Ethical consideration has been part of social science research since the 1960s and has been predominantly used in qualitative research (Guillemin and Gillam, 2004).

As described by Guillemin and Gillam (2004), ethical considerations usually arise in three main forms – procedural ethics, ethics in practice and professional code of conducts or ethics. *Procedural ethics* are concerned with that part of ethics which relates to the process of seeking approval from a recognised authority or body prior to the commencement of the research; e*thics in practice* relates to the ethical issues which arise during the research process; and *professional code of* *ethics* relates to the relevant rules and procedure which govern the professional environment within which the researcher works.

As in qualitative research, quantitative methods can be subject to ethical dilemmas. Quantitative techniques can be used to report the 'truth' and can also be used 'cheat or lie' (Panter and Sterba, 2011). Ethical consideration are explicitly and implicitly required to ensure that researchers undertake their work with highest level of integrity. For instance, if a sample is selected at random from a dataset and analysed with specific statistical technique, selecting another sample and re-testing with a different technique on the basis that the researcher does not like the result of the first test could be described as unethical. Other ethical issues which may arise in quantitative work relates to data fabrication, data analytical errors arising from ignorance or sometimes intentional misrepresentation.

In terms of ethics in practice, this research made us of secondary data which have been anonymized and in the public domain. It is therefore devoid of ethical issues which are associated with primary data collection. A strict moral code of conduct was also adopted to ensure any adjustments made to the original data is explicitly stated as well as the rational for the adjustments and its potential impacts on the results of the analyses.

However, there is a potential risk for mapping practices that classifies areas into various socioeconomic groupings, such as those adopted in this research, to promote stereotypes and stigmatization. Developments in mapping and classification practices have improved significantly from the days of Booth (1893) where classifications such as "Vicious, semi-criminal" were used, yet, the risk of the negative publicity places can attract from labels remain significant.

There are real people with varying and complex socioeconomic conditions living within these geographic spaces. Some of these dynamics can be so complex to the extent that it can be difficult to place two households within one category if all variables that have the potential to influence the outcomes of people are to be considered. Mapping and classifying areas by indices tend to over simplify the complexities. We must therefore be circumspect in the use of labels and classifications and the context within which they are used. However, these potential risk have to be balanced with the need to send the appropriate message to relevant actors. As describe by Tyler and Slater (2018), although stigma is usually seen in the negative sense, "how stigma is used by individuals, communities and the state to produce and reproduce inequality" is usually missing from debates and analyses.

This thesis made use deprivation deciles for classifying places as used by the creators of the English Indices of Deprivation in order to make it relatively easy to compare the results of the empirical analyses with that of the original IMD. Secondly, statistical classification such as deciles have become increasingly more acceptable than descriptive such as "Rich" or "Poor".

With regards to procedural ethics, the research received ethical approval from The University of Sheffield's research ethics committee prior to the commencement of the study. Beyond these, there were no other foreseeable ethical issues which needed to be considered.

4.3.3 Power and Positionality

Positionality in research can be described as the physical and/or social characteristics of the researcher and how it influences the research process (Herod, 1999). Researcher's characteristics such as race, nationality, gender and social class relative to the characterisation of the subjects of the research is considered to be an influencing factor on the research process (Milner, 2007 and Rose, 1997). Dualist categories such as 'insider' and 'outsider' or 'elite' and 'non-elite' has often been used in discussing issues relating to researcher's power and positionality in the research process Merriam et al., (2001). Although, to Smith (2006) and Herod (1999), such dualist categorisations are not always feasible as the researchers positon can change during the research process. Within the context of the broader researcher perspectives and approach to research, Foote and Bartell (2011) described positionality as the researcher's view of the world and chosen approach to perform a specified research objective.

Beyond the extent to which my positionality as a researcher may have implicitly influenced my epistemological and ontological perspectives and the choice of methodological approach used in this study, this research relied on secondary data for empirical analyses. There are therefore no other concerns about issues of power and positionality during the research process and no specific processes were put in place to address such issues.

4.4 **Conclusion**

The contextualisation of neighbourhood locational characteristics and attributes in the measurement of neighbourhood deprivation can have profound effects on the identification of deprived areas, the specification of neighbourhood problems, the design and implementation of policy actions and the effective allocation of resources. In spite of these potential benefits, the measures of deprivation – specifically the Indices of Deprivation used in England and other countries within the United Kingdom to identify deprived areas, underplay the role of local spatial context in its approach.

Whereas there are several approaches which can be used to identify deprived areas including qualitative approaches that have the capacity to explore micro-sociological questions and provide in-depth analyses (Hastings, 2000, Flick, 2009), quantifications are essential to justify policy actions and the use of state resources (Miller, 2001) and to provide a uniform basis for a consistent national measure of deprivation (Fischbacher, 2014).

An examination of the literature on the subject area in Chapters 1, 2, and 3 also highlighted the need for further empirical studies to examine the spatial context – deprivation discourse. The conceptual framework and the methods described in this chapter are therefore deemed appropriate to attempt to fill the identified gaps. Thus, I will now proceed to investigate the topic in greater depth, using a three-pronged analytical approach, as described in the next two chapters.

5. Impact of Spatial Relations on the Measurement of Deprivation

In this chapter, I present the empirical analyses on the conceptualization of the Indices of Deprivation to account for the role of spatial relations between neighbourhoods. As discussed in Chapters 2 and 3 of this thesis, inter-neighbourhood relations has the potential to expand the spatial opportunity structure of neighbourhoods and influence experiences of neighbourhood deprivation. This can be beneficial to people within certain neighbourhoods and can also be detrimental to others.

Here, I focus on how to account for differences in the spatial opportunity structure of neighbourhoods due to inter-neighbourhood relations within measures of relative deprivation. This is achieved by incorporating the deprivation levels of connected Lower Super Output Areas (LSOAs)[24] into the measurement process. Within the context of this research, connected LSOAs refers to nearby or distant LSOAs which have significant spatial interdependencies with the target LSOA.

As discussed in Chapter 2, theories such as behavioural economics underscores the importance of context in decision making process. In making decisions about where to live (where possible), people do not only take into account the availability of services such as schools, dental services, GP surgeries, supermarkets

[24] These small geographic areas used as a proxy for neighbourhoods in the measurement of deprivation in England and Wales.

and other essential services within the neighbourhoods of their usual place of residence, but also the availability of such services in nearby places as well as services which can be accessed from places of usual commute. In this regard, the unavailability of certain services such as a large supermarket or dental practice within the LSOA of usual residence may not necessarily imply the residents of that LSOA are deprived of those services. Residents may well be able to access such services from other nearby LSOAs or from an LSOA which they frequently commute. In fact, the unavailability of a large supermarket for example, in the LSOA of residence and its related traffic problems may well be the reason why some of the residents chose to live within the LSOA.

Secondly, where residents of a specific LSOA have the capacity to expand their spatial opportunity structure through commuting for instance, such people do not only have access to such amenities and services within their usual LSOA of residence they also have additional resources within this expanded spatial opportunity. Yet people within deprived neighbourhoods that also lack the capacity to expand their spatial opportunity structure are forced to rely on what is available within their LSOAs only even if their LSOAs of residence have effective transportation infrastructure to connect them to other places.

There is also a third scenario whereby some isolated LSOAs may be deprived of such services if these are not located within their boundaries due to poor levels of connectivity and the reduced level of spatial relations with other LSOAs. Assuming two LSOAs, one remote and isolated from other LSOAs and the other well connected to other LSOAs. IF these two LSOAs have identical deprivation scores in all areas or domains of the Indices of Deprivation but for the existence of a large supermarket, dental practice or hospital, the deprivation scores should reflect these differences. Although both LSOAs may not have may not have these services located within their boundaries, residents within the isolated LSOA are likely to be more deprived than residents of the well-connected LSOA if the residents within the well-connected LSOA have the capacity to expand their spatial opportunity structure to areas which have adequate supply of these services.

Using the spatial analytical tools described in chapter 4 of this thesis, the impacts of variations in such neighbourhood spatial relations on the measurement of neighbourhood deprivation were examined are presented in this chapter.

5.1 **Towards a Spatially Sensitive Index of Multiple Deprivation**

The impact of neighbourhood spatial context on the measurement of deprivation vary with the type of socioeconomic indicators under consideration. One of the IMD domains which can be significantly influenced by differences in spatial relations is the Barriers to Housing and Services domain (BHS). This is because it measures accessibility to services such as schools, post offices, supermarkets, GP surgeries among other wider barriers to housing (Smith et al., 2015) and these services are usually located to serve catchment areas. The IMD in its current state considers distances travelled to access these services. The farther such services are from where you live, the more deprived you are considered to be (Smith et al., 2015). The analyses contained in this chapter takes the conceptualisation of the BHS domain a step further by also taking into account the effect of inter-neighbourhood relations.

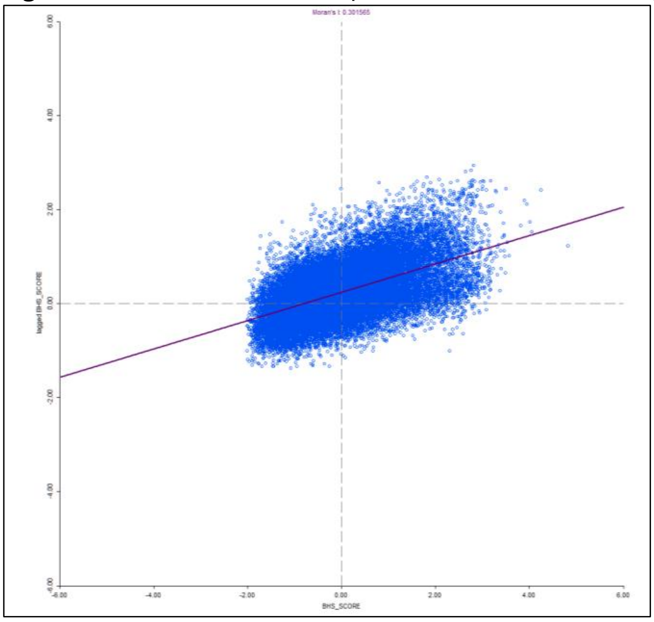
In neighbourhoods where a significant proportion of the people have the capacity to and do commute to other places regularly (for work for example), these people have a relatively wider spatial opportunity structure than people in deprived neighbourhoods where the majority of the residents do not regularly commute to other places as well as LSOAs which are isolated. The argument here is that, if people normally travel to other areas as part of their daily routine, accessing services from relatively farther places does not add any extra strain to their daily lives and may not necessarily consider themselves to be deprived of a particular service or need. On the other hand, where people have to travel long distances mainly to access services because they are not available within the LSOAs of their usual place of residence, their experience of deprivation is considerably different. The IMD should therefore incorporate these elements in the calculation of the domain scores. The extent of isolation or integration between LSOAs were empirically examined and are presented in the following section.

5.2 Analysis of Integration or Isolation of the Barriers to Housing and Services Domain

Measurement of spatial association can be grouped into global and local measures. Whilst global measures tests for spatial association of the entire study area or dataset, local tools measure spatial associations by concentrating on various subsets of the study area to ascertain any spatial patterns that are present in those parts of the study area (Ceccato and Karlstrom, 2000). In theory, the average of all the local indicators for the study area make up the Global indicator. However, as described by Anselin (1995), tools used in assessing local spatial association can identify some variations which may not be identified when the Global statistics is computed.

As discussed in Chapter 4, Moran's I computations considers the relationships between pairs of polygons (in this case LSOA) by using a pre-specified weight term. The weight term as discussed in chapter 4 is a numerical expression of the extent of spatial relationship between each pair of LSOAs. The global Moran's I statistics for the ID2015 Barriers to Housing and Services domain scores were calculated using the proportion of the total LSOA population that commute to connected LSOAs as the spatial weight (see chapter 4 for full description of the method). The resulting Moran's I statistic is 0.3015 and illustrated in Figure 5.1 where the BHS domain scores are plotted against the lagged BHS domain scores. This suggests there is some level of positive spatial clustering of deprivation in socioeconomic processes concerned with the BHS domain.

Figure 5. 1 – Global Moran's I plot of Barriers to Housing and Services Doman (ID2015)

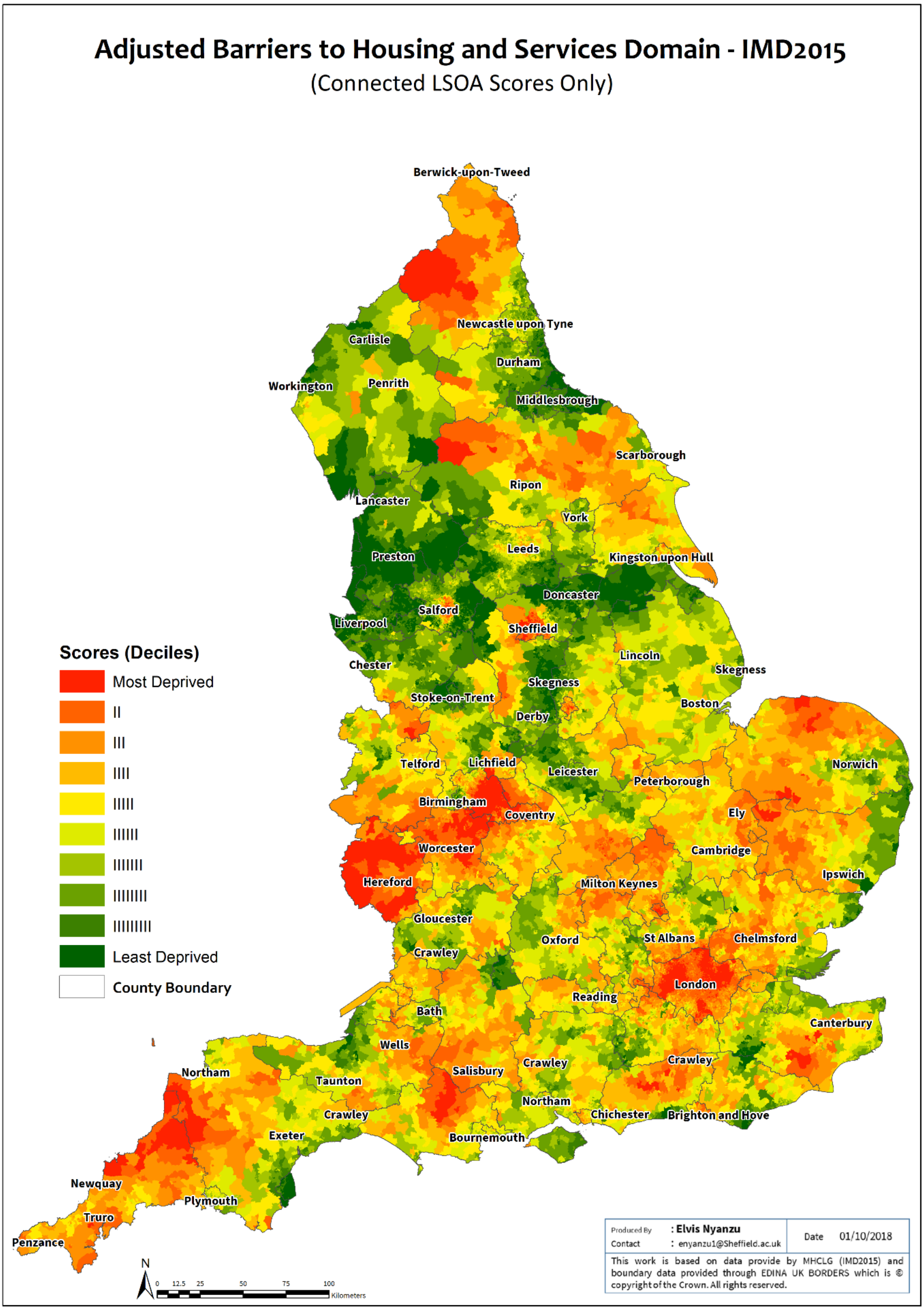


Source: Author

Note: Moran's Scatter plot shows standardized values of ID2015 BHS Scores and Lagged BHS scores with a global Moran's *I* statistic of 0.293207

The lagged values which represents the calculated BHS domain scores after taking into account the scores of connected LSOAs at the appropriate weighs were saved and mapped to show the new spatial distribution of deprivation within BHS domain (see Figure 5.2). The map shows a much clearer pattern of deprivation and affluence. It shows significant levels of deprivation in the BHS domain in the Greater London area, parts of the West Midlands, Herefordshire, Cornwall and Northumberland as well as some major towns and cities. An important revelation from the map is that some rural areas of Lancashire, Cumbria, Durham, Lincolnshire and North Yorkshire moved from the most deprived decile in the original BHS domain scores to the two least deprived deciles.

Figure 5. 2 – BHS Domain of ID2015- Connected LSOAs



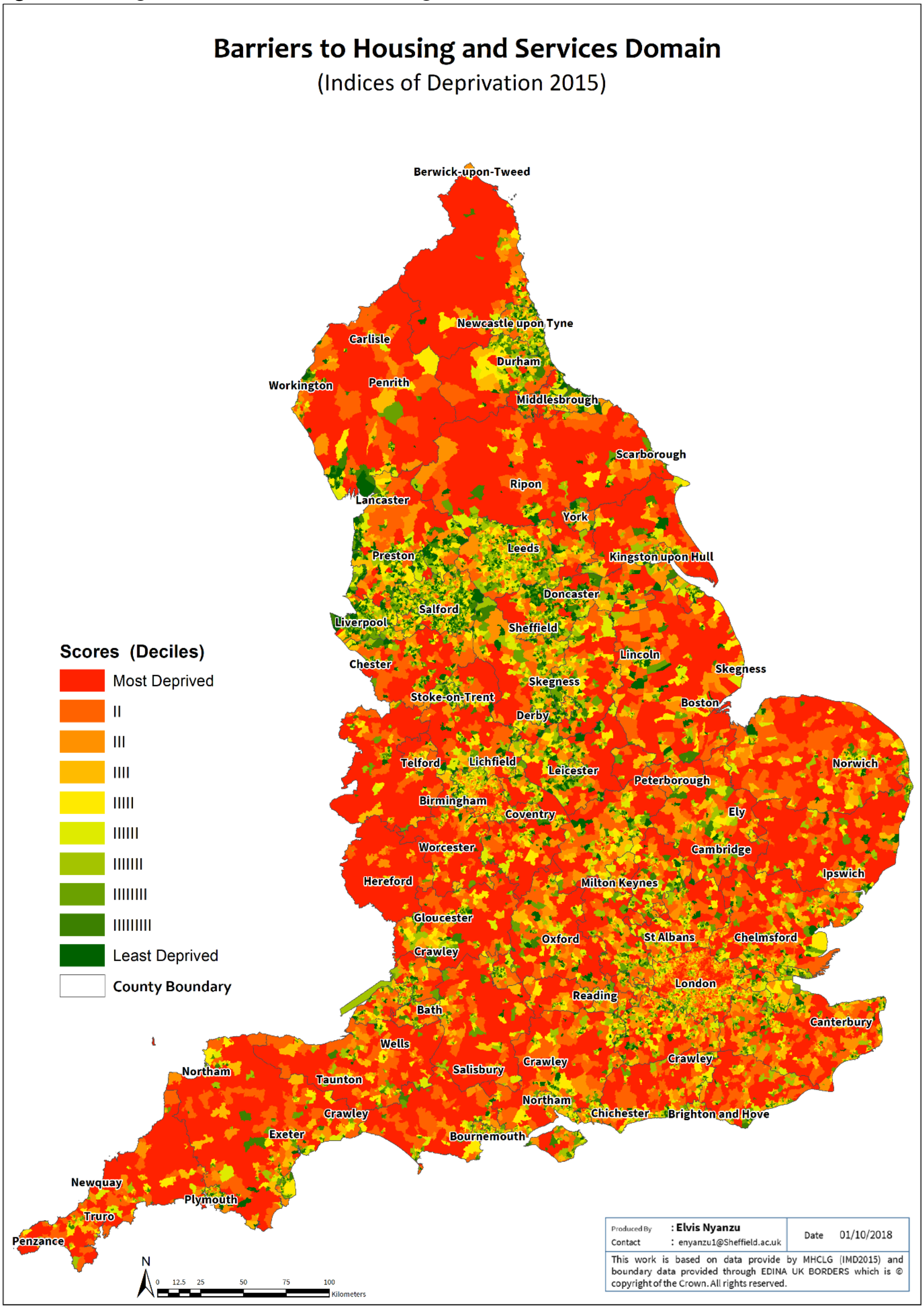
Source: Author

Note: This map shows the spatial distribution of deprivation and affluence in the BHS domain based on the LSOA sores derived from only connected LSOA computed through Moran's I spatial lags.

As discussed in Chapter 4 of this thesis, the computed Moran's I spatial lag values used in producing the adjusted BHS map shown on Figure 5.2 does not take into account the scores of the target LSOA. This is a limitation of the Moran's I technique although it does not detract from its statistical effectiveness in identifying areas of significant spatial interdependency (Rae, 2009). However, given that not all residents of the target LSOA commute to a connected LSOAs, it is necessary to attach some importance to what pertains within the target LSOA by taking into account the scores originally calculated for its socioeconomic attributes (the original BHS domain score). To this end, different combinations of weightings were assigned to scores for the target LSOA and the scores derived from its connected LSOAs.

Figures 5.3, 5.4, 5.5, and 5.6 show maps of adjusted BHS domain scores in deciles using different combination weightings for both the ID2015 BHS domain scores and the BHS domain scores derived from connected LSOAs. From the maps, it can be seen that where higher weights have been assigned to domain scores derived from connected LSOAs, smoother distinctive patterns of deprivation and affluence develop and LSOAs in the most deprived decile become more identifiable. A significant proportion of the rural areas which were considered to be deprived in this domain of the ID2015 scored lower and move out of the most deprived decile. Areas that are deprived both spatially and in terms of attributes become more identifiable making it relatively efficient for targeting interventions.

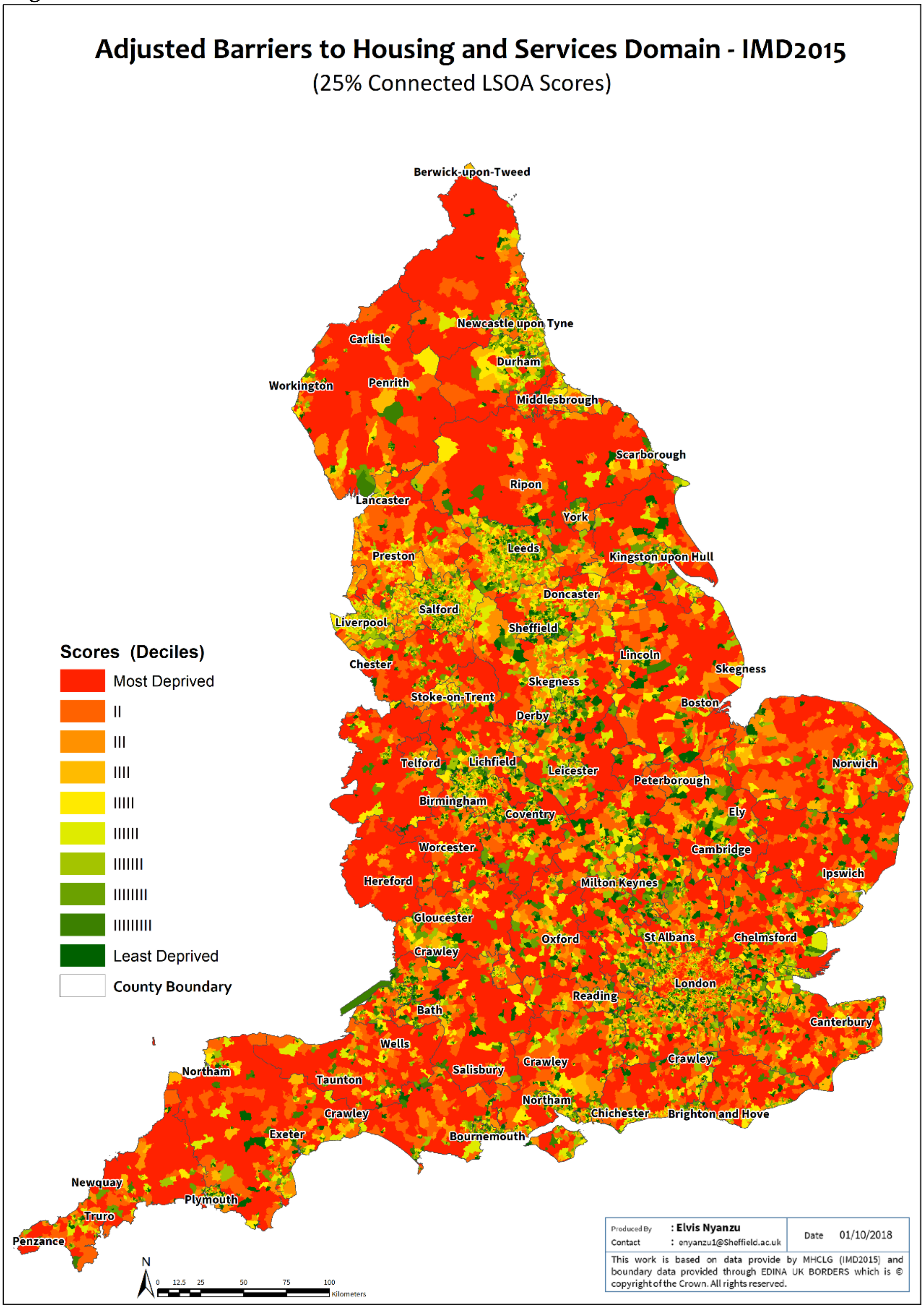
Figure 5. 3–Original ID2015 Barriers to Housing and Services Domain Classification



Source: Author

Note: This map shows the spatial distribution of deprivation for the ID2015 BHS domain scores only.

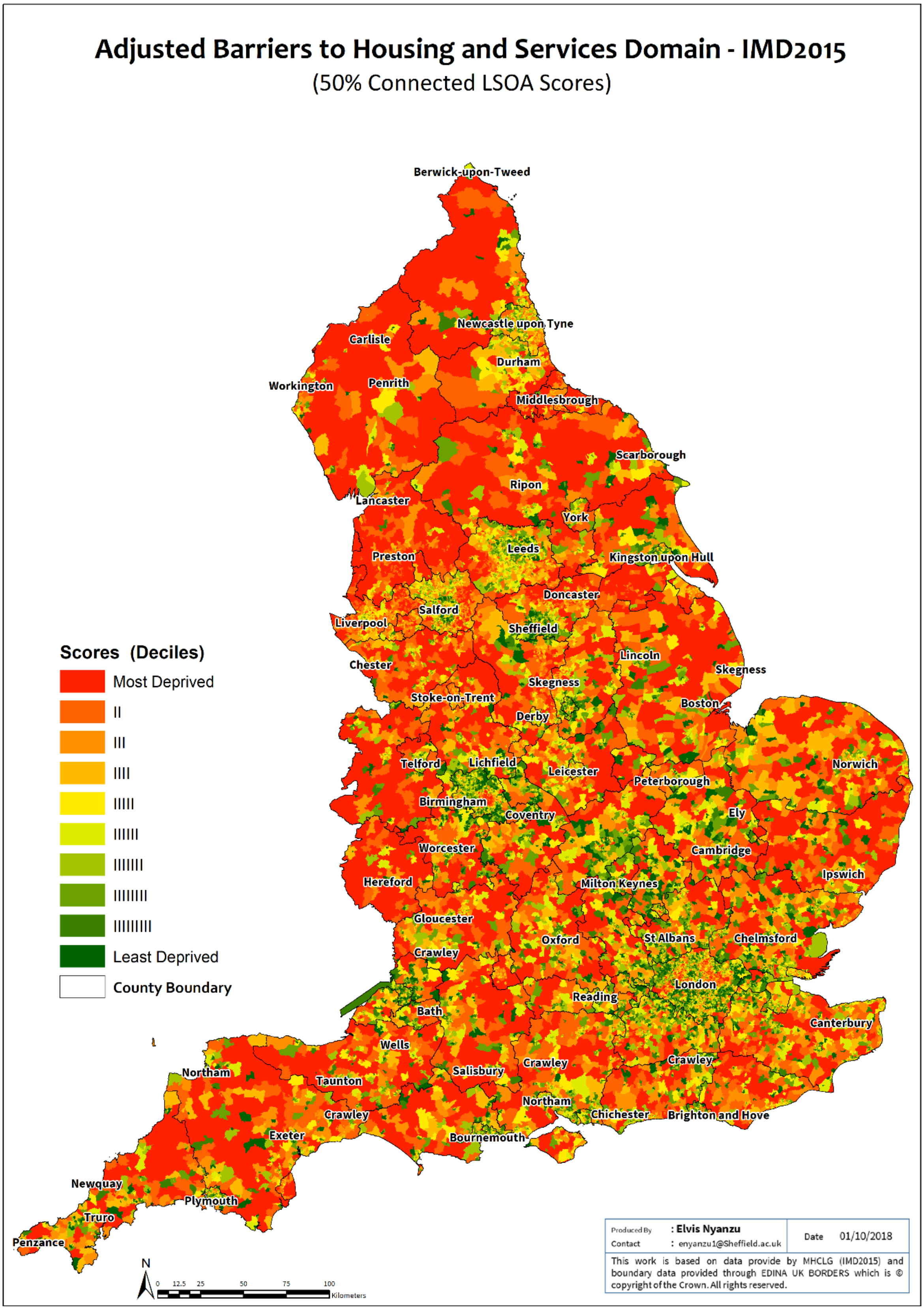
Figure 5. 4– A combination of 25% of connected LSOA scores and 75% of Scores of the original BHS domain Scores



Source: Author

Note: This map shows the spatial distribution of deprivation for BHS the domain computed from 75% ID2015 BHS domain scores and 25% of the scores derived from connected LSOAs.

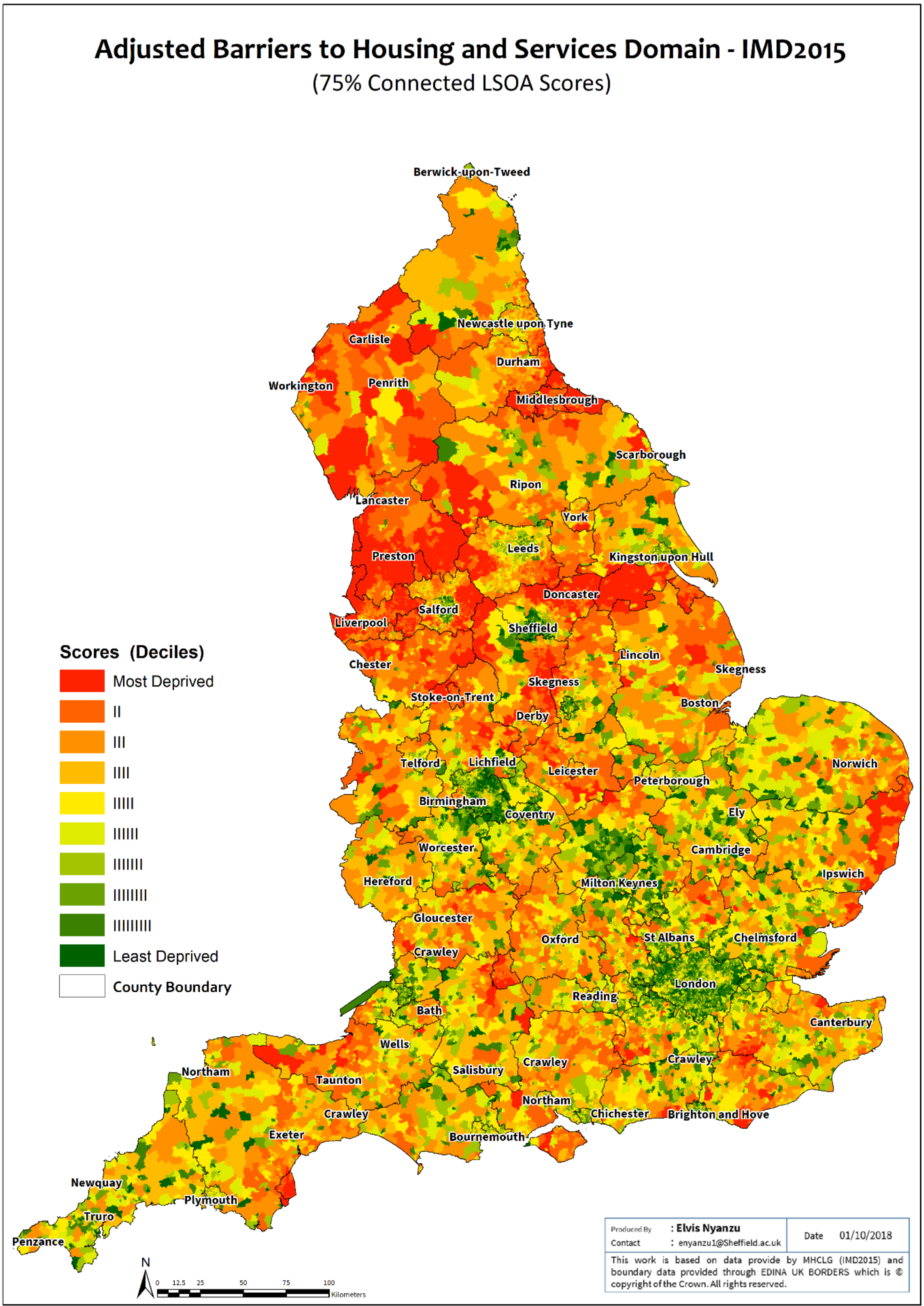
Figure 5. 5– A combination of 50% of Connected LSOA scores and 50% of the original BHS domain scores



Source: Author

Note: This map shows the spatial distribution of deprivation for BHS the domain computed from 50% ID2015 BHS domain scores and 50% of the scores derived from connected LSOAs.

Figure 5. 6 – A combination of 75% of Connected LSOA scores and 25% of the original BHS domain scores



Source: Author

Note: This map shows the spatial distribution of deprivation for BHS the domain computed from 25% ID2015 BHS domain scores and 75% of the scores derived from connected LSOAs.

To understand the extent of changes in BHS domain classifications as result of the spatial contextualisation of the ID2015 BHS domain scores, 40 of the most deprived LSOAs in the BHS domain of the ID2015 were examined and the results are shown in Table 5.1 At a combination of 25% connected LSOA scores and 75% ID2015 domain scores, approximately 52% of LSOAs moved out this sub-group and were ranked higher (The higher the rank, the better). Brent 008D which is the most deprived LSOA in this domain, was ranked 24th. With the exception of Aylesbury Vale 010D, St Edmundsbury 008E, and Hambleton 008E, all the other 15 rural LSOAs within the 40 most deprived LSOAs in this domain scored lower. 13 of these rural LSOAs which achieved better adjusted BHS ranks are in Herefordshire and are all classified in income and employment deciles 7 or better (the higher the decile the more affluent the LSOA). This suggest that people within these LSOAs are not necessarily deprived of essential amenities and services. They are more likely have the capacity to expand their spatial opportunity structure through commuting and the places they commute also have these services in adequate supply.

As the proportion of connected LSOA scores increases, the adjusted BHS domain ranks also improved significantly. For instance, at the combination of 50% connected LSOA BHS scores and 50% ID2015 BHS domain scores, all 40 LSOAs move out of this group and achieve better ranks all they all remain in the most deprived decile. At 75% connected LSOA BHS scores and 25% ID2015 BHS domain scores, all of the 40 most deprived LSOAs move to different deciles (a rank of 3285 or better is in the second decile). Approximately 30% of these LSOA moved to decile 4.

Table 5. 1– Ranking of BHS Domain Scores Adjusted with Scores of Connected LSOAs

Ranking of BHS Domain Scores Adjusted with Scores of Connected LSOAs					
			Adjusted BHS Domain Ranking		
NAME	Rural/ Urban	ID2015 BHS Rank	*25 Percent*	*50 Percent*	*75 Percent*
Brent 008D	U	1	24	304	9456
Birmingham 050F	U	2	33	375	10041
Ealing 016A	U	3	31	348	9787
Brent 021E	U	4	35	365	9928
Birmingham 022B	U	5	38	383	10030
Brent 021C	U	6	41	388	10052
Birmingham 079F	U	7	39	370	9913
North Dorset 005B	R	8	25	285	9066
Barnet 026B	U	9	36	343	9623
Birmingham 138A	U	10	49	402	10129
Herefordshire 001C	R	11	14	178	7602
Waltham Forest 013D	U	12	29	290	9084
Enfield 037D	U	13	37	315	9392
Herefordshire 004C	R	14	48	372	9801
Herefordshire 020A	R	15	52	379	9833
Birmingham 138D	U	16	57	407	10021
Sheffield 042G	U	17	54	380	9797
Herefordshire 018B	R	18	22	222	8065
Cornwall 008A	R	19	47	340	9435
Sheffield 073E	U	20	65	430	10148
Colchester 008G	U	21	9	82	5274
Herefordshire 020C	R	22	60	374	9665
Manchester 055C	U	23	18	184	7501
Ealing 018C	U	24	63	371	9612
Herefordshire 007F	R	25	53	323	9209
Birmingham 134E	U	26	75	455	10276
Birmingham 049B	U	27	77	457	10289
Herefordshire 006E	R	28	64	353	9432
Herefordshire 005B	R	29	56	321	9107
Herefordshire 018C	R	30	34	243	8200
Birmingham 070D	U	31	80	470	10285
Herefordshire 004B	R	32	69	364	9446
Herefordshire 005A	R	33	59	302	8886
Herefordshire 021A	R	34	30	219	7782
Herefordshire 023D	R	35	71	369	9430
Redbridge 009C	U	36	72	382	9501
Birmingham 136A	U	37	92	495	10395
Aylesbury Vale 010D	R	38	10	97	5500
St Edmundsbury 008E	R	39	17	148	6712
Hambleton 008E	R	40	21	164	6914

Source: Author

Further analyses of potential LSOA decile classification differences within the BHS domain were undertaken using different weighting combinations of ID2015 BHS domain scores and BHS scores derived from connected LSOAs. Table 5.2 illustrates a cross tabulation of ID2015 BHS domain deciles and the deciles of adjusted BHS domain deciles computed with 50% weightings of BHS scores calculated from connected LSOAs and 50% of ID2015 BHS domain scores.

Overall, approximately 85% of all LSOAs moved to different deciles. In the fourth, fifth, sixth and seventh deciles, approximately 90% of LSOA changed decile classification. Within the first and second most deprived deciles, approximately 53% and 87% of the LSOAs respectively, changed deciles classifications. At the other end of the scale where the least deprived LSOAs are grouped, 87% and 81% of LSOAs in the ninth and tenth deciles respectively change deciles. The tenth decile is the least deprived deciles.

Table 5. 2– Analysis of Changes in Decile Classification (I)

	BHS Domain - ID2015 (Most Deprived									Least Deprived)	
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
Adjusted BHS 50% Connected LSOAs Scores (Most Deprived … Least Deprived)	1	**1532**	223	157	129	138	129	154	166	226	430	3284
	2	1079	**438**	247	180	185	186	199	192	240	338	3284
	3	636	683	**359**	237	195	228	206	220	224	297	3285
	4	37	1035	446	**289**	251	225	239	250	251	261	3284
	5	0	736	530	401	**319**	279	262	267	244	247	3285
	6	0	169	859	490	375	**330**	287	269	256	249	3284
	7	0	0	638	655	478	398	**302**	306	264	244	3284
	8	0	0	49	776	624	485	390	**364**	332	264	3285
	9	0	0	0	127	680	638	557	501	**439**	343	3284
	10	0	0	0	0	40	386	688	750	808	**612**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

The above analysis was repeated using different combination of weightings. Findings from those analyses indicate that the higher the weightings assigned to the domain scores computed from connected LSOAs, the higher the proportion of LSOA decile classification changes. Tables 5.3 and 5.4 illustrates the results of the analyses using 25% of connected LSOA domain scores and 75% of connected LSOA scores respectively.

Table 5. 3– Analysis of Changes in Decile Classification (II)

	BHS Domain - ID2015 (Most Deprived									Least Deprived)	
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
Adjusted BHS 25% Connected LSOAs Scores (Most Deprived	1	**3016**	238	27	3	0	0	0	0	0	0	3284
	2	268	**2385**	423	114	63	24	7	0	0	0	3284
	3	0	661	**1648**	430	195	119	90	64	50	28	3285
	4	0	0	1131	**930**	359	226	160	122	127	229	3284
	5	0	0	56	1321	**662**	373	264	192	182	235	3285
	6	0	0	0	485	1046	**569**	372	291	232	289	3284
	7	0	0	0	1	868	820	**506**	418	340	332	3284
	8	0	0	0	0	92	953	767	**573**	463	436	3285
	9	0	0	0	0	0	200	966	883	**687**	549	3284
Least Deprived)	10	0	0	0	0	0	0	152	742	1203	**1187**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

Table 5. 4– Analysis of Changes in Decile Classification (III)

	BHS Domain - ID2015 (Most Deprived									Least Deprived)	
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
Adjusted BHS 75% Connected LSOAs Scores (Most Deprived	1	**367**	322	371	406	386	391	311	325	235	170	3284
	2	557	**378**	312	337	312	319	298	237	299	235	3284
	3	386	440	**330**	317	319	280	300	322	297	294	3285
	4	296	390	332	**320**	309	321	321	318	319	358	3284
	5	283	337	335	336	**342**	310	322	331	340	349	3285
	6	342	265	314	319	333	**343**	287	334	345	402	3284
	7	357	269	315	273	307	317	**353**	321	376	397	3284
	8	334	307	298	306	303	318	353	**339**	352	374	3285
	9	257	326	327	311	327	326	367	344	**352**	348	3284
Least Deprived)	10	105	250	351	359	347	359	372	414	369	**358**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author.

When the proportion of connected BHS scores was reduced to 25% (shown in Table 5.3), the decile classifications of 63% of the LSOA changed. The respective percentage at 75% of connected BHS domain scores was 89%.

Changes in the percentage of LSOA decile changes were similar at various combinations in terms of the deciles with the highest number of LSOAs that moved into different groups. The fifth, sixth and seventh deciles had the highest number of changes. The exception is at the combination of 75% connected LSOAs and 25 percent IMD2015 BHS domain scores where the proportionate change in decile classification was approximately 90 for all of the 10 groups. This is shown in Table 5.4 above.

The analyses thus far indicate that the impacts of local spatial context on the BHS domain is significant even when smaller weights are assigned to spatial relations through connected LSOAs. Proportionally, the impact is greater on rural areas than urban areas as the ranks of LSOAs in rural areas improving the most. Even though this is a significant finding, the objective here is to understand the extent to which such spatial relations can influence the overall IMD index through changes to the BHS domain scores. I will therefore proceed to present the empirical analyses undertaken to examine the extent to which changes in the BHS domain scores through the contextualisation of spatial relations impacts the overall 2015 Index of Multiple Deprivation.

5.3 Producing an Overall IMD Index Adjusted for Spatial Relations

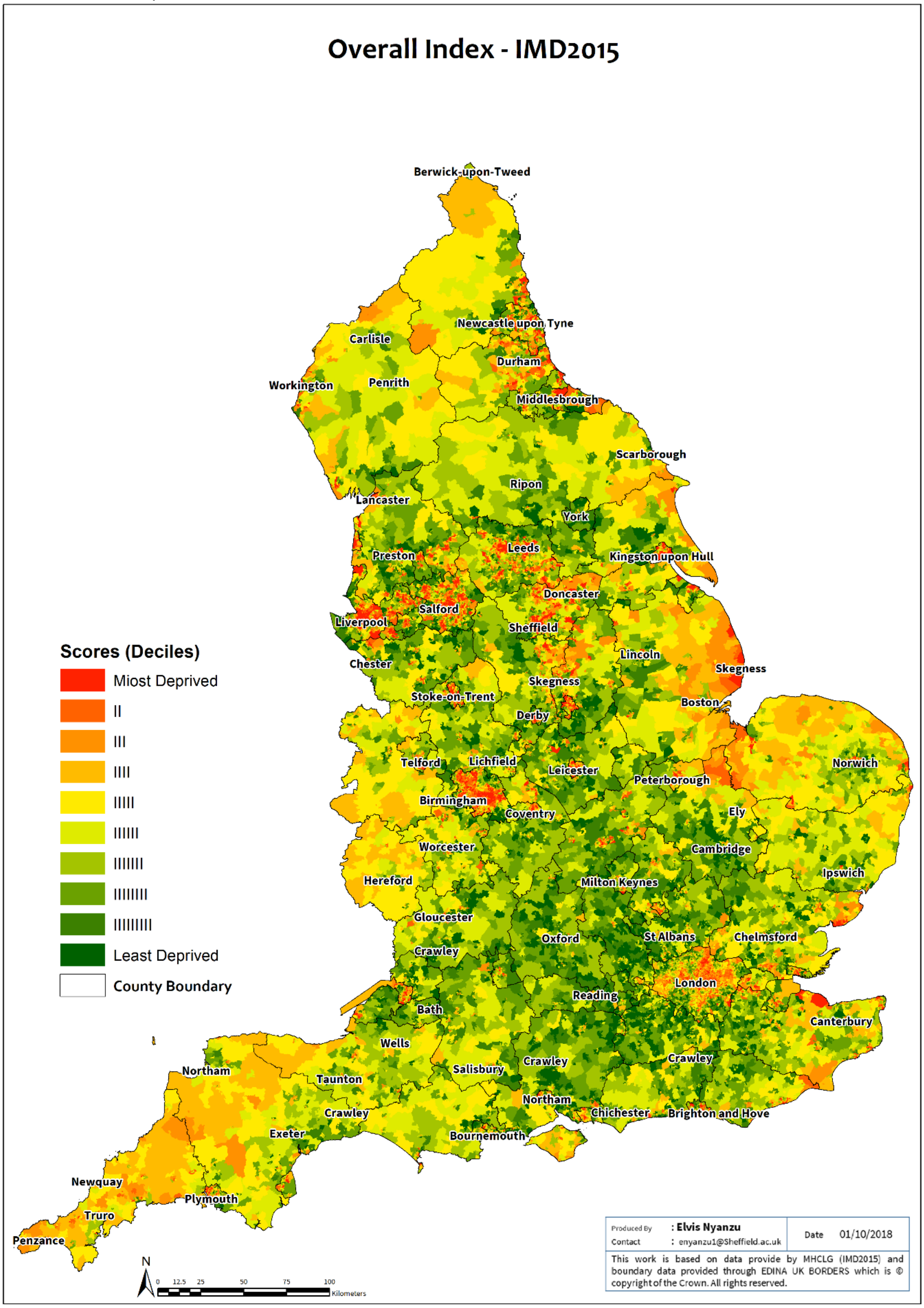
It is clear from the above analyses that interactions between connected LSOA affects the IMD2015 BHS domain scores. This is in line with the assertion that "phenomenon external to an area of interest affects what goes on in the inside" (Tobler, 1999, p. 87). The extent of influence depends on how much weight is considered appropriate to be assigned to the external influence through spatial relations. In this section, I present the analyses of the impacts of the adjusted BHS scores on the Overall IMD2015 scores.

Figures 5.5, 5.6, 5.7 and 5.8 are maps showing the original IMD2015 index and versions of the adjusted overall index in deciles. The adjusted IMD maps are made up of the IMD2015 domain scores for all seven domains using the same domain weights as the original IMD2015 index. The only adjustment made to the index is to the BHS domain scores as discussed above. It is therefore worth noting that the BHS domain of the IMD2015 is weighted 9.3% of the IMD index. This implies that adjustments to LSOA scores to test for sensitivity to different spatial relations only affects 9.3% of the overall index score.

Figure 5.6 is a map of the adjusted IMD scores with the BHS domain score made up of 25% external influence; spatial relations accounts for only 2.3% of the adjusted index. In this category, there are some obvious changes in deciles in areas such as Northumberland, Cornwall, Devon, Lincolnshire, Norfolk, Herefordshire, and North Yorkshire. Most of the LSOAs with changes to their respective deciles in these areas are within the third, fourth and fifth deciles as well as the three least deprived deciles.

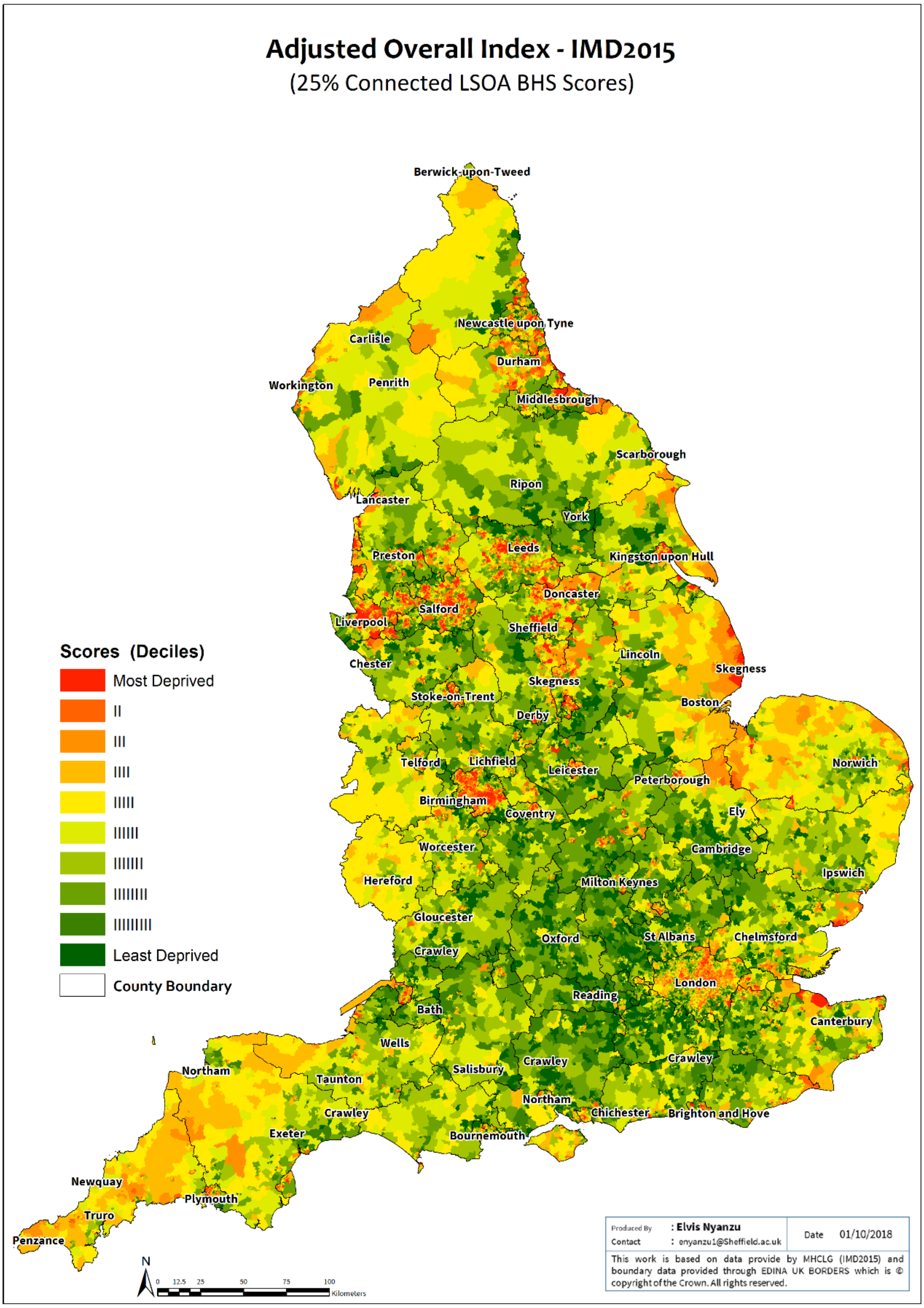
Figures 5.7 and 5.8 are modified versions of the IMD with 50% and 75% of the BHS domain scores assigned to spatial relations respectively. The areas previously mentioned continue to achieve better scores and move into less deprived deciles.

Table 5. 5– Comparisons of Variations to the overall IMD2015 – **Overall IMD2015**



Source: Author

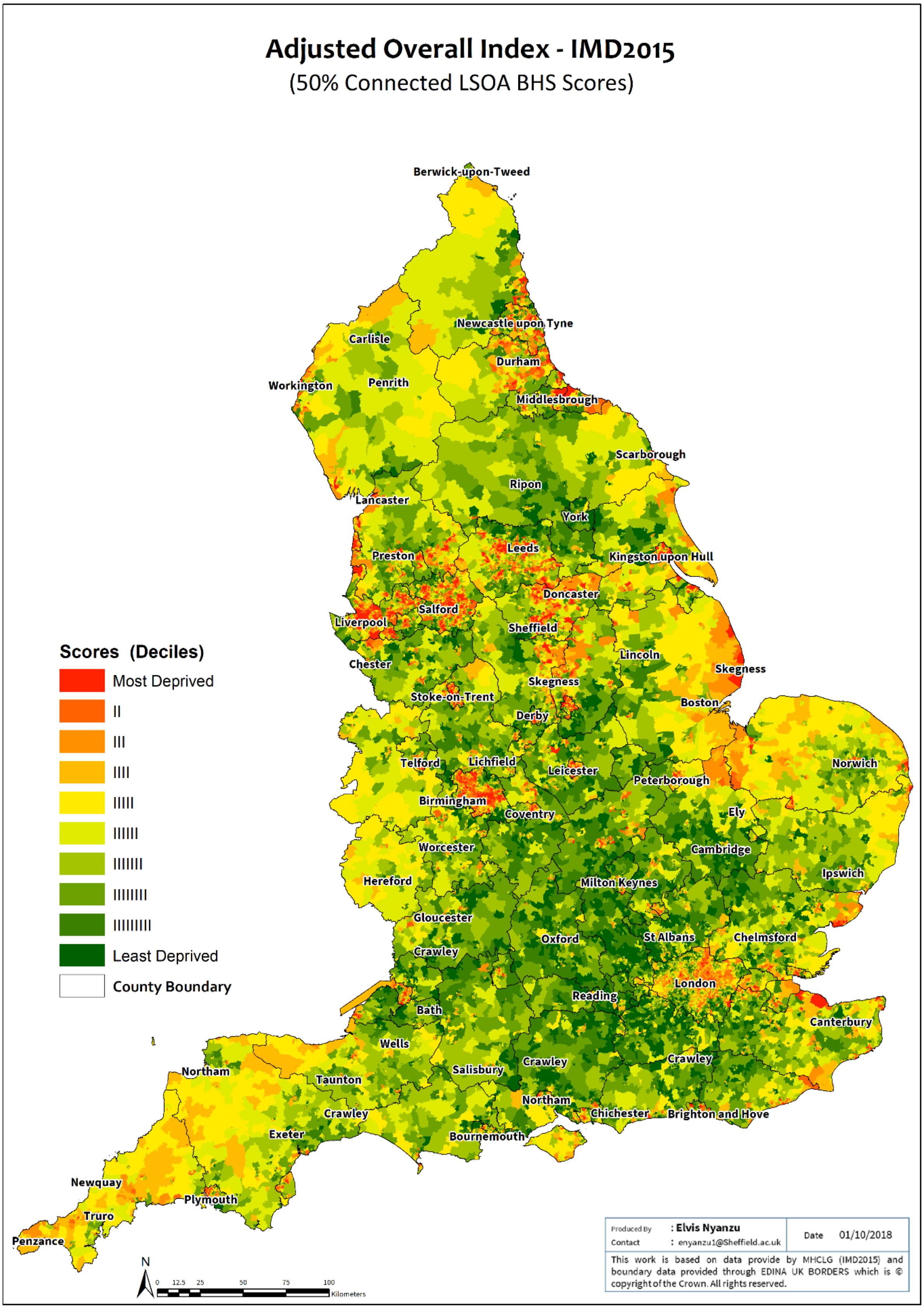
Table 5. 6– Comparisons of Variations to the overall IMD2015 – **25% Connected LSOAs**



Source: Author

Notes: Overall IMD scores computed with a combination of 25% of Connected LSOA scores and 75% of the original BHS domain scores in the same domain weightings

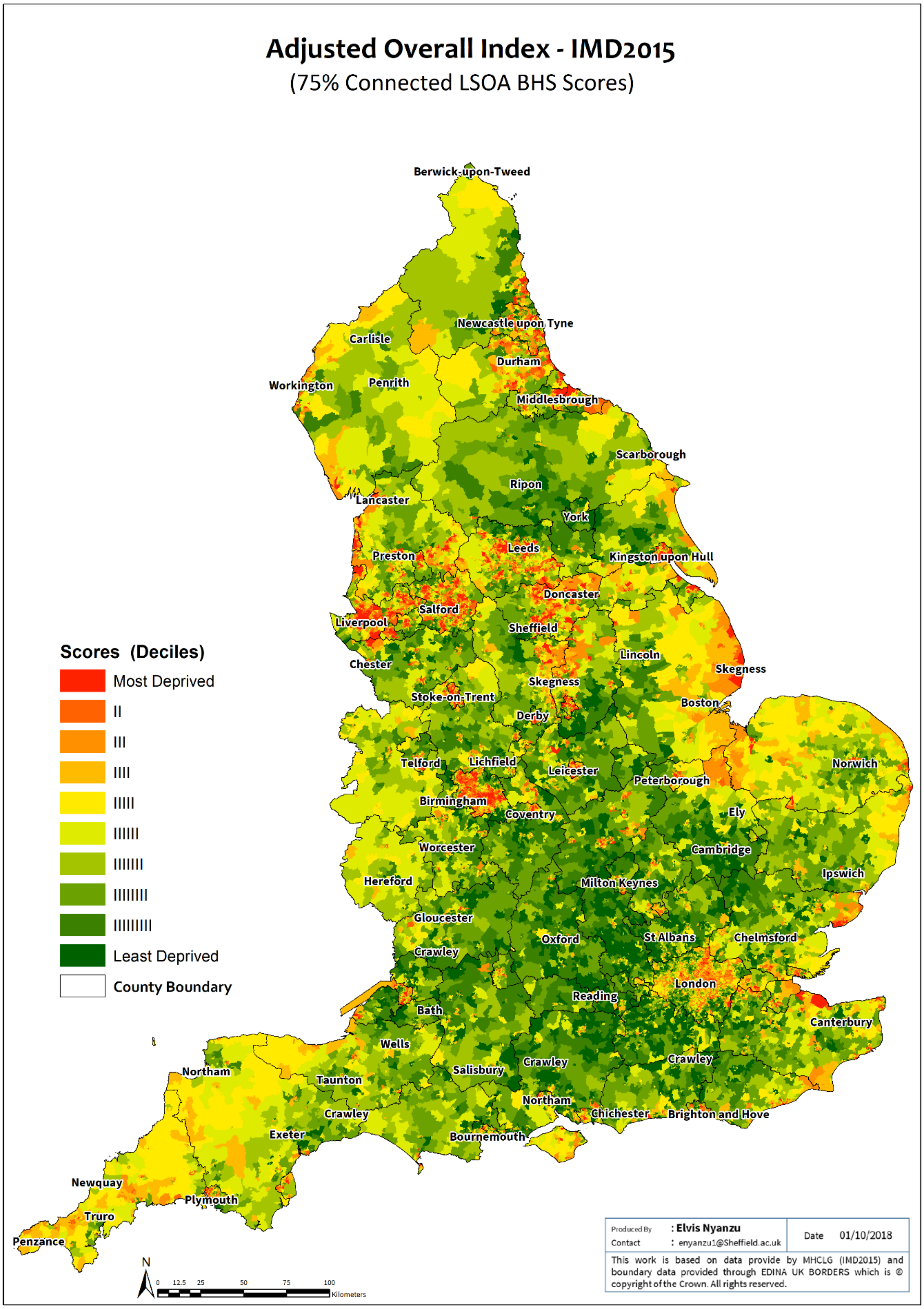
Table 5. 7– Comparisons of Variations to the overall IMD2015 – **50% connected LSOAs**



Source: Author

Notes: Overall IMD scores computed with a combination of 50% attributed to BHS domain scores directed from Connected LSOA and 50% of the original BHS domain scores in the same domain weightings

Table 5. 8– Comparisons of Variations to the overall IMD2015 – 75% Connected LSOAs



Source: Author

Notes: Overall IMD scores computed with a combination of 75% attributed to BHS domain scores directed from Connected LSOA and 25% of the original BHS domain scores in the same domain weightings

However, most of the LSOAs in the most deprived deciles within London, the coastal areas of Lincolnshire and LSOAs along the north-eastern coast remained in their original IMD2015 decile classifications. Deprived LSOAs within major towns and cities also mainly stayed within the same decile with some exceptions in London. For instance, several LSOAs within local authority areas of Newham, Hackney and Tower Hamlets had improved scores.

Table 5.9 shows the IMD2015 ranks of the first forty most deprived LSOAs and their new ranks when their spatial relations with other LSOAs are taken into account. The rankings of the three most deprived LSOAs - Tendring 018A, Blackpool 010A and Blackpool 006A remained unchanged at AIMD25 and AIM50. At AIMD75 Blackpool 010 moved from second to first whilst Tendering 0185A moved from first to second. Although there were changes in ranks within the selected group of LSOAs, most of them remained within the forty most deprived. At AIMD25 only 6 LSOAs move out of the forty most deprived group. The most improved LSOAs is Birmingham 121B which moved from IMD2015 rank of 38 to an AIMD25 rank of 64. It ranked 102nd, and 143rd within AIMD50 and AIMD75 respectively.

At AIMD25, AIMD50 and AIMD75 approximately 15%, 25% and 30% of LSOA among the 40 most deprived achieved new ranks higher than 40. The new ranks suggest these areas are relatively not as deprived as the IMD2015 ranks suggest. Considering spatial relations were only integrated into the BHS domain scores which accounts for 9.3% of the overall index, these changes in LSOA ranking suggest the role of spatial relations on the experiences of deprivation and affluences can be significant and should be considered when assessing neighbourhood deprivation.

Table 5. 9– Comparison of IMD2015 Ranks to Adjusted IMD Ranks

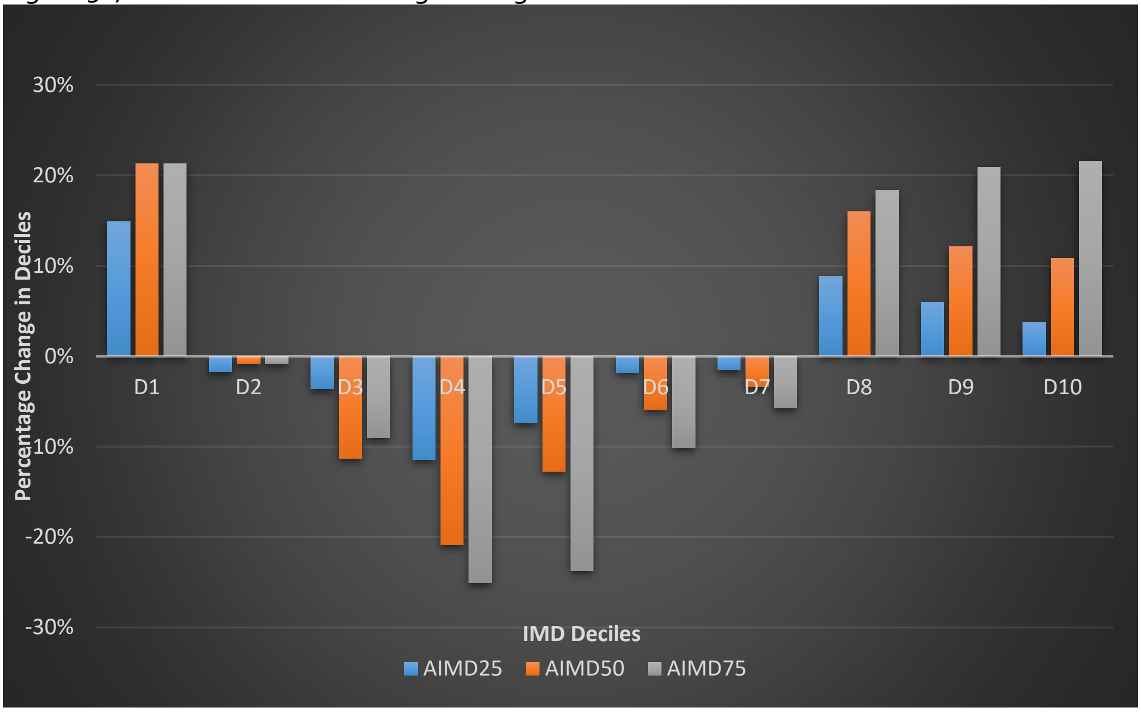
LSOA Name	Rural/ Urban	IMD2015 Rank	*Ranks after Adjustments to BHS Domain Scores* 25% AIMD25	50% AIMD25	75% AIMD25
Tendring 018A	R	1	1	1	2
Blackpool 010A	U	2	2	2	1
Blackpool 006A	U	3	3	3	3
Thanet 001A	U	4	8	13	17
Blackpool 013D	U	5	4	4	4
Tendring 016B	U	6	7	7	7
Blackpool 013A	U	7	5	5	6
Coventry 007E	U	8	15	23	39
Blackpool 011A	U	9	6	6	5
Waveney 007D	U	10	10	15	16
Blackpool 010E	U	11	9	8	8
Kingston upon Hull 017E	U	12	22	31	42
North East Lincolnshire 006A	U	13	18	18	19
Burnley 010E	U	14	14	14	14
Burnley 007C	U	15	17	17	15
Mansfield 009E	U	16	20	20	24
Blackpool 013B	U	17	11	9	9
Blackpool 006B	U	18	12	10	10
Blackburn with Darwen 006E	U	19	13	11	11
Great Yarmouth 006C	U	20	23	25	28
Thanet 001E	U	21	24	30	36
Leeds 086C	U	22	29	39	61
Blackpool 008D	U	23	16	12	12
Liverpool 012A	U	24	21	19	21
North East Lincolnshire 002B	U	25	25	28	29
Blackpool 008B	U	26	19	16	13
North East Lincolnshire 002A	U	27	27	29	31
Liverpool 028E	U	28	26	24	25
Liverpool 018F	U	29	32	34	37
Coventry 024C	U	30	52	89	138
North East Lincolnshire 002C	U	31	31	32	32
Manchester 009G	U	32	37	52	75
Rochdale 010C	U	33	39	48	63
Kingston upon Hull 017D	U	34	45	58	80
Thanet 003A	U	35	36	42	52
Wirral 011C	U	36	28	22	23
Leeds 082C	U	37	41	50	66
Birmingham 121B	U	38	64	102	147
Manchester 009A	U	39	54	70	94
Bradford 052B	U	40	47	55	72

Source: Author

An examination of the IMD and domain scores by the office of national statistics revealed that most rural LSOAs faired relatively well in all domains of the IMD2015 except in the BHS domain (ONS, 2009). In as much as rural LSOAs may well be deprived in this domain, it may also be that the basis of calculating the BHS domain scores put rural LSOAs at a disadvantage making them appear to be more deprived than they are in reality. In order to test for this, examined the rural/urban split in the various IMD deciles when changes made to the BHS domain scores to incorporate neighbourhood spatial relation in the calculation of the IMD.

Figure 5.6 shows the percentage change in deciles when the various versions of the revised IMD deciles are compared to the original IMD deciles. When 25% of the BHS domain scores was assigned to connected areas, the number of rural LSOAs in the most deprived decile increased by 15%. This increased to 21% when 50% and 75% of the BHS domain scores were attributed to connected areas. There were decreases in the second, third, fourth, fifth, sixth and seventh deciles. Deprivation decile four and five had most reduction in the proportion of rural LSOAs after adjustments to the BHS scores (average reduction of 19% and 15% respectively depending on the weight assigned to connected areas in the BHS domain).

Figure 5. 7– Rural LSOAs Percentage Change in Deciles



Source: Author

Notes: AIMD25 is the version of the IMD computed 25% of the BHS domain score attributed to spatial relations with other LSOAs. The spatial relations weighting in AIMD50 is 50% and AIMD75 is 75%.

Although regeneration projects and interventions aimed at spatial inequalities can be community and neighbourhood led, in most cases they are local government led with support from central government (DCLG, 2011). In this regard, it was worth looking at how local authority areas rank in terms of the proportion of their LSOAs in the most deprived decile and in the most deprived 20% of all LSOAs in England.

The first 25 local authority areas with the highest proportion of their LSOAs within these categories are presented in Tables 5.10 and 5.11 respectively (see Appendices XIX and XX for tables showing the first 60 local authority areas). In the most deprived decile, Middlesbrough remained the local authority area with the highest percentage of deprived LSOAs in all three scenarios. However, Knowsley and Kingston Upon Hull, ranked second and third respectively by the

IMD2015 moved to third and fourth respectively at all instances of the adjusted overall index.

Liverpool which is ranked 4th according to the IMD2015 index moves to second within all of the adjusted IMD versions. With the exception of Leicester, Tower Hamlets and St Helens, all local authority districts remained within the 25 most deprived LADs at AIMD25. At AIMD50, Tower Hamlet, St Helens and Wolverhampton were the exceptions. The most improved LAD within this group after adjustment to the IMD is Tower Hamlet – the only London borough within the 25 most deprived LADs. Tower Hamlet was originally ranked 24th by the IMD2015 but achieved new ranks of 43rd, 51st and 91st respectively.

With the exception of Middlesbrough, all 25 LADs changed ranks in at least one of the 3 combinations illustrated in Table 5.10. Whilst some local authority areas improved in rankings, the ranks of others deteriorated.

When LADs are ranked according to the proportion of their total number of LSOAs within the most deprived 20% of the overall IMD2015 index (this includes LSOAs in the most deprived decile), Knowsley is the most deprived LAD with approximately 61% of its LSOAs in the most deprived 20% of the 2015 IMD. With an increased number of LSOAs under consideration, Middlesbrough is ranked 7th in this category.

The three most deprived LADs; Knowsley, Liverpool and Nottingham retained their respective ranks at AIMD25. At AIMD50 Nottingham moved to forth whilst the Knowsley and Liverpool were remained first and second respectively. At

AIMD75 Blackpool became the most deprived LAD, Knowsley and Liverpool were ranked second and third respectively.

Comparatively, the largest variations in LAD ranks occurred at AIMD75, the three London boroughs of Hackney, Barking and Dagenham and Tower Hamlets made the most improvements in LAD ranks. It is worth noting that the only adjustment made to the IMD2015 overall index scores to obtain AIMD75 is that 75% of the BHS domain scores was obtained from the domain scores of connected LSOA. Given that the BHS domain is weighed 9.3% it implies that this change represents approximately 7% of the overall index scores. Considering LADs such as the London Boroughs of Hackney, Tower Hamlet and Barking and Dagenham moved from ranks of 8th, 6th and 4th to new ranks of 40th, 12th and 37th respectively at AIMD75, it can be argued that spatial relations can have significant impacts on deprivation and that there is a strong case for reviewing the computation of the IMD to accommodate the role of local spatial context.

To gain further insight into how spatial relations impacts the overall IMD, the deciles of the IMD2015 were compared to deciles of AIMD25 and AIMD50. The results of differences in decile classifications at AIMD25 are shown in Table 5.12. Approximately 13% of all English LSOAs were classified in different deprivation deciles after adjusting the IMD. Deprivation deciles seven and eight recorded the highest percentage of LSOA which changed decile classification (19%).

Table 5. 10– Ranking of Local Authorities in the most Deprived Decile of the IMD

Local Authority Districts	*Number of LSOAs*	IMD2015		AIMD25		AIMD50		AIMD75	
		Percentage of Deprived LSOAs	*Rank*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*
Middlesbrough	86	48.8%	1	48.8%	1	51.2%	1	51.2%	1
Knowsley	98	45.9%	2	45.9%	3	45.9%	3	46.9%	3
Kingston upon Hull, City of	166	45.2%	3	45.2%	4	44.0%	4	44.0%	4
Liverpool	298	45.0%	4	46.6%	2	47.3%	2	48.0%	2
Manchester	282	40.8%	5	40.8%	5	40.8%	6	40.4%	7
Birmingham	639	39.6%	6	37.2%	8	34.1%	10	31.9%	15
Blackpool	94	38.3%	7	40.4%	6	41.5%	5	43.6%	6
Nottingham	182	33.5%	8	31.9%	12	31.3%	15	30.8%	18
Burnley	60	33.3%	9	35.0%	9	36.7%	8	40.0%	8
Hartlepool	58	32.8%	10	34.5%	10	36.2%	9	36.2%	10
Bradford	310	32.6%	11	32.3%	11	32.3%	13	32.6%	14
Blackburn with Darwen	91	30.8%	12	37.4%	7	39.6%	7	44.0%	5
Hastings	53	30.2%	13	30.2%	15	30.2%	18	30.2%	20
Stoke-on-Trent	159	30.2%	14	31.4%	14	33.3%	12	34.6%	13
North East Lincolnshire	106	29.2%	15	30.2%	16	32.1%	14	35.8%	11
Salford	150	28.7%	16	28.7%	17	28.0%	21	28.0%	23
Rochdale	134	28.4%	17	28.4%	18	29.1%	19	28.4%	22
Pendle	57	28.1%	18	31.6%	13	33.3%	11	35.1%	12
Halton	79	26.6%	19	26.6%	20	27.8%	22	30.4%	19
Great Yarmouth	61	26.2%	20	26.2%	22	26.2%	24	26.2%	24
Wolverhampton	158	25.9%	21	24.7%	24	23.4%	29	22.2%	38
Hyndburn	52	25.0%	22	26.9%	19	30.8%	16	30.8%	17
Leicester	192	24.0%	23	24.5%	26	24.5%	25	25.5%	26
Tower Hamlets	144	23.6%	24	20.1%	43	17.4%	51	9.7%	91
St. Helens	119	23.5%	25	24.4%	27	24.4%	26	25.2%	27

Source: Author

Table 5. 11 – Ranking of the 20% Most Deprived Local Authority Areas

Local Authority Districts	*Number of LSOAs*	IMD2015		AIMD25		AIMD50		AIMD75	
		Percentage of Deprived LSOAs	*Rank*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*
Knowsley	98	61.2%	1	62.2%	1	64.3%	1	64.3%	2
Liverpool	298	60.7%	2	61.4%	2	61.7%	2	63.4%	3
Nottingham	182	60.4%	3	60.4%	3	60.4%	4	60.4%	5
Barking and Dagenham	110	59.1%	4	52.7%	12	46.4%	20	40.0%	37
Manchester	282	58.5%	5	58.2%	4	56.7%	6	56.4%	7
Tower Hamlets	144	58.3%	6	55.6%	6	54.2%	8	52.1%	12
Middlesbrough	86	57.0%	7	58.1%	5	58.1%	5	58.1%	6
Hackney	144	55.6%	8	51.4%	14	41.7%	32	38.2%	40
Sandwell	186	54.8%	9	53.2%	9	52.7%	11	52.2%	11
Birmingham	639	54.8%	10	53.2%	10	52.0%	12	50.9%	15
Kingston upon Hull, City of	166	52.4%	11	53.0%	11	53.0%	10	53.0%	10
Wolverhampton	158	51.3%	12	51.3%	15	50.6%	16	50.6%	17
Blackpool	94	51.1%	13	55.3%	7	61.7%	3	68.1%	1
Stoke-on-Trent	159	50.9%	14	51.6%	13	51.6%	14	54.7%	9
Blackburn with Darwen	91	49.5%	15	54.9%	8	56.0%	7	61.5%	4
Halton	79	49.4%	16	50.6%	16	50.6%	15	50.6%	16
South Tyneside	102	47.1%	17	47.1%	18	47.1%	18	47.1%	19
Walsall	167	46.1%	18	46.1%	21	46.1%	22	46.1%	21
Burnley	60	45.0%	19	50.0%	17	53.3%	9	55.0%	8
Hyndburn	52	44.2%	20	46.2%	20	51.9%	13	51.9%	13
Salford	150	44.0%	21	45.3%	22	45.3%	24	45.3%	23
Islington	123	43.9%	22	41.5%	28	40.7%	35	36.6%	43
Leicester	192	43.2%	23	45.3%	23	45.8%	23	45.8%	22
Hartlepool	58	43.1%	24	46.6%	19	50.0%	17	51.7%	14
Bradford	310	42.3%	25	42.9%	26	42.9%	28	43.9%	25

Source: Author

The decile with the least percentage change is the most deprived decile (3%). Percentage change in the least deprived decile was 7%. Overall, changes in decile classifications occurred in both directions with almost identical split between LSOAs which had improved deciles and LSOAs that moved into deprived deciles.

Table 5. 12 -- IMD2015 and Adjusted IMD with 25% Linked LSOA Scores in the BHS Domain

		IMD2015 (Most Deprived						Least Deprived)				
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
AIMD25 25% Linked LSOAs Scores (Least Deprived Most Deprived)	1	**3185**	99	0	0	0	0	0	0	0	0	3284
	2	99	**3029**	156	0	0	0	0	0	0	0	3284
	3	0	156	**2936**	193	0	0	0	0	0	0	3285
	4	0	0	193	**2854**	237	0	0	0	0	0	3284
	5	0	0	0	237	**2795**	253	0	0	0	0	3285
	6	0	0	0	0	253	**2731**	300	0	0	0	3284
	7	0	0	0	0	0	300	**2668**	317	0	0	3284
	8	0	0	0	0	0	0	316	**2654**	314	0	3285
	9	0	0	0	0	0	0	0	314	**2739**	232	3284
	10	0	0	0	0	0	0	0	0	231	**3053**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

Table 5. 13 -- IMD2015 and Adjusted IMD with 40% Linked LSOA Scores in the BHS Domain

		MD2015 (Most Deprived						Least Deprived)				
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
AIMD40 50% Linked LSOAs Scores (Least Deprived Most Deprived)	**1**	**3094**	190	0	0	0	0	0	0	0	0	3284
	2	190	**2785**	309	0	0	0	0	0	0	0	3284
	3	0	309	**2599**	377	0	0	0	0	0	0	3285
	4	0	0	377	**2437**	469	1	0	0	0	0	3284
	5	0	0	0	469	**2295**	512	9	0	0	0	3285
	6	0	0	0	1	513	**2167**	582	21	0	0	3284
	7	0	0	0	0	8	583	**2050**	617	27	0	3284
	8	0	0	0	0	0	21	629	**2052**	573	9	3285
	9	0	0	0	0	0	0	14	594	**2235**	442	3284
	10	0	0	0	0	0	0	0	1	449	**2834**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

Table 5. 14 -- IMD2015 and Adjusted IMD with 75% connected LSOA Scores in the BHS Domain

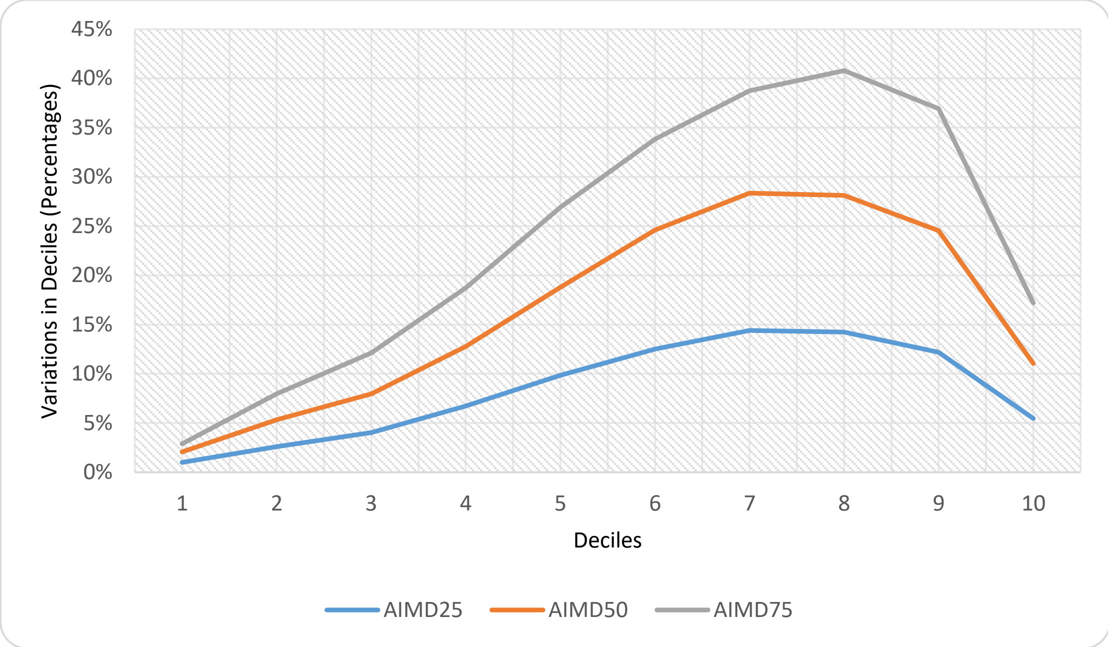
AIMD75 75% Linked LSOAs Scores (Least Deprived ← Most Deprived)	**IMD2015** (Most Deprived → Least Deprived)										
Deciles	1	2	3	4	5	6	7	8	9	10	Total
1	**2998**	286	0	0	0	0	0	0	0	0	3284
2	286	**2561**	437	0	0	0	0	0	0	0	3284
3	0	437	**2280**	556	12	0	0	0	0	0	3285
4	0	0	561	**2046**	640	37	0	0	0	0	3284
5	0	0	7	639	**1879**	685	73	2	0	0	3285
6	0	0	0	43	657	**1724**	731	127	2	0	3284
7	0	0	0	0	97	701	**1609**	743	132	3	3284
8	0	0	0	0	0	132	742	**1610**	734	66	3285
9	0	0	0	0	0	5	126	751	**1813**	590	3284
10	0	0	0	0	0	0	3	52	603	**2626**	3285
Total	3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

The result of the comparison between the deciles of AIMD50 and the deciles of the IMD2015 Index are presented in Table 5.13 above. Approximately 25% of the 32844 LSOAs moved into different deprivation deciles. As expected, the higher the weight assigned to spatial relations, the higher the number of LSOAs with varying decile classifications. The proportion LSOAs in the most deprived decile which moved into other deciles was 6%, approximately 91 LSOAs more than the number of LSOAs that changed deciles at AIMD25. The results of AIMD75 presented in Table 5.14 depicts a similar pattern to AIMD25 and AIM50 discussed above.

Although the percentage of LSOA decile changes within all deciles at AIMD50 and AIMD75 are more than they were at AIMD25, they follow a similar pattern. The number of LSOAs that changed decile classifications increase from the first deciles through to the seventh decile at which point it peaks. It then begins to decrease towards the least deprived decile (see Figure 7.22).

Figure 5. 8– Illustration of LSOAs decile changes within AIMD25, AIMD50 and AIMD75



Source: Author

5.4 **Conclusion**

This section of the empirical analyses sought to address the research question relating to the impact of spatial relations on the measurement of neighbourhood deprivation (Research question 1). LSOA interrelations were found to have relatively higher than expected impact on the measurement of deprivation. For instance, giving that the BHS domain is only 9.3% of the overall index, if the weight assigned to connected LSOA is considered to be 50% within the BHS domain and remaining 50% assigned to the original BHS domain scores, the adjustment made to the overall index is 4.67%. At this level, 25% of LSOAs representing 8211 LSOAs could potentially be misclassified, impacting approximately 10 million people. Where an intervention targets LSOAs within the most deprived decile, about 190 LSOAs could be mistargeted with the same number of LSOA missing out on such intervention opportunities because they are not classified in the appropriate decile. With 650 average household per LSOA, this implies that approximately 82,500 households could potential be affected. If a higher weight is assigned to the BHS domain, the impact could be significantly higher. The empirical analyses also suggest that the impact spatial relations on deprivation appear to be higher on rural LSOAs than urban LSOAs.

The approach described within this chapter makes it possible to identify relevant LSOAs to a target LSOA in terms of spatial relations and determine their individual weights without the limitations of the traditional approaches to specifying spatial weights. Over a period of time, this approach can also make it possible to measure and quantify the efficiency of certain initiatives aimed at improving connectivity between various parts of the country and how they impact deprivation levels. For instance, the impact HS2 and the proposals under the northern power house development.

Spatial relations are just one of the ways way through which the IMD can take into account geography and locational attributes in assessing relative deprivation. Another aspect which should be considered is clustering of deprivation and affluence due to differences in spatial structure and scale. Empirical analyses undertaken with respect to the sensitivity of the IMD to these spatial contexts are presented in the next chapter.

6. EFFECTS OF DIFFERENCES IN SPATIAL STRUCTURE ON THE MEASUREMENT OF DEPRIVATION

The empirical analyses of the impact of taking into account two other aspects of spatial context (spatial structure and spatial scale) on the measurement of deprivation are presented in this chapter. The relevance of spatial concentration of deprivation and affluence to experiences of deprivation and the translation of individual attributes into desired outcomes has been established throughout the preceding chapters. Government initiatives such as the devolution of powers to local authority governments and the focus on sectorial initiatives like the northern power house project were in part necessitated by the clustering of deprivation and the unequal distribution of wealth across the country. The promotion of area based regeneration programmes were also based on the understanding of the impacts segregation and deprivation which excludes groups of people from "mainstream" socioeconomic processes within the country (Harris and Johnston, 2003).

In spite of the sustained attempts to reduce spatial concentrations of affluence and deprivation in England for decades, the phenomenon has remained a problem for successive governments. In fact, some argue that the gap between the deprived and the affluent has widened (Lawless, 2004, Rhodes et al., 2005). The approach used in identifying deprived areas for policy targeting is critical to the quest to reduce spatial socioeconomic inequality. However, the Indices of

Deprivation in England and its regional variations are based on the socioeconomic attributes of inhabitants and underplays the significance of the spatial circumstances of these areas.

As discussed in various sections of this thesis, the spatial context within which deprivation manifests matter and there is the need for it to be taken into account when assessing deprivation. This is not only necessary for the appropriate identification and classification of deprived areas, but also relevant to the understanding of the spatial extent of the relevant issues and inform the design and implementation of appropriate intervention programmes.

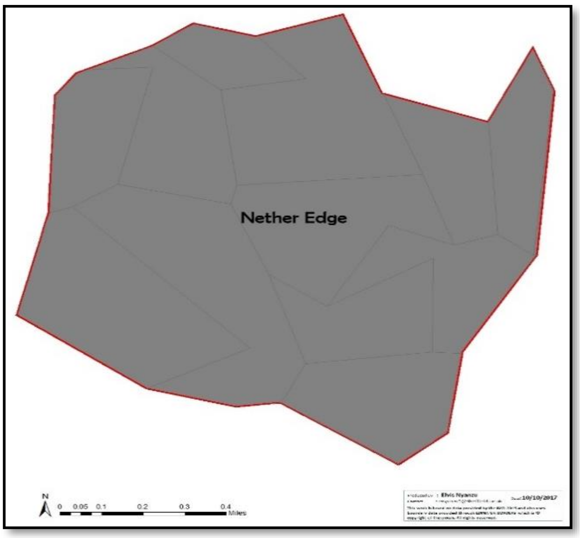
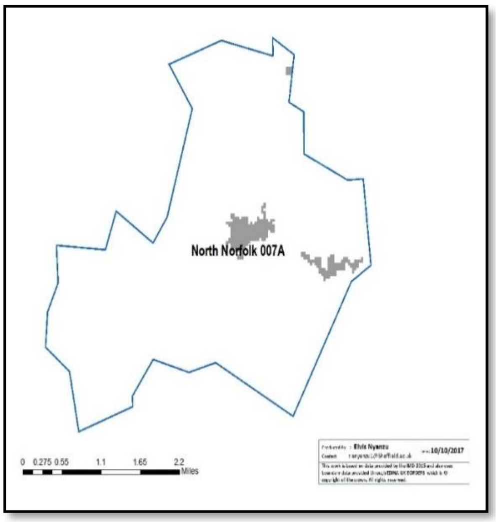
In earlier chapters of this thesis, local spatial context was unpacked into spatial relations, spatial scale and spatial structure. The effect of spatial relations on the measurement of deprivation has been examined and presented in Chapter 5. The impacts of spatial structure and spatial scale are presented in the rest of this chapter.

6.1 **Contextualizing Spatial Structure and Scale in Assessing Deprivation**

As discussed in Chapters 4 and 5, socioeconomic processes take place at various spatial scales. Ignoring the relevance of these scales can result in over-boundedness or under-boundedness when assessing deprivation especially when dealing with smaller units like Lower Layer Super Output Areas (LSOA) (Rae, 2009a) (LSOAs. In urban areas where population densities are very high, a number of LSOAs need to be combined to form what can be described as a 'neighbourhood' in order to fully appreciate the scale of issues affecting the level of deprivation within the area. Certain socioeconomic processes also continue beyond the community boundary limits into larger areas like an entire city region or in some cases an entire administrative district. Conversely, isolated areas like some rural LSOAs may have socioeconomic processes occurring within the target LSOA with little or no interaction with other LSOAs.

To illustrate what has been described above, Figure 6.1 shows two areas with very different spatial attributes. Nether Edge, shown in Map A is an area in Sheffield with high population density and completely built up. It has 12 LSOAs covering a total area of approximately 1.86 square miles. Map B is a single rural LSOA with only small proportion of its total area of approximately 18.6 square miles being built-up. People who live in LSOAs within Nether Edge (map A) are likely to have higher spatial interdependencies regarding socioeconomic processes within the group of LSOAs than the residents of North Norfolk 007A and its surrounding LSOAs.

Figure 6. 1 - Neighbourhood Spatial Structural Differences

Map A	Map B
	

Source: Author

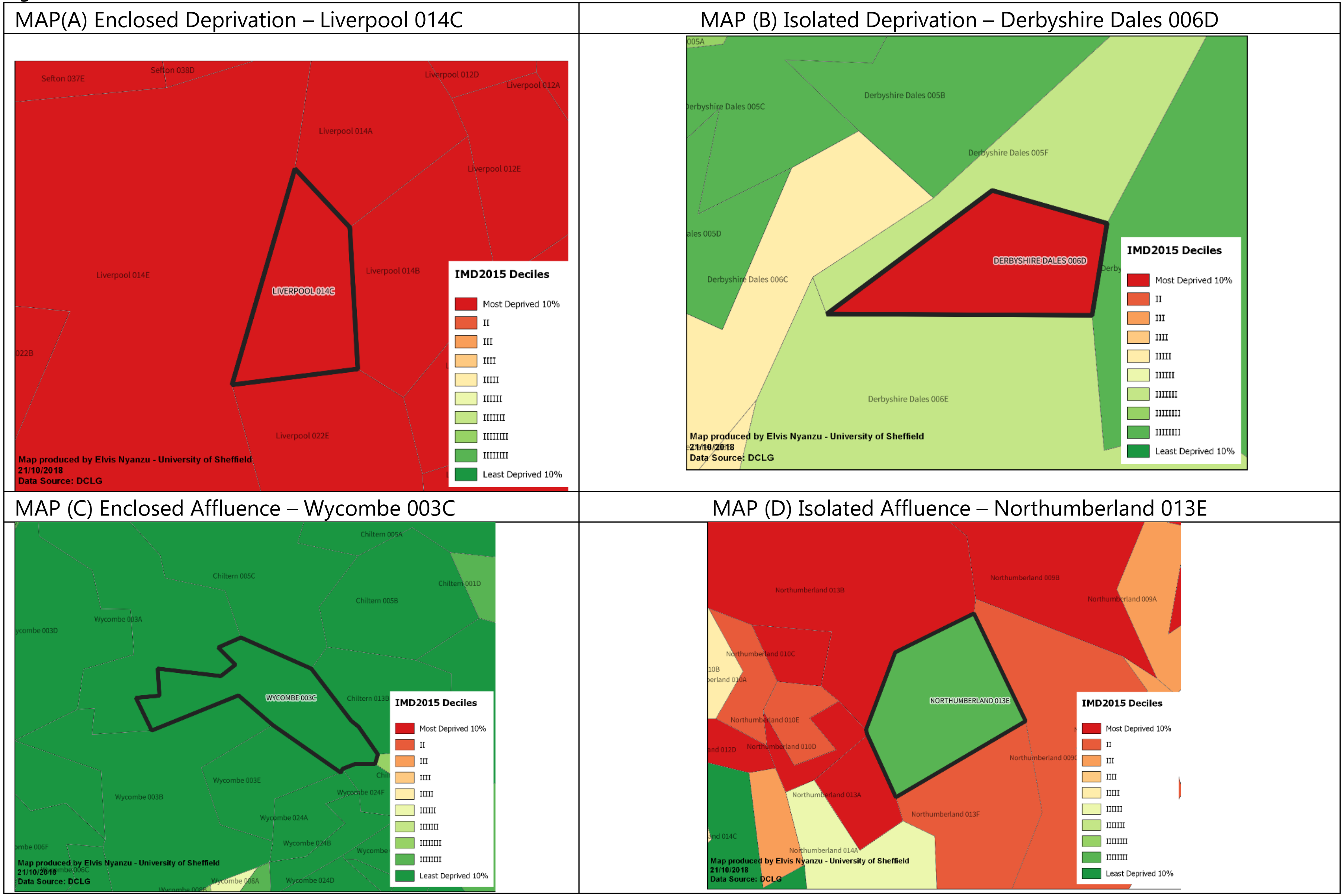
The existence of these spatial scalar differences and their impacts on spatial inequality and deprivation need not only be acknowledged but also incorporated in the measurement of deprivation.

Closely related to spatial scale is spatial structure which is concerned with the state of the socioeconomic conditions of an area (in this case LSOA) relative to the socioeconomic conditions of other LSOAs within its wider environs. The manifestation of neighbourhood deprivation over space can be categorised into four main typologies: isolated deprivation, isolated affluence, enclosed deprivation and enclosed affluence (Rae, 2009). An LSOA is said to be in the category of *isolated deprivation* if the LSOA is deprived but within the general environs of affluent LSOAs. The reverse, where an affluent LSOA is within a generally deprived wider area is said be *isolated affluence. Enclosed deprivation* is the situation where an LSOA is within a deprived wider area and *enclosed affluence* is when the LSOA is within a generally wider area of affluence.

Figures 6.2 below is an illustration of enclosed deprivation, isolated deprivation, enclosed affluence and isolated affluence. Based on a visual inspection of LSOAs IMD2015 decile classification map, Liverpool 014C (map A) is a deprived LSOA within a cluster of deprived LSOAs and can be described to be experiencing spatially enclosed deprivation. Derbyshire Dales 006D (Map B) is a deprived LSOA within a cluster of relatively affluent LSOAs and therefore deemed to be in the isolated deprivation. Map C shows Wycombe 003C which is in the least deprived decile of the IMD2015 and also within a cluster of LSOAs that have been categorised as being generally affluent. This is an illustration of enclosed affluence. Northumberland 013E can be described as an isolated affluence because it is in one of the least deprived deciles of the IMD2015 but within a cluster of LSOAs that are within the most deprived deciles.

Although, LSOAs experiencing isolated deprivation or enclosed deprivation may exhibit similar socioeconomic characteristics within their respective LSOAs, each situation poses different challenges. For instance, proponents of bridging social capital would suggest that holding all other factors constant but for their spatial context, residents of Derbyshire Dales 006D (Figure 6.2 MAP B) are in a better position to form relations with their affluent neighbourhoods which can help them 'get ahead' (Putman, 2000) than residents of Liverpool 014C (Figure 6.2 – map A), even though in terms of within neighbourhood attributes, both LSOAs are deprived. In addition, isolated deprivation and enclosed deprivation may require different approaches to tackle the respective issues in order to address the widening disparity between deprived and affluent areas. It is therefore necessary to incorporate these spatial differences in the assessment of relative deprivation.

Figure 6. 2 - Illustration of the four main LISA Classification



Source: Author

*8.2.1 **Assessing Spatial Association and Specifying Spatial weights***

As discussed in Chapters 4 and 5 there are several approaches to assessing spatial association and to examine the effects of spatial scale and structure on deprivation. Each of these approaches have specific benefits and limitations. The preference for global Moran's I and Local Indicators of Spatial Autocorrelation (LISA) is continued in this section of the analysis.

Within the global Moran's I technique there are several ways of specifying relevant spatial weights. Various approaches such as adjacency, distance and Nearest-K neighbour approaches were tested and each produced different results. This is expected because with analysis of spatial association, the approach used in determining the spatial weight significantly influences the results (De Smith et al., 2007). It is therefore recommended that the same approach to specifying spatial weights is used if a comparative study of results from different time periods are being undertaken for consistency (Rae, 2009).

Since spatial structural and scalar context of LSOAs and their environs are of interest in this part of the analysis, the approach to determine spatial weight has to be one which centralises the target LSOA within the context of its neighbouring LSOAs. As highlighted in Chapter 4, nearest K-neighbour and the distance approaches do not always fulfil this requirement. Attempts to ensure this requirement is met through these two approaches leads to over specification of neighbours and overgeneralisation of the results. The adjacency criteria or contiguity approach was deemed appropriate because it is the only approach which guarantees that the target LSOA is centralised in all instances when specifying spatial weights. In addition, it ensures all LSOAs which are physically bounded to the target LSOA are included in the analysis.

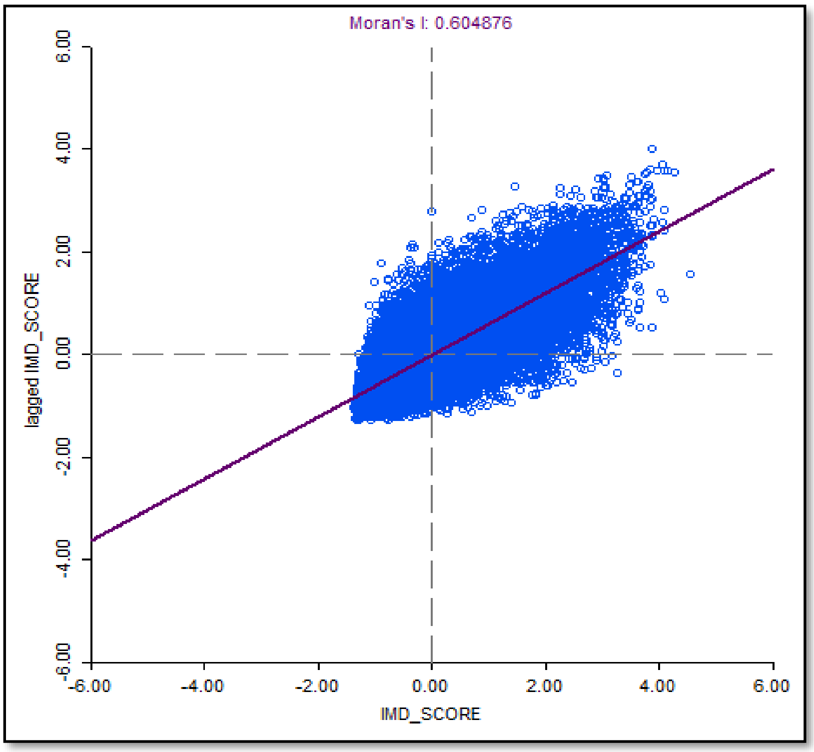
An important consideration in spatial autocorrelation analysis using the adjacency criteria is the order of contiguity. The choice of contiguity structure and order should be influenced by the knowledge of the spatial relationships between polygons (LSOAs) where possible (Flahaut et al., 2003). As discussed in Chapters 4, there are three main types of contiguity representations – rook, queen and bishops. In this instance, queen contiguity is considered the most appropriate option as it ensures all adjoining LSOAs are included in the analysis.

6.2 **Locational Context of IMD2015 Scores**

In order to understand the extent to which the IMD2015 scores for LSOAs in England are influenced spatially, global Moran's I statistics at first order queen contiguity was computed and the results are illustrated in Figure 6.3. From the scatter plot, where the IMD scores are plotted against the lagged IMD scores, there is a positive spatial association between the variables. In terms of quantification, the resulting global Moran's I statistic of 0.6049 is the quantifiable measure which is used to measure the extent of spatial dependency and the nature of relationship – in this case, a strong positive spatial association between IMD Scores[25]. A positive Moran's I statistic suggest the prevalence of spatial clustering of deprivation.

[25] Moran's I statistics values falls within -1 and +1. Where values approaching -1 indicates strong negative spatial association, values approaching +1 indicates strong positive spatial association. Values around 0 suggests randomness.

Figure 6. 3 - Moran's I scatter Plot



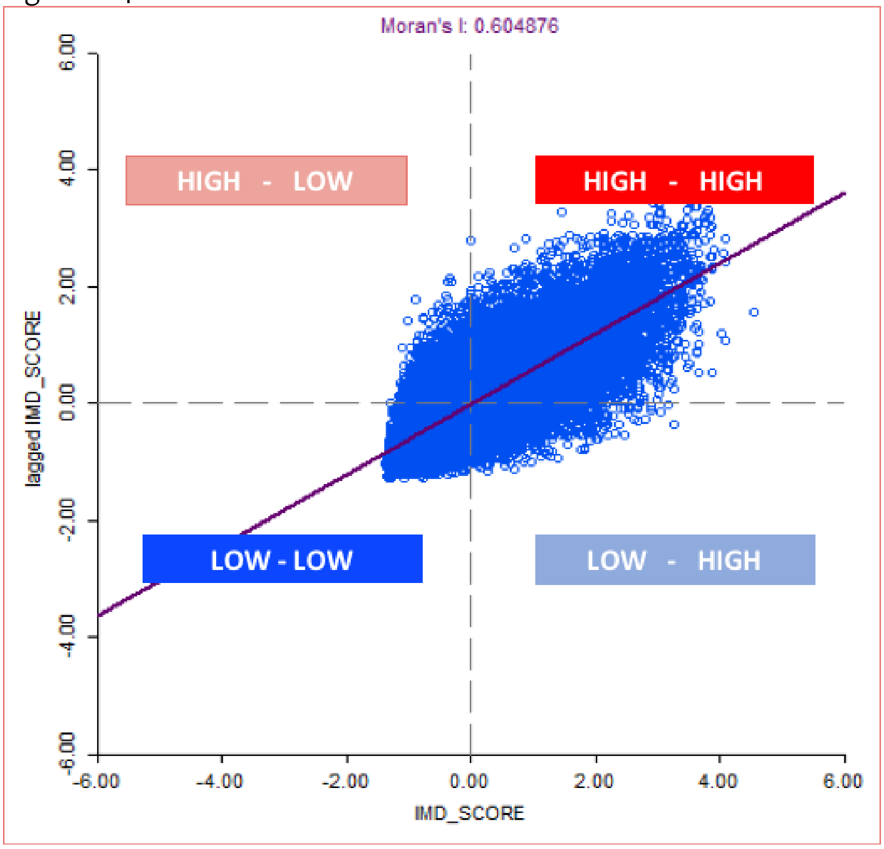
Source: Author

Whereas the Global Moran's I is very useful in indicating the extent of spatial association within the data, to understand the nature of clustering which accounts for the overall figure of 0.6049 and to identify areas of the country which are more or less clustered, further analyses are required. In this regard, Anselin (1995) Local Indicator of Spatial Association (LISA), also known as Local Moran's I statistics were computed for LSOAs. The LISA statistics tests for local spatial association. Where the statistic is significant, the type of association is determined and classified into one of the four main LISA cluster types.

In GeoDA, a LISA cluster classification of 1 is assigned to all LSOAs within the top right quadrant of the Moran's I scatter plot (see Figure 6.4) and refers to high IMD scores within a cluster of LSOAs with high IMD scores. A classification of 2 is assigned to LSOA within the Lower left quadrant of the scatter plot and refers to LSOAs with Lower IMD scores within a cluster of similarly lower IMD scores. LSOAs within the top left quadrant are classified as 3, these are outliers and have high IMD scores within a cluster of LSOAs with generally low IMD Scores or LSOAs with IMD scores deemed to be insignificant in terms of spatial dependency. The final classification given to LSOAs with significant local Moran's I statistics is 4; this is assigned to outlier LSOAs with lower IMD scores but within a cluster of LSOAs with high IMD scores or with insignificant LISA statistics for spatial dependency. These can be found in the lower right quadrant of the scatter plot.

A LISA classification of zero (0) is assigned to all LSOAs with insignificant local Moran's I statistics. These LSOAs may have high or low scores but their scores are not significantly influenced by scores of other LSOAs.

Figure 6. 4 - LISA Classifications



Source: Author

Rae's (2009) LISA classification typology of enclosed deprivation, isolated deprivation, enclosed affluence and isolated affluence used in describing the four main LISA clusters has been adopted in this analysis and presented in Table 6.1 below.

Table 6. 1 - Local Moran's I Classification

LISA Classification	Description	Rae's Typology
1	High-High	Enclosed Deprivation
2	Low-Low	Enclosed Affluence
3	Low-High	Isolated Deprivation
4	High- Low	Isolated Affluence
0	Insignificant (statistically)	

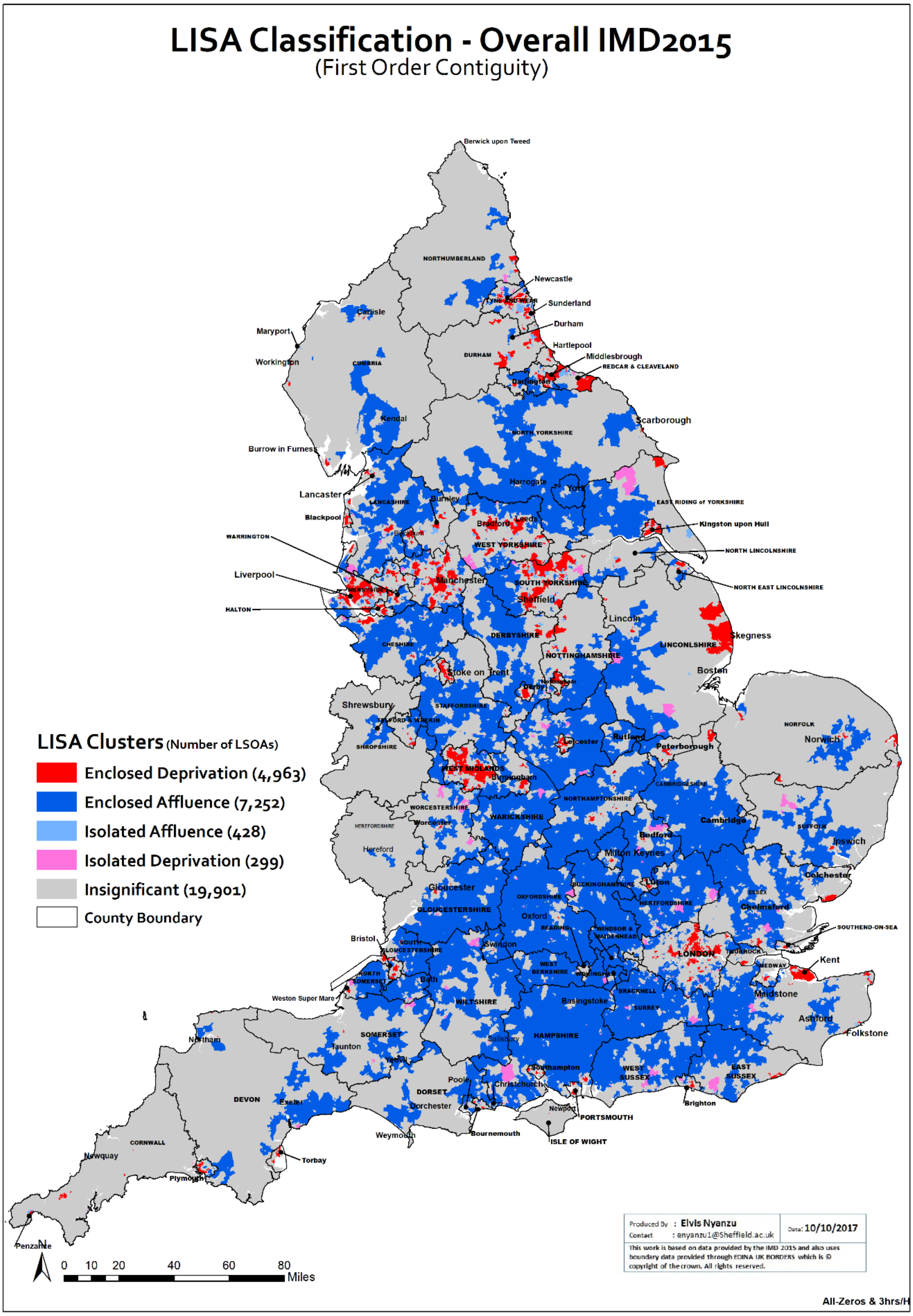
Source: Adapted from Rae (2009)

Figure 6.5 below illustrates the LISA classification of English LSOA IMD2015 scores at first order contiguity. It can be seen from the map that most of the significant clusters are within the enclosed affluence category; this is followed by the enclosed deprivation group. The majority of the entrenched deprivation clusters are in the West Midlands, Yorkshire, Merseyside, Greater Manchester, coastal areas of Lincolnshire and the north-east coast.

Although the majority of the deprived LSOAs classed within the category of isolated deprivation are in the South East and South West, there are a number of isolated deprived LSOAs in other parts of the country including the three Northern Regions, the Midlands and London where most of the LSOAs classed in the enclosed deprivation category can also be found.

Whereas there is the likelihood to focus on the red areas of the map because these are the areas deemed to be experiencing entrenched deprivation, we must not lose sight of the LSOAs with higher IMD scores yet classed as statistical insignificant in terms of local spatial association and their spatial extent. Approximately 3% of all LSOAs in the most deprived decile are within this category. The map shows large areas of Northumberland, Durham, Cumbria, Norfolk, Shropshire, Herefordshire, Devon, Cornwall and North Yorkshire with LSOA which have IMD scores deemed statistically insignificant in terms of spatial clustering. Overall, 61% of all 32844 LSOAs returned LISA scores which were statistically insignificant when first order contiguity was used as spatial weights (see Figure 6.6). A detailed examination of the spatial structure of these areas may help understand why they are deemed to be statistically insignificant.

Figure 6. 5 - First order contiguity LISA Classification

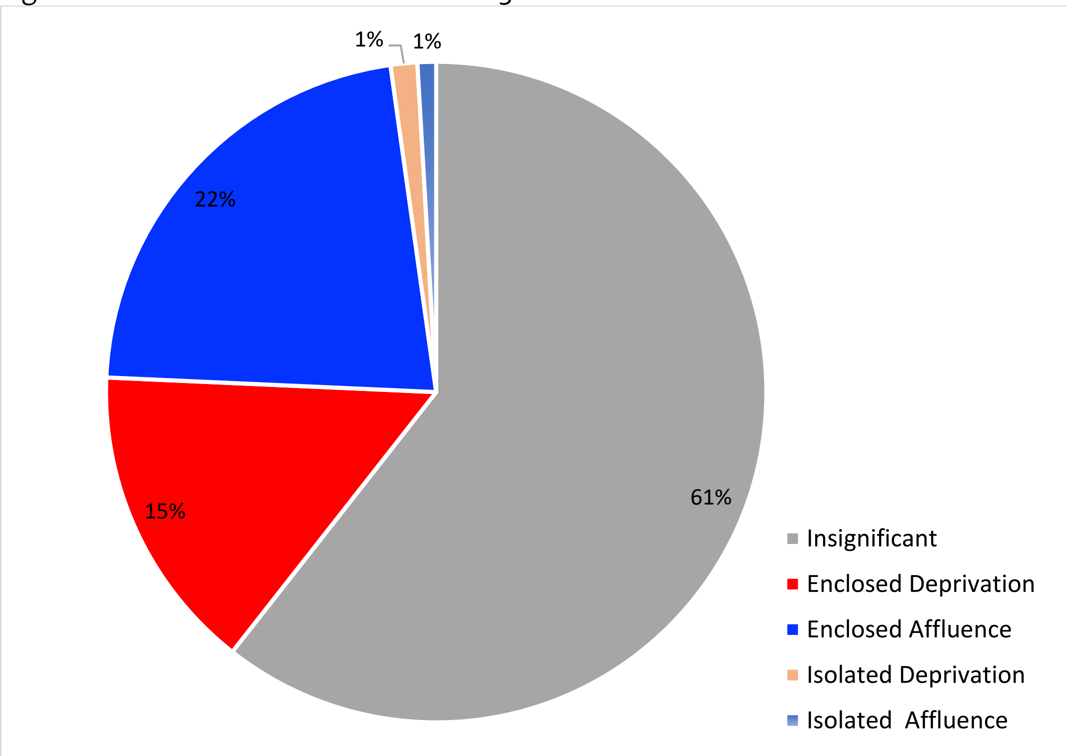


Source: Author

It is estimated that 10.6% of the total land area of England is built up and about 95% of the population of England live in urban areas (Watson et al., 2011). In this regard, a map showing LISA clusters and significance for only built up areas will be useful in examining the spatial structure of LSOAs and how these can influence their level of deprivation or affluence and LISA classification.

The dasymetric map presented in Figure 6.7 displays LISA classifications for only built up areas. It can be seen from the map that large expanses of areas in Northumberland, Durham, Cumbria, Norfolk, Shropshire, Herefordshire, Devon, Cornwall and North Yorkshire which were shown on Figure 6.5 as insignificant are actually sparsely populated with most of the land areas un-occupied. The lack of closer relations between LSOAs in these areas with other LSOAs could be the reason why their IMD scores are considered to be statistically insignificant.

Figure 6. 6 - LISA Clusters of LSOAs in England

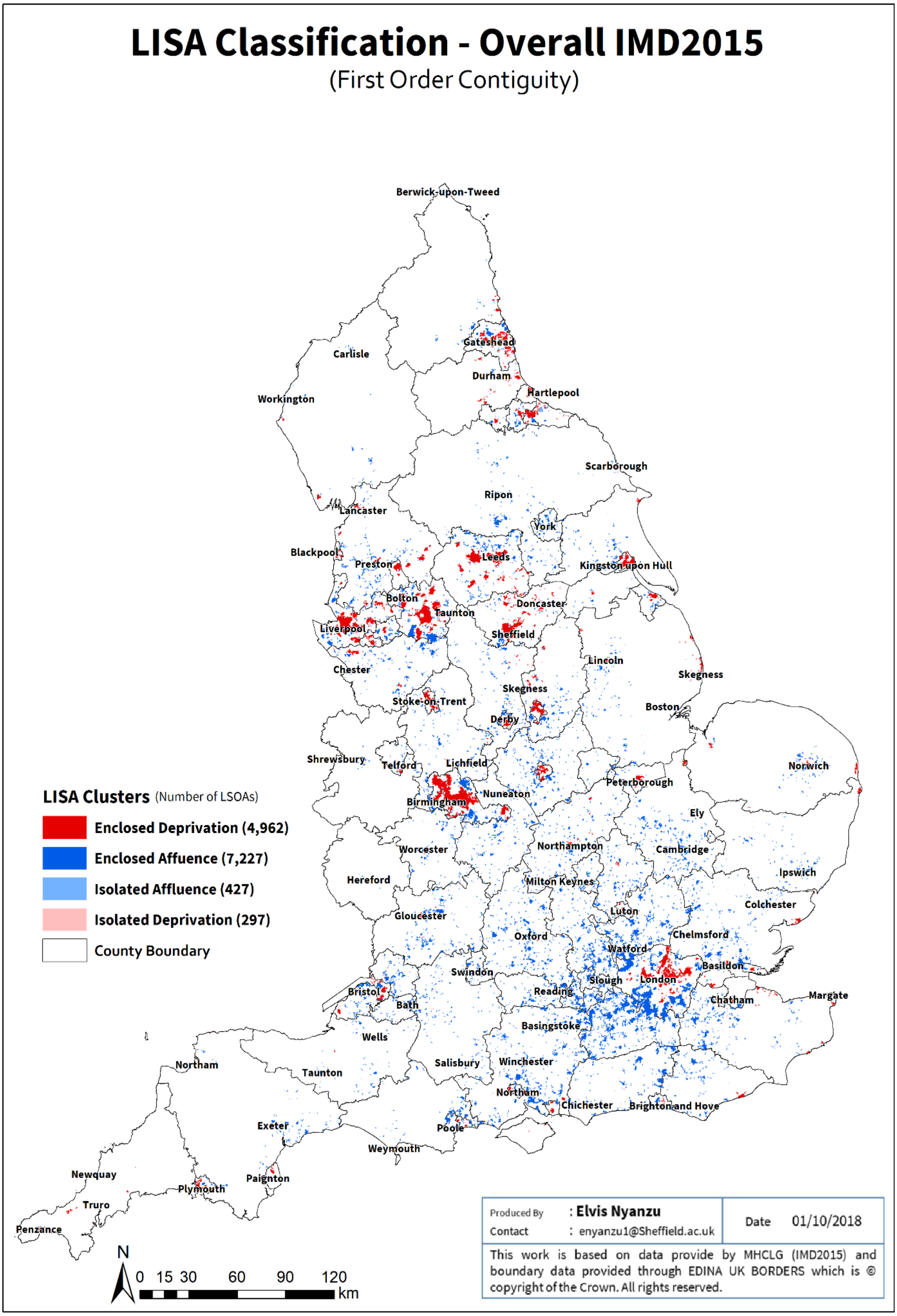


Source: Author

However, there are LSOAs within densely populated areas such as London, Birmingham, Sheffield, Manchester and other towns and cities that have IMD scores deemed to be spatially insignificant. This suggests that these LSOAs do not have significant spatial dependencies with the other LSOAs which form part of their first order contiguity.

Increasing the order of contiguity can result in different spatial dependency significance. A careful consideration must therefore be given to the choice of spatial scale (level of contiguity) to use in such analysis to produce the relevant outcomes. In this regard, some background knowledge or preliminary analysis of the study area would be useful in deciding on the appropriate spatial scale and level of contiguity to be used.

Figure 6. 7 - Dasymetric Map of LISA Classification



Source: Author

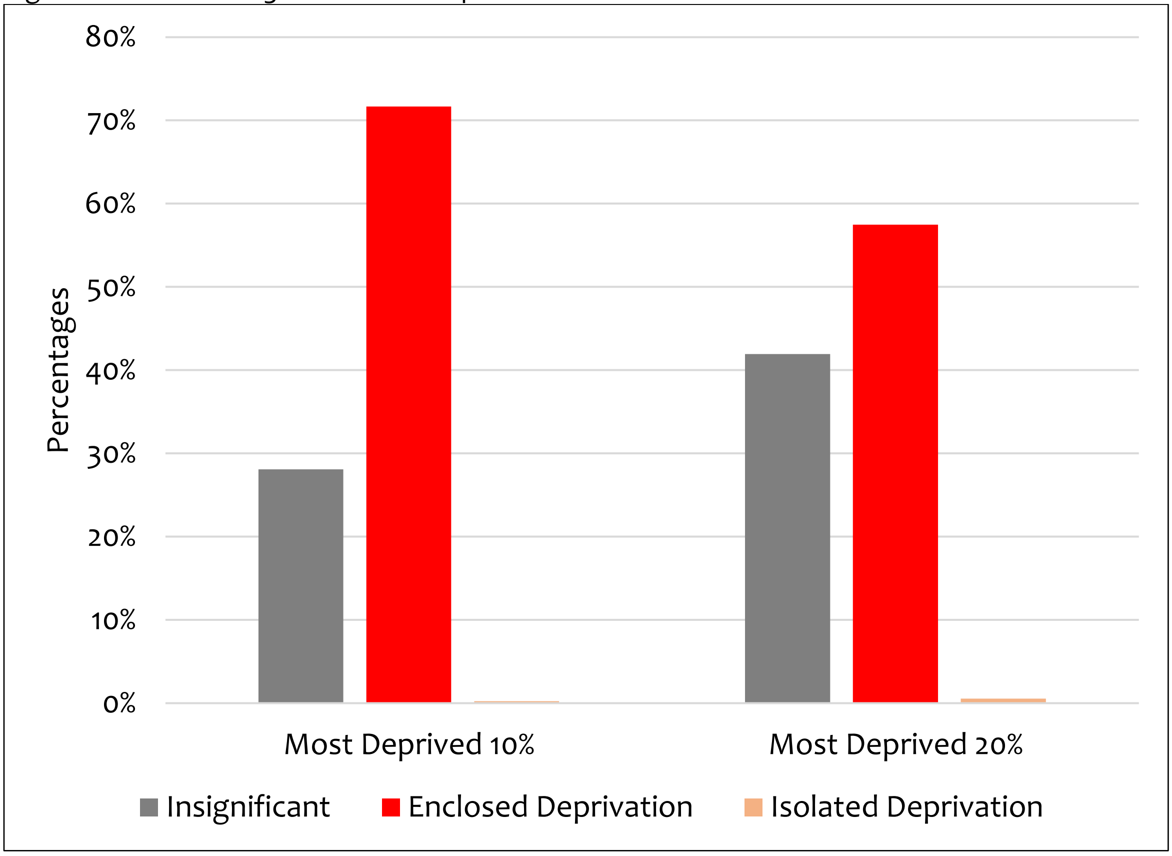
6.3 Spatial Clustering and Deprivation

Concentration of deprivation in certain parts of England has been a subject of interest to successive governments and urban policy analysts and has been well documented (Rae 2012). Attempts have been made over decades to break up the concentration of deprivation through local and central government initiatives with arguable less success (Tallon, 2010). This section of the analysis focuses on clustering of deprivation within the two most deprived deciles of the overall IMD2015 index to examine any spatial patterns which may exist.

The most deprived decile has 3284 LSOAs and the most deprived 20% which includes LSOAs in the most deprived decile are made up of 6568 LSOAs. In the most deprived decile, 72% of the LSOAs are within enclosed deprivation whilst approximately 28% have insignificant LISA scores (see Figure 6.8). Eight LSOAs, representing approximately 0.2% are classed as isolated deprivation and all of them are within urban areas. Whereas some of the LSOAs in the isolated deprivation category share boundaries with some LSOAs classed in the enclosed affluence category, most of the LSOAs surrounding the isolated deprivation LSOAs are within the statistically insignificant group (see Figure 6.5)

When the analysis was expanded to include all LSOAs in the most deprived 20% (also shown in Figure 6.8), the proportion of LSOAs in the enclosed deprivation category was 57%. Although this is less than the 72% reported in the most deprived decile, it implies that 3744 LSOAs in England are experiencing entrenched deprivation which is more than the total number of LSOAs within the first decile of the IMD2015. The proportion of LSOAs in the statistically insignificant LISA score group increased to 42% and the remaining 1% classified in the isolated deprivation category.

Figure 6. 8 - Clustering in the most Deprived Deciles



Source: Author

The impact of differences in local spatial context on the thirty most deprived LSOAs in England according to the IMD 2015 rankings is illustrated with Table 6.2 below. With the exception of Mansfield 009E, all LSOAs within the first 30 most deprived group are classified in the enclosed deprivation category. Even though all the LSOAs remained in the most deprived decile (to move out of the most deprived decile, the LSOAs must achieve a ranking of 3285 or greater), 47% achieved rankings are better than 30 with most improved LSOAs being Mansfield 009E. Tendering 018A - the most deprived LSOA according the IMD2015 Index achieved a rank of 191 when its spatial structure was accounted for through the LISA index scores. Its place was taken by Blackpool 013B which was originally ranked 17th by the IMD2015 Index. The only LSOA (among the 30 most deprived) which did not change rank is Blackpool 010A, it is ranked the second most deprived LSOA in England.

Table 6. 2 - Thirty most Deprived LSOAs (IMD2015)

Name	*IMD Score*	*IMD Rank*	*Rural/ Urban*	*LISA Rank*	*LISA Cluster*	*P-Value*
Tendring 018A	92.601	1	Rural	191	1	0.008
Blackpool 010A	88.523	2	Urban	2	1	0.001
Blackpool 006A	86.444	3	Urban	4	1	0.001
Thanet 001A	85.616	4	Urban	19	1	0.001
Blackpool 013D	85.561	5	Urban	43	1	0.001
Tendring 016B	85.527	6	Urban	724	1	0.020
Blackpool 013A	85.271	7	Urban	5	1	0.001
Coventry 007E	85.056	8	Urban	30	1	0.001
Blackpool 011A	84.862	9	Urban	3	1	0.001
Waveney 007D	84.621	10	Urban	580	1	0.038
Blackpool 010E	83.492	11	Urban	6	1	0.001
Kingston upon Hull 017E	82.599	12	Urban	36	1	0.002
North East Lincolnshire 006A	82.332	13	Urban	17	1	0.001
Burnley 010E	82.317	14	Urban	51	1	0.001
Burnley 007C	82.156	15	Urban	72	1	0.001
Mansfield 009E	82.107	16	Urban	2151	0	0.096
Blackpool 013B	82.032	17	Urban	1	1	0.001
Blackpool 006B	82.012	18	Urban	83	1	0.001
Blackburn with Darwen 006E	81.851	19	Urban	246	1	0.001
Great Yarmouth 006C	81.769	20	Urban	12	1	0.001
Thanet 001E	81.652	21	Urban	24	1	0.001
Leeds 086C	81.591	22	Urban	21	1	0.001
Blackpool 008D	81.549	23	Urban	7	1	0.001
Liverpool 012A	81.530	24	Urban	53	1	0.001
North East Lincolnshire 002B	81.054	25	Urban	10	1	0.001
Blackpool 008B	80.685	26	Urban	8	1	0.001
North East Lincolnshire 002A	80.558	27	Urban	11	1	0.001
Liverpool 028E	80.374	28	Urban	29	1	0.001
Liverpool 018F	80.316	29	Urban	18	1	0.001
Coventry 024C	80.283	30	Urban	270	1	0.001

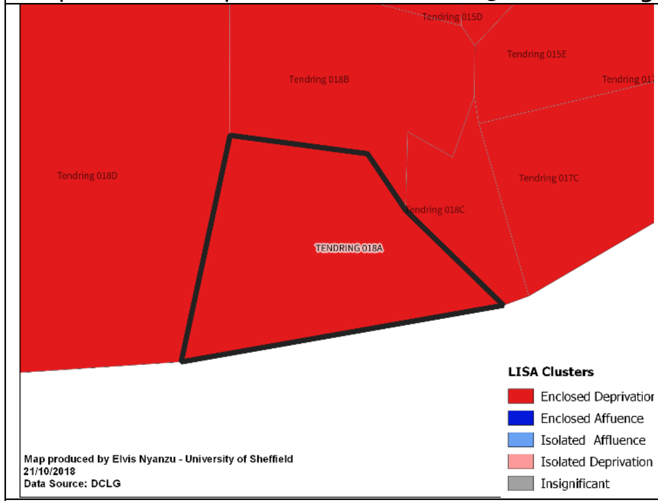
Source: Author

In order to understand why Tendring 018A moved to 191st and was replaced by Blackpool 013B, the spatial structure of these LSOAs were examined and are illustrated in Figure 6.9. It can be seen from Map A that Tendering is a rural area along the south-eastern coast of England. Its land boundaries are shared with other deprived LSOAs and it is classified within the enclosed deprivation category. Blackpool 013B shown in Map B of Figure 6.9 is on the north-western coast and also within the enclosed deprivation category. However, there are some significant differences in terms of their relative spatial context which can impact the level of deprivation. Whilst a significant proportion of the spatial extent of Tendering 018A (Figure 6.9 Map A) is farmland and not inhabited, the entire area of Blackpool 013B (Map B) is built-up. Most of the built-up areas of Tendering are along the coastal section which implies that spatial relations and dependencies with other LSOAs are limited to the west and south-east. Blackpool 013B is completely bounded by deprived LSOAs.

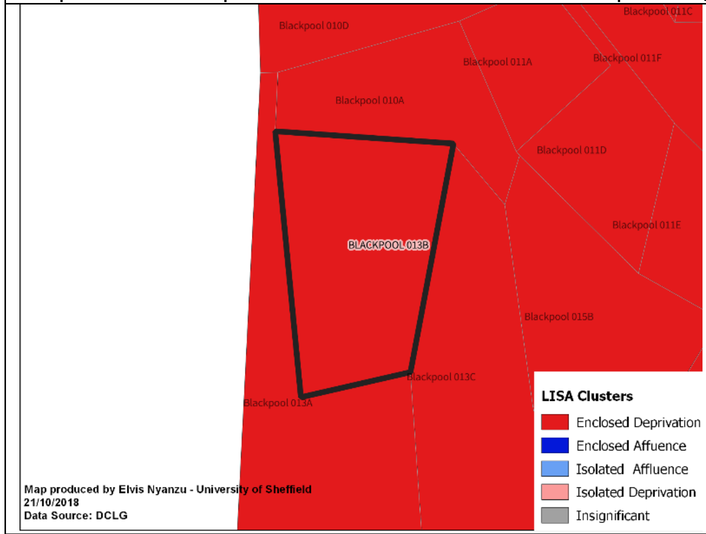
The focus here is to illustrate that their different spatial structures imply the spatial scale at which interventions (where necessary) are to be implemented to achieve the desired results are likely to be different for these two LSOAs. Blackpool 013B falls within a relatively larger spatial scale than Tendering 018A.

Figure 6. 9 - Comparison of Tendering 018A and Blackpool 013B

Map (A) Most Deprived LSOA (IMD2015) - Tendering 018A



Map (B) Most Deprived LSOA (LISA Index) - Blackpool 013B



Source: Author

Overall, 15% of the total number of LSOAs in England are deemed to be experiencing spatially entrenched deprivation. If the average population of an LSOA is 1614 (ONS, 2011), it implies approximately 15% of the population in England are living in areas with spatially entrenched deprivation according to LISA classification. Using the IMD2004 overall Index data, Rae (2009)[26] estimated that 49% of LSOAs in the most deprived 20% of that index (IMD2004) were in areas of spatially enclosed deprivation. The corresponding percentage in terms of the total number of English LSOAs at the time[27] in the enclosed deprivation category was 14%. This implies that relative deprivation within the most deprived areas is becoming more entrenched and clustered. This also supports the assertions of some academics and urban policy analysts that urban regeneration programmes and other interventions of the past aimed at reducing the concentration of deprivation and spatial inequality in general have not been successful but rather the situation has worsened over time (Tallon, 2010).

The argument here is, due to the differences in spatial structure, some deprived LSOAs are within areas of enclosed deprivation whereby they are mostly surrounded by other deprived areas. Other deprived LSOAs are surrounded by affluent LSOAs or LSOAs deemed to be statistically insignificant in terms of spatial dependencies. It is therefore essential for interventions aimed at alleviating the problems of deprivation within areas of enclosed deprivation to be on a relatively

[26] Rae (2009) use Anselin's Local Indicators of spatial Autocorrelation with first order contiguity as spatial weights in computation. This makes his result comparable to the work in this thesis.
[27] As result of boundary changes, the number of LSOAs in England have increased from 32482 to 32844 for IMD2004 and ID2015 respectively.

larger spatial scale in order to address the problems of all the other LSOAs within the group concurrently if such intervention are to be successful. This type of approach may not be required for LSOAs within the isolated deprivation category or those in the statistically insignificant group. Measures of this nature can only be put in place if such places are appropriately identified and highlighted by the Index of Multiple Deprivation or any other measure aimed at measuring relative deprivation. Adopting an approach which contextualises the spatial structure of LSOAs and the relative spatial scale of problems is essential to the success or otherwise of any intervention aimed at dealing with spatial inequality.

6.4 **Effects of Spatial Scale and Structure on the IMD2015**

The analysis of the impact of the spatial structural and scalar differences of LSOAs on their relative levels of deprivation so far made use of first order queen contiguity as the spatial weight matrix. As described above and in Chapter 4, first order contiguity considers only LSOAs which are immediately physically bounded to the target LSOA when computing the spatial weight matrix. However, differences in the spatial scale at which issues relating to neighbourhood deprivation occur can in some cases necessitate the use of second or even third order contiguity for specifying spatial weight matrices in order to capture all the relevant LSOAs.

Using Moran's I tools, three different levels of contiguities (first, second and third) were used to specify the spatial weights and to compute new IMD scores, ranks and deciles for all 32844 LSOAs in England. Table 6.3 shows a comparison of the original IMD ranks of the first thirty most deprived LSOAs to the respective new ranks achieved when their relative spatial structures at three different spatial scales were taken into consideration. It is worth noting that a rank less than 3286 implies that the LSOA is in the most deprived decile, whilst all LSOAs in the most deprived 20% are ranked below 6569.

At the first order contiguity level, Tendering 018A which is ranked the most deprived LSOA in terms of the socioeconomic attributes of its population by the IMD2015 achieved a rank of 1446 in terms of its spatial structure. Blackpool 013B which is ranked 17th according to the IMD2015 became the most deprived LSOA. Out of the 30 LSOAs sampled, 37% achieved a ranks which were better than 30th. Two LSOAs – Tendring 016B and Mansfield 009E moved out of the most deprived decile into the second and third deciles respectively. The first order contiguity LISA classification of these two LSOAs and their aerial images are shown in Figure 6.10

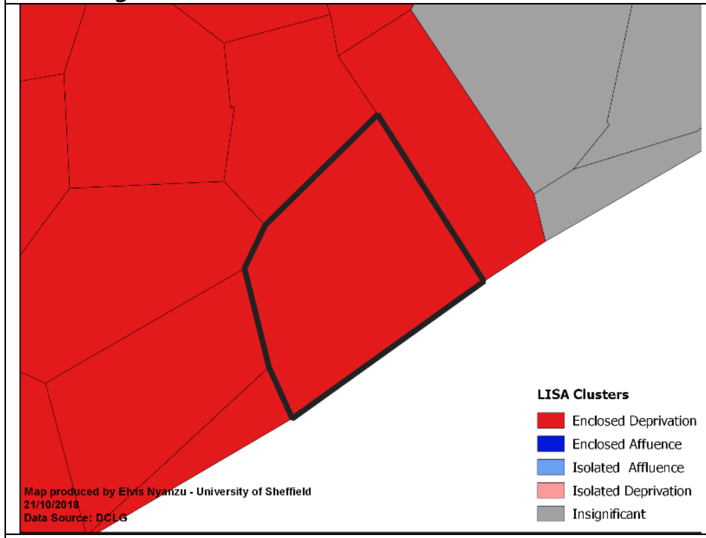
Table 6. 3 - First, Second and Third Order Contiguity Ranks: Most Deprived 30 LSOAs

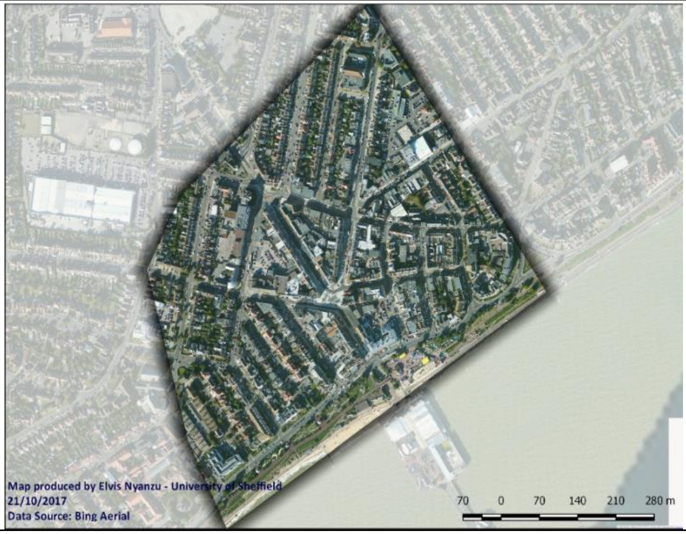
LSOA Name	IMD Rank	SS-IMD Rank		
		1st Order continuity	*2nd Order Contiguity*	*3rd Order contiguity*
Tendring 018A	1	1446	1174	1874
Blackpool 010A	2	8	7	48
Blackpool 006A	3	5	37	89
Thanet 001A	4	77	455	844
Blackpool 013D	5	250	232	172
Tendring 016B	6	3383	1566	1187
Blackpool 013A	7	4	72	83
Coventry 007E	8	171	3062	6167
Blackpool 011A	9	2	3	5
Waveney 007D	10	2638	5191	6256
Blackpool 010E	11	6	9	66
Kingston upon Hull 017E	12	144	420	723
North East Lincolnshire 006A	13	41	103	316
Burnley 010E	14	215	1528	3407
Burnley 007C	15	321	875	2258
Mansfield 009E	16	7400	11181	12469
Blackpool 013B	17	1	2	26
Blackpool 006B	18	356	358	173
Blackburn with Darwen 006E	19	1062	1250	2558
Great Yarmouth 006C	20	27	5	4
Thanet 001E	21	63	115	1149
Leeds 086C	22	45	157	384
Blackpool 008D	23	3	41	91
Liverpool 012A	24	207	114	25
North East Lincolnshire 002B	25	18	135	535
Blackpool 008B	26	7	86	177
North East Lincolnshire 002A	27	21	226	683
Liverpool 028E	28	85	59	86
Liverpool 018F	29	33	15	9
Coventry 024C	30	1085	1157	2708

Source: Author

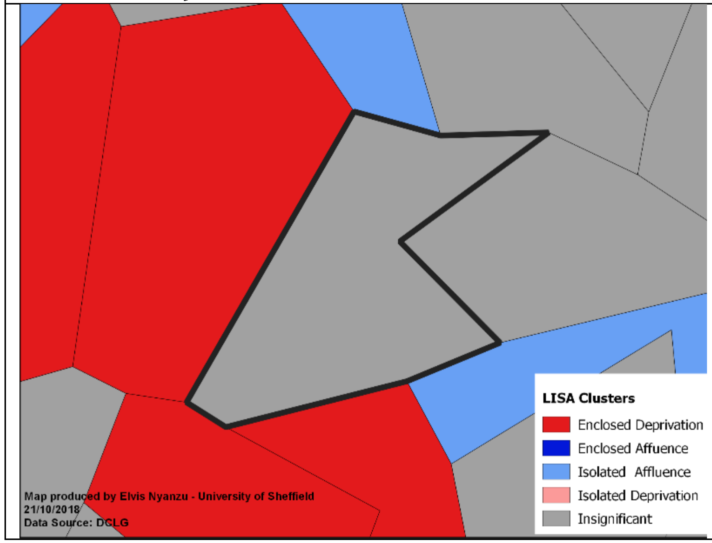
Figure 6. 10 - First order Contiguity Spatial Structural Context

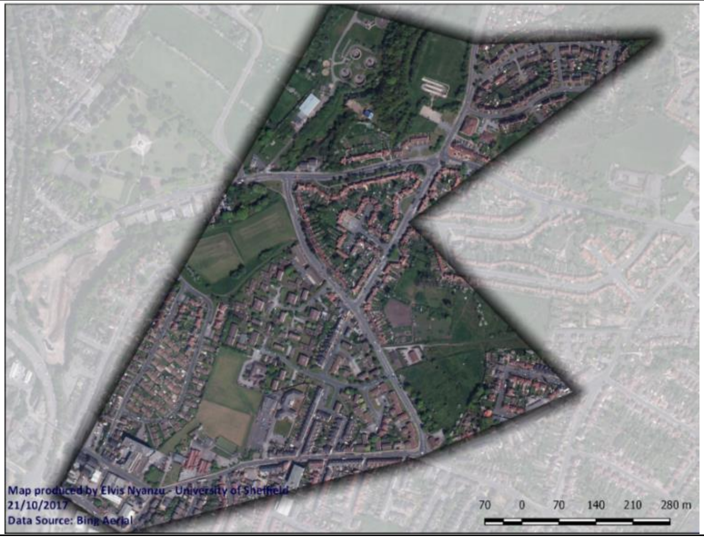
Tendring 016B





Mansfield 009E





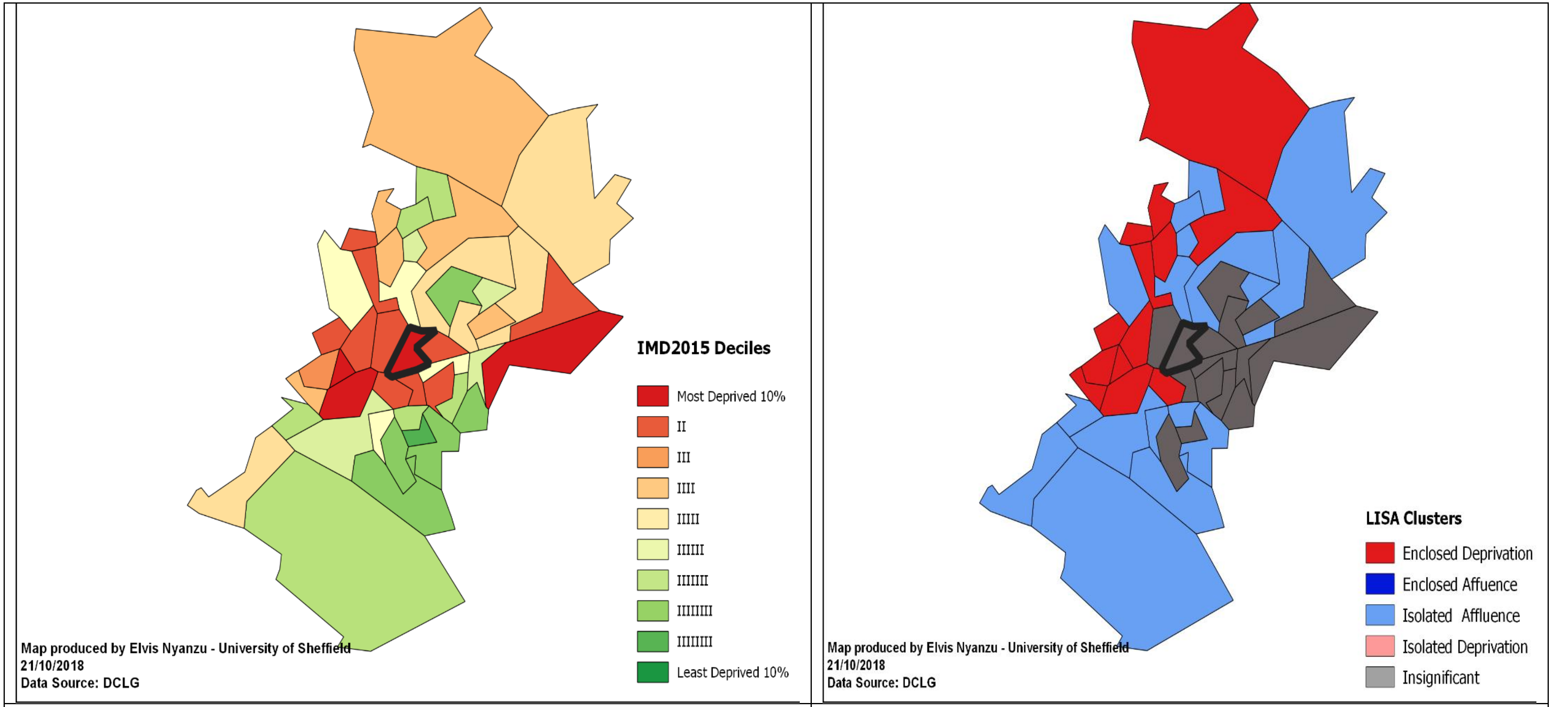
Source: Author

At second order contiguity, the most deprived LSOA is Great Yarmouth 006A which was originally ranked 700th by the IMD2015 and therefore not shown in Table 6.3. 8% of the LSOAs originally ranked within the 30 most deprived areas in England achieved ranks higher than 30. Both Mansfield 009E and Waveney 007D moved from the first decile to the fourth and second deciles respectively.

It is evident from Table 6.3 that the wider the spatial scale (level of contiguity) used, the higher the number of LSOAs that moved out of the first 30 most deprived group and achieved better ranks. At third order contiguity, four LSOAs representing 13% of the sampled LSOAs moved out of the first decile into other deciles. Once again, Mansfield 009E continued to improve in rankings by achieving a rank of 12469 which is in the fourth decile. The spatial structural context of Mansfield 009E is illustrated in Figure 6.11.

Both maps show the entire spatial extent of Mansfield 009E at third order contiguity. Map I on the left shows the IMD2015 deprivation deciles of all 46 LSOAs (including Mansfield 009E). It can be seen that the target LSOA is surrounded immediately by LSOAs with varying IMD decile classifications. There are a number of deprived LSOAs to the west but as you move further out, the number of less deprived LSOAs increase especially to the south. Map (II) on the right shows the LISA classification of these LSOAs using the third order contiguity as spatial weights. Out of the 45 neighbouring LSOAs, 33% are classified as insignificant in terms of local spatial dependency. Within the remaining 30 LSOAs 57% are classified as affluent areas.

Figure 6. 11 - Mansfield 009E in the context of all LSOAs within its third order contiguity



MAP(I) IMD2015 Deciles | MAP(II)Third order contiguity LISA classification

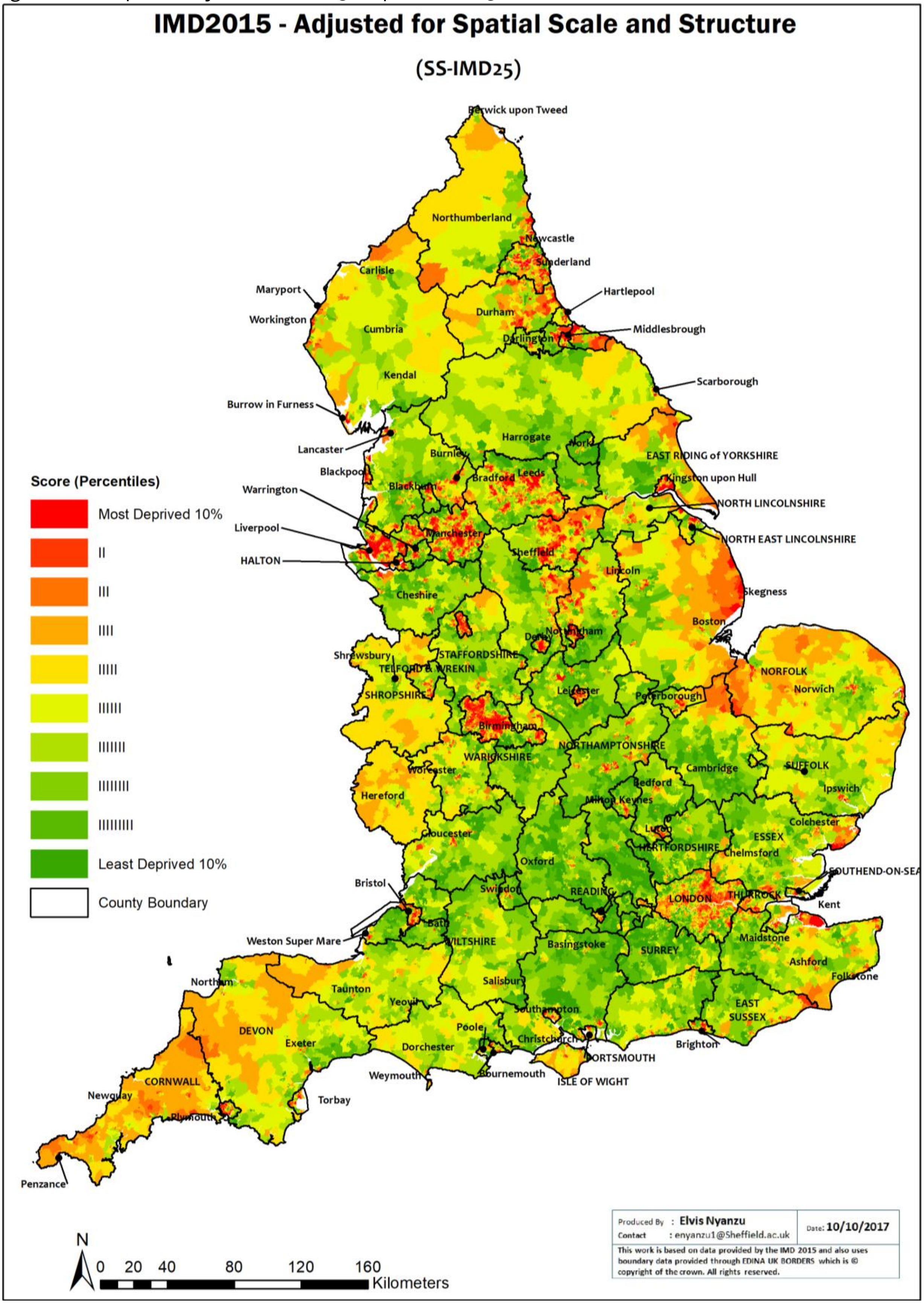
Source: Author

This implies that most of the neighbouring LSOAs are either considered affluent and spatially significant in terms of LISA statistics or considered to be insignificant. One can therefore understand why the scores of Mansfield 009E does improve when its neighbouring LSOA scores are taken into account.

This part of the analysis has so far focused on how the overall IMD scores and deciles can be influenced by spatial structural differences at various scales. Until this point, the LISA and Moran's I spatial lagged values computed have been used directly for the analysis. However as indicated in Chapter 4 and 5, a limitation of the Moran's I statistics is that it does not take into account the IMD scores of the target LSOA when calculating the new scores (Rae, 2009). To account for the deprivation scores of the target LSOA as part of the calculations, it has to be combined with the computed Moran's I or LISA spatial lagged values. To this end, Moran's I scores computed with first order contiguity spatial weights were combined with the original IMD scores using three different percentage combinations and are presented below.

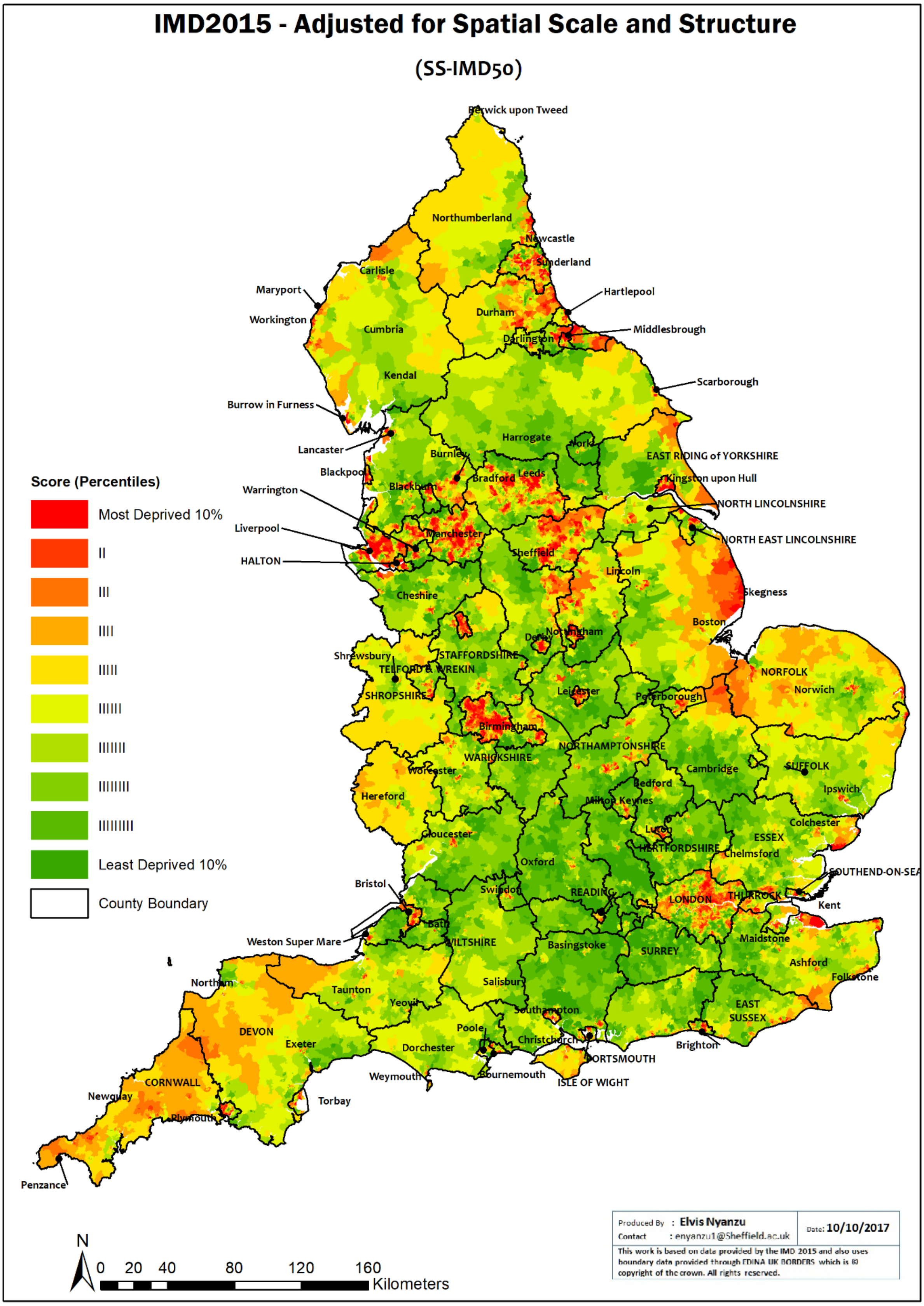
Figures 6.12, and 6.13 are two new IMD maps; SS-IMD25 and SS-IMD50. These maps were produced from a combination of the original overall IMD2015 index scores and the IMD scores computed with first order contiguity spatial weights. SS-IMD25 which is illustrated by Figure 6.12 is composed of 25% of Moran's I computed lagged values and 75% IMD2015 scores. SS-IMD50 (Figure 6.13) is composed of 50% Moran's I contiguity computed lagged values with the remaining 50% assigned to IMD2015 overall Index scores. Compared to the map of IMD2015 overall index scores (shown in Figure 5.5), there are LSOA decile changes in various parts of the country. Places such as Northumberland, Shropshire, North Yorkshire, Cumbria, Suffolk and Devon show identifiable differences. Whereas there were more subtle differences in other LSOAs in places such as London, Oxfordshire and Hampshire among others.

Figure 6. 12 - Spatial Adjsuted IMD2015 Map (SS-IMD25)



Source: Author

Figure 6. 13 - Spatial Adjsuted IMD2015 Map (SS-IMD50)



Source: Author

Changes in the decile classifications become more pronounced as the weight assigned to the Moran's I computed lagged scores increase. It can be seen from Figure 6.13 (SS-IMD50) that LSOAs surrounded by clusters of less deprived LSOAs tend to improve in decile classification, whilst relatively less deprived areas surrounded by deprived areas decline to the deciles which are worse than their original deciles. What is even more important here is that there is a focus on areas of the country which are deprived both in terms of socioeconomic attributes of its people and the locational context. Within towns and cities which have a relatively high proportion of their LSOAs in the most deprived 20% such as Liverpool, Birmingham, Middlesbrough, Manchester and Bradford among others, the most deprived areas within these towns and cities become more visible.

Changes in LSOA IMD rankings after accounting for Local spatial structural and scalar differences are presented in Table 6.4 below. Tendering 018A which is the most deprived LSOA in England as determined by IMD2015 improved in ranking to 7th, 30th and 64th at SS-IMD25, SS-IMD40 and SS-IMD50 respectively. The second most deprived LSOA, Blackpool 010A ranked first at both SS-IMD25 and SS-IMD40. It was ranked second at SS-IMD50. These suggest that in terms of spatial structure and scale, Blackpool 010A is relatively more deprived than Tendring 018A.

Whilst some LSOAs achieved better rankings when the locational differences were accounted for, others declined in rankings. 20% of the most deprived 25 LSOAs achieved ranks better than 25 when 25% of the IMD scores were attributed to Locational context (SS-IMD25). This proportion increased to 40% and 48% at SS-IMD40 and SS-IMD50 respectively. SS-IMD40 and SS-IMD50 had higher weights assigned to the spatial context of the LSOAs (40% and 50% respectively). An interesting revelation from the analysis was that whilst most of the LSOAs that achieved better rankings continued to improve as the weight assigned to locational context increased. Other LSOAs like Liverpool 028E initially declined in rank at SS-IMD25 but achieved better ranks at SS-IMD40 and SS-IMD50. All of the 25 LSOAs remained in the first decile at the various spatial contextual combinations.

Further analysis was undertaken to examine the changes in Local Authority Districts with a high proportions of their LSOAs in the most deprived 10% and 20% of the overall IMD2015. The first 30 local authority areas with the highest percentage of their LSOA in the most deprived decile are presented in Table 6.5. The first 8 most deprived LADs remain in the first 8 at SS-IMD25, and SS-IMD50 but there were changes in ranks. Middlesbrough which is ranked the most deprived LAD by the IMD2015 based on the number of LSOAs in the most deprived decile as percentage of the total number of LSOA within the LAD, remained the most deprived LAD at both SS-IMD25 and SS-IMD50. Knowsley, originally ranked second moved to third and back to second at SS-IMD25 and SS-IMD50 respectively.

Table 6. 4 - LSOA IMD Rank Changes

LSOA Name	IMD Score	IMD Rank	SS-IMD25		SS-IMD40		SS-IMD50	
			Score	Rank	Score	Rank	Score	Rank
Tendring 018A	92.601	1	80.9907	7	74.0245	30	69.3803	64
Blackpool 010A	88.523	2	85.6373	1	83.9059	1	82.7516	2
Blackpool 006A	86.444	3	84.2064	2	82.8639	2	81.9688	4
Thanet 001A	85.616	4	80.5579	9	77.5230	12	75.4997	18
Blackpool 013D	85.561	5	79.0339	15	75.1176	24	72.5067	32
Tendring 016B	85.527	6	73.6856	45	66.5808	161	61.8442	270
Blackpool 013A	85.271	7	83.3303	4	82.1659	5	81.3896	5
Coventry 007E	85.056	8	79.2266	11	75.7290	21	73.3972	25
Blackpool 011A	84.862	9	83.4719	3	82.6379	4	82.0818	3
Waveney 007D	84.621	10	73.5476	46	66.9035	153	62.4742	250
Blackpool 010E	83.492	11	81.9104	6	80.9614	6	80.3288	6
Kingston upon Hull 017E	82.599	12	77.6481	22	74.6775	27	72.6971	31
North East Lincolnshire 006A	82.332	13	78.9749	16	76.9606	14	75.6177	16
Burnley 010E	82.317	14	76.8627	24	73.5901	33	71.4084	42
Burnley 007C	82.156	15	76.1074	31	72.4783	39	70.0589	56
Mansfield 009E	82.107	16	69.0192	152	61.1665	369	55.9314	654
Blackpool 013B	82.032	17	82.4811	5	82.7505	3	82.9302	1
Blackpool 006B	82.012	18	75.8429	32	72.1414	43	69.6737	59
Blackburn with Darwen 006E	81.851	19	73.5463	47	68.5634	105	65.2415	161
Great Yarmouth 006C	81.769	20	79.1538	12	77.5847	11	76.5387	11
Thanet 001E	81.652	21	77.7919	19	75.4759	22	73.9319	24
Leeds 086C	81.591	22	78.2591	18	76.2599	18	74.9271	20
Blackpool 008D	81.549	23	80.6686	8	80.1404	7	79.7883	7
Liverpool 012A	81.530	24	76.3085	28	73.1755	36	71.0869	43
North East Lincolnshire 002B	81.054	25	79.0688	14	77.8777	10	77.0836	10

Source: Author

The LAD with the most number of LSOAs in England – Birmingham remained at the original rank of sixth at both SS-IMD25 and SS-IMD50. Pendle improved the most from an original rank of 18^{th} to ranks of 28^{th} and 31^{st} at SS-IMD25 and SS-IMD50 respectively. Tower hamlets declined significantly from 24^{th} to 16^{th} at SS-IMD25 and 12^{th} at SS-IMD50. In addition to Middlesbrough and Birmingham, which have already been mentioned, Blackpool and Nottingham also remained at their IMD2015 ranks of 7^{th} and 8^{th} respectively at SS-IMD25 and SS-IMD50.

In the most deprived 20% presented in Table 6.6, the LAD with highest percentage of LSOAs according the IMD2015 classification is Knowsley at 61%. It was ranked 3^{rd} at SS-IMD25 and 4^{th} at SS-IMD50. The most deprived LAD at SS-IMD25 and SS-IMD50 is Barking and Dagenham, it was originally ranked 4^{th}. The LAD which improved the most is Hyndburn – it moved from 20^{th} as per IMD2015 to 34th and 40^{th} at SS-IMD25 and SS-IMD50 respectively. All five London boroughs in the most 30 deprived LADs declined in rankings at both SS-IMD25 and SS-IMD50. London borough of Newham declined from 29^{th} as per IMD2015 ranks to 22^{nd} and 17^{th} at SS-IMD25 and SS-IMD50.

Figure 6.14 illustrates maps comparing IMD2015 decile classifications and SS-IMD50 deciles of the local authority area of Sheffield. The map also shows how deprivation levels of other local authority districts (LAD) adjoining the target LAD can influence the deprivation levels of the target LAD. This shows that to address relevant issues affecting neighbourhood deprivation at the appropriate scale, it may sometimes require two or more LADs to work together on identified problems (see Appendices XXI, XXII and XXII for further examples).

Table 6. 5 - Local Authority Areas with the Most Deprived LSOA in the First Decile

LAD Name	Number of LSOAs	IMD2015 Percentage	IMD2015 Rank	SS-IMD25 Percentage	SS-IMD25 Rank	SS-IMD50 Percentage	SS-IMD50 Rank
Middlesbrough	86	49%	1	50%	1	52%	1
Knowsley	98	46%	2	47%	3	52%	2
Kingston upon Hull, City of	166	45%	3	46%	5	46%	5
Liverpool	298	45%	4	49%	2	52%	3
Manchester	282	41%	5	46%	4	50%	4
Birmingham	639	40%	6	42%	6	45%	6
Blackpool	94	38%	7	40%	7	41%	7
Nottingham	182	34%	8	37%	8	39%	8
Burnley	60	33%	9	33%	10	35%	11
Hartlepool	58	33%	10	33%	11	31%	15
Bradford	310	33%	11	33%	13	36%	10
Blackburn with Darwen	91	31%	12	34%	9	36%	9
Hastings	53	30%	13	30%	15	28%	22
Stoke-on-Trent	159	30%	14	33%	12	32%	14
North East Lincolnshire	106	29%	15	31%	14	32%	13
Salford	150	29%	16	29%	18	30%	19
Rochdale	134	28%	17	29%	17	30%	20
Pendle	57	28%	18	25%	28	23%	31
Halton	79	27%	19	27%	20	30%	17
Great Yarmouth	61	26%	20	26%	22	21%	35
Wolverhampton	158	26%	21	27%	19	30%	18
Hyndburn	52	25%	22	25%	26	23%	30
Leicester	192	24%	23	23%	33	24%	27
Tower Hamlets	144	24%	24	30%	16	35%	12
St. Helens	119	24%	25	24%	29	23%	32
Sheffield	345	23%	26	25%	25	26%	24
Oldham	141	23%	27	26%	24	28%	23
Sandwell	186	23%	28	24%	30	25%	26
Barrow-in-Furness	49	22%	29	27%	21	31%	16
Newcastle upon Tyne	175	22%	30	22%	35	23%	29

Source: Author

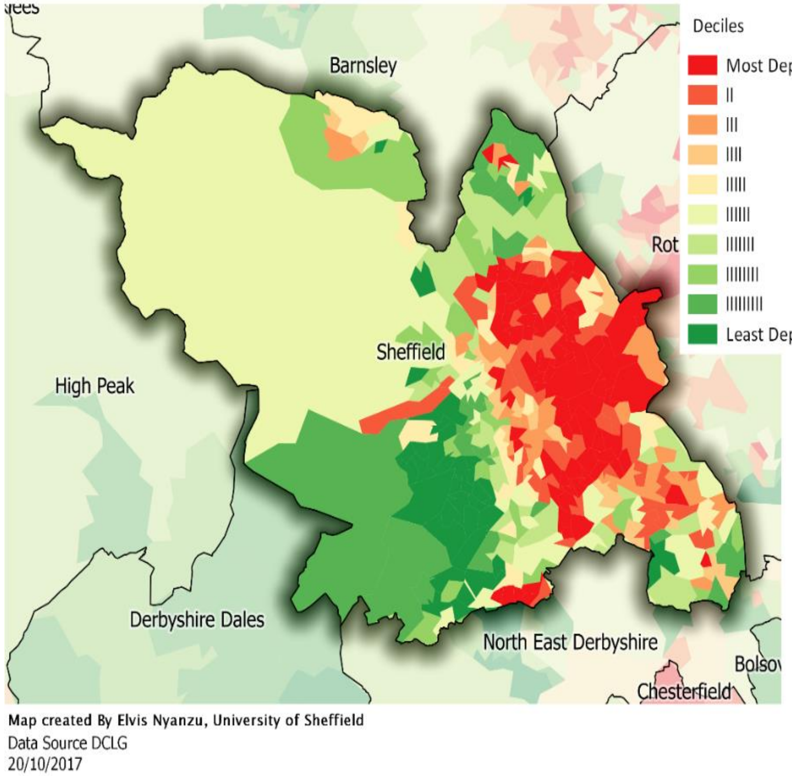
Table 6. 6 - Proportion of Local Authority Areas LSOAs in the most deprived 20%

LAD Name	Number of LSOAs	IMD2015		SS-IMD25		SS-IMD50	
		Percentage	Rank	Percentage	Rank	Percentage	Rank
Knowsley	98	61%	1	64%	3	67%	4
Liverpool	298	61%	2	63%	5	66%	6
Nottingham	182	60%	3	65%	2	63%	7
Barking and Dagenham	110	59%	4	67%	1	76%	1
Manchester	282	59%	5	62%	6	67%	5
Tower Hamlets	144	58%	6	64%	4	69%	2
Middlesbrough	86	57%	7	58%	8	59%	12
Hackney	144	56%	8	61%	7	68%	3
Sandwell	186	55%	9	57%	10	61%	9
Birmingham	639	55%	10	57%	9	60%	11
Kingston upon Hull, City of	166	52%	11	56%	12	60%	10
Wolverhampton	158	51%	12	53%	14	54%	14
Blackpool	94	51%	13	56%	11	62%	8
Stoke-on-Trent	159	51%	14	50%	15	50%	20
Blackburn with Darwen	91	49%	15	53%	13	56%	13
Halton	79	49%	16	48%	18	51%	19
South Tyneside	102	47%	17	49%	16	46%	28
Walsall	167	46%	18	46%	21	45%	29
Burnley	60	45%	19	48%	17	52%	18
Hyndburn	52	44%	20	40%	34	38%	40
Salford	150	44%	21	45%	25	47%	27
Islington	123	44%	22	46%	20	52%	16
Leicester	192	43%	23	44%	26	48%	25
Hartlepool	58	43%	24	45%	24	53%	15
Bradford	310	42%	25	46%	19	48%	24
Rochdale	134	42%	26	43%	28	49%	21
Oldham	141	41%	27	43%	30	41%	31
Norwich	83	41%	28	41%	33	39%	39
Newham	164	41%	29	46%	22	52%	17
Barrow-in-Furness	49	41%	30	43%	29	39%	38

Source: Author

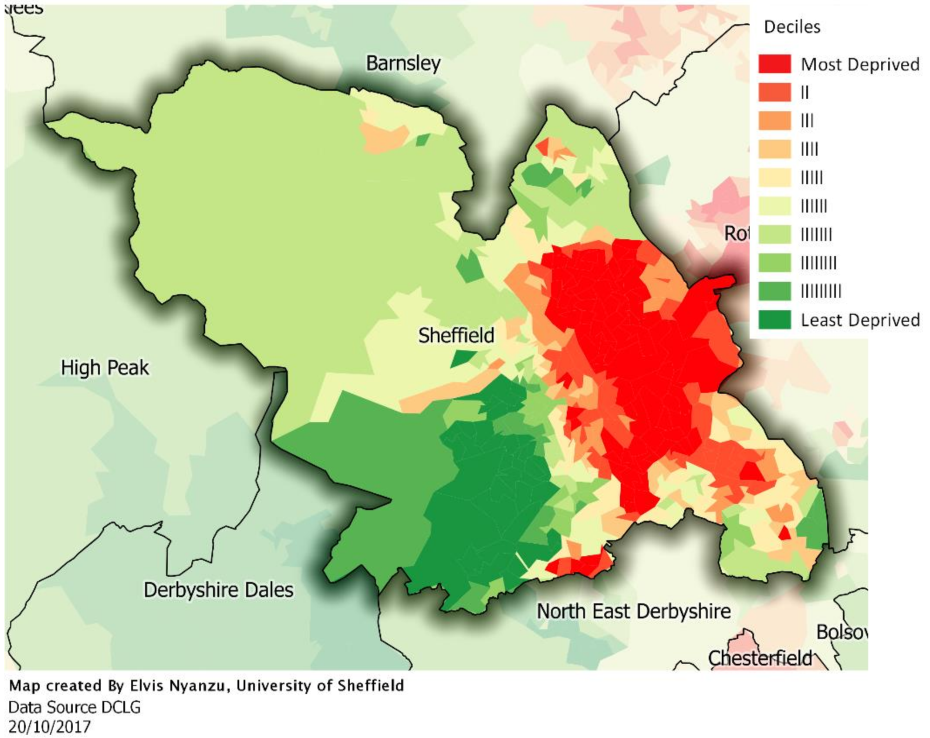
Figure 6. 14 - Sheffield

IMD2015 Decile Classification



Ranked 26th (10% most Deprived LSOAs) and ranked 47th - (20% most deprived LSOAs)

SS-IMD50 Decile Classification



Ranked 24th (10% most Deprived LSOAs) and ranked 43rd - (20% most deprived LSOAs)

Source: Author

The complete overview of IMD decile changes after the incorporation of local spatial attributes are presented in Tables 6.7 and 6.8. Table 6.7 illustrates decile classifications between IMD2015 and SS-IMD25. At SS-IMD25, approximately 30% of all LSOAs were categorised in a decile which is different from their IMD2015 deciles. The sixth and seventh deciles have the highest number of LSOAs (43%) classified in deciles that are different to the IMD2015 deciles. In the most deprived decile, 270 LSOAs out of 3284 changed deciles, all of these LSOAs were classified in the second decile of the modified index. It is also the decile with the least number of LSOAs that were classified in different deciles.

Table 6. 7 - Comparison of IMD2015 Deciles and SS-IMD25 Deciles

		IMD2015 (Most Deprived → Least Deprived)										
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
SS-IMD25 (Most Deprived → Least Deprived)	1	**3014**	270	0	0	0	0	0	0	0	0	3284
	2	270	**2604**	408	2	0	0	0	0	0	0	3284
	3	0	410	**2357**	510	8	0	0	0	0	0	3285
	4	0	0	520	**2179**	549	35	1	0	0	0	3284
	5	0	0	0	592	**2023**	614	53	2	1	0	3285
	6	0	0	0	1	699	**1880**	618	81	5	0	3284
	7	0	0	0	0	6	749	**1865**	599	64	1	3284
	8	0	0	0	0	0	6	743	**1962**	547	27	3285
	9	0	0	0	0	0	0	4	641	**2202**	437	3284
	10	0	0	0	0	0	0	0	0	465	**2820**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

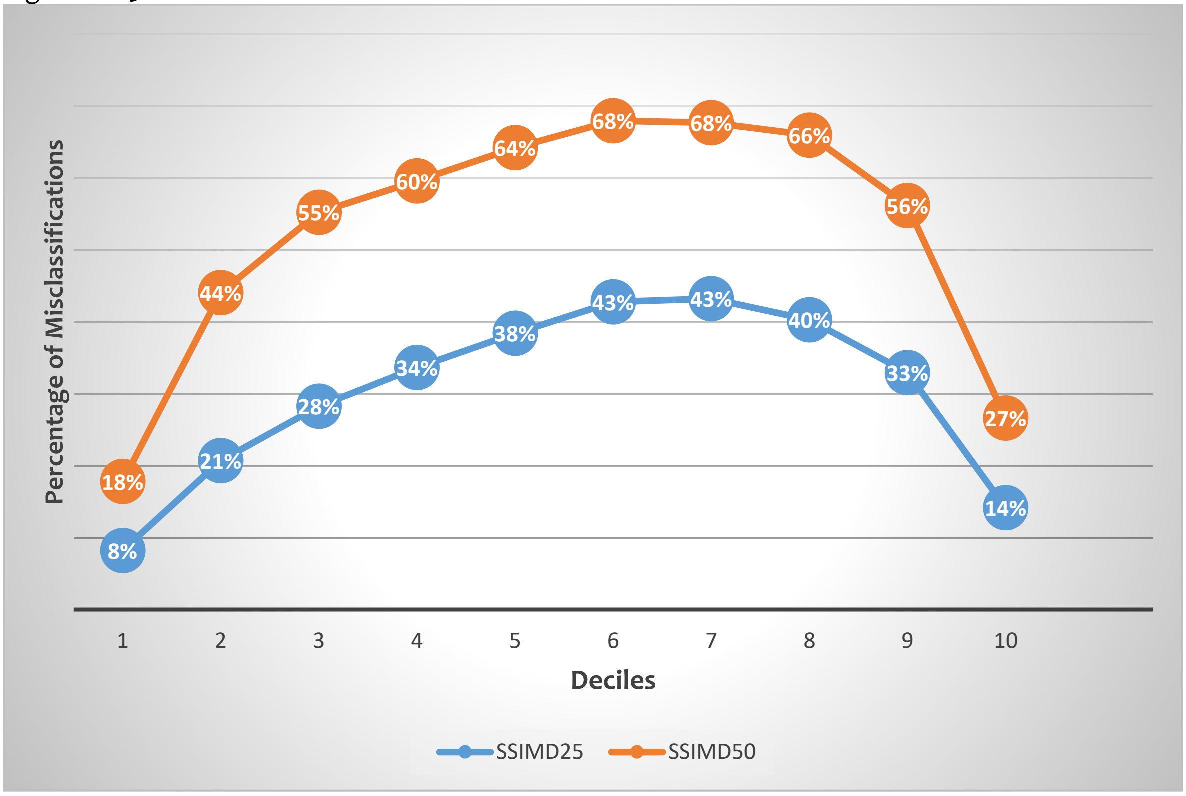
Table 6. 8 - Comparison of IMD2015 Deciles and SS-IMD50 Deciles

		IMD2015 (Most Deprived						Least Deprived)				
	Deciles	1	2	3	4	5	6	7	8	9	10	Total
SS-IMD50 (Most Deprived → Least Deprived)	1	**2699**	550	32	3	0	0	0	0	0	0	3284
	2	555	**1838**	751	122	13	5	0	0	0	0	3284
	3	30	778	**1471**	733	207	56	7	2	1	0	3285
	4	0	114	806	**1328**	683	256	71	22	4	0	3284
	5	0	4	207	822	**1177**	670	287	98	19	1	3285
	6	0	0	18	248	870	**1053**	676	309	98	12	3284
	7	0	0	0	28	300	877	**1062**	700	269	48	3284
	8	0	0	0	0	35	344	947	**1119**	686	154	3285
	9	0	0	0	0	0	23	226	936	**1440**	659	3284
	10	0	0	0	0	0	0	8	99	767	**2411**	3285
Total		3284	3284	3285	3284	3285	3284	3284	3285	3284	3285	32844

Source: Author

Similar analysis was undertaken using SSI-IMD50 which was computed with a relatively higher weight (50%) assigned to the deprivation scores which takes into account spatial structural differences. From Table 6.8, it can be seen that the result follows a similar pattern to that of SS-IMD25 but the percentages of LSOAs classified in deciles that are different to the respective deciles of the original IMD are higher than it was at SS-IMD25. Overall, 53% of English LSOAs are potentially 'misclassified', the decile with the least number of 'misclassified' LSOAs is the first decile and the decile with most number of 'misclassified' LSOAs are the sixth and seventh deciles. The percentage change in decile classifications between the original IMD and the modified deprivations scores (SS-IMD25 and SS-IMD50) are shown in Figure 6.15 below.

Figure 6. 15 - Potential IMD Decile Misclassifications



Source: Author

6.5 Conclusion

This section of the analysis focussed on the empirical questions relating to the extent to which spatial structural differences influence the measurement of neighbourhood deprivation and the sensitivity of the IMD to variations in the spatial scales at which problems occur. The main findings from the empirical analyses were:

a) Deprivation in England is highly clustered. The majority of the LSOAs in the most deprived decile (72%) are experiencing enclosed deprivation which implies that these LSOAs have neighbouring LSOAs that are equally deprived. Nationally 15% of all LSOAs in England are experiencing enclosed deprivation. This has the potential to exacerbate the level of deprivation within these areas yet the IMD does not explicitly account for this.

b) Accounting for spatial structural differences resulted in significant changes in LSOA IMD rankings. At first order contiguity, the most deprived LSOA in England according the IMD2015 achieved a new rank of 191st and 42% of all LSOAs in the most deprived decile of the IMD2015 achieved better classifications. Four (4) LSOAs moved from the 1st decile of the IMD2015 to the 9th decile after their local spatial structure were taken into account.

c) Analysis of deprivation at varying spatial scales (1st, 2nd and 3rd order contiguities) also revealed significant changes in the LSOA IMD rankings and decile classifications. The proportion of potential decile misclassifications increases with the extent to which the IMD was spatially contextualised for variations in spatial scale and structure. In all instances, the level of potential decile misclassification were higher in the middle deciles (5, 6, and 7) than they were in the two most deprived and the two least deprived deciles.

The importance of spatial context to the socioeconomic outcomes of people has been examined by academics and urban policy analysts (Smith et al., 2000; Buck, 2001; Bolster et al., 2007; Rae, 2009; among others) and there is no doubt about its relevance in the quest to reduce socioeconomic inequalities and deprivation in England.

We have seen illustrations of how the relative levels of deprivation can be influenced by differences in the local spatial structure of the various LSOAs and how this can in turn impact the spatial scales at which deprivation can occur. A deprived LSOA surrounded by other equally deprived LSOAs is more likely to experience deprivation at a wider spatial scale. This is because if these areas are all deprived in terms of employment for example, people would have to travel very far in order to find suitable employment and that makes the scale of employment deprivation wider. On the other hand, if a deprived LSOA is within a cluster of affluent LSOAs, the spatial scale of the problem is likely to be narrower or could even be restricted to the target LSOA.

The incorporation of spatial contextual differences is not only essential to the identification of deprived areas, it also helps to understand the nature of the issues facing such areas which is necessary to inform the design and execution of interventions programmes targeting spatial inequalities. In the next and final chapter, the key findings of this thesis and its contribution to the theories, methods and policies of the subject area are highlighted. Policy recommendations, operational challenges of this research and future directions are also discussed.

7. DISCUSSION OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

The aim of this research has been to investigate the relevance of neighbourhood spatial context to experiences of deprivation and its measurement and to make contributions to its conceptualisation and operationalisation. This has been motivated by:

- Critiques of the indices of Deprivation (ID) for underplaying local spatial context in its measurement approach (Rae, 2009a);
- The decline in area-based interventions like urban regeneration which has been partly linked to the underachievement of past programmes[28] (Jones and Evans, 2008; Imrie and Raco, 2003);
- The rising interests in neighbourhood effects and its potential impacts on the life chances of people (Trickett and Lee, 2010; Brannstrom, 2004) which has given prominence to examination of differences in neighbourhood spatial opportunity structures (Galster and Sharkey, 2017) and how they impact experiences of deprivation; and
- The need to understand and find practical solutions to account for differing local spatial context in the measurements of deprivation as policy makers at both central and local government levels strive to define or re-

[28] The Implementation of austerity measures and the "rolling back" of the state is sometimes seen to be the main reason for the decline of area based regeneration programmes (O'Brien and Matthews, 2015)

define urban policies in a bid to address spatial socioeconomic inequalities.

The study is designed to investigate and answer three main empirical research questions which include:

1. What is the impact of spatial relations on the measurement of neighbourhood deprivation?
2. To what extent do spatial structural differences influence the measurement of neighbourhood deprivation?
3. How sensitive are deprivation measures to differences in the spatial scales and levels at which problems may occur?

Spatial analytical techniques were used to empirically examine the effects of spatial relations (research question 1), spatial structure (research question 2), and spatial scale (research question 3) on the English Indices of Deprivation 2015. The main spatial analytical techniques used were global Moran's I spatial autocorrelation and Anselin's (1995) Local Indicators of Spatial Autocorrelation (LISA). Data employed in the study were mainly sourced from the MHCLG - Indices of Deprivation 2015, the Office of National Statistics and Edina UK Borders.

This is the concluding chapter of the thesis and it is presented in three parts. The summary of the key findings and how they relate to the research objectives and questions will be discussed in the first part. The second part reflects on the theoretical and practical implications of the research. An effort will also be made to highlight contributions to the field of spatial inequality and policy interventions in general and specifically to the methods of assessing spatially sensitive neighbourhood deprivation. The final part of this chapter focuses on the general challenges of the study and recommendations for future research.

7.1 PART ONE – Summary of findings

The findings of the empirical study were presented in Chapters 5 and 6 of this thesis. Chapter 5 focussed on the examination of the impact of spatial relations between neighbourhoods on experiences of deprivation and its measurement. The impact of neighbourhood spatial structural differences and variations in the operational spatial scale of socioeconomic processes on the measurement of deprivation were presented in Chapter 6. In this section, the research findings are summarised and related back to the research questions identified in Chapter 4 and the research objectives outlined in Chapter 1 of this thesis.

7.1.1 Spatial Relations and the Measurement of Deprivation

One of the objectives of this research is to examine the extent to which the English Indices of Deprivation (ID) accounts for spatial relations between neighbourhoods (LSOAs) when assessing relative deprivation. This is for two main reasons: First, behavioural economics (discussed in chapter 2 of this thesis) suggest that the decisions and choices people make are influenced by the full spectrum of socioeconomic, environmental, political and psychological conditions affecting the individual (Cunhan and Heckman, 2009). For instance decisions relating to where to live may be influenced by where you work or would like to work (if employment is relevant to the individual) (Gordon and Vickerman ,1982). Assessing relative deprivation should therefore not be a function of the neighbourhood of usual residence alone but also a function of other neighbourhoods which are relevant to the socioeconomic activities of people within the subject neighbourhood.

The second is related to differences in neighbourhood spatial opportunity structure and how that might impacts socioeconomic processes and the experience of deprivation or affluence. Concepts such as “spillover” and “spatial externalities” which are central to new economic geography, discussed in chapter 2, highlights the importance spatial interdependencies between neighbourhoods to socioeconomic processes. These interactions are not guided by administrative boundaries (Wicht and Nonnenmacher, 2017). What constitutes an individual’s or a neighbourhood’s spatial opportunity structure differ from one neighbourhood to the other. In affluent neighbourhoods with effective transportation networks, the extent of their spatial opportunity structure can be very wide compared to isolated neighbourhoods with poor connectivity to other places. The experience of deprivation within an isolated and poorly connected neighbourhood is likely to be relatively worse than the experience of deprivation in a neighbourhood with a wider spatial opportunity structure. Such differences in spatial relations due to differences in spatial opportunity structure need to be accounted for in the measurement of deprivation.

The third and final point which is also related to those mentioned above relates to the use of catchment areas. The siting of services, such as school, hospitals, GP surgeries, super markets among others are usually based on catchment areas which have different geographic boundaries to administrative boundaries. This usually results in services being located within the administrative boundaries of very few neighbourhoods (LSOAs) where most people from nearby LSOAs have to access these services from. When properly sited, such service points tend to be places which are easily accessible to all neighbourhoods within the catchment area. There are however, instances where service points may be less accessible to certain neighbourhoods because of where they are located.

All of the scenarios outlined above can influence experiences of deprivation and affluence and need to be captured by measures of neighbourhood deprivation. To examine the impacts of differences in neighbourhood spatial relations on the Indices of Deprivation, the process of measuring deprivation within the Barriers to Housing and Services domain of the ID2015 was conceptualised to account for differences in neighbourhood spatial relations through commuting patterns.

The result of the analyses showed that experiences of neighbourhood deprivation can be significantly influenced by neighbourhood spatial relations. In general, most LSOAs changed BHS domain ranks with rural LSOAs improving the most when their spatial relations and connectedness to other LSOA were taken into account. Rural LSOA with relatively wealthy population in areas like Hart where most of the people have the ability to expand their spatial opportunity structure and are well connected to urban centres improved the most. The higher the weight assigned to the scores derived from spatial relations, the higher the percentage change in decile classifications.

The impacts of these findings on the overall IMD index scores were also examined and presented in Chapter 5. Most LSOAs changed IMD ranks, the most significant changes occurred in the 5^{th}, 6^{th}, 7^{th} and 8^{th} deciles.

Decile classification differences between the original IMD scores and the spatially contextualised scores were higher than expected. For instance, when 2.38% percent of the overall index was assigned to spatial relations, 13% of all LSOAs were classified in deciles which were different to their original decile classifications. These variations did not only affect deprived areas, it also affected LSOAs in the least deprived deciles.

Underplaying local spatial context in the conceptualisation of access to services by the Indices of Deprivation in calculating the BHS domain scores has significant impacts on the domain scores and this in turn affects the overall IMD ranks and decile classifications. By explicitly accounting for neighbourhood relations, deprived and isolated neighbourhoods can be identified differently from neighbourhoods that are deprived but well connected to other areas from which services can be accessed. Such differences can also be quantified and reflected in the deprivation scores.

7.1.2 Spatial Structural Differences and Deprivation

As discussed in chapter 2, new economic geography theorises that the balance of centripetal forces that pull economic activities together in a location and the opposing centrifugal forces accounts for variations in neighbourhood economic spatial structure and spatial socioeconomic inequalities (Acanu et al, 2012; Wicht and Nonnenmacher, 2017). Understanding the interplay between these forces and how they manifest within the neighbourhood spatial opportunity structure is essential to the understanding of the manifestation of neighbourhood problems and the experience of deprivation.

The spatial manifestation of deprivation and affluence can be classified into four main categories: isolated deprivation, isolated affluence, enclosed deprivation and enclosed affluence. Isolated deprivation occurs when a deprived neighbourhood is within a generally affluent area. The reverse, where an affluent neighbourhood is surrounded by deprived neighbourhoods is described as isolated affluence. A deprived neighbourhood within a cluster of deprived areas is classified as enclosed deprivation and an affluent area within a cluster of affluent neighbourhood is deemed to be experiencing enclosed affluence. How measures of deprivation conceptualise and quantify these spatial differences is one of the objectives of this research and the focus of research question 2.

The result of the empirical analyses of the IMD2015 within the context of neighbourhood local spatial structure is presented in Chapter 6 of this thesis. The main finding in this part of the analyses is that experiences of deprivation differ significantly with varying neighbourhood spatial structure. The deprivation scores of deprived LSOAs surrounded by equally deprived LSOAs deteriorated as this creates a wider spatial structure of concentrated deprivation. On the other hand, the scores of deprived LSOAs within affluent areas, as well as deprived rural areas at the fringes of urban areas improved.

Other relevant findings are:

a) Deprived areas in England are mostly clustered and within the category of enclosed deprivation (72% of all LSOAs in the most deprived decile). Most of these LSOA are within towns, cities and large urban conurbations where there are significant spatial interdependencies;
b) 15% (approximately 8 million) of the total population of England live in areas experiencing enclosed deprivation; and
c) The spatial clustering of deprivation and affluence in England appears to be increasing.

7.1.3 ***Deprivation and Spatial Scale***

The spatial extent at which various socioeconomic processes or activities take place varies extensively from one process to the other and also from place to place (Harris and Johnston, 2003). Measuring deprivation within predetermined administrative boundaries that are established for different purposes can be problematic as it usually results in either overstating or understating neighbourhood problems; depending on the administrative boundary used for the assessment. It also violates the principles of spatial dependency as proposed by new economic geography (Krugman et al, 2001), it is not consistent with behavioural economics theory (Borgahams et al, 2008) and the boundaries of the spatial opportunity structure of neighbourhoods are more likely to be different to these administrative boundaries (Galster and Sharkey, 2017).

Analysis of the potential impact of varying neighbourhood spatial scales revealed that the IMD ranks and decile classifications changed markedly at different spatial scales. For instance, the most deprived LSOA as per the IMD2015 rankings was ranked 1446th, 1174th and 1874th at first, second and third order contiguities[29] respectively. Using a combination of the first order contiguity IMD scores (to represent the locational context) and the original IMD2015 scores (representing the socioeconomic attributes of the people within the target LSOA) in different proportions, two new deprivation indices were computed. 30% of all LSOA were classified in deciles that were different to their original IMD deciles when 25% of their IMD scores was attributed to local spatial structural and scalar context. When the percentage assigned to spatial context was increased to 50%, the proportion of LSOAs that were classified in deciles that were different from their original IMD deciles increased to 50%. Between the original IMD deciles and the deciles of the newly constructed deprivation index, the proportion of LSOAs classified in deciles which were different to their original IMD deciles ranged from 8% to 43% at first order contiguity.

It was also evident from the analysis that there is no one spatial scale which can be deemed appropriate for all areas when assessing deprivation. The appropriate spatial scale for assessing deprivation depends on the local spatial structure of

[29] First order contiguity is relatively large spatial scale which covers all LSOAs which are physically bounded to the subject LSOA. Second order contiguity covers all LSOA at the first order contiguity and LSOA which physical bounded to them. Second order contiguity therefore covers a wider spatial area than first order contiguity. The higher the level of contiguity the wider the wider the spatial extent.

the neighbourhood in question and also the nature of socioeconomic activity or process of interest. The extent of interdependencies between neighbourhoods vary, as such, using a blanket spatial scale across the entire country can dilute the results in some parts of the country because areas that have insignificant spatial association to the target LSOA are captured in the analysis.

In general, first order contiguity is regarded as a reasonable approach to use for such analysis (Rae, 2009) to at least capture some of the locational attributes of the target neighbourhood in order to contextualise the socioeconomic attributes of the people within the target area. However, in some instances, first order contiguity was not wide enough to cover the entire spatial extent of the subject of interest in relation to the target LSOA. In urban areas with very high population densities, second or even third order contiguity may be more appropriate. This is one area which will benefit from further research and development.

Ideally, a combination of local knowledge about the socioeconomic processes within the neighbourhood and analysis of the spatial structure through the use of Local Indicators of Spatial Autocorrelation (LISA) to test for the significance of spatial association is necessary to define the spatial scale at which deprivation should be assessed. This will allow the spatial scale to vary appropriately from place to place and between IMD domains and Indicators. As stated in chapter 1, 4 and other sections of this thesis, neighbourhoods (even rural LSOAs) do not exist in isolation and it is better to put the deprivation level of LSOAs within the context of neighbouring LSOAs. This is essential to understand the extent of the problem and how to address the necessary issues effectively.

7.2 PART TWO: DISCCUSSION – Theoretical, Operational and Policy Implications

The need for a deeper understanding of the effects of local spatial context on neighbourhood deprivation as well as how it can be conceptualised and incorporated in the measures of relative deprivation is the premise of this research. In this section, I discuss the contribution of the research findings to the theorisation of the importance of neighbourhood local spatial context to spatial opportunity structures, experiences of deprivation and the measurement of deprivation. The potential policy impacts of the research findings and the methodological contribution to measurement of deprivation are also highlighted

7.2.1 The Spatial Opportunity Structure, Neighbourhood Effects and Experiences of Deprivation

Space and what can be found within them has always been an important consideration for the realisation of outcomes. Places such as Silicon Valley in the San Francesco Bay area, the Midlands in England and the City of London are all examples of places which through agglomeration are critical to the operational models of business and industries located within them. This is not very different for the socioeconomic outcomes of individuals and households. Places within which individuals and households are embedded can have profound impact on their socioeconomic outcomes.

Neighbourhood effects studies (reviewed in Chapter 3) explores various pathways through which what can be found within the neighbourhood of residence and the entire network of neighbourhoods which form part of its spatial opportunity structure influences the outcomes of individuals and households. These can be in the form of access to basic functions such as the availability good schools, GPs, hospitals, recreational facilities, good housing stock, improved air quality and employment opportunities to the more complex and endogenous processes such as the availability of role models, social cohesion, networks and neighbourhood stigmatization.

However, neighbourhoods, are made up of evolving layers of complex interactions between overlapping social-economic, environmental, cultural and political networks which are defined by the accessibility of areas to different activities (Galster, 2001). The spatial extent of any given neighbourhood depends on the socioeconomic activity of interest and the extent to which the interactions within the target area and between other areas become less significant. The measurement of relative deprivation based on smaller administrative boundaries that tend to treat neighbourhoods as self-contained units does not reflect the complex interaction between places and how they impact experiences of deprivation. As posited by Van Ingen (2018), understanding larger locational contexts of neighbourhoods is an essential prerequisite to the understanding of the manifestation of neighbourhood deprivation.

In chapter 1, I mentioned a study in The Independent which suggested that school children from poor backgrounds in London and the south are more likely to move up the social ladder than their counterparts in the North of England and the Midlands (Casidy, 2015). Even though this has not been subjected to empirical examination as part of this research, in places like London where there is an extensive and effective transportation network, the spatial opportunity structure is wider for some socioeconomic processes. Secondly, a review of the general deprivation profile in London shows that deprived neighbourhoods are usually not too far from less deprived neighbourhoods. Whereas it can be argued that deprived neighbourhoods within areas that are considered to be general affluent can result in hidden deprivation, as highlighted by the tragic case of the Grenfell Tower fire within The London Borough of Kensington and Chelsea, the potential for positive neighbourhood effects on people from poorer households within these neighbourhoods through social interaction, presence of role models, the lack of neighbourhood stigmatisation on children (particularly) is relatively high and can produce desirable outcomes. Similarly, as posited by Putman (2000), there is the potential for people within deprived neighbourhoods in such parts of London to move up the social ladder through bridging social capital with people from their neighbouring affluent areas.

On the other hand, villages, some towns and even some cities, the spatial extent of socioeconomic processes could be limited to a relatively smaller scales due to barriers such as inadequate transportation networks and the lack of opportunities. Most of the northern deindustrialised towns and cities fall within this category. The northern power house project which in part has committed to invest £13 billion to improve transportation networks and connectivity can been seen as an attempt to widen the spatial extents of opportunities and to address some of these drawbacks associated with cities and towns in the north of England.

The introduction of combined authorities, whereby several local authorities in England that are considered to be part of the same functional economic area are given devolved powers to jointly improve the area is a step towards the recognition that socioeconomic processes are not usually limited within administrative boundaries. Taking appropriate steps to explicitly account for the socioeconomic conditions of the wider local area as part of the measurement of neighbourhood deprivation can provide in-depth insights into the extent of deprivation within the neighbourhood and how people within these neighbourhoods experience various types of deprivation.

7.2.2 Clustering of Disadvantaged Neighbourhoods and Experiences of Deprivation

The 2010 government white paper "Local Growth: Realising Every Place's Potential", acknowledges that "…places have specific geographic, historic, environment and economic circumstances that help to determine the prospects for growth" (HM Government 2010, p.7). Neighbourhood socioeconomic problems are partly a product of the historical development of the area and the range of policies that have been implemented locally over time (Lee and Nevin, 2002). Such processes tend to create certain path dependencies which have significant influence on the socioeconomic trajectories of such places and the people within them. Market process alone are not sufficient to alter such developments but rather require some form of externalities such as interventions programs.

Experiences of deprivation within deindustrialise towns, cities or regions in the north of England and parts of the Midlands have different contextual issues to deprived coastal towns and such as Blackpool, Scarborough and Bridlington among others and these will also be different form isolated deprived neighbourhoods within Hart and Cheshire.

The research findings indicated that areas of England that are considered to be among the most deprived such as parts of City of Manchester, Liverpool, Blackpool, coastal areas of Lincolnshire and part of Yorkshire tend to be surrounded by equally deprived neighbourhoods and can therefore be considered to be experiencing some form of entrenched deprivation. Experience of deprivation within these clusters are exacerbated because of the level of deprivation within their spatial opportunity structure. These are areas that have undergone significant economic structural changes which has resulted in the decline of previously well performing industries. The deteriorating local economies and general living conditions have resulted in spatial lock-in whereby people within these areas find it challenging to escape the worsening conditions. The extent of neighbourhood socioeconomic deprivation people within such places experience requires fundamental structural changes which can only be well understood if the measurements of neighbourhood deprivation is conceptualised to take into account the wider local spatial context.

Another contributor to the clustering of deprivation within certain neighbourhoods is inadequate social housing and affordable housing for low income groups within seemingly affluent areas. One of the unintended consequences of the provision of social housing and the uneven spatial spread of social housing locations is that low income households that are eligible for such schemes are usually sent to neighbourhoods where most of the residents are within the low income brackets. It is therefore not unusual to find a significant number of homes within some of the most deprived neighbourhoods in England are mainly social housing. Such neighbourhood's tend to be stigmatized and lack the necessary social capital which are considered to be essential for the production of positive neighbourhood effects. In situations whereby a number of such developments are in close proximity, it can results a wider cluster of disadvantaged neighbourhoods. Where such clusters of disadvantaged neighbourhoods exceed certain thresholds, they tend to be associated with a disproportionate increase in the likelihood of experiencing negative neighbourhood effects (Quercia and Galster, 2000).

Whereas I acknowledge that some geographic unit must be used for the analysis of neighbourhood deprivation, and that the use of administrative boundaries tend to ensure responsibilities for neighbourhood deprivation problems can be assigned to identifiable authorities. A careful consideration must be given to the type of indicators used and their spatial extents. For instance, an LSOA may be appropriate for the spatial extent of neighbourhood problems (e.g. an isolated rural area), but in most urban areas with high population densities, the spatial extents of most LSOAs are relatively small. Domains of the indices of Deprivation and/or indicators need to be properly conceptualised in order to establish the true extent of deprivation and the extent to which problems need to be addressed. This is necessary to identify and prevent the dangers of spatial concentration of deprivation.

In abolishing the Regional Development Agencies (RDAs), the conservative party green paper "*Control Shift: Returning power to Local Communities*" (2009) and the subsequent coalition government programme "*The Coalition: Our Programme for Government*" (2010) stated that RDA boundaries were arbitrary and did not reflect the natural boundaries for socio –economic processes. In place of RDAs, Local Enterprise Partnerships (LEPs) were introduced. The geographic boundaries of each LEP area is meant to "…reflect the natural economic areas of England." (HM Government, 2010 p. 12).

There are two main reasons why LEPs are inadequate to reduce spatial socioeconomic inequalities and deprivation. First, the bounding of LEP areas is not adequate for addressing socio-economic deprivation at the appropriate spatial scales in various parts of England. Clusters of deprived areas fall within two or more LEP areas making it difficult for such problems to be addressed holistically. This is in-line with Lord Heseltine's (2012) recommendation for LEPs boundaries to be reviewed to ensure functional economic areas do not overlap with other LEPs, Second, LEPs to do not have a mandate to specifically target deprived areas. With the emphasis on local government-private partnership, areas with thriving local business or enterprisers are likely to benefit more from LEPs than deprived areas.

It is therefore recommended that LEPs are given specific objectives to deal with neighbourhood deprivation and have their boundaries amended to accommodate the deprived areas at the appropriate spatial scales. There should also be a mechanism for two or more LEPS to work together to achieve a common objective. In this way, where it is not administratively feasible for a single LEP to cover the relevant area, they can work with other LEPS within an established framework.

7.2.3 Incorporating Local Spatial Context within the Measurement of Deprivation

One of the main drawbacks of incorporating local spatial context in the measurement of neighbourhood deprivation relates to the operationalisation of the theoretical concepts. In this regard, this research has been able to address, but by no means explicate some of the methodological issues surrounding the explicit incorporation of local spatial context in the measurement of neighbourhood deprivation.

The conceptualisation of local spatial context put forward in Chapter 4 of this thesis unpacks local spatial context into three components – spatial scale, spatial structure and spatial relations. This makes it relatively easy to design and use specific methods to produce deprivation measures which accounts for the impacts of local spatial context through the impacts of spatial scale, spatial structure and spatial relation on neighbourhood deprivation. It also makes it possible to place emphasis on any of these three aspects depending on what is being measured.

In this research, several spatial analytical techniques were used to model spatial relationships, generate the relevant spatial weights and produced various versions of the IMD which are sensitive to differing neighbourhood spatial contexts. One of the main findings of this research is that the specific techniques or tools used for the measurement of neighbourhood deprivation is largely dependent on the nature of socioeconomic processes of interest, the type of variables or indicators used to represent these socioeconomic processes and the perceived importance of spatial context to the activity to be measured.

Other relevant neighbourhood specific attributes such as demography can also be an important consideration for the choice of techniques. For instance, in assessing the impacts of neighbourhood spatial relations on the measurement of deprivation within the Barriers to Housing and Services domain of the ID2015, I adopted an approach which measures distances to the closest location of amenities from the target neighbourhood as well as the level of amenities within locations where residents of the target neighbourhood regularly commutes (see Chapter 4 for full description of methods). Although, this approach is by no means perfect, it can capture the availability of amenities within target neighbourhoods, nearby locations and distant but connected neighbourhoods. This approach was considered suitable because the BHS domain relied on indicators such as access to GP surgeries, schools, supermarkets, post offices among others in assessing deprivation within the domain. In instances where different indicators are used, this approach may not suitable. For instance commuting to a place of work is not enough to suggest social integration. Even within this instance, where the focus is on access to services, other variable such as the mode of commuting can impact the extent to which one can access such services.

After a review of the existing techniques for generating spatial weights, contiguity based approaches were considered the most feasible for analysing the impact of spatial structure and spatial scale. This is mainly because it guarantees that the target LSOA is centralised and also ensures that all LSOAs which are physically bounded to the target LSOA are included in the analysis. In addition, where the analysis needs to be on larger spatial scale, the order of contiguity can be increased. However, as indicated earlier, the level of contiguity and spatial scale to be used for the analysis will also be influence by what is being measured, the indicators used and the location circumstances of the neighbourhood of interest. These issues have not be investigated as part of this research and may be a suitable area to be considered for further investigation in order to further develop the techniques employed in this study.

Enhancing the socioeconomic circumstances of people and reducing the gap between affluent and deprived areas are central to the production of deprivation indices. This implies that measuring the socioeconomic attributes of individuals and families as calculated by the producers of the Indices of Deprivation will always remain an important tool for central and local governments. The methods described in this thesis have the potential to capture the full extent of deprivation within the spatial opportunity structure of neighbourhoods and improved the understanding of how this can influence experiences of deprivation. This adds an extra dimension to the existing approach to the measurement of neighbourhood deprivation through which a deeper understanding of neighbourhood deprivation emanating from the locational attributes of the target areas, which may have otherwise been missed, yet critical to the development of the area, can be obtained.

7.2.4 Summary of Recommendations for Policy and Practice

- The calculation of neighbourhood deprivation scores should be spatially contextualised to account for variations neighbourhood spatial structure and relations with other neighbourhoods. This can make it possible for the IMD to highlight neighbourhoods that may be subjects of entrenched deprivation because of the deprivation levels of neighbourhoods within their spatial opportunity structure and the potential for these to impact experiences of deprivation and affluent. The techniques used in this thesis to contextualise neighbourhood spatial relations and spatial structure can be used as starting point.
- The concentration of social housing within certain neighbourhoods contributes to the clustering of deprivation within these areas. This can result in neighbourhood stigmatization, inadequate social capital, and increased neighbourhood problems. Ensuring equitable distribution of social housing and good stock of affordable housing can help break-up the concentration of deprivation within certain areas and promote bridging social capital and its potential benefits on individual socioeconomic outcomes.

- The conceptualisation and implementation of urban policies should be undertaken to address problems at the appropriate spatial scales. If the IMD is spatially contextualised as recommended above, identifiable patterns of deprivation will be more visible, as clusters of neighbourhoods experiencing similar disadvantages will be highlighted by the index of multiple deprivation. This would be useful for the development and implementation of urban polices.
- Related to the above is the need to establish a framework within which different local authorities can work together to address cross boundary socioeconomic issues in order to address problems associated with deprivation at the appropriate spatial scales and deal with clusters of deprivation that extend beyond one local authority district boundary.

7.3 PART THREE – Conclusions, Limitations and Direction for future Research

The analysis of neighbourhood deprivation is primarily about the socioeconomic circumstance of people and families. These circumstance are, however, connected to the functions of the place, neighbourhood or community within which they live. The socioeconomic conditions prevailing in the neighbourhood is to some extent influenced by the prevailing conditions of other nearby or connected neighbourhoods they engage with for other activities such as employment, shopping, and recreational activities among others.

The concentration of business and industries in one locality due to agglomeration economies results in the concentration of jobs within the area. However, it can also result in the lack of employment opportunities within that industry in other locations which are considered less attractive for such investments. Neighbourhood deprivation is therefore a function of people, processes within the target neighbourhood and other neighbourhoods connected to the target neighbourhoods.

Even though the notion of neighbourhood circumstances affecting the socioeconomic outcomes of individuals and families is not new and has been extensively investigated, the practicality of quantifying such neighbourhood effects has remained daunting and under-developed. There is however, sufficient evidence (as discussed in various parts of this thesis) to suggest that opportunities available to individuals and household to achieve desired socioeconomic outcomes cannot all be found within their neighbourhoods of residence but rather lie within various spatial scales which form part of their neighbourhood's urban structure – this has been referred to us the spatial opportunity structure throughout this thesis.

London is the most productive city in the UK with high concentrations of business, particularly in financial services. Due to the effective transportation networks available, about 37% of all workers who live in outer London work in inner London areas. The spatial opportunity structure of such outer London neighbourhoods for employment extends to inner London areas (Hunter, 2019). Of course, this also means that 63% of workers who live in outer London work within outer London.

The point here is that, within neighbourhood deprivation is important but deprivation within the local neighbourhood context, especially those within the spatial opportunity structure for the socioeconomic activity of interest is also important.

If this is the case, then one would question why the measurement of deprivation remain confined to administrative boundaries? Several reasons may be responsible for this development but the two most prominent are:

(ii) Within policy contexts, dealing with the 'modifiable area unit problem' (MAUP) is more complex than it appears. Whilst the manifestation of deprivation and neighbourhood problems are likely to be different if measured within different boundaries, local authority districts, which are mainly responsible for dealing with urban problems have boundaries which are not modifiable (at least in the short term). There is therefore a stronger attraction to keep the measurement of neighbourhood deprivation within administrative boundaries where specific local authorities can be made responsible for identified problems. There is little incentive to consider other spatial scales which will result in modified boundaries.

(iii) Practically, spatial opportunity structures varies with the socioeconomic activity of interest. The spatial scale for the measurement of economic deprivation such as employment or income will be different to that of the prevalence of crime, health outcomes among others. These scalar differences imply that different boundaries may well be used for each domain or indicator making it more difficult to produce an overall index of deprivation for the same area.

This research set out to develop a framework through which the complex relationship between people, neighbourhoods and other places can be conceptually and methodologically improved in the effort to identify deprived neighbourhoods and reduce spatial socioeconomic inequality.

The study identifies and proposes three ways through which the spatial contexts of neighbourhoods can vary and are relevant to the measurement of deprivation: the socioeconomic circumstance of the target neighbourhood in relation to other nearby neighbourhoods (***spatial structure***), relationships between people in the target neighbourhoods and other neighbourhoods they engage in socioeconomic processes with (***Spatial Relations***) and differences in the spatial extent of socioeconomic activities (***Spatial Scale***). These make up the neighbourhood spatial opportunity structure within which individual attributes are developed to achieve desired outcomes and should be incorporated into the processes for measuring deprivation.

It then developed a framework through which spatial relations, spatial structure and spatial scales can be conceptualised and quantified using spatial analytical techniques in order to measure deprivation within local spatial contexts which are more reflective of local spatial structures. Various versions of the IMD2015 which are spatially sensitive to neighbourhood spatial relations, scale and structure were produced.

The research findings highlights the extent to which differences in neighbourhood local spatial context can deepen neighbourhood disadvantages, exacerbate experiences of deprivation and make it difficult to achieve the relevant socioeconomic policy outcomes aimed at addressing urban problems if not properly accounted for.

In order to understand neighbourhood problems and properly identify deprived communities, the problems and its spatial extent need to be correctly framed. The conceptualisation and methods employed in this research demonstrates that with careful considerations given to the indicators, sub domain and domains of the IMD, incorporating local spatial context into the measurement of deprivation is methodological feasible without significant changes to the current approach. The techniques used in this research can be used as the starting point for the contextualisation of neighbourhood locational attributes. The applicability of these techniques is not limited to the English Indices of Deprivation. It can be used in other countries with deprivation indices which have similar basis for computation as the English IMD.

*7.3.1 **Limitations and Directions of Future Research***

In as much as this research has led to some significant findings in the quest to improve the understanding of the manifestation of deprivation at the neighbourhood level, within the local spatial opportunity structure and the production of deprivation indices which explicitly accounts for local neighbourhood spatial context, the study is not without limitations. These identified limitations, some of which point to gaps in knowledge and future areas for investigation are highlighted below:

- The measurement of neighbourhood deprivation encompasses complex socioeconomic processes involving people and places. Some of these processes and interactions do not lend themselves to quantification. As such, deprivation indices such as the IMD and measures described in this thesis cannot fully account for them. Further research into the use of qualitative measures to augment the quantification approach is recommended as an areas for further investigation, as this can produce better knowledge about the understanding of neighbourhood deprivation and what is of utmost importance to people.
- The conceptualisation of the measurement neighbourhood deprivation proposed in this research (see chapter 4) highlights the importance of deprivation within nearby and distant but connected neighbourhoods to experiences of within neighbourhood deprivation. However, this research has not been able to specify the appropriate weights to be assigned to within neighbourhood deprivation, deprivation in nearby neighbourhoods and deprivation in distant but connected neighbourhoods. The weights assigned to these three elements of neighbourhood deprivation are to a large extent dependent on the socioeconomic activity of interest, the indicators used in its measurement and the perceived importance of spatial context. An attempt has been made to determine the perceived relevance of local spatial context to the each of the domains of the English

Indices of Deprivation, 2015 (see chapter 3).This can be a useful basis for the development of a framework which can be used to determined appropriate weights to be assigned to each of the key elements of the measurement of neighbourhood deprivation.

- Similar to the points above, this research has not specified the optimal spatial lag or contiguity necessary for the spatial contextualisation of neighbourhood deprivation. This is because various factors such as the neighbourhood spatial structure, the perceived spatial scale of the indicators to be measured and socioeconomic activity of interest all have an impact on the selection the optimal level of contiguity and or spatial lag. Further research in this direction is required to help develop models for establishing an appropriate spatial lag or contiguity for the measurement of deprivation.
- The decision to use of commuting flows as proxy for identifying connected areas and to account for neighbourhood spatial relations was mainly based on the indicators used in the measurement of deprivation within the Barriers to Housing and Services domain of the 2015 Indices of deprivation. Whilst commuting to certain areas can impact accessibility to certain services such as supermarket, post offices, and some health facilities as those measured by the creators of the 2015 Indices of Deprivation, commuting to an area for work may not be adequate for measuring certain process such as socio-cultural integration. A careful examination of what is being measured is important to the selection of appropriate variable for connectedness.

- In more general terms, the neighbourhood spatial opportunity structure is significant to the realisation of desired socioeconomic outcomes for people within these areas. The spatial extent of neighbourhood opportunity structures differ from place to place and also differ with socioeconomic activity of interest. In some instances the responsibility for addressing problems within these areas lie with different local authorities. If neighbourhood deprivation is to be assessed at appropriate spatial scales, there is the need to explore and device measures for addressing cross-boundary problems effectively. This is beyond the scope of this research and it is recommended for further investigation.

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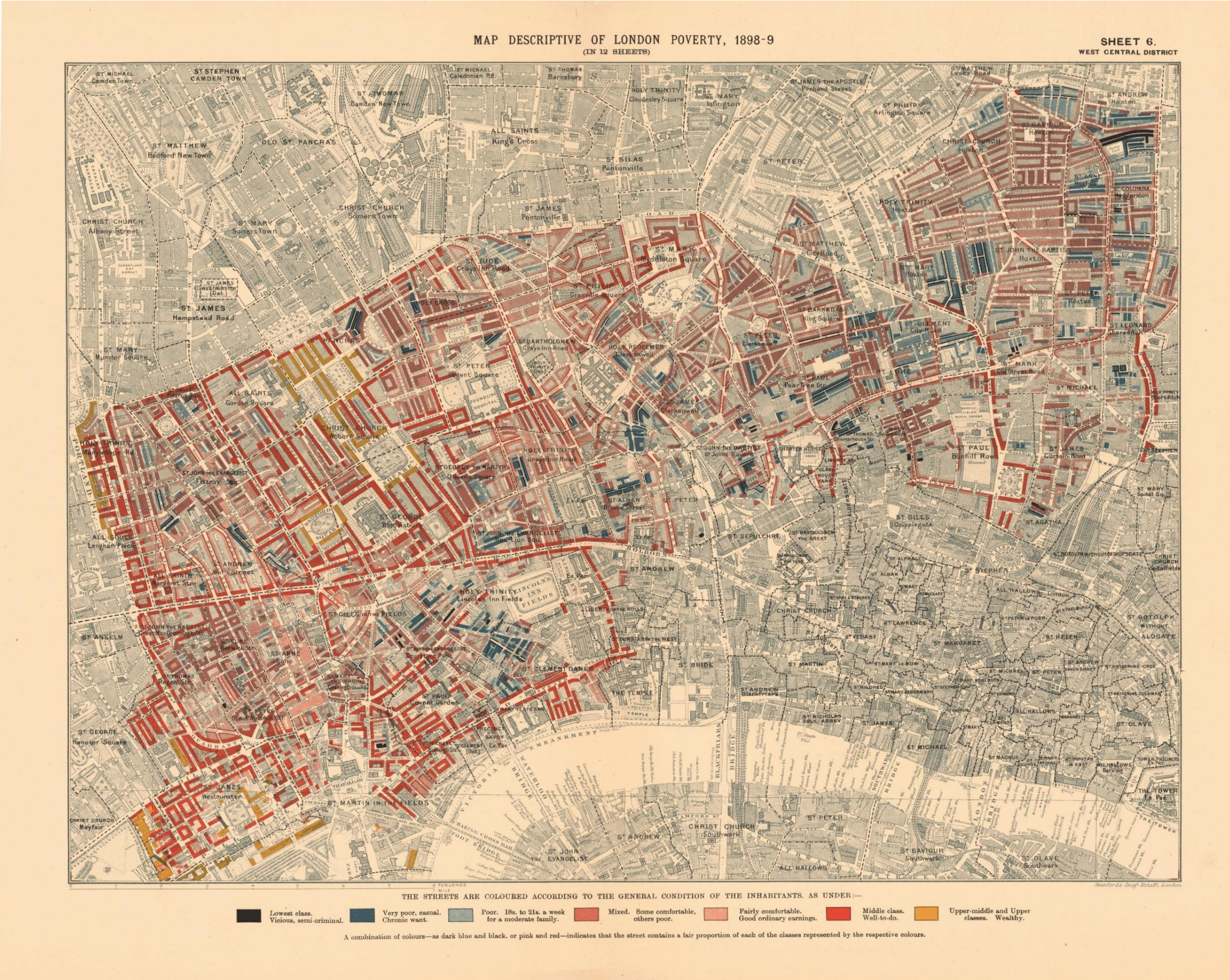
Appendix I - Charles Booth London Poverty



Appendix II – Indicators, Domains and Sub-Domains the 2015 English Indices of Deprivation

DOMAIN		INDICATORS	STEP1		STEP 2	STEP 3	WEIGHTS
Income	1	Adults & Children in Income Support Families	A				
	2	Adults & Children in Income-based job seekers allowances families	B				
	3	Adults & Children in Income-based employment and support Allowance Families	C				
	4	Adults &Y Children in Pension Credit (Guarantee families)	D	(A+B+C+D+E+F)/G	Apply shrinkage procedure		22.50%
	4	Adults & Children in Child tax Credit and Working Tax credit families not already Counted	E				
	6	Asylum Seekers in England in receipt of subsistence support, accommodation support or both	F				
		LSOA Total Population	G				
Employment	7	Claimants of Job Seekers Allowance	H				
	8	Claimants of Employment and support Allowance	I				
	9	Claimants of Incapacity Benefit	J	(H+I+J+K+L)/(M/64)	Apply shrinkage procedure		22.50%
	10	Claimants of severe Disablement Allowance	K				
	11	Claimants of Carer's Allowance	L				
		LSOA Population aged 18-59	M				
Health Deprivation	12	Years of Potential Life Lost					
	13	Comparative Illness and disability ratio					
	14	Acute Morbity			Factor Analysis used to generate Weights to combine the indicators		13.50%
	15	Mood and anxiety disorders					
			Apply shrinkage to the various Indicators				
Education, Skills & Training		**Children & Young People:**					
	16	Key Stage 2 attainment					
	17	Key Stage 4 attainment			Factor Analysis used to generate Weights to combine the indicators in children sub-domain		
	18	secondary School absence					
	19	staying on in education					13.50%
	20	Entry to higher education					
		Adult Skills					
	21	Adults with low or no qualifications				The two sub-domains standardize, exponentially transformed and combined with equal weights	
	22	English language proficiency	Apply shrinkage to all data		Adult skills indicators combined as non-overlapping count		
Crime		Crime Rates for:					
	23	Violence					9.30%
	24	Burglary					
	25	Theft	Constrain numerators to CDRP totals then Apply shrinkage procedure to the four rates				
	26	Criminal damage			Factor Analysis used to generate Weights to combine the indicators		
Barriers to Housing and Services		**Geographical Barriers**					
		Road distance to:					
	27	Post office					
	28	Primary School					
	29	General Store or supermarket	Apply shrinkage to overcrowding				
	30	GP surgery			Standardise indicators in sub-domains and combine with equal weights	The two sub-domains standardize, exponentially transformed and combined with equal weights	9.30%
		Wider Barriers					
	31	House hold overcrowding					
	32	Homelessness					
	33	Housing affordability					
Living Environment		Indoors Living Environment				The two sub-domains standardize, exponentially transformed and combined using weights (0.66 for indoors and 0.33 for outdoors	
	34	Housing in poor condition					
	35	Houses without central heating					
		Outdoors Living Environment:					9.30%
	36	Air Quality	Apply Shrinkage to everything except air quality		Standardise indicators in sub-domains and combine with equal weights		
	37	Road Traffic accidents					

Source: Author – Adapted from DCLG, ID2015

Appendix III – Most Deprived 20% - Overall Index

20% Most Deprived LSOAs
(Overall IMD Index)

Rank	*Local & Unitary Authorities*	*No LSOAs*	*Average Rank*	*Minimum Score*	*Maximum Score*	*Percentage of LSOAs in the Most Deprived 20%,*
1	Knowsley	98	7056	10.32	77.30	61.2
2	Liverpool	298	7433	3.03	81.53	60.7
3	Nottingham	182	7469	5.21	77.59	60.4
4	Barking and Dagenham	110	6771	15.77	56.57	59.1
5	Manchester	282	6683	7.11	80.03	58.5
6	Tower Hamlets	144	7507	7.30	58.32	58.3
7	Middlesbrough	86	9353	3.21	78.03	57.0
8	Hackney	144	6701	15.91	64.26	55.6
9	Sandwell	186	8020	8.11	69.12	54.8
10	Birmingham	639	8140	3.10	79.03	54.8
11	Kingston upon Hull, City of	166	7650	7.99	82.60	52.4
12	Wolverhampton	158	9819	5.43	71.84	51.3
13	Blackpool	94	6993	12.07	88.52	51.1
14	Stoke-on-Trent	159	9584	4.69	74.31	50.9
15	Blackburn with Darwen	91	10066	4.14	81.85	49.5
16	Halton	79	10972	6.34	68.25	49.4
17	South Tyneside	102	10739	3.63	70.49	47.1
18	Walsall	167	11744	3.32	67.96	46.1
19	Burnley	60	9503	7.07	82.32	45.0
20	Hyndburn	52	10720	6.75	66.15	44.2
21	Salford	150	10442	3.09	78.17	44.0
22	Islington	123	8144	10.31	63.96	43.9
23	Leicester	192	9248	5.82	73.15	43.2
24	Hartlepool	58	11101	5.59	71.68	43.1
25	Bradford	310	11057	1.67	79.00	42.3
26	Rochdale	134	10477	6.22	79.57	41.8
27	Oldham	141	12335	4.60	77.15	41.1
28	Norwich	83	11590	2.60	57.69	41.0
29	Newham	164	7464	10.53	57.07	40.9
30	Barrow-in-Furness	49	11477	6.17	74.56	40.8

Source: Author

Appendix IV– Most Deprived 10% - Living Environment Domain

10% Most Deprived LSOAs (Living Environment Domain)			
Local & Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 10%*
Kensington and Chelsea	103	81	78.6
Westminster	128	99	77.3
City of London	6	3	50.0
Camden	133	65	48.9
Torridge	37	18	48.6
Cornwall	326	156	47.9
Eden	36	17	47.2
Portsmouth	125	57	45.6
West Devon	31	14	45.2
Mid Devon	43	19	44.2
West Somerset	21	9	42.9
Barrow-in-Furness	49	20	40.8
Pendle	57	23	40.4
Hammersmith and Fulham	113	44	38.9
Hackney	144	56	38.9
Lambeth	178	66	37.1
Islington	123	45	36.6
Herefordshire, County of	116	41	35.3
Blackpool	94	33	35.1
Burnley	60	21	35.0
Hyndburn	52	18	34.6
Liverpool	298	101	33.9
Ryedale	30	10	33.3
Southwark	166	54	32.5
Birmingham	639	195	30.5
Lancaster	89	26	29.2
Bradford	310	89	28.7
Hastings	53	15	28.3
Brighton and Hove	165	45	27.3
Scarborough	71	19	26.8
Preston	86	23	26.7
North Devon	58	15	25.9
Calderdale	128	33	25.8
Tower Hamlets	144	37	25.7

Source: Author

Appendix V – Most Deprived 20% -Living Environment Domain

	20% Most Deprived LSOAs (Living Environment Domain)		
Local & Unitary Authorities	*No LSOAs*	*No of Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Kensington and Chelsea	103	101	98.1
Westminster	128	124	96.9
Camden	133	111	83.5
Hammersmith and Fulham	113	94	83.2
Islington	123	102	82.9
Hackney	144	119	82.6
Lambeth	178	139	78.1
Portsmouth	125	87	69.6
Southwark	166	114	68.7
Tower Hamlets	144	98	68.1
City of London	6	4	66.7
Cornwall	326	210	64.4
Torridge	37	23	62.2
Pendle	57	35	61.4
Haringey	145	88	60.7
Eden	36	21	58.3
West Devon	31	18	58.1
Birmingham	639	367	57.4
Ryedale	30	17	56.7
Wandsworth	179	97	54.2
Hyndburn	52	28	53.8
West Somerset	21	11	52.4
Mid Devon	43	22	51.2
Blackpool	94	47	50.0
Barrow-in-Furness	49	24	49.0
Liverpool	298	143	48.0
Waltham Forest	144	67	46.5
Calderdale	128	59	46.1
Lewisham	169	77	45.6
Bradford	310	135	43.5
Burnley	60	26	43.3
Southampton	148	64	43.2
Leicester	192	83	43.2

Source: Author

Appendix VI – Most Deprived 10% - Barriers to Housing and Services

	10% Most Deprived LSOAs (Barriers to Housing and Services)		
Local & Unitary Authorities	*No LSOAs*	*No of Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 10%*
Newham	164	137	83.5
Tower Hamlets	144	89	61.8
Waltham Forest	144	81	56.3
Hackney	144	77	53.5
Brent	173	86	49.7
Hounslow	142	66	46.5
Herefordshire, County of	116	53	45.7
Barking and Dagenham	110	49	44.5
Haringey	145	63	43.4
Richmondshire	34	14	41.2
Birmingham	639	260	40.7
North Dorset	37	15	40.5
Ryedale	30	12	40.0
Westminster	128	46	35.9
Wychavon	78	28	35.9
Forest Heath	34	12	35.3
Torridge	37	13	35.1
North Norfolk	62	20	32.3
Cotswold	51	16	31.4
Hambleton	52	16	30.8
Eden	36	11	30.6
Rutland	23	7	30.4
Redditch	55	16	29.1
West Devon	31	9	29.0
Luton	121	33	27.3
Mid Suffolk	56	15	26.8
Malvern Hills	45	12	26.7
Ealing	196	52	26.5
Uttlesford	46	12	26.1
Mid Devon	43	11	25.6
Islington	123	30	24.4
Shropshire	193	47	24.4
Kensington and Chelsea	103	25	24.3

Source: Author

Appendix VII – Most Deprived 20% -Barriers to Housing and Services

20% Most Deprived LSOAs (Barriers to Housing and Services)			
Local & Unitary Authorities	*No LSOAs*	*No of Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Newham	164	161	98.2
Barking and Dagenham	110	102	92.7
Brent	173	149	86.1
Hackney	144	124	86.1
Waltham Forest	144	123	85.4
Tower Hamlets	144	120	83.3
Hounslow	142	107	75.4
Westminster	128	86	67.2
City of London	6	4	66.7
Birmingham	639	413	64.6
Haringey	145	93	64.1
Southwark	166	95	57.2
Croydon	220	125	56.8
Richmondshire	34	19	55.9
Luton	121	67	55.4
Enfield	183	101	55.2
Herefordshire, County of	116	63	54.3
North Dorset	37	20	54.1
Uttlesford	46	24	52.2
Redditch	55	28	50.9
Eden	36	18	50.0
Islington	123	60	48.8
Lewisham	169	82	48.5
West Somerset	21	10	47.6
Wychavon	78	37	47.4
Lambeth	178	84	47.2
Forest Heath	34	16	47.1
North Norfolk	62	29	46.8
Ealing	196	91	46.4
Mid Suffolk	56	25	44.6
Babergh	54	24	44.4
Ryedale	30	13	43.3
Torridge	37	16	43.2

Source: Author

Appendix VIII – Most Deprived 10% - Crime Domain

10% Most Deprived LSOAs (Crime Domain)			
Local and Unitary Authorities	*No LSOAs*	*No of Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 10%*
Lambeth	178	96	53.9
Newham	164	77	47.0
Islington	123	57	46.3
Hackney	144	63	43.8
Tower Hamlets	144	62	43.1
Barking and Dagenham	110	47	42.7
Blackpool	94	38	40.4
Kingston upon Hull, City of	166	64	38.6
Southwark	166	64	38.6
Middlesbrough	86	33	38.4
North East Lincolnshire	106	39	36.8
Gravesham	64	23	35.9
Waltham Forest	144	51	35.4
Manchester	282	99	35.1
Burnley	60	21	35.0
Haringey	145	50	34.5
Thanet	84	26	31.0
Nottingham	182	56	30.8
Southampton	148	42	28.4
Lewisham	169	46	27.2
Bradford	310	84	27.1
Leicester	192	49	25.5
Croydon	220	55	25.0
Rochdale	134	32	23.9
Slough	80	19	23.8
Liverpool	298	70	23.5
Stoke-on-Trent	159	37	23.3
Luton	121	28	23.1
Dartford	58	13	22.4
Enfield	183	41	22.4
Blackburn with Darwen	91	20	22.0
Basildon	110	24	21.8
Northampton	133	28	21.1

Source: Author

Appendix IX – Most Deprived 20% - Crime Domain

Local and Unitary Authorities	*No LSOAs*	*No of Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Islington	123	97	78.9
Lambeth	178	140	78.7
Newham	164	117	71.3
Southwark	166	117	70.5
Barking and Dagenham	110	77	70.0
Hackney	144	96	66.7
Waltham Forest	144	94	65.3
Haringey	145	92	63.4
Tower Hamlets	144	89	61.8
Gravesham	64	39	60.9
Manchester	282	171	60.6
Lewisham	169	102	60.4
Middlesbrough	86	47	54.7
Kingston upon Hull, City of	166	90	54.2
Blackpool	94	49	52.1
Nottingham	182	92	50.5
Burnley	60	30	50.0
North East Lincolnshire	106	53	50.0
Croydon	220	108	49.1
Slough	80	39	48.8
Southampton	148	72	48.6
Bradford	310	142	45.8
Enfield	183	83	45.4
Thanet	84	37	44.0
Rochdale	134	57	42.5
Dartford	58	24	41.4
Ealing	196	81	41.3
Luton	121	50	41.3
Liverpool	298	123	41.3
Greenwich	151	62	41.1
Stoke-on-Trent	159	65	40.9
Blackburn with Darwen	91	37	40.7
Brent	173	68	39.3

Source: Author

Appendix X- Most Deprived 10% - Income Domain

10% Most Deprived LSOAs (Income Domain)			
Local and Unitary Authorities	*No LSOAs*	*No of Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 10%*
Middlesbrough	86	42	48.8
Knowsley	98	45	45.9
Kingston upon Hull, City of	166	69	41.6
Liverpool	298	121	40.6
Manchester	282	106	37.6
Birmingham	639	233	36.5
Hartlepool	58	21	36.2
Tower Hamlets	144	50	34.7
Blackpool	94	31	33.0
Wolverhampton	158	50	31.6
Walsall	167	52	31.1
Nottingham	182	54	29.7
Halton	79	23	29.1
South Tyneside	102	29	28.4
Salford	150	41	27.3
Sandwell	186	50	26.9
Rochdale	134	36	26.9
Oldham	141	37	26.2
Bradford	310	80	25.8
Stoke-on-Trent	159	41	25.8
North East Lincolnshire	106	27	25.5
Newcastle upon Tyne	175	44	25.1
Leicester	192	47	24.5
Sunderland	185	45	24.3
Blackburn with Darwen	91	22	24.2
Redcar and Cleveland	88	21	23.9
St. Helens	119	28	23.5
Burnley	60	14	23.3
Great Yarmouth	61	14	23.0
Hastings	53	12	22.6
Bolton	177	39	22.0
Sheffield	345	75	21.7
Stockton-On-Tees	120	26	21.7

Source: Author

Appendix XI – Most Deprived 20% - Income Domain

20% Most Deprived LSOAs (Income Domain)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Barking and Dagenham	110	69	62.7
Tower Hamlets	144	89	61.8
Sandwell	186	111	59.7
Knowsley	98	57	58.2
Liverpool	298	171	57.4
Middlesbrough	86	48	55.8
Manchester	282	152	53.9
Wolverhampton	158	84	53.2
Nottingham	182	96	52.7
Birmingham	639	337	52.7
South Tyneside	102	52	51.0
Hackney	144	73	50.7
Kingston upon Hull, City of	166	84	50.6
Hartlepool	58	29	50.0
Walsall	167	82	49.1
Blackpool	94	44	46.8
Enfield	183	85	46.4
Blackburn with Darwen	91	41	45.1
Islington	123	54	43.9
Haringey	145	63	43.4
Stoke-on-Trent	159	68	42.8
Leicester	192	81	42.2
Sunderland	185	78	42.2
Burnley	60	25	41.7
Halton	79	32	40.5
Oldham	141	57	40.4
Bradford	310	125	40.3
Rochdale	134	54	40.3
Salford	150	60	40.0
Norwich	83	33	39.8
Southwark	166	66	39.8
North East Lincolnshire	106	41	38.7
Lewisham	169	65	38.5

Source: Author

Appendix XII – Most Deprived 10% - Employment Domain

10% Most Deprived LSOAs (Employment Domain)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 10%*
Knowsley	98	48	49.0
Middlesbrough	86	41	47.7
Liverpool	298	142	47.7
Kingston upon Hull, City of	166	75	45.2
South Tyneside	102	43	42.2
Hartlepool	58	24	41.4
Blackpool	94	34	36.2
Halton	79	27	34.2
Stoke-on-Trent	159	54	34.0
Manchester	282	94	33.3
Birmingham	639	208	32.6
Wolverhampton	158	49	31.0
Sunderland	185	57	30.8
Hastings	53	16	30.2
Blackburn with Darwen	91	27	29.7
Nottingham	182	54	29.7
Redcar and Cleveland	88	26	29.5
Rochdale	134	39	29.1
Salford	150	43	28.7
St. Helens	119	34	28.6
Barnsley	147	41	27.9
County Durham	324	86	26.5
Barrow-in-Furness	49	13	26.5
Thanet	84	22	26.2
Wirral	206	53	25.7
Burnley	60	15	25.0
Hyndburn	52	13	25.0
Oldham	141	35	24.8
Great Yarmouth	61	15	24.6
North East Lincolnshire	106	26	24.5
Bradford	310	76	24.5
Newcastle upon Tyne	175	41	23.4
Rotherham	167	39	23.4

Source: Author

Appendix XIII – Most Deprived 20% - Employment Domain

20% Most Deprived LSOAs (Employment Domain)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Knowsley	98	62	63.3
Liverpool	298	181	60.7
South Tyneside	102	60	58.8
Middlesbrough	86	50	58.1
Hartlepool	58	33	56.9
Wolverhampton	158	88	55.7
Sandwell	186	102	54.8
Birmingham	639	333	52.1
Manchester	282	144	51.1
Halton	79	40	50.6
Kingston upon Hull, City of	166	84	50.6
Nottingham	182	92	50.5
Stoke-on-Trent	159	79	49.7
Blackburn with Darwen	91	45	49.5
Mansfield	67	33	49.3
Blackpool	94	46	48.9
Walsall	167	81	48.5
Burnley	60	29	48.3
Sunderland	185	88	47.6
County Durham	324	150	46.3
Barnsley	147	68	46.3
St. Helens	119	55	46.2
Hyndburn	52	24	46.2
Hastings	53	23	43.4
Rochdale	134	58	43.3
Salford	150	64	42.7
Rotherham	167	70	41.9
Bolton	177	74	41.8
Doncaster	194	80	41.2
Oldham	141	58	41.1
Barrow-in-Furness	49	20	40.8
Newcastle upon Tyne	175	71	40.6
Gateshead	126	51	40.5

Source: Author

Appendix XIV – Most Deprived 10% - Education Skills and Training

10% Most Deprived LSOAs (Education, Skills and Training)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	***Percentage of LSOAs in the Most Deprived 10%***
Middlesbrough	86	38	44.2
Kingston upon Hull, City of	166	70	42.2
Knowsley	98	41	41.8
Norwich	83	30	36.1
Nottingham	182	62	34.1
Stoke-on-Trent	159	53	33.3
Bradford	310	101	32.6
Leicester	192	61	31.8
Great Yarmouth	61	19	31.1
Barnsley	147	45	30.6
Blackburn with Darwen	91	27	29.7
Ipswich	85	25	29.4
Doncaster	194	55	28.4
North East Lincolnshire	106	30	28.3
Basildon	110	31	28.2
Wakefield	209	58	27.8
Peterborough	112	31	27.7
Walsall	167	46	27.5
Havant	78	21	26.9
Mansfield	67	18	26.9
Corby	41	11	26.8
Sheffield	345	92	26.7
Oldham	141	36	25.5
Blackpool	94	23	24.5
Rotherham	167	40	24.0
Sandwell	186	44	23.7
Liverpool	298	70	23.5
Boston	36	8	22.2
Carlisle	68	15	22.1
Fenland	55	12	21.8
Burnley	60	13	21.7
Ashfield	74	16	21.6
Portsmouth	125	27	21.6

Source: Author

Appendix XV – Most Deprived 20% -Education, Skills and Training

20% Most Deprived LSOAs (Education, Skills and Training)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Nottingham	182	102	56.0
Corby	41	22	53.7
Kingston upon Hull, City of	166	89	53.6
Sandwell	186	96	51.6
Stoke-on-Trent	159	82	51.6
Middlesbrough	86	44	51.2
Knowsley	98	50	51.0
Walsall	167	85	50.9
Leicester	192	97	50.5
Mansfield	67	33	49.3
Barnsley	147	72	49.0
Great Yarmouth	61	29	47.5
Wolverhampton	158	75	47.5
Blackburn with Darwen	91	41	45.1
Liverpool	298	134	45.0
Ipswich	85	38	44.7
Norwich	83	37	44.6
Bolsover	48	21	43.8
Basildon	110	48	43.6
Fenland	55	24	43.6
Burnley	60	26	43.3
Doncaster	194	84	43.3
Bradford	310	134	43.2
Ashfield	74	31	41.9
Boston	36	15	41.7
Wakefield	209	87	41.6
Birmingham	639	263	41.2
Manchester	282	116	41.1
Peterborough	112	46	41.1
Hartlepool	58	23	39.7
North East Lincolnshire	106	42	39.6
Rotherham	167	65	38.9
Castle Point	57	22	38.6

Source: Author

Appendix XVI – Most Deprived 10% - Health Deprivation and Disability

10% Most Deprived LSOAs (Health Deprivation and Disability)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 10%*
Manchester	282	185	65.6
Knowsley	98	63	64.3
Liverpool	298	188	63.1
Blackpool	94	55	58.5
Middlesbrough	86	48	55.8
Blackburn with Darwen	91	45	49.5
Barrow-in-Furness	49	24	49.0
Halton	79	37	46.8
Burnley	60	28	46.7
Salford	150	70	46.7
Hyndburn	52	24	46.2
Hartlepool	58	24	41.4
Sunderland	185	76	41.1
South Tyneside	102	41	40.2
St. Helens	119	46	38.7
Stoke-on-Trent	159	60	37.7
Newcastle upon Tyne	175	61	34.9
Nottingham	182	63	34.6
Preston	86	29	33.7
Tameside	141	47	33.3
Wirral	206	68	33.0
Rochdale	134	43	32.1
Lincoln	57	18	31.6
Barnsley	147	46	31.3
County Durham	324	101	31.2
Redcar and Cleveland	88	27	30.7
Pendle	57	17	29.8
Gateshead	126	37	29.4
Oldham	141	40	28.4
Chesterfield	69	19	27.5
Sefton	189	51	27.0
Kingston upon Hull, City of	166	43	25.9
Wigan	200	50	25.0

Source: Author

Appendix XVII – Most Deprived 20% - Health Deprivation and Disability

20% Most Deprived LSOAs (Health Deprivation and Disability)			
Local and Unitary Authorities	*No LSOAs*	*Deprived LSOAs*	*Percentage of LSOAs in the Most Deprived 20%*
Manchester	282	240	85.1
Blackpool	94	79	84.0
Liverpool	298	237	79.5
Knowsley	98	76	77.6
Burnley	60	41	68.3
Salford	150	102	68.0
South Tyneside	102	69	67.6
Hyndburn	52	35	67.3
Nottingham	182	119	65.4
Barrow-in-Furness	49	32	65.3
Middlesbrough	86	55	64.0
Sunderland	185	118	63.8
Blackburn with Darwen	91	56	61.5
Stoke-on-Trent	159	97	61.0
Halton	79	48	60.8
St. Helens	119	72	60.5
Hartlepool	58	35	60.3
Rochdale	134	80	59.7
Preston	86	49	57.0
Tameside	141	80	56.7
County Durham	324	176	54.3
Barnsley	147	78	53.1
Copeland	49	26	53.1
Newcastle upon Tyne	175	91	52.0
Gateshead	126	64	50.8
Chesterfield	69	35	50.7
Kingston upon Hull, City of	166	83	50.0
Sandwell	186	91	48.9
Pendle	57	27	47.4
Wirral	206	97	47.1
Oldham	141	66	46.8
Norwich	83	38	45.8
Bolton	177	81	45.8

Source: Author

Appendix XVIII – LSOA Flows with over 50km Network Distance

Number of Commuters	*Pairs of LSOA Flows*	*Percentage*	*Cumulative Percentage*	*Number of Commuters*	*Pairs of LSOA Flows*	*Percentage*	*Cumulative Percentage*
1	863043	87.8891	87.8891	37	14	0.0014	99.9914
2	88978	9.0612	96.9503	38	7	0.0007	99.9922
3	17020	1.7333	98.6836	39	6	0.0006	99.9928
4	5903	0.6011	99.2847	40	7	0.0007	99.9935
5	2501	0.2547	99.5394	41	3	0.0003	99.9938
6	1411	0.1437	99.6831	42	7	0.0007	99.9945
7	794	0.0809	99.7639	43	6	0.0006	99.9951
8	515	0.0524	99.8164	44	6	0.0006	99.9957
9	334	0.0340	99.8504	45	1	0.0001	99.9958
10	238	0.0242	99.8746	46	3	0.0003	99.9961
11	185	0.0188	99.8935	47	2	0.0002	99.9963
12	149	0.0152	99.9087	49	2	0.0002	99.9965
13	108	0.0110	99.9197	50	3	0.0003	99.9968
14	97	0.0099	99.9295	51	2	0.0002	99.9970
15	78	0.0079	99.9375	52	1	0.0001	99.9971
16	62	0.0063	99.9438	53	1	0.0001	99.9973
17	56	0.0057	99.9495	54	1	0.0001	99.9974
18	50	0.0051	99.9546	55	1	0.0001	99.9975
19	40	0.0041	99.9587	56	3	0.0003	99.9978
20	41	0.0042	99.9628	58	2	0.0002	99.9980
21	22	0.0022	99.9651	59	1	0.0001	99.9981
22	29	0.0030	99.9680	62	1	0.0001	99.9982
23	17	0.0017	99.9698	63	2	0.0002	99.9984
24	25	0.0025	99.9723	64	1	0.0001	99.9985
25	17	0.0017	99.9740	65	3	0.0003	99.9988
26	22	0.0022	99.9763	66	1	0.0001	99.9989
27	17	0.0017	99.9780	68	1	0.0001	99.9990
28	22	0.0022	99.9802	69	1	0.0001	99.9991
29	11	0.0011	99.9814	70	1	0.0001	99.9992
30	15	0.0015	99.9829	71	2	0.0002	99.9994
31	10	0.0010	99.9839	72	1	0.0001	99.9995
32	11	0.0011	99.9850	76	1	0.0001	99.9996
33	14	0.0014	99.9865	81	1	0.0001	99.9997
34	14	0.0014	99.9879	88	1	0.0001	99.9998
35	10	0.0010	99.9889	89	1	0.0001	99.9999
36	11	0.0011	99.9900	100	1	0.0001	100.0000
37	14	0.0014	99.9914	**Total**	**981,968**		

Source: Author

Appendix XIX - Rank Changes of the 60 Most Deprived Local Authorities after Spatial Contextualisation (Proportion of LSOAs in the most deprived Decile)

Local Authority Districts	*Number of LSOAs*	IMD2015 *Percentage of Deprived LSOAs*	IMD2015 *Rank*	AIMD25 *Percentage of Deprived LSOAs*	AIMD25 *Rank*	AIMD50 *Percentage of Deprived LSOAs*	AIMD50 *Rank*	AIMD75 *Percentage of Deprived LSOAs*	AIMD75 *Rank*
Middlesbrough	86	48.8%	1	48.8%	1	51.2%	1	51.2%	1
Knowsley	98	45.9%	2	45.9%	3	45.9%	3	46.9%	3
Kingston upon Hull, City of	166	45.2%	3	45.2%	4	44.0%	4	44.0%	4
Liverpool	298	45.0%	4	46.6%	2	47.3%	2	48.0%	2
Manchester	282	40.8%	5	40.8%	5	40.8%	6	40.4%	7
Birmingham	639	39.6%	6	37.2%	8	34.1%	10	31.9%	15
Blackpool	94	38.3%	7	40.4%	6	41.5%	5	43.6%	6
Nottingham	182	33.5%	8	31.9%	12	31.3%	15	30.8%	18
Burnley	60	33.3%	9	35.0%	9	36.7%	8	40.0%	8
Hartlepool	58	32.8%	10	34.5%	10	36.2%	9	36.2%	10
Bradford	310	32.6%	11	32.3%	11	32.3%	13	32.6%	14
Blackburn with Darwen	91	30.8%	12	37.4%	7	39.6%	7	44.0%	5
Hastings	53	30.2%	13	30.2%	15	30.2%	18	30.2%	20
Stoke-on-Trent	159	30.2%	14	31.4%	14	33.3%	12	34.6%	13
North East Lincolnshire	106	29.2%	15	30.2%	16	32.1%	14	35.8%	11
Salford	150	28.7%	16	28.7%	17	28.0%	21	28.0%	23
Rochdale	134	28.4%	17	28.4%	18	29.1%	19	28.4%	22
Pendle	57	28.1%	18	31.6%	13	33.3%	11	35.1%	12
Halton	79	26.6%	19	26.6%	20	27.8%	22	30.4%	19
Great Yarmouth	61	26.2%	20	26.2%	22	26.2%	24	26.2%	24
Wolverhampton	158	25.9%	21	24.7%	24	23.4%	29	22.2%	38
Hyndburn	52	25.0%	22	26.9%	19	30.8%	16	30.8%	17
Leicester	192	24.0%	23	24.5%	26	24.5%	25	25.5%	26
Tower Hamlets	144	23.6%	24	20.1%	43	17.4%	51	9.7%	91
St. Helens	119	23.5%	25	24.4%	27	24.4%	26	25.2%	27
Sheffield	345	23.5%	26	23.2%	28	22.9%	32	22.3%	36
Oldham	141	22.7%	27	24.8%	23	29.1%	20	31.9%	16
Sandwell	186	22.6%	28	20.4%	40	19.9%	43	19.4%	45
Barrow-in-Furness	49	22.4%	29	26.5%	21	30.6%	17	38.8%	9
Newcastle upon Tyne	175	22.3%	30	22.9%	29	22.9%	33	22.9%	32
Leeds	482	21.8%	31	21.6%	36	21.6%	36	21.8%	39
Barnsley	147	21.8%	32	24.5%	25	26.5%	23	28.6%	21
Redcar and Cleveland	88	21.6%	33	22.7%	31	23.9%	27	26.1%	25
South Tyneside	102	21.6%	34	21.6%	37	20.6%	41	19.6%	44
Thanet	84	21.4%	35	22.6%	33	22.6%	34	22.6%	35
Wirral	206	21.4%	36	22.8%	30	23.8%	28	24.8%	28
Doncaster	194	20.6%	37	22.7%	32	23.2%	31	24.2%	30
Norwich	83	20.5%	38	21.7%	34	21.7%	35	22.9%	31
Walsall	167	20.4%	39	21.0%	38	21.6%	38	22.2%	37
Bolton	177	20.3%	40	20.3%	42	20.3%	42	20.9%	42
Sefton	189	20.1%	41	20.6%	39	21.2%	39	22.8%	33
Sunderland	185	19.5%	42	21.6%	35	23.2%	30	24.3%	29
Rotherham	167	19.2%	43	20.4%	41	21.6%	37	21.6%	41
Haringey	145	18.6%	44	15.9%	55	13.8%	65	11.0%	82
Derby	151	18.5%	45	19.2%	44	19.2%	45	19.2%	46
Coventry	195	18.5%	46	18.5%	47	17.9%	48	16.9%	52
Stockton-on-Tees	120	18.3%	47	19.2%	45	20.8%	40	21.7%	40
Lincoln	57	17.5%	48	17.5%	48	15.8%	57	14.0%	64
Hackney	144	17.4%	49	15.3%	61	12.5%	74	11.1%	81
Tameside	141	17.0%	50	19.1%	46	19.9%	44	22.7%	34
Plymouth	161	16.8%	51	16.8%	51	16.8%	53	16.8%	55
Swale	85	16.5%	52	16.5%	53	17.6%	49	18.8%	47
Preston	86	16.3%	53	17.4%	49	18.6%	46	19.8%	43
Peterborough	112	16.1%	54	16.1%	54	16.1%	55	14.3%	62
Bristol, City of	263	16.0%	55	15.6%	58	15.2%	60	14.8%	60
Tendring	89	15.7%	56	16.9%	50	18.0%	47	18.0%	50
Torbay	89	15.7%	57	15.7%	56	15.7%	58	16.9%	54
Darlington	65	15.4%	58	15.4%	60	15.4%	59	16.9%	53
Calderdale	128	14.8%	59	15.6%	57	17.2%	52	17.2%	51
East Lindsey	81	14.8%	60	14.8%	62	16.0%	56	16.0%	56

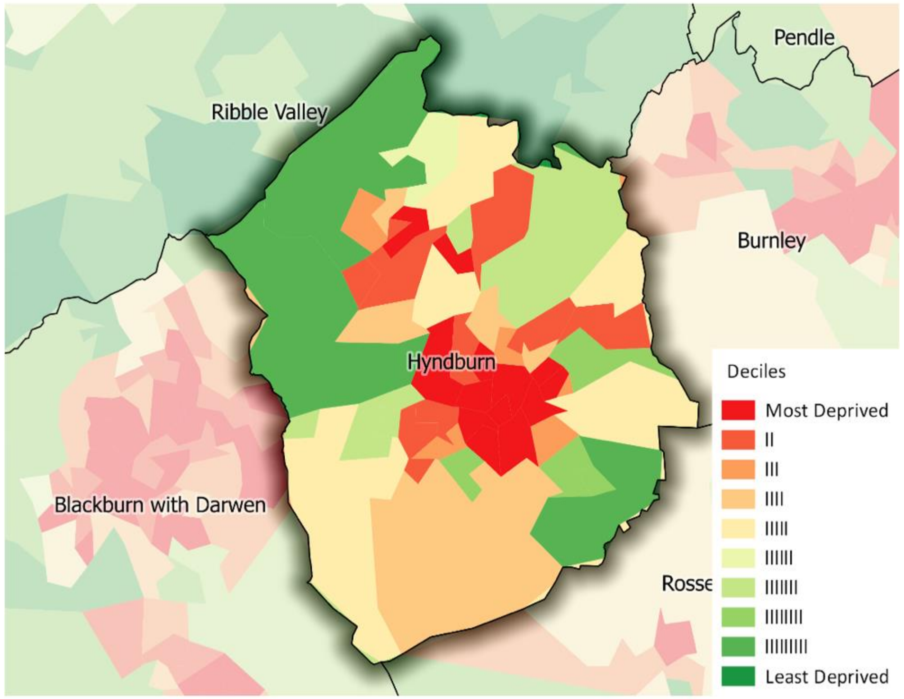
Source: Author

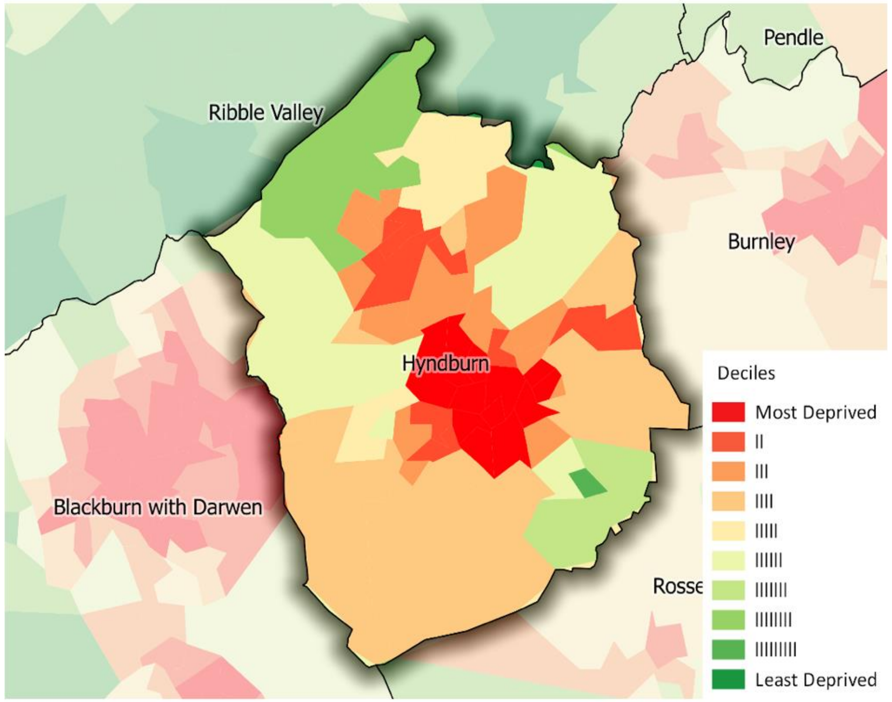
Appendix XX - Rank Changes of the 60 Most Deprived Local Authorities after Spatial Contextualisation (Proportion of LSOAs in the 20% most deprived category)

		IMD2015		AIMD25		AIMD50		AIMD75	
Local Authority Districts	*Number of LSOAs*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*	*Percentage of Deprived LSOAs*	*Rank*
Knowsley	98	61.2%	1	62.2%	1	64.3%	1	64.3%	2
Liverpool	298	60.7%	2	61.4%	2	61.7%	2	63.4%	3
Nottingham	182	60.4%	3	60.4%	3	60.4%	4	60.4%	5
Barking and Dagenham	110	59.1%	4	52.7%	12	46.4%	20	40.0%	37
Manchester	282	58.5%	5	58.2%	4	56.7%	6	56.4%	7
Tower Hamlets	144	58.3%	6	55.6%	6	54.2%	8	52.1%	12
Middlesbrough	86	57.0%	7	58.1%	5	58.1%	5	58.1%	6
Hackney	144	55.6%	8	51.4%	14	41.7%	32	38.2%	40
Sandwell	186	54.8%	9	53.2%	9	52.7%	11	52.2%	11
Birmingham	639	54.8%	10	53.2%	10	52.0%	12	50.9%	15
Kingston upon Hull, City of	166	52.4%	11	53.0%	11	53.0%	10	53.0%	10
Wolverhampton	158	51.3%	12	51.3%	15	50.6%	16	50.6%	17
Blackpool	94	51.1%	13	55.3%	7	61.7%	3	68.1%	1
Stoke-on-Trent	159	50.9%	14	51.6%	13	51.6%	14	54.7%	9
Blackburn with Darwen	91	49.5%	15	54.9%	8	56.0%	7	61.5%	4
Halton	79	49.4%	16	50.6%	16	50.6%	15	50.6%	16
South Tyneside	102	47.1%	17	47.1%	18	47.1%	18	47.1%	19
Walsall	167	46.1%	18	46.1%	21	46.1%	22	46.1%	21
Burnley	60	45.0%	19	50.0%	17	53.3%	9	55.0%	8
Hyndburn	52	44.2%	20	46.2%	20	51.9%	13	51.9%	13
Salford	150	44.0%	21	45.3%	22	45.3%	24	45.3%	23
Islington	123	43.9%	22	41.5%	28	40.7%	35	36.6%	43
Leicester	192	43.2%	23	45.3%	23	45.8%	23	45.8%	22
Hartlepool	58	43.1%	24	46.6%	19	50.0%	17	51.7%	14
Bradford	310	42.3%	25	42.9%	26	42.9%	28	43.9%	25
Rochdale	134	41.8%	26	41.8%	27	42.5%	29	42.5%	30
Oldham	141	41.1%	27	43.3%	25	44.7%	25	44.7%	24
Norwich	83	41.0%	28	43.4%	24	43.4%	27	43.4%	28
Newham	164	40.9%	29	36.0%	42	27.4%	75	22.6%	96
Barrow-in-Furness	49	40.8%	30	40.8%	29	46.9%	19	46.9%	20
Haringey	145	40.0%	31	39.3%	36	36.6%	41	31.7%	59
Hastings	53	39.6%	32	39.6%	34	39.6%	39	41.5%	33
St. Helens	119	39.5%	33	40.3%	32	42.0%	31	42.0%	31
Southwark	166	39.2%	34	36.1%	40	33.7%	49	30.7%	63
North East Lincolnshire	106	38.7%	35	39.6%	35	40.6%	36	40.6%	36
Sunderland	185	38.4%	36	40.0%	33	42.2%	30	43.8%	27
Bolton	177	37.9%	37	38.4%	37	40.7%	34	40.7%	35
Lewisham	169	37.3%	38	35.5%	45	30.8%	62	26.0%	79
Pendle	57	36.8%	39	40.4%	31	43.9%	26	43.9%	26
Barnsley	147	36.7%	40	40.8%	30	46.3%	21	49.0%	18
Newcastle upon Tyne	175	36.0%	41	35.4%	46	36.0%	43	35.4%	47
Mansfield	67	35.8%	42	35.8%	43	37.3%	40	38.8%	39
Peterborough	112	35.7%	43	35.7%	44	35.7%	46	34.8%	50
Doncaster	194	35.6%	44	38.1%	38	40.2%	38	41.8%	32
Tameside	141	35.5%	45	36.2%	39	40.4%	37	42.6%	29
Redcar and Cleveland	88	35.2%	46	35.2%	47	36.4%	42	37.5%	42
Sheffield	345	34.8%	47	33.9%	49	33.3%	50	32.8%	57
Thanet	84	34.5%	48	34.5%	48	35.7%	45	35.7%	45
Preston	86	33.7%	49	36.0%	41	40.7%	33	40.7%	34
Lincoln	57	33.3%	50	33.3%	50	33.3%	51	33.3%	54
Lambeth	178	33.1%	51	31.5%	57	27.0%	77	24.2%	87
Ipswich	85	32.9%	52	32.9%	53	32.9%	52	34.1%	52
Great Yarmouth	61	32.8%	53	32.8%	54	32.8%	53	32.8%	56
Derby	151	32.5%	54	33.1%	51	33.8%	48	33.8%	53
Waltham Forest	144	31.9%	55	25.0%	85	21.5%	98	18.8%	118
Torbay	89	31.5%	56	32.6%	55	36.0%	44	39.3%	38
Coventry	195	31.3%	57	30.8%	60	29.2%	66	28.2%	71
Rotherham	167	31.1%	58	32.3%	56	32.3%	55	35.9%	44
Wakefield	209	31.1%	59	33.0%	52	34.4%	47	37.8%	41
Leeds	482	30.7%	60	30.7%	61	30.9%	60	31.1%	61

Source: Author

Appendix XXI – Hyndburn

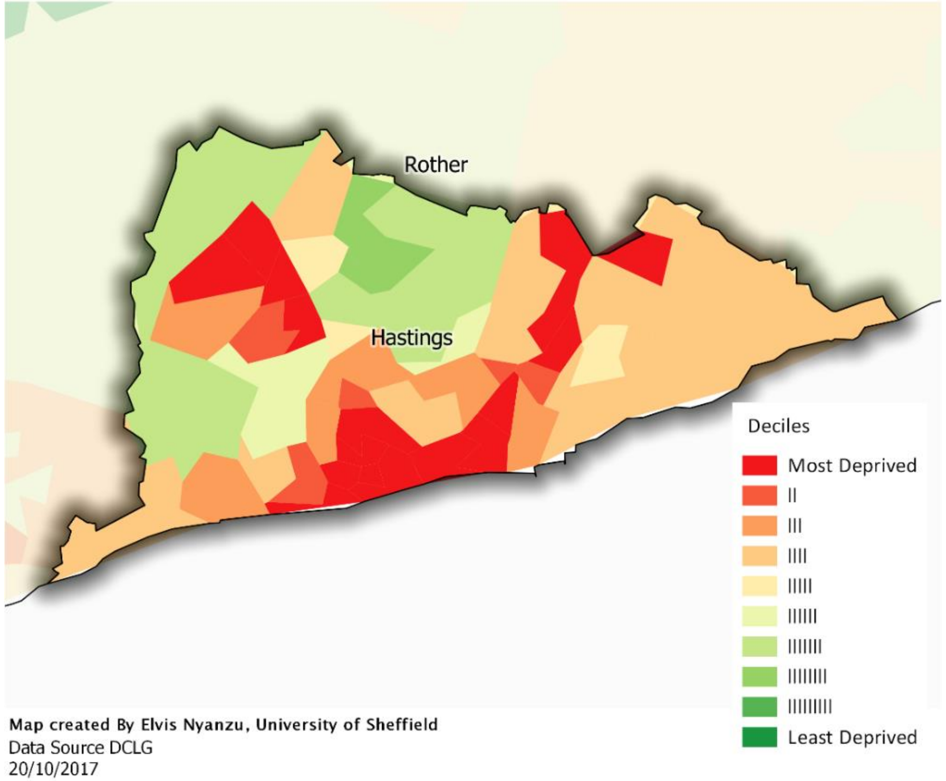
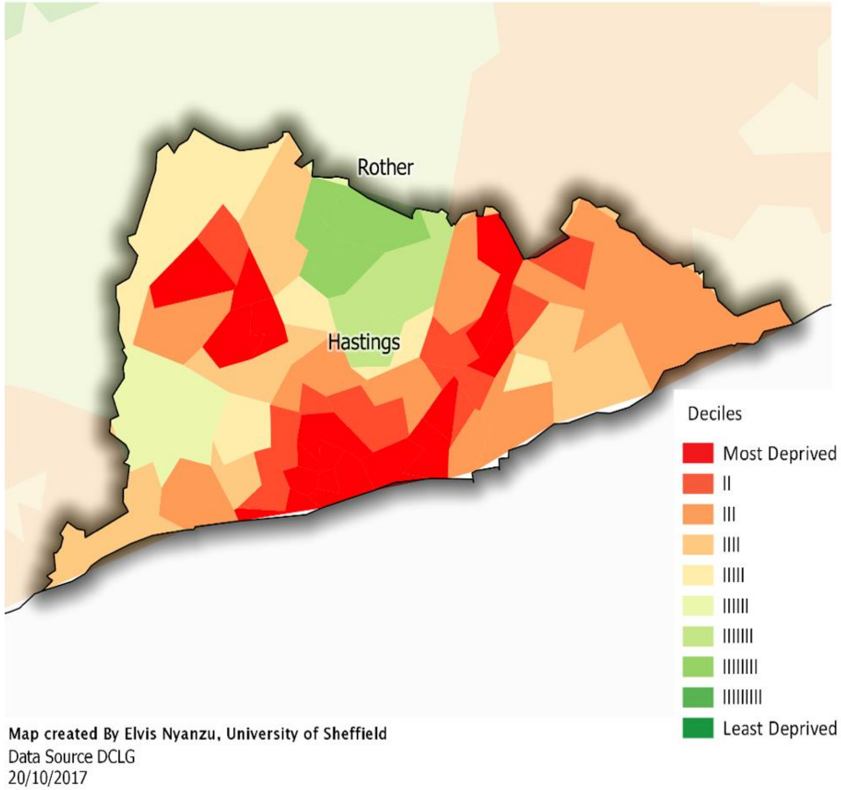
<table>
<tr><td>IMD2015 Decile Classification</td><td>SS-IMD50 Decile Classification</td></tr>
<tr><td>

Map created By Elvis Nyanzu, University of Sheffield
Data Source DCLG
20/10/2017</td><td>

Map created By Elvis Nyanzu, University of Sheffield
Data Source DCLG
20/10/2017</td></tr>
<tr><td>Ranked 22nd (10% most Deprived LSOAs) and ranked 20th - (20% most deprived LSOAs)</td><td>Ranked 26th (10% most Deprived LSOAs) and ranked 34th - (20% most deprived LSOAs)</td></tr>
</table>

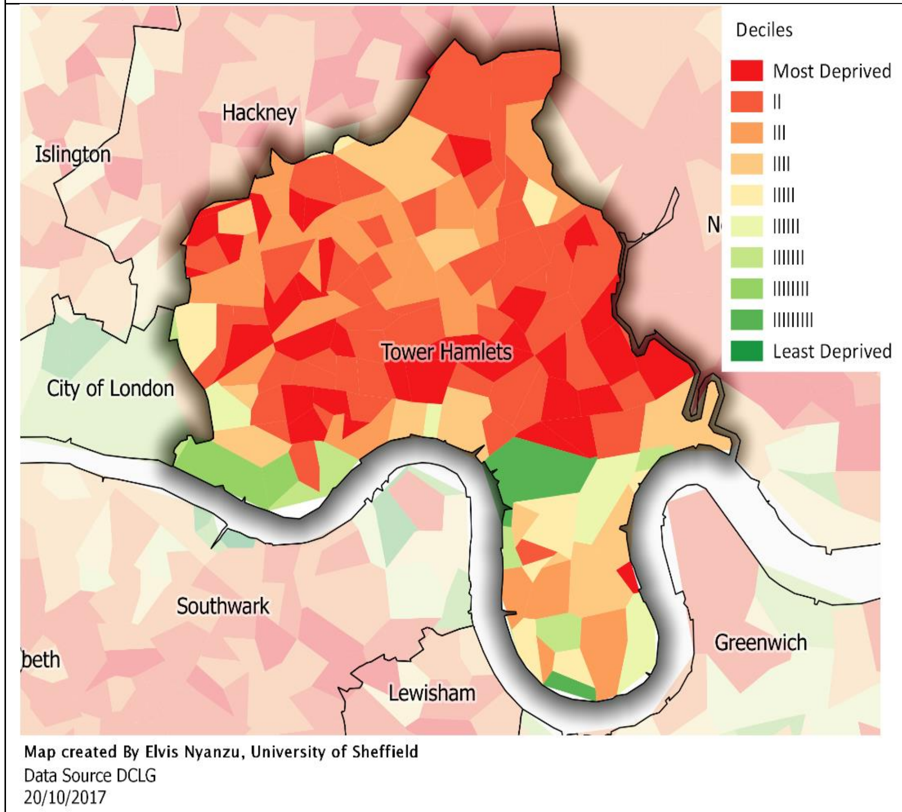
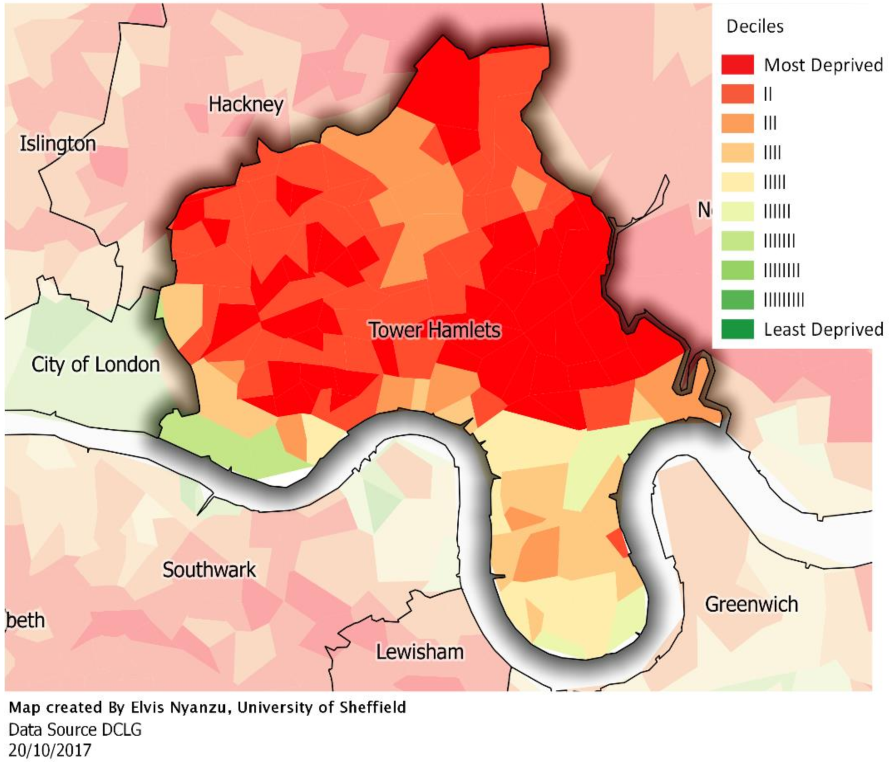
Source: Author

Appendix XXII- Hastings

<table>
<tr><td>IMD2015 Decile Classification</td><td>SS-IMD50 Decile Classification</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Ranked 13th (10% most Deprived LSOAs) and ranked 32nd - (20% most deprived LSOAs)</td><td>Ranked 22nd (10% most Deprived LSOAs) and ranked 22nd - (20% most deprived LSOAs)</td></tr>
</table>

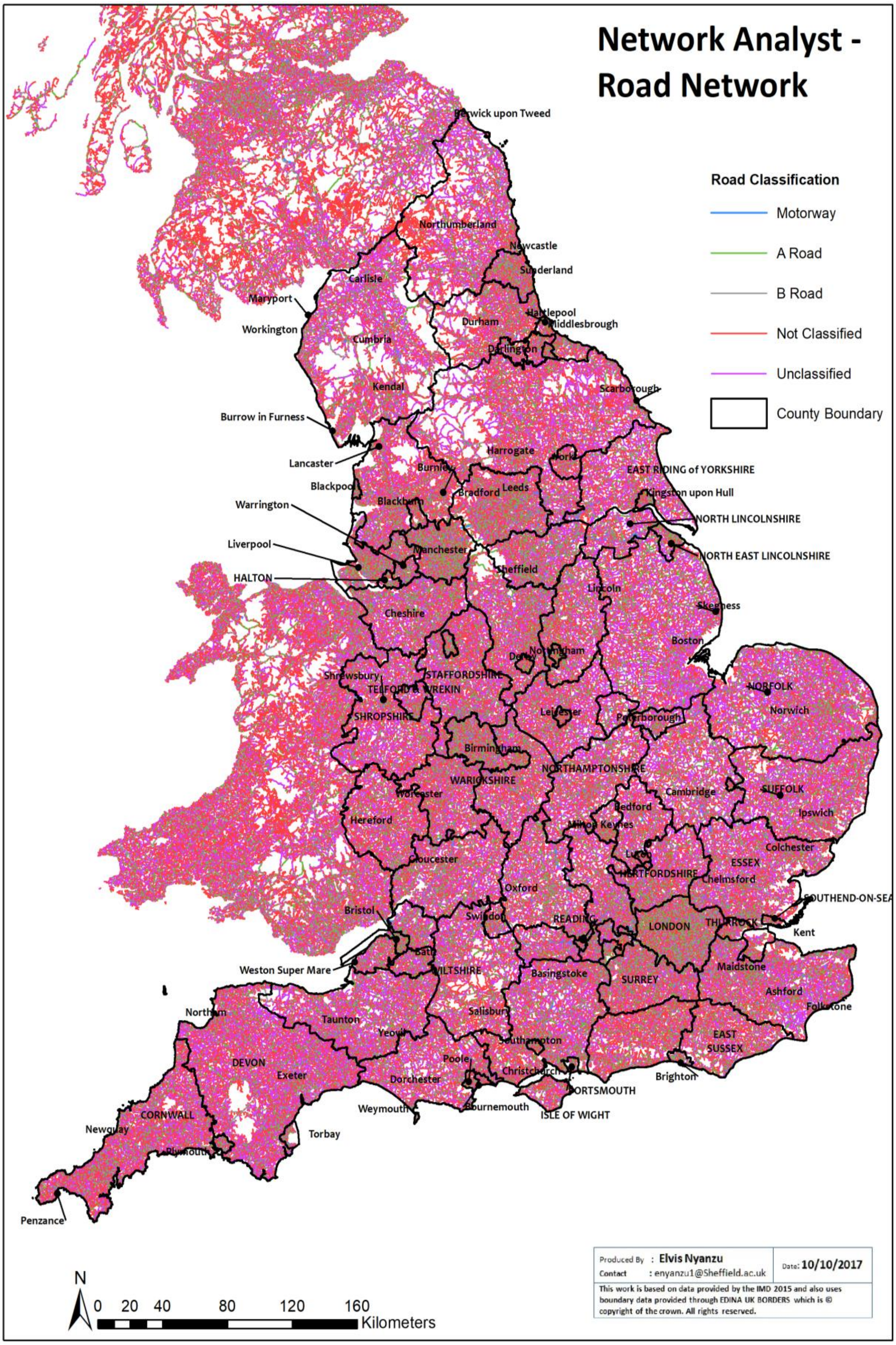
Source: Author

Appendix XXIII - London Borough of Tower Hamlets

<table>
<tr><td>IMD2015 Decile Classification</td><td>SS-IMD50 Decile Classification</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Ranked 24th (10% most Deprived LSOAs) and ranked 6th - (20% most deprived LSOAs)</td><td>Ranked 12th (10% most Deprived LSOAs) and ranked 2nd - (20% most deprived LSOAs)</td></tr>
</table>

Source: Author

Appendix XXIV – Road Network for Network Analyst



Source: Author